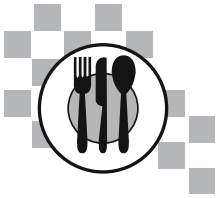
Food Safety

19



Introduction

"Food is our common ground, a universal experience," says James Beard. However, we must keep it safe! Food safety is an important issue today as there are many demands on the food production system and a variety of food handlers serving numerous individuals who are immunocompromised.

Providing safe food is the responsibility of many individuals/groups. For example, federal agencies such as the U.S. Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA), Centers for Disease Control and Prevention (CDC), as well as the state and local counterparts, numerous professional organizations, food processors, and consumers are all interested in preventing the occurrence of foodborne illness. Further discussion of government regulation and labeling appears in a later chapter (see Chap. 20). The FDA ranking of food safety concerns, according to risk ranks foodborne illness as the primary concern, followed by nutritional adequacy of foods, environmental contaminants, naturally occurring toxicants, pesticide residues, and food additives (FDA).

While efforts are made to educate the consumer regarding food safety, hazards in the food supply may be controlled/prevented *before* foods reach the consumer. It is said that the achievements of scientists are not readily explained to the public (Stier 2006), yet it is known that the United States has one of the most diverse and safe food supplies in the world.

The effective use of the Hazard Analysis and Critical Control Point (HACCP) method of food safety, practiced in the food processing industry, has been shown to yield safer foods. Irradiation is also employed to reduce the incidence of disease.

As well, there are numerous aspects of preservation and processing, additives, packaging, and government regulation that contribute to food safety. These are discussed in Chaps. 17–20.

Many tables and much data are included in this chapter! Food safety is addressed in a plethora of reference articles, some of which are included in this chapter. Relevant internet sites may appear in order to emphasize specific points. The food safety of individual food commodities is also discussed in appropriate chapters throughout this text.

> Food & Drug Administration (FDA) has jurisdiction over 80 percent of the food supply, including seafood, dairy and produce. The US Dept of Agriculture (USDA) regulates meat, poultry and processed egg products, while FDA regulates all other food products.
>
> - FDA, USDA, National Oceanic and Atmospheric Administration (NOAA) Statements on Food Safety

Examples that appear in this chapter on foodborne illness and food safety are varied and the reader information may be applied in the

V.A. Vaclavik and E.W. Christian, *Essentials of Food Science, 4th Edition*, Food Science Text Series,
DOI 10.1007/978-1-4614-9138-5_19, © Springer Science+Business Media New York 2014

retail foodservice operation and commercial warehouse or at home.

Foodborne Illness

Since the FDA ranks foodborne illness as the *primary* food safety concern (Department of Health and Human Services, Public Health Service, Food and Drug Administration), this chapter will focus on its *causes* and *prevention*. *Foodborne illness* represents disease carried to people by food and is the result of various biological, chemical, or physical hazards to the food supply. These hazards will be addressed in this chapter.

Foodborne illness is typically due to ingestion of contaminated *animal* products, yet *plant* foods may be implicated as a result of airborne, water, soil, insect, or even human contamination when they are grown or raised. Recently, national foodborne illness cases, including one death, were the result of eating contaminated bagged spinach.

Natural and synthetic foods that support the growth of microorganisms are classified by the FDA as *potentially hazardous foods* (phf), defined as follows:

(a) "Potentially hazardous food" means a FOOD that is natural or synthetic and that requires temperature control because it is in a form capable of supporting:
  (i) The rapid and progressive growth of infectious or toxigenic microorganisms
  (ii) The growth and toxin production of *Clostridium botulinum*
  (iii) In shell eggs, the growth of *Salmonella enteritidis*

(b) "Potentially hazardous food" includes an animal FOOD (a FOOD of animal origin) that is raw or heat-treated, a FOOD of plant origin that is heat-treated or consists of raw seed sprouts, cut melons, and garlic and oil mixtures that are not acidified or otherwise modified.

(c) "Potentially hazardous food" does not include:
  (i) An air-cooled hard-boiled egg with shell intact
  (ii) A FOOD with a WATER ACTIVITY (A_w) value of 0.85 or less
  (iii) A FOOD with a pH level of 4.6 or below when measured at 75 °F (24 °C)
  (iv) A FOOD, in an unopened HERMETICALLY SEALED CONTAINER, that is commercially processed to achieve and maintain commercial sterility under conditions of nonrefrigerated storage and distribution
  (v) A FOOD for which laboratory evidence demonstrates that rapid and progressive growth of infectious and toxigenic microorganisms or the growth of *S. enteritidis* in eggs or *C. botulinum* cannot occur, such as a food that has an A_w and a pH that are above the levels specified above that may contain a preservative or other barriers to growth
  (vi) A FOOD that may contain an infectious or toxigenic microorganism or chemical, physical contaminant at a level sufficient to cause illness but that does not support the growth of microorganisms as specified in the definition of potentially hazardous food

While *prevention* policies are the first line of defense against hazards (avoidance in the first place), control of biological or chemical agents, or physical objects as well as *rapid detection* of contaminants, is imperative to food safety. Any risk of disease must be controlled throughout the steps of manufacturing, processing, storage, and distribution as well as

final cleanup of foods, equipment and utensils, and the food prep areas.

Some *examples* of potentially hazardous foods are products that contain:

• Meat	• Shellfish
• Poultry	• Some synthetic ingredients
• Eggs	• Tofu
• Milk	• Baked potatoes
• Fish	• Cut melon

Wise actions are needed in combating foodborne illness. The government must regulate the food supply, and both the manufacturer and consumer play vital roles in food safety.

Food manufacturers are significantly involved in food safety. "Quality control and anti-tampering measures developed by the food industry in cooperation with government agencies over the past 2 decades have made the U.S. food supply the safest in the world. Since the September 11 [2001] attacks, our industry has recognized that we must take additional proactive measures to ensure safety of consumers. The safeguards that we developed to address long-standing food safety issues and past tampering incidents are being reexamined, strengthened and enforced with vigilance in light of these recent events." (International Foodservice Distributors Association, IFDA, Mclean, VA)

Biological (Microbiological) Hazards to the Food Supply

Biological hazards that cause foodborne illness include *microorganisms* such as bacteria, viruses, fungi, and parasites. These may be small in size, yet they can cause serious foodborne illness or death. Biological hazards to food are controlled by the following:

- Temperature—adequate cooking, cooling, refrigeration, freezing, and handling
- The avoidance of cross-contamination
- Enforcement of personal hygiene among food handlers

Bacteria: The Major Biological Foodborne Illness

Bacteria are the *primary* microbiological hazard organism implicated in foodborne disease and are therefore the *primary* microbial concern of many consumers, food processors, microbiologists, and other personnel responsible for producing and serving safe food.

Bacteria cause foodborne illnesses by one of three manners: infection, intoxication, or toxin-mediated infection as noted in the following:

Foodborne *infection* results from ingesting *living*, pathogenic bacteria such as *Salmonella, Listeria monocytogenes*, or *Shigella* (see Fig. 19.1).

Foodborne *intoxication* results if a preformed *toxin* (poison) is ingested, such as that produced by *Staphylococcus aureus*, *Clostridium botulinum*, and *Bacillus cereus* present in the food (Fig. 19.1).

A *toxin-mediated infection* is caused by ingestion of *living*, infection-causing bacteria such as *C. perfringens* and *E. coli* O157:H7 that also produce a *toxin* in the intestine (Figs. 19.1 and 19.2).

The Educational Foundation of the National Restaurant Association has compiled data on the most common *pathogenic,* or disease-causing bacteria in foods (The Educational Foundation of the National Restaurant Association, Chicago, IL). In Fig. 19.1, the bacteria name, incubation period, duration of illness, symptoms, reservoir, foods implicated, and means of prevention in foods are presented. An astute manager of a food manufacturing operation (as well as the consumer at home!) understands the benefit of having this knowledge and applying this food safety information to their own food products. Such understanding and practice promotes customer goodwill and prevents foodborne illness.

Major foodborne diseases of bacterial origin							
	Salmonellosis Infection	Shigellosis Infection	Listeriosis Infection	Staphyloccal Intoxication	Clostridium Perfringens Toxin Mediated Infection	Bacillus Cereus Intoxication	Botulism Intoxication
Bacteria	*Salmonella* (facultative)	*Shigella* (facultative)	*Listeria monocytogenes* (reduced oxygen)	*Staphylococcus aureus* (facultative)	*Clostridium perfringens* (anaerobic)	*Bacillus cereus* (facultative)	*Clostridium botulinum* (anaerobic)
Incubation Period	6–72 hours	1–7 days	1 day to 3 weeks	1–6 hours	8–22 hours	1/2–5 hours; 8–16 hours	12–36 hours + 72
Duration of Illness	2–3 days	Indefinite, depends on treatment	Indefinite, depends on treatment, but has high fatality in the immuno-compromised	24–48 hours	24 hours	6–24 hours; 12 hours	Several days to a year
Symptoms	Abdominal pain, headache, nausea, vomiting, fever, diarrhea	Diarrhea, fever, chills, lassitude, dehydration	Nausea, vomiting, headache, fever, chills, backache, meningitis	Nausea, vomiting, diarrhea, dehydration	Abdominal pain, diarrhea	Nausea and vomiting; diarrhea, abdominal cramps	Vertigo, visual disturbances, inability to swallow, respiratory paralysis
Reservoir	Domestic and wild animals; also humans, especially as carriers	Human feces, flies	Humans, domestic and wild animals, fowl, soil, water, mud	Humans (skin, nose, throat, infected sores); also, animals	Humans (intestinal tract), animals, and soil	Soil and dust	Soil, water
Foods Implicated	Poultry and poultry salads, meat and meat products, milk, shell eggs, egg custards and sauces, and other protein foods	Potato, tuna, shrimp, turkey and macaroni salads, lettuce, moist and mixed foods	Unpasteurized milk and cheese, vegetables, poultry and meats, seafood, and prepared, chilled, ready-to-eat foods	Warmed-over foods, ham and other meats, dairy products, custards, potato salad, cream-filled pastries, and other protein foods	Meat that has been boiled, steamed, braised, stewed or roasted at low temperature for a long period of time, or cooled slowly before serving	Rice and rice dishes, custards, seasonings, dry food mixes, spices, puddings, cereal products, sauces, vegetable dishes, meat loaf	Improperly processed canned goods of low-acid foods, garlic-in-oil products, grilled onions, stews, meat/poultry loaves
Spore Former	No	No	No	No	Yes	Yes	Yes
Prevention	Avoid cross-contamination, refrigerate food, cool cooked meats and meat products properly, avoid fecal contamination from foodhandlers by practicing good personal hygiene	Avoid cross-contamination, avoid fecal contamination from foodhandlers by practicing good personal hygiene, use sanitary food and water sources, control flies	Use only pasteurized milk and dairy products, cook foods to proper temperatures, avoid cross-contamination	Avoid contamination from bare hands, exclude sick foodhandlers from food preparation and serving, practice good personal hygiene, practice sanitary habits, proper heating and refrigeration of food	Use careful time and temperature control in cooling and reheating cooked meat dishes and products	Use careful time and temperature control and quick chilling methods to cool foods, hold hot foods above 140°F (60°C), reheat leftovers to 165°F (74°C)	Do not use homecanned products, use careful time and temperature control for sous-vide items and all large, bulky foods keep sous-vide packages refrigerated, purchase garlic-in-oil in small quantities for immediate use, cook onions only on request

Fig. 19.1 Major foodborne diseases of bacterial origin (*Source*: Reprinted with permission from *Applied Foodservice Sanitation: A Certification Coursebook, Fourth Edition*, © 1992, The Educational Foundation of the National Restaurant Association)

As well, the CDC has compiled extensive data. Some of that data is available at the end of this chapter.

Beyond the immediacy of illness, there is also USDA increasing evidence that foodborne gastrointestinal (GI) pathogens may give rise to other illness such as chronic joint disease, i.e., arthritis (Agricultural Research Service, USDA, Washington, DC).

As is the case of *bacteria in general*, the *bacteria causing foodborne illness may require* the following elements for growth:

Campylobacteriosis Infection	*E. coli* 0157: H7 Infection/Intoxication	Norwalk Virus Illness
Campylobacter jejuni	*Escherichia coli*	Norwalk and Norwalk-like viral agent
3–5 days	12–72 hours	24–48 hours
1–4 days	1–3 days	24–48 hours
Diarrhea, fever, nausea, abdominal pain, headache	Bloody diarrhea; severe abdominal pain, nausea, vomiting, diarrhea, and occasionally fever	Nausea, vomiting, diarrhea, abdominal pain, headache, and low-grade fever
Domestic and wild animals	Humans (intestinal tract); animals, particularly cattle	Humans (intestinal tract)
Raw vegetables, unpasteurized milk and dairy products, poultry, pork, beef, and lamb	Raw and undercooked beef and other red meats, imported cheeses, unpasteurized milk, raw finfish, cream pies, mashed potatoes, and other prepared foods potatoes, and other prepared foods	Raw vegetables, prepared salads, raw shellfish, and water contaminated from human feces
No	No	No
Avoid cross-contamination, cook foods thoroughly	Cook beef and red meats thoroughly, avoid cross-contamination, use safe food and water supplies, avoid fecal contamination from foodhandlers by practicing good personal hygiene	Use safe food and water supplies, avoid fecal contamination from foodhandlers by practicing good personal hygiene, thoroughly cook foods

Fig. 19.2 Emerging pathogens that cause foodborne illness (*Source:* Reprinted with permission from *Applied Foodservice Sanitation: A Certification Coursebook*, 4th ed., © 1992, The Educational Foundation of the National Restaurant Association)

- **Protein** (or sufficient nutrients)
- **Moisture** [water activity (A_w) above 0.85]
- **pH** (above pH of 4.5, generally neutral—pH 7)
- **Oxygen** (if aerobic)
- A general **temperature** 40–140 °F (4–60 °C), the *temperature danger zone* (TDZ) (consult your local jurisdiction for specific temperature requirements that may differ)

Bacterial growth is portrayed in Fig. 19.3. Bacteria vary in their *temperature* requirements—e.g., they may be *thermophiles* (high temperatures needed for survival), *mesophiles,* or *psychrotrophs* (cooler temperatures of 50–70 °F [10–20 °C] requirements). Bacteria also vary in their *nutrient needs*.

Once bacteria are in the TDZ, they remain in the LAG phase of bacterial growth for approximately 4 h (cumulative); there is generally no increase in number. Yet, due to unsafe temperatures of holding food, or especially

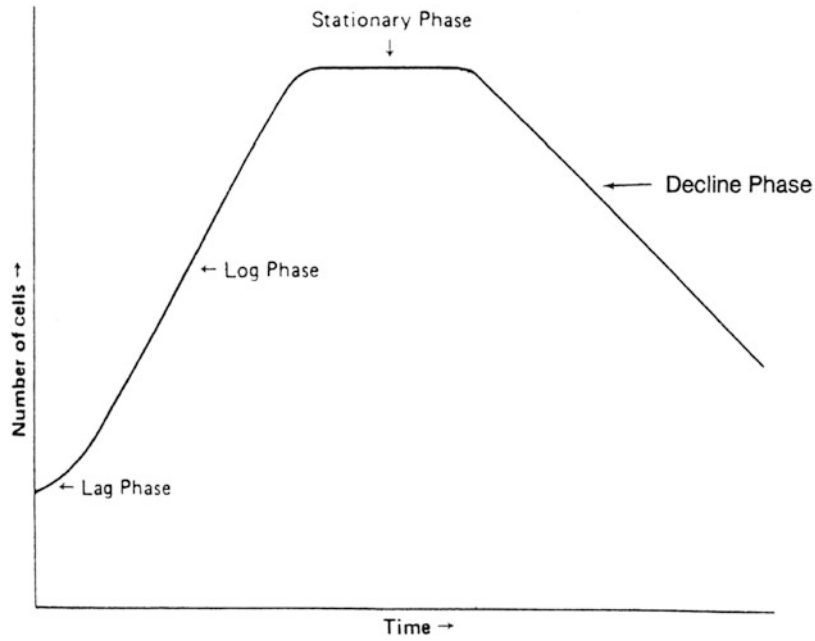


Fig. 19.3 Bacterial growth curve (*Source*: Reprinted with permission from *Applied Foodservice Sanitation: A Certification Coursebook*, 4th ed., © 1992, The Educational Foundation of the National Restaurant Association)

improper cooling, bacterial growth becomes exponential. Then, after the LAG phase, the unicellular structure undergoes binary fission, and rapid growth occurs in foods which are phfs. This rapid growth or multiplication of bacteria is termed the LOG (logarithmic) phase of bacterial growth. It is followed by the STATIONARY phase, where growth rates approximate death rates and there is no net change in the number of pathogens in the food, and, subsequently, by the DECLINE phase of bacterial growth, where the level of bacteria is reduced.

It is important to recognize the fact that although the end of the DECLINE phase may show *less* than the original amount of bacteria, this phase may contain *more* harmful waste products or toxins that *cannot* be destroyed by cooking. In addition to toxins, the two *Clostridium* bacteria and *Bacillus cereus* may contain *spores* (unlike the spores of mold), which are highly resistant formations in bacterium that remain in food, even after vegetative cells are destroyed.

As mentioned, this makes *prevention* of food contamination the *primary* defense against foodborne illness—harmful substances or possibly their waste products *cannot* be destroyed later through cooking. A careful time–temperature control of potentially hazardous food is required. Refrigeration, for example, *slows* growth, and freezing *halts* growth; however, neither *destroys* bacteria.

The CDC reports that *improper cooling* of large quantities of food is the number one cause of foodborne illness. (Despite the fact that large quantities of food may be in a pot placed in the refrigerator at cold temperatures, bacteria do not "know" that they are in the refrigerator. Rather, they are in a large, warm stockpot or steam table pan and LOVE it!)

Adherence to specific heat application temperatures aids in promoting food safety and is required of food preparation staff. The topic of food temperature requires important consideration. There is the traditional food thermometer that may be used as part of ensuring food safety. With this instrument, food temperature is read

when the thermometer is inserted up to the "dimple" mark appearing on the thermometer stem. The thermometer reading presented represents an average temperature of all food contacting the length of the thermometer stem up to the "dimple."

In another mention of temperature, use of a device known as a TTI (**time–temperature indicator)** or a smart label shows the accumulated time–temperature history of a product. The indicator is commonly used to indicate exposure to excessive temperature (and length of time at temperature). The approximate dimensions of the TTI labels are 47 × 78 mm or 1.8″ × 3″. Time–temperature indicator labels are designed to be used during processing, storage, and shipping. The labels change color irreversibly if there is an unacceptable temperature exposure.

As well as using a TTI or a smart label, there is a wide array of products, including the plastic *pop-up* type of temperature indicators that were once only used for cooking the traditional holiday turkey—with their use, temperature control in cooking is better assured. The *Food Temperature Indicator Association* works with the USDA and food manufacturers to conduct studies regarding temperature and food safety. As mentioned, such specialized pop-up timers may be on items such as turkeys, yet also on a variety of meats and fish to indicate doneness. Paper thermometers to save in files or dispose of after each use are available. Paper may be used to measure temperatures with food or dishware.

Reading thermometers is important. A pop-up plastic thermometer may indicate doneness by a simple *binary* indicator. (Believe it or not, it may be remelted, pushed closed, cooled, and then used again!) *Thermocouple thermometers* measure in a matter of seconds by utilizing two wires located at the tip of the probe inserted into the food. A thermocouple is designed to be used near the end of the cooking cycle. *Thermistors* are another temperature tool. They are designed for use outside of the oven and take approximately 10 s to register the food temperature. Due to the fact that the semiconductor used to measure temperature is located in the tip, either thin or thick foods may be "temped."

A *thermometer fork* is another tool used to monitor a safe food supply—usually it had outdoor cooking applications. The fork uses a thermocouple or thermistor in the fork tines to read the food temperature which is then displayed on the fork handle. These forks or perhaps spatulas are frequently used in outdoor grilling applications and are able to accurately measure even thin foods.

Today, the USDA's Food Safety and Inspection Service (FSIS) requires establishments that slaughter cattle, chicken, swine, and turkeys to test specifically for bacteria *E. coli*. They must verify the adequacy of process controls for the prevention and removal of fecal contamination and associated bacteria. Additionally, the FSIS has extended such testing to establishments that slaughter species including ducks, equines, geese, goats, guineas, and sheep.

According to the manufacturer of one TTI, "From supplier through warehousing and distribution all the way to the consumer, the ThermoTrace TTI system gives customers the exact data they need to assess product quality and shelf life." Its size is approximately 47 × 78 mm or 1.8″ × 3″ (Fig. 19.4).

Viruses

In addition to bacteria, although with lesser incidence, viruses may also be responsible for an unsafe food supply and foodborne illness. A virus does *not* multiply in food, as do bacteria, yet it can *remain* in food if it is insufficiently cooked. Subsequently, viruses infect individuals who ingest it. It is possible for *spot contamination* of food to occur, so that only those individuals consuming the contaminated portion of the food become ill.

A virus of concern to the consumer, or a food processing and handling operation, is the hepatitis A virus. A person will become infected with the virus 15–50 days following ingestion of a contaminated product and will shed the virus unknowingly, contaminating *other* people or food *prior* to displaying symptoms of illness. Although the actual infection may last several

Fig. 19.4 (**a**) DeltaTRAK's ThermoTrace time temperature indicator (TTI) (Source: "courtesy of DeltaTRAK Inc. http://www.deltatrak.com".). (**b**) ThermoTrace time temperature indicator (TTI) used on a smart phone ® (Source: "courtesy of DeltaTRAK Inc. http://www.deltatrak.com".)

weeks or months and exhibit symptoms such as abdominal pain, jaundice, and nausea, there are possible widespread and long-lasting financial implications of this illness to the business that is responsible for its spread.

Two sources of the hepatitis A virus are (a) raw shellfish from polluted water where sewage is discarded and (b) feces (and urine) of infected persons. To control the first listed source, the growth and harvesting of raw shellfish (clams, oysters, mussels) is subject to inspection and regulation by the FDA. The FDA inspects the water beds from which shellfish is harvested. Also, a *tag* must appear on commercial fresh shellfish to show its source. The tag needs to be retained by the receiver for 90 days. Unfortunately, some unreputable suppliers may obtain their shellfish supply from "off-limits" contaminated water, thus harvesting a contaminated product.

Control for the second source of the hepatitis virus is that consumers at home and food handlers in food processing or assembly operations must practice *good personal hygiene*. Just minute amounts of feces may spot contaminate food, causing foodborne illness when the food is ingested. A number of state or local health department jurisdictions require the use of disposable gloves by food handlers responsible for handling food that is not subject to further cooking.

Hepatitis A is of major concern. Another virus of significance to the consumer and food processing operation is HIV. The CDC states that there is no evidence that this can be transmitted by food (CDC).

Fungi

Mold and yeast are *fungi* that may be responsible for *spoilage* in the food supply. Details on each appear below.

Mold

The (accidental) ingestion of mold is not known to cause gastrointestinal distress. Rather, it has been implicated in other long-term illness, such as liver cancer, in animals that have been fed moldy crops. Mold obviously causes food spoilage. It also causes loss of food, dissatisfied consumers, and waste of money.

Mold is a multicellular fungus that reproduces by spore formation. After spores form, they are then dispersed through the air and may replicate when in contact with food (mold spores are unlike bacterial spores). Mold is the unwanted blue, green, white, and black fuzzy growth on food. It may be considered acceptable in medicine, such as penicillin, or some cheeses such as blue cheese. A small percent of persons may fatally suffer from allergies to molds.

Yeast. Yeast is a unicellular structure that grows by the budding process. It causes food *spoilage*, as is evidenced by the formation of pink patches on moist cheeses or cloudy liquid

in condiment (such as olives) jars. Foodborne yeast has *not* been shown to cause illness, yet, nonetheless, undesirable growth of yeast must be controlled, or food is damaged and wasted. Yeast is *generally* shown to have beneficial uses in the food industry such as when it leavens baked products or is used in fermentation to produce alcoholic beverages.

Parasites

Parasites may be a source of foodborne illness. Parasites are tiny organisms that depend on living hosts for their nourishment and life. Undercooked pork products, for example, may carry the parasite *Trichinella spiralis*, which causes the disease trichinosis. Two days to 28 days following ingestion of the Trichinella parasite, an individual may exhibit nausea, vomiting, abdominal pain, and swelling of tissue surrounding the eye. Fever and muscular stiffness then develop. Since pork may be contaminated with *Trichinella spiralis*, all pork products must be cooked to 155 °F (68 °C) [or 170 °F (77 °C) if cooked in a microwave oven], and all equipment used in its preparation should be sanitized.

Fish from *unapproved* sources may carry the parasite Anisakis and result in the parasitic disease *anisakiasis*. Reputable suppliers to processing plants are the best assurance that the product has been handled safely. Freezing for the correct time and temperature actually can kill Anisakis. On the other hand, when fresh fish is served *raw*, food safety takes on new significance!

Contamination and Spoilage

Contamination and spoilage are not the same. The latter *may not* ever cause illness due to the fact that the consumer *sees* signs of spoilage and that spoiled food never gets eaten! Illness is more likely to be the result of ingesting unseen microbial (or chemical) contamination. Thus, it is *contaminated* food that is truly "bad" food—is *not* apparent to the eye. Impure or harmful substances may be too small or unnoticeable. *Spoiled* food has visible damage to the eating quality of food and is *not* the primary cause of foodborne illness.

In order to maintain food safety, any chance of initial contamination should be prevented and then subsequent growth controlled. *Cross-contamination*, or the transfer of germs from one contaminated food or place to another by hands, equipment, or other foods, should be avoided.

Beside those pathogens mentioned, there is the possibility of contamination by other *emerging* pathogens. Their incidence has increased within the last few years or they threaten to increase in the near future.

Chemical Hazards to the Food Supply

All food is made of chemicals and is expected to be safe for consumption. However, a chemical hazard to the food supply may occur when dosages or levels of specific chemicals reach toxic levels. Hazards may be accidental, caused by additives, by toxic metals, or naturally occurring.

As mentioned previously, chemical contamination includes accidental chemical contamination, such as when contents of a container, perhaps unlabeled, are mistakenly used in food. Excessive quantities of additives become problematic especially when an individual has a specific allergy.

As well, included in the list of chemical hazards are toxic metals such as galvanized iron. Steel may permanently bond to the metal zinc through galvanizing. Such zinc-coated material may be beneficially used for building fabrication or for shelving, however, should be avoided as a food contact surface since it is highly reactive with acids. In the past, containers used for beverages, temporary working surfaces, and shelving made of toxic galvanized steel had been part of many restaurant operations.

One additional type of chemical hazard is the animal/plant foodstuff itself. Naturally occurring toxins in various foods such as the puffer fish or different mushrooms may cause severe illness.

Control of chemical hazards prior to receipt or use, and control in inventory, storage, and

Table 19.1 Control of chemical hazards (Watson)

I.	*Control before receipt*. Raw material specifications; vendor certification/guarantees; spot checks—verification
II.	*Control before use*. Review purpose for use of chemical; ensure proper purity, formulation, and labeling; control quantities used
III.	*Control storage and handling conditions*. Prevent conditions conducive to production of naturally occurring toxicants
IV.	*Inventory all chemicals in facility*. Review uses and records of use

Source: Ref. Watson DH. *Safety of Chemicals in Food: Chemical Contaminants*

Table 19.2 Main materials of concern as physical hazards and common sources

Material	Injury potential	Sources
Glass	Cuts, bleeding; may require surgery to find or remove	Bottles, jars, light fixtures, utensils, gauge covers
Wood	Cuts, infection, choking; may require surgery to remove	Fields, pallets, boxes, buildings
Stones	Choking, broken teeth	Fields, buildings
Metal	Cuts, infection; may require surgery to remove	Machinery, fields, wire, employees
Insects, other filth	Illness, trauma, choking	Fields, plant postprocess entry
Insulation	Choking, long term if asbestos	Building materials
Bone	Choking, trauma	Fields, improper plant processing
Plastic	Choking, cuts, infection; may require surgery to remove	Fields, plant packaging materials, pallets, employees
Personal effects	Choking, cuts, broken teeth; may require surgery to remove	Employees

Source: Adaptation from Corlett (Pierson & Corlett 1992)

handling are identified in Table 19.1. Care must be taken to avoid chemical hazards.

Cleaning and sanitizing solutions must be safely stored and utilized. Of course they need to be appropriately measured for strength to be effective. Whether the solutions are in a cleaning and sanitizing bucket; spray bottle; sink, such as a three-compartment sink; or dish machine, safety is important to the facility, the health inspector, and the public.

Physical Hazards to the Food Supply

Physical hazards to the food supply are any *foreign objects* found in food that may contaminate it. Certainly, they are unwanted by the consumer! Certainly they should not be deliberate! They may be present due to harvesting, or some phase of manufacturing, or they may be intrinsic to the food, such as bones in fish, pits in fruits, eggshells, and insects or insect parts.

Animals or crops grown in open fields are subject to physical contamination, although hazards may enter the food supply due to a variety of incidences that range from faulty machinery, to packaging wraps, to human error. An astute manager prevents the chance of physical contamination by following good manufacturing practices (GMPs) and using his/her observational skills.

The foremost materials of concern as physical hazards include foreign bits and pieces such as glass, wood, metal, plastic, stones, insects and other filth, insulation, bones, and personal effects (Katz 2000) (Table 19.2). Modern optical scanning technologies are capable of sorting difficult, potential problem products and are designed to minimize such contamination at the processing plant. Devices such as screen, filters, magnets, and metal detectors may be used online or throughout the manufacturing plant to search for foreign objects and avert health disasters or product recalls. X-ray units are reliable in detecting a variety of objects (Fig. 19.5).

Metal detectors are designed to detect metals in liquid, solid, granular, or viscous food products, in various packaging trays and wraps. The use of the common X-ray, a 40-year-old technology, is now a quality assurance tool in the inspection of finished food products. Its use may be a requirement of vendors supplying their foods to a warehouse club. Continual developments make it more affordable, compact, and faster to use in the manufacturing plant (Higgins 2006).

Personal effects, such as jewelry, may not be worn in the production areas. Personnel rules such as "no gum chewing" and "cover hair" need to be enforced in the workplace.

Physical hazards may harm a consumer's health and cause psychological trauma or dissatisfaction. Ill, upset, or dissatisfied consumers may call or write to the responsible manufacturer or processor, contact the foodservice establishment, or involve the local health department in investigating their complaint. Any chance of physical objects getting into the food supply should be prevented.

Foreign substance laboratories in food manufacturing companies as well as personnel in foodservice establishments need to look out for and be informed of any reported food safety problems—chemical or physical, so that they may investigate and prevent possible problems. Consumers benefit from this prevention and incidences of contamination are reduced.

See current and recent discussions on *food safety*: http://www.foodproductdesign.com/reports.aspx.

See later in this chapter

http://www.choosemyplate.gov/food-groups/downloads/TenTips/DGTipsheet23BeFoodSafe.pdf.

Food Protection Systems

Numerous agency names appear in this section of text, with each agency addressing food protection systems. While the listing may be lengthy, the names actually represent only a portion of the many groups responsible for the United States' food safety—considered the safest in the world. The CDC, the FDA, the USDA's FSIS, and state and county health departments have regulatory authority for food protection, and they provide education to the public. There are also numerous trade associations and professional organizations involved in providing education and protecting the public from foodborne illness.

A coordination of inspection, enforcement, and research may all contribute to food safety. Many food companies also maintain extensive food protection systems. Eliminating or reducing the biological, chemical, and physical hazards to the food supply is the goal of food safety.

In the quest to destroy pathogens and better protect foods, the FDA approved irradiation of meat in 1997, as it was shown to yield safer meat than meat that is not irradiated (Crawford and DVM). Irradiation, both off-site and online, is also being utilized as a means of food safety for a wide array of food items (Higgins 2003).

> Food safety and defense is mission critical. Through its focus on issues of concern and hot topics, IFT provides viewpoints and technical resources that will enhance your understanding of additive and ingredient safety, allergens, novel technologies, and microbial and chemical contaminants. (IFT)

With regard to the newer term *traceability*, safety guidelines are crucial and the following is said:

> Supply chain management in the food industry, and more specifically supply chain quality management, encompasses all types of raw materials, products and items. Suppliers and manufacturers must be able to track many shipments, and to do so effectively, they need complete histories of where each material comes from and where it is delivered to. Food traceability is vital when dealing with farm-to-fork food shipments. . .
>
> Proper safety guidelines need to be followed at each point of the farm-to-fork supply chain, beginning with the growing stage. . . . *Food traceability* allows you to further track your shipments of

Conveyor metal detection system for packaged products.

Pipeline metal detection system with reject valve for pumped liquid and slurry applications

Gravity drop metal detection system with divert valve for bulk powder application.

Fig. 19.5 Metal detectors (*Source*: Advanced Detection Systems)

processed and packaged food to ensure they are delivered on time.
(Global Supplier Quality Assurance) [GSQA]

An alternative safety mechanism processing plants may use in their food protection programs, although perhaps not providing *real-time* information is *statistical analysis*. It may be used to define acceptable upper and lower control limits and then to improve product quality. Statistical Process Control (SPC) provides advances in microbiological analyses that in turn will allow the manufacturing process to integrate testing with quality improvement and productivity (Hussain 2000). SPC may also be integrated with the HACCP method of food safety (discussed in a later section of this chapter, below).

In addition to a corporate level *manufacturing concern*, many retail *foodservice operations* have sent at least one manager to local training in Food Protection Management. Numerous news shows, newspapers, and magazines have addressed the issue of food safety for consumers, and receiving training can supply added assurance to the wary customer that the *restaurant* food supply is served safely.

FDA (See Chap. 20)

The FDA, the CDC of the U.S. Department of Health and Human Services (HHS), and the FSIS of the USDA release new edition of the Food Code every 4 years.

See Food Safety Research Information Office (FSRIO). Also see FDA Food Code:

http://fsrio.nal.usda.gov/faq-page/regulations-standards-and-guidelines

http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodCode/default.htm

The reader should remain current on foodborne illness prevention and produce safety.

The New FDA Food Safety Modernization Act (FSMA)

The House of Representatives and the Senate passed the FDA Food Safety Modernization Act. It was signed into law on January 4, 2011.

Some of the provisions in the new law:

- **Issuing recalls:** For the first time, FDA will have the authority to order a recall of food products. Up to now, with the exception of infant formula, the FDA has had to rely on food manufacturers and distributors to recall food voluntarily.
- **Conducting inspections:** The law calls for more frequent inspections and for those inspections to be based on risk. Foods and facilities that pose a greater risk to food safety will get the most attention
- **Importing food:** The law provides significant enhancements to FDA's ability to oversee food produced in foreign countries and imported into the United States. Also, FDA has the authority to prevent a food from entering this country if the facility has refused US. inspection.
- **Preventing problems:** Food facilities must have a written plan that spells out the possible problems that could affect the safety of their products. The plan would outline steps that the facility would take to help prevent those problems from occurring.
- **Focusing on science and risk:** The law establishes science-based standards for the safe production and harvesting of fruits and vegetables. This is an important step forward. These standards will consider both natural and man-made risks to the safety of fresh produce.
- **Respecting the role of small businesses and farms:** The law also provides some flexibility, such as exemptions from the produce safety standards for small farms that sell directly to consumers at a roadside stand or farmer's market as well as through a *community supported agriculture* program (CSA).

Later came the **Current Good Manufacturing Practice and Hazard Analysis and Risk-Based Preventive Controls for Human Food Proposed Rule**.

http://www.gpo.gov/fdsys/pkg/FR-2013-01-16/html/2013-00125.html

"The rule has two major features. First, it contains new provisions requiring hazard analysis and risk-based preventive controls. Second, it would revise the existing Current Good Manufacturing Practice (CGMP) requirements found in 21 CFR part 110" rule.

The proposed rule:

Summary

The Food and Drug Administration (FDA or we) is extending the comment period for the proposed rule, and for the information collection related to the proposed rule, "Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption" that appeared in the Federal Register of January 16, 2013. We are taking this action in response to requests for an extension to allow interested persons additional time to submit comments on the proposed rule. We also are taking this action to keep the comment period for the information collection provisions associated with the rule consistent with the comment period for the proposed rule.

Dates

The comment period for the proposed rule published January 16, 2013, at 78 FR 3504, is extended. In addition, the comment period for the information collection issues in the proposed rule, extended February 19, 2013, at 78 FR 11611, is further extended. Submit either electronic or written comments on the proposed rule by September 16, 2013. (FDA)

USDA Food Protection (See Chap. 20)

The USDA FSRIO has created a website for the general public and food safety researchers. The site contains educational, professional, and foreign government links for food safety (http://www.nal.usda.gov/fsrio).

See more specifics in the chapters on milk, eggs, and poultry.

The HACCP System of Food Protection: USDA

In order to assess and reduce foodborne illness risks from biological, chemical, or physical hazards, the *Hazard Analysis and Critical Control Point—HACCP* (pronounced hassip)—system of food safety may be required for use by food processors and foodservice operations (Table 19.3). The system depends upon *prevention*, rather than strictly *inspection*.

The "Mega-Reg" or Pathogen Reduction: HACCP System regulation was signed by the US President in 1996. It codified principles for the prevention and reduction of pathogens and required both the development of Sanitation Standard Operating Procedures (SSOPs) and a written HACCP plan that is monitored and verified by inspectors of various food processing plants. Compliance deadlines were phased in, depending upon the size of the company.

FSIS tests raw livestock and poultry in the slaughtering processes for *Salmonella* and *E. coli*. Seafood HACCP became effective in 1997. Juice processors must have HACCP. Later, HACCP plans for protection against L. monocytogenes in ready-to-eat meat products were required by the FSIS. Currently, egg processors, as well as dairy plants, and additional industries have implemented HACCP.

HACCP traces the flow of food from entry into an operation through exit. It does more

Table 19.3 Steps of a hazard analysis and critical control point (HACCP) program

I. Assessing the hazards
Hazards are assessed at each step in the flow of food throughout an operation
II. Identifying critical control points (CCPs)
Identify CCPs regarding hygiene, avoiding cross-contamination, and temperatures and procedures for cooking and cooling. A flowchart of preparation steps is developed, showing where monitoring is necessary to prevent, reduce, or eliminate hazards
III. Setting up control procedures and standards for critical control points
Establish standards (criteria) for each CCP and measurable procedures such as specific times and temperatures, moisture and pH levels, and observable procedures such as hand washing
IV. Monitoring critical control points
Checking to see if criteria are met is one of the most crucial steps in the process. Assigning an employee to monitoring temperatures of storage, cooking, holding, and cooling is necessary to see if controls against hazards are in place
V. Taking corrective action
Observe if there is a deviation between actual and expected results. Correct the procedures by using an alternate plan if a deficiency or high-risk situation is identified in using the original procedure. This may be accomplished by a trained employee empowered to initiate corrective action without a supervisor being present
VI. Develop a record-keeping system to document HACCP
Time–temperature logs, flowcharts, and observations are used for record keeping
VII. Verify that the system is working
Make use of time and temperature logs completed during preparation, holding, or cooling. Observe

See Ref on HACCP

than *detect and correct* errors *after* they have occurred; as mentioned, it is a program that *prevents* errors regarding food safety before they occur. By definition of a Quality Assurance [QA] Program, HACCP may not fit QA. Sanitation is typically a separate program at a food manufacturing facility and is not put into the same category as other aspects of food quality. Sanitation is a 24/7 duty and may compose the entire third shift of a 24-h food manufacturing plant.

HACCP was originally designed by the Pillsbury Company, in cooperation with Natick Laboratories of the US Army and the U.S. Air Force Space Laboratory Project Group. The system was designed for use by the National Aeronautics and Space Administration (NASA) Program. HACCP has been used as a food safety system in the food industry since 1971, and it offers practical food protection techniques that are needed anywhere food is prepared or served.

The National Advisory Committee for Microbiological Criteria for Foods (NACMCF) (National Advisory Committee for Microbiological Criteria for Foods) has identified seven major steps involved in the HACCP system (Table 19.3). HACCP can be used in multiple spots within the food chain, for example, in growing, harvesting, processing, preparing, or serving of foods.

With the establishment of an HACCP Program, new terminology may be used; some selected HACCP definitions are given in Table 19.4. Many food companies must have an HACCP system in place.

Using the HACCP system, the HACCP team must first identify phf's that are prepared in their operation. Then, they must observe the flow of those phf's from the acquisition of raw ingredients to completion of the finished product, especially studying the flow of sensitive ingredients known to have been associated with a hazard and for which there is a reason for concern. This observation leads to the development of a flowchart.

After identifying those foods that are potentially hazardous and creating a flowchart, management needs to identify specific, measurable Critical Control Points (CCPs). In the absence of

Table 19.4 Selected HACCP definitions (health and human service)

Control point: any point, step, or procedure at which biological, physical, or chemical factors can be controlled
Corrective action: procedures to be followed when a deviation occurs
Critical control point (CCP): a point, step, or procedure at which control can be applied and a food safety hazard can be prevented, eliminated, or reduced to acceptable levels
Critical limit: a criterion that must be met for each preventive measure associated with a critical control point
Deviation: failure to meet a critical limit
HACCP Plan: the written document which is based on the principles of HACCP and which delineates the procedures to be followed to assure the control of a specific process or procedure
HACCP system: the result of the implementation of the HACCP plan
HACCP team: the group of people who are responsible for developing an HACCP plan
Hazard: a biological, chemical, or physical property that may cause a food to be unsafe for consumption
Monitor: to conduct a planned sequence of observations or measurements to assess whether a CCP is under control and to produce an accurate record for future use in verification
Risk: an estimate of the likely occurrence of a hazard
Sensitive ingredient: an ingredient known to have been associated with a hazard and for which there is reason for concern
Verification: the use of methods, procedures, or tests in addition to those used in monitoring to determine if the HACCP system is in compliance with the HACCP plan and/or whether the HACCP plan is working

CCPs, food is subject to *unacceptable* risks or likelihood of a hazard.

Subsequently, control procedures and criteria for critical limits must be established and then *monitored* by the individual assigned responsibility for tracking CCP procedures. The CCPs may include temperature of the food product and processing equipment, time of processing, package integrity, and more. Measurements and observational skills are employed in order to reveal any unacceptable deviations between actual and expected results. Deviation may require corrective action in order to prevent foodborne illness.

A view of the headings on the foodservice HACCP of chicken salad and ribs, HACCP (Figs. 19.6 and 19.7) indicates several major concepts. *First*, the flow process of foods is drawn from the point of receiving food until it is discarded. *Secondly*, the CCPs are identified, and *next*, criteria for control are established and briefly stated for ease of understanding. Criteria for control specify such factors as minimum and maximum temperatures that must be reached, correct storage procedures, instructions for personal hygiene and equipment sanitation, and discard rules.

Note that monitoring and verifying the HACCP program includes instructions to follow for assurance of compliance with criteria. It may be taking temperatures, measuring time to complete preparation, measuring depth of storage pans, or observing procedures that are used in preparation or storage. The entire HACCP process also states the action to be taken if the criteria are not met. HACCP systems require that a designated individual using reliable tools/instruments must monitor the CCPs. The reliability of instruments such as thermometers or thermocouples must be validated.

Handling a phf requires knowledge of the flow process and how to keep food safe. For example, in *receiving* chicken, the corrective action to take if established criteria are not met would be to reject the products upon delivery. In *storage*, the product may require a lower air temperature if the established criteria for maximum temperature were not met.

A further *cooking* criterion requires that chicken reach a minimum temperature of 165 °F (74 °C). If the temperature is not met at an initial check for doneness, the chicken must continue to be cooked until that temperature is reached. Thus, the HACCP *continues* with corresponding action to take for *each* criterion if the criterion is not met and includes corrective practices for handling, personal hygiene, equipment sanitation, food storage, and discarding food.

Identifying such items as the flow process of food, stating CCPs and criteria for control, monitoring and verifying, and specifying action to

HAZARD ANALYSIS CRITICAL CONTROL POINT FLOW PROCESS FOOD: CHICKEN SALAD

FLOW PROCESS	*CCP*	*CRITERIA FOR CONTROL*	*MONITOR & VERIFY*	*ACTION TO TAKE IF CRITERIA NOT MET*
Receive refrigerated whole chickens		-Maximum 45°F internal temperature	-Take internal meat temperature with metal stem thermometer	-Reject product
Store in Walk-in-Cooler (WIC)		-Maximum 45°F internal temperature	-Observe proper storage practices -Monitor air temperature each shift-record on log	-Store chicken in approved manner -Lower air temperature
		-Store chickens off floor -Prevent cross-contamination -Air temperature 40°F or less		
Boil chickens	CCP	-Minimum 165°F internal temperature of meat	-Take internal meat temperature -Observe cooking time	-Cook chicken until temperature is reached
Cool to debone (30 minutes in WIC)		-Do not cover chickens	-Observe storage in WIC	-Store chicken to allow rapid cooling to debone
Debone/dice chicken meat	CCP	-Clean hands or gloves used to handle meat	-Observe handling procedures -Inspect employee hands daily	-Instruct workers to wash hands or use gloves
		-No infected wounds or bandages on hands	-Observe proper cleaning of equipment	-Remove worker or require gloves -Have equipment rewashed
		-Wash and sanitize equipment used after completion		
Mix ingredients (mayo, sour cream, relish, spices, meat)		-Use utensils for mixing	-Observe use of utensils	-Correct practice
		-Limit time for preparation of meat salad – refrigerate when completed	-Measure time to complete preparation process	-Modify procedures to limit time at room temperature
		-Use refrigerated ingredients	-Observe use	-Change practice
Store 1/3 of salad in prep cooler	CCP	-Cool to 45°F within 4 hours after preparation	-Measure salad temperature periodically to determine cooling rate	-Remove excess salad from pan
Store 2/3 of salad in WIC (Use 1/2 each day at prep cooler)			-Lower air temperature	
		-Maximum 45°F internal temperature in storage	-Take internal temperature	-Store in coolest part of cooler
			-Measure depth of salad stored in pans	
		Store salad 3 inches or less in pans -Air temperature 40°F or less	-Monitor air temperature each shift – record on log	
Sell				
Discard after 3 days from preparation		-Old salad not mixed with fresh salad	-Observe storage process	-Correct practice
			-Observe salad discarded	-Discard salad
		-Discard remaining salad		

Fig. 19.6 HACCP flow process. Food: chicken salad (*Source:* Alvin Black, R.S. City of Farmers Branch, Environmental Health Division. Farmers Branch, TX)

take if the criteria are not met, all function to assist management in controlling the spread of disease. Applying an HACCP system to food manufacturing or the foodservice operation is an effective means of reducing the likelihood of foodborne illness. HACCP is so much more than inspection, and to be effective, it requires dedication and perseverance on the part of employees and management.

In *food manufacturing plants*, manufacturers must take steps to ensure that food is safe! They must do so, by law. As a result of taking those critical steps, only a *small* percentage of all foodborne illness cases is linked to poor processing practices. A *greater* number of cases are the result of faulty practices in foodservice operations and the home. Many state and local health departments have adopted rules for *foodservice establishments* also, requiring knowledge of foodborne illness and HACCP principles. These foodservice establishments include hospitals, restaurants, retail grocery stores, and schools.

HAZARD ANALYSIS CRITICAL CONTROL POINT FLOW PROCESS FOOD: BBQ RIBS

FLOW PROCESS	*CCP*	*CRITERIA FOR CONTROL*	*MONITOR & VERIFY*	*ACTION TO TAKE IF CRITERIA NOT MET*
Frozen beef ribs		-Received frozen	-Feel if frozen upon delivery	-Reject if thawed
Thaw in walk-in-cooler (WIC)		-Meat thawed under refrigeration	-Observe ribs stored in WIC	-Store ribs properly to prevent contamination or cross-contamination
		-Store meat off floor	-Observe proper storage practices	
		-Prevent cross-contamination		
Cook in oven (add BBQ sauce)	CCP	-Minimum 140°F internal temperature of ribs	-Take internal meat temperature with metal stem thermometer -Observe cooking time and oven temperature	-Cook ribs until temperature is reached
Hold at steam table with overhead heat lamp	CCP	-Minimum 140°F internal temperature	-Take temperature of meat every 2 hours – record on log	-Reheat ribs
				-Discard ribs if held below 130°F over 2 hours -Check equipment
Sell				
Leftover ribs cooled in WIC overnight	CCP	-Cool from 140° to 45°F within 4 hours	-Measure meat temperature periodically to determine cooling rate in WIC	-Remove excess ribs from pan
				-Lower air temperature
		-Store meat 3 inches or less in pans	-Measure depth of meat stored in pan	Remove covers
			-Monitor air temperature of WIC each shift-record on log	-Eliminate stacking
		-No tight cover during cooling process		-Move ribs to coolest part of WIC
			-Observe meat uncovered during cooling process	-Discard inadequately cooled ribs
		-Do not stack pans -Store meat close to fans in WIC -Air temperature 40°F or less		
Reheat in convention oven next morning	CCP	-Minimum 165°F internal temperature within 2 hours -Leftovers not mixed with fresh ribs	-Take internal meat temperature with metal stem thermometer -Observe reheating time and oven temperature	-Reheat meat until temperature is reached -Discard meat
		-Discard remaining ribs	-Observe meat discarded	
Steam table Sell		-Same instructions as above		
Discard by 6:00 p.m.		-Leftovers not mixed with fresh ribs -Discard remaining ribs	-Observe storage process -Observe meat discarded	-Correct practice -Discard meat

Fig. 19.7 HACCP flow process. Food: BBQ Ribs (*Source:* Alvin Black, R.S. City of Farmers Branch, Environmental Health Division. Farmers Branch, TX)

An example of HACCP plans for foodservice operations has been shown for chicken salad and BBQ beef ribs.

As well as the HACCP Flow Process charts mentioned, samples of *two written recipes* that incorporate the HACCP principles appear in Figs. 19.8 and 19.9. These recipes demonstrate ways in which a foodservice operation may include CCPs in preparation steps and flowcharts. For example, an acceptable method of defrosting, cooking, and holding is stated after labeling the preparation step as a CCP, and CCPs are highlighted in the flowcharts.

Today, *numerous* foods are processed in manufacturing plants (Table 19.5) and are distributed to operations such as retail grocery stores, hotels, restaurants, or institutional operations. These foods must provide assurance of food quality, including *microbiological (M), chemical (C), and physical (P)* safety, and have critical limits, including meeting all safety specifications prior to shipping, measuring temperatures of incoming and chilled ingredients with calibrated instruments, using microbiological tests for food contact surfaces and the environmental area, sanitizing equipment, storing, refrigerating palletizing products, distribution, and labeling.

A revised HACCP model designed by the FSIS has shown improvements in food safety. Young chicken plants have demonstrated a

Fig. 19.8 HACCP. Basic beef chili (*Source*: La Vella Food Specialists St. Louis, MO)

Basic Beef Chili

Ingredients	Amount	25	50	100
Lean Ground Beef	Lbs	7	14	28
Canned Tomatoes	Qts	1 ½	3	6
Canned Kidney Beans	Qts	1 ¾	3 ½	7
Tomato Paste	Cups	1 ¾	3 ½	7
Water	Gals	½	1	2
Dehydrated Onions	Ozs	1	2	4
Chili Powder	Tbsp	3	6	12
Sugar	Tbsp	1 ¼	2 ½	5
Cumin	Tbsp	2	4	8
Garlic Powder	Tbsp	1	2	4
Onion Powder	Tbsp	1	2	4
Paprika	Tbsp	1	2	4
Black Pepper	Tbsp	½	1	2

Preparation

1. **CCP** Thaw ground beef under refrigeration (41°F, maximum 1 day).

2. Place ground beef in steam kettle or in large skillet on stove top. Cook meat using medium high heat until lightly browned (15 minutes). While cooking, break meat into crumbs of about ½″ to ¼″ pieces.

3. Drain meat well, stirring while draining to remove as much fat as possible. If desired, pour hot water over beef and drain to remove additional fat.

4. Mash or grind canned tomatoes with juice. Add to kettle or stock pot with cooked ground beef. Add remaining ingredients to mixture and stir well.

5. **CCP** Simmer chili mixture for 1 hour, stirring occasionally. Temperature of cooked mixture must register 155°F or higher.

6. Remove from heat and portion into service pans.

7. **CCP** Cover and hold for service (140°F, maximum 1 hour).

8. Portion: 1 cup (8 ounces) per serving.

Service:

1. **CCP** Maintain temperature of finished product above 140°F during entire service period. Keep covered whenever possible. Take and record temperature of unserved product every 30 minutes. Maximum holding time, 4 hours.

Storage:

1. **CCP** Transfer unserved product into clean, 2-inch deep pans. Quick-chill. Cooling temperature of product must be as follows: from 140° to 70°F within 2 hours and then from 70° to 41°F or below, within an additional 4 hour period. Take and record temperature every hour during chill-down.

2. **CCP** Cover, label, and date. Refrigerate at 41°F or lower for up to 10 days (based on quality maintained) or freeze at 0°F for up to 3 months.

Reheating:

1. **CCP** Thaw product under refrigeration, if frozen (41°F).

2. **CCP** Remove from refrigeration, transfer into shallow, 2-inch deep pans and immediately place in preheated 350°F oven, covered. Heat for 30 minutes or until internal temperature reaches 165°F or above.

Discard unused product.

Chicken Stew

Ingredients	Amount	25	50	100
Chicken Pieces, 8 cut, frozen	Lbs	10	20	40
Carrots, fresh, peeled, cut in ¾ inch pieces	Lbs	2 ½	5	10
Onions, chopped	Qts	½	1	2
Potatoes, peeled, cut into ¾ inch pieces	Lbs	3 ¾	7 ½	15
Green Peas, frozen	Lbs	2	4	8
Margarine	Cups	½	1	2
Flour	Cups	1 ½	3	6
Chicken Stock	Qts	1	2	4
Salt	tsp	1	2	4
Pepper	tsp	1	2	4

Preparation

1. **CCP** Thaw raw chicken pieces under refrigeration (41°F, 1 day).

2. **CCP** Wash carrots, onions, and potatoes under cool running water. Cut as directed. Use immediately in recipe or cover and refrigerate until needed (41°F, maximum 1 day).

3. Place chicken pieces on sheet pans. Cover and bake in preheated 350°F conventional (325°F convection) oven for 30 minutes.

4. Cook potatoes, carrots, and peas separately in steamer or on stovetop, until tender (4–15 minutes).

5. Remove chicken from oven; dr ain off juices and fat. Place in 4 -inch deep steamtable pans, cover, and return to heated oven (while preparing gravy).

6. In stockpot over medium heat, melt margarine and sauté onions until tender. Add flour and stir until smooth. Add chicken drippings, s tirring well. Add chicken broth as needed for gravy-like consistency. Season with salt and pepper.

7. Add cooked vegetables and gravy to chicken pieces. Cover, place back in 350°F conventional (325°F convection) oven and bake for 30 minutes or until chicke n pieces are tender and sauce is flavorful.

8. **CCP** Internal temperature of cooked stew must register 165°F for 15 seconds at end of cooking process.

9. **CCP** Cover and hold for service (140°F, maximum 1 hour).

10. Portion: 1 –2 pieces of chicken, ½ cup vegeta bles with gravy (10 ounces) per serving

Service:

1. **CCP** Maintain temperature of finished product above 140°F during entire service period. Keep covered whenever possible. Take and record temperature of unserved product every 30 minutes. Maximum holding time, 4 hours.

Storage:

1. **CCP** Transfer unserved product into clean, 2 -inch deep pans. Quick -chill. Cooling temperatures of product must be as follows: from 140° to 70°F within 2 hours and then from 70° to 41°F or below, within an additional 4 hours. Take and record temperature every hour during chill-down.

2. **CCP** Cover, label, and date. Refrigerate at 41°F or lower for up to 10 days (based on quality maintained) or freeze at 0°F for up to 3 months.

Reheating:

1. **CCP** Thaw product under refrigeration, if frozen (41°F).

2. **CCP** Remove from refrigeration, transfer into shallow, 2 -inch deep pans and immediately place in preheated 350°F oven, covered. Heat for 30 minutes or until internal temperature reaches 165°F or above.

Discard unused product.

Fig. 19.9 HACCP. Chicken stew (*Source*: La Vella Food Specialists St. Louis, MO)

Table 19.5 Ingredients of refrigerated chicken salad (Pierson and Corlett) (Pierson & Corlett 1992)

CCP number	CCP description	Critical limit(s) description
1-MPC	Hazard controlled	1.1 Sanitary condition
	Microbiological, physical, and chemical	1.2 Refrig. material ≤45 °F
		1.3 Frozen material ≤32 °F
	Point or procedure: incoming inspection	1.4 Vendor met all safety specifications before shipping
2-T	Hazard controlled: microbiological	2.1 Material internal temperature not to exceed 45 °F
	Point or procedure: refrigerated	
	Ingredient storage	2.2 Calibrate temperature-measuring devices before shift
3-M	Hazard controlled: microbiological	3.1 Comply with USDA sanitation requirements
	Point or procedure: sanitation requirements in	
		3.2 Sanitation crew trained
	• Preparation area	3.3 Each area must pass inspection before shift start-up
	• Staging area	
	• Filling/packaging area	
	Hazard controlled	3.4 Food contact surface: microbiological test
	Point or procedure: *Listeria*	
		3.5 Environmental area: microbiological tests (USDA methodology for 3.4 and 3.5)
4-M	Hazard controlled: microbiological	Application of alternative approved treatments
	Point or procedure: controlled treatment to reduce microbiological contamination on raw celery and onions	
		4.1 Wash product with water containing
		• Chlorine, or
		• Iodine, or
		• Surfactants, or
		• No process additives
		4.2 Hot water or steam blanch followed by chilling
		4.3 Substitute processed celery or onions
		• Blanched frozen
		• Blanched dehydrated
		• Blanched canned
5-M	Hazard controlled: microbiological	5.1 Not to exceed 45 °F
	Point or procedure: chilled storage temperature of prepared celery, onions, and chicken	5.2 Refrigerator not to exceed 45 °F
		5.3 Daily calibration of temperature-measuring devices
6-MPC	Hazard controlled: microbiological, physical, and chemical	6.1 Physical barrier in place
	Point or procedure: physical barrier to prevent cross-contamination from raw material preparation area	6.2 Doors kept closed when not in use
		6.3 Color-coded uniforms
		6.4 Supervision in place
7-M	Hazard controlled: microbiological	7.1 Comply with USDA sanitation requirements

(continued)

Table 19.5 (continued)

CCP number	CCP description	Critical limit(s) description
	Point or procedure: cross-contamination prevention from transfer equipment from raw material area	7.2 Prevent entry of soiled pallets cart wheels, totes, and other equipment
8-M	Hazard controlled: microbiological	8.1 Time limit not to exceed 4 h for any materials in staging area
	Point or procedure: time limit for in-process food materials	
9-M	Hazard controlled: microbiological	9.1 Product pH must not exceed a pH of 5.5
	Point or procedure: maximum pH limit on finished salad before packaging	9.2 pH meter must be calibrated with approved standards before each shift
10-M	Hazard controlled: microbiological	10.1 Internal temperature not to exceed 45 °F
	Point or procedure: chilled product storage temperature and time before packaging	10.2 Product must not be held more than one shift before filling/packaging
11-P	Hazard controlled: physical	11.1 Ferrous metal detection device for individual packages
	Point or procedure: metal detector for packages	11.2 Calibration or inspection not to exceed every 4 h
12-M	Hazard controlled: microbiological	12.1 Physical barrier in place
	Point or procedure: physical barrier to prevent cross-contamination from warehouse area	12.2 Doors kept closed when not in use
		12.3 Color-coded uniforms
		12.4 Supervision in place
13-M	Hazard controlled: microbiological	13.1 Product internal temperature not to exceed 45 °F in 4 h
	Point or procedure: refrigerated storage of cased/palleted finished product	13.2 Temperature-measuring devices calibrated before shift
14-M	Hazard controlled: microbiological	14.1 Shipping compartments must be precooled to 45 °F or less before loading product
	Point or procedure: truck and shipping containers for distribution of finished product	
15-M	Hazard controlled: microbiological	15.1 Each package or bulk case shall have label instructions
	Point or procedure: label instructions	
		15.2 Each label shall include
		• Keep refrigerated
		• Code
		• Storage instructions

Source: Pierson MD, Corlett DA
HACCP principles and applications
M microbiological hazard, *P* physical hazard, *C* chemical hazard

greater achievement of performance standards in FSIS verification checks over traditional slaughter inspection (FSIS).

Using research data from testing in large plants over a 2-year period, the FSIS reports that there are substantial reductions in the prevalence of *Salmonella* compared to pre-HACCP baseline figures in raw meat and poultry.

Traditionally, lower moisture ingredients and grain-based products are not typically considered potentially hazardous foods. However, unless products are pasteurized, companies need to set up a plan

> that includes hazard identification and risk analysis from farm to fork to deal with potential food safety issues that may arise. (Kuntz 2012)

For more, see HACCP Principles & Application Guidelines. Last Updated: 03/15/2013 (Application Guidelines 1997).

Surveillance for Foodborne Disease Outbreaks

The FDA estimates of foodborne diseases have been reported to be in the tens of millions, while the actual report of cases to the CDC is in the thousands. Since all illnesses are *not* reported, the true number is unknown.

For more than a quarter century, since 1973, the CDC has maintained surveillance data regarding the occurrence and causes of foodborne disease outbreaks (FBDOs). Now, the CDC actively surveys emerging foodborne diseases. The Foodborne Diseases Active Surveillance Network (FoodNet) is the primary foodborne disease component of the CDC's Emerging Infections Program (EIP). It began in the mid-1990s with five states and now includes many more states, representing over 25.4 million persons (more than 10 % of the United States population).

"The Foodborne Diseases Active Surveillance Network, or FoodNet, has been tracking trends for infections commonly transmitted through food since 1996. FoodNet provides a foundation for food safety policy and prevention efforts. It estimates the number of foodborne illnesses, monitors trends in incidence of specific foodborne illnesses over time, attributes illnesses to specific foods and settings, and disseminates this information." (CDC.gov)

The tracking is an "active" reporting system where public health officials frequently contact laboratory directors for data that is then electronically transmitted to the CDC. It has five components as shown below:

- Active laboratory-based surveillance
- Survey of clinical laboratories
- Survey of physicians
- Survey of the population
- Epidemiologic studies

The reporting data is tabulated and appears several years after the occurrence of illness. Recent summary statistics are found at the CDC:

See http://www.cdc.gov/foodborneoutbreaks/outbreak_data.htm (CDC's Outbreak Response Team).

See http://www.cdc.gov/foodborneburden/PDFs/FACTSHEET_B_TRENDS.PDF (1996–2010).

The number of FBDOs is reported by state and territorial health departments to the CDC on a standard reporting form.

Various food safety CDC data in Morbidity and Mortality Weekly Report (MMWR) is in the following and is cited in relevant text material:

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6203a1.htm?s_cid=mm6203a1_w%22

> During 2009–2010, a total of 1,527 foodborne disease outbreaks (675 in 2009 and 852 in 2010) were reported, resulting in 29,444 cases of illness, 1,184 hospitalizations, and 23 deaths. Among the 790 outbreaks with a single laboratory-confirmed etiologic agent, norovirus was the most commonly reported, accounting for 42 % of outbreaks. *Salmonella* was second, accounting for 30 % of outbreaks.
> CDC.gov (Fig. 19.10)

Many individuals who become ill do *not* relate it to food consumption or report this incident to appropriate authorities. Therefore, perhaps only a small percentage of actual FBDOs are reported. Nonetheless, surveillance data provide "an indication of the etiologic agents, vehicles of transmission, and contributing factors associated with FBDO and help direct public health actions."

Persons most "at risk" for, or likely to become ill with, a foodborne illness include the elderly (the largest risk segment of the US population), pregnant and nursing women, school-age children, and infants. These are represented as "highly susceptible populations." As well, increasing numbers of persons testing positive

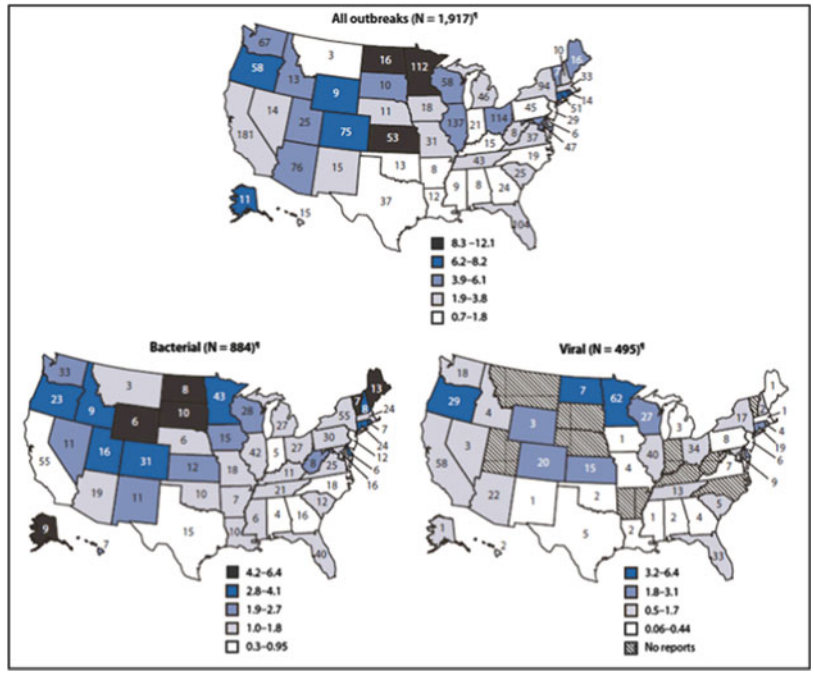


Fig. 19.10 Average annual rate of reported foodborne disease outbreaks per one million population and number of outbreaks, by state and major etiology group—Foodborne Disease Outbreak Surveillance System, United States, 2009–2010

for the human immunodeficiency virus (HIV), and persons with acquired immunodeficiency syndrome (AIDS), or persons with a weakened immune system due to pharmaceutical or radiological treatment are very susceptible to illness.

The growth of the *number* of persons at risk, coupled with a greater *number* of meals eaten away from home, provides *increasing* opportunities for the occurrence of foodborne illness. Controlling hazards and ensuring a safe food supply is possible through such methodologies as the use of an HACCP system and employee training. It is recommended that FSIS should seek authority to impose monetary penalties for violations and do a better job of monitoring test procedures (Food Eng 2000).

The CDC Guide to Confirming a Diagnosis in Foodborne Disease is located in:

http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm

http://www.cdc.gov/outbreaknet/

The USDA FSIS is *science-based* and responsible for "ensuring the quality of the nation's meat, poultry, and egg products is a process that is increasingly dependent upon science." They state, "learn more about how the agency is protecting public health through science."

Other Causes of Spoilage and Contamination

In addition to the biological, chemical, and physical hazards that may contaminate the food supply, enzymatic activity and exposure to excessive moisture spoil food. Pests also contaminate food, perhaps making it noticeably nonedible. Cockroaches and insects carry germs, and some insects regurgitate on food with their acidic saliva in order to break it down prior to ingestion. Rodents, for example, do not have bladders and may contaminate all surfaces with which they make contact.

Throughout the world, in developed and underdeveloped countries, food spoilage may be responsible for a lot of food waste. Diligence in care is a must. Depending upon resources and beliefs, preservation, the use of additives, and packaging (see appropriate chapters for each topic) are all methods that may be used for controlling undesirable spoilage or contamination.

For further study and exploration of disease related to foods, see *food toxicology*. One example is seen here: "**Food toxicology** is the study of

the nature, properties, effects, and detection of toxic substances in food, and their disease manifestation in humans. . . .including dose–response relationships, absorption of toxicants, distribution and storage of toxicants, biotransformation and elimination of toxicants, target organ toxicity, teratogenesis, mutagenesis, carcinogenesis, food allergy, and risk assessment. . .examine chemicals of food interest such as food additives, mycotoxins, and pesticides, and how they are tested and regulated . . . the etiology of foodborne disease related to naturally-occurring toxins and . . . the ecology of food." (The University of Idaho)

Responsibility for Food Safety

Governments, food companies, foodservice establishments, and consumers are each responsible for safe food. There are increasing numbers of "at-risk" populations that complicate the prevention of foodborne and waterborne illnesses. The food supply should be safe.

Governments around the world regulate their own food supply (Chap. 20) to assure its safety and wholesomeness, by fostering science-based regulation, inspection and enforcement services, education, and research. In the United States, the FDA and the USDA's FSIS have a history of providing their numerous, well-researched documents (also available on their websites) on foodborne illness and risk assessment to both the food manufacturer and consumer. Below is a .gov reference that becomes the resolve of consumers.

The *USDA* continues to collaborate with states and private companies to protect food. "Food safety remains top priority at USDA" (USDA Homeland Security). Food defense exercises are taking place throughout the United States to coordinate government, nongovernment, and the private sector alike.

The Food and Drug Center for Food Safety and Applied Nutrition cites seven critical hindrances to maintaining a sanitary operation. These areas include the aforementioned microorganisms: bacteria and mold; chemical contamination; pests including birds, insects, and rodents; and ignorance/carelessness. Thus, targeted employee training in these critical areas is crucial to food safety.

In the food *industry*, a loss of human life, loss of brand loyalty, or loss of the company itself may propel personnel to maintain the right attitude and do things right. Crisis management teams and crisis management plans must emphasize prevention.

Food manufacturing and processing industries, as well as foodservice operations, including hospitals, nursing homes, and restaurants, must comply with government regulations. For example, as a means of food protection, foods companies have reevaluated strategies to provide required plant sanitation and prevent product recalls. Increases in both time and financial resources allocated to food safety are apparent, as is the hiring of plant design engineers trained in sanitation (Van Milligen 2001).

Food processors including slaughterhouses are subject to close scrutiny from the FSIS so that there is no risk of mad cow disease in the nation's meat supply. Inspectors continually receive audits and training to ensure safety. Food safety websites provide the latest in food safety news and recall information consumer advice, instructions on reporting possible foodborne illnesses, and more. (http://www.foodsafety.gov/presidentscouncil)

The Center for Science in the Public Interest (CSPI) has the following to say regarding food safety (http://www.cspinet.org/foodsafety):

CSPI Mission Statement

Foodborne illness, commonly called "food poisoning," causes an estimated 48 million illnesses, 128,000 hospitalizations, and 3,000 deaths in the United States annually. These illnesses can range from troubling cases of nausea, vomiting, and diarrhea to life-threatening illnesses that require hospitalization. Most of these illnesses are entirely preventable with care throughout the food chain. From the farmer to the chef and from the food processor to the guy at

the grill, everyone has a role to play in making safe food.

Food safety is a key area of focus for the Center for Science in the Public Interest. **The mission of CSPI's Food Safety Program is to reduce the burden of foodborne illnesses.** We provide solid food safety advice to consumers on our website and in Nutrition Action Healthletter, and our staff of experts encourages policymakers, government regulators, and the food industry to work harder to protect American consumers from contaminated food.

The Food Safety Program's lawyers and public health researchers work with Congress and State legislatures to strengthen food safety laws and to provide funding for the federal agencies that protect our food supply and public health. We encourage the Food and Drug Administration and the U.S. Department of Agriculture to improve federal food safety programs and increase oversight of industry practices. We provide those agencies with our best thinking on food safety policy through petitions, comments, and participation in public hearings. We also communicate directly with industry leaders on ways they can ensure the safety of the food products they market.

The Food Safety Program provides useful, up-to-date research to the public, policymakers, and regulators on current and emerging food safety issues. CSPI's publication Outbreak Alert! is an ongoing compilation of foodborne illnesses and outbreaks, organized by food categories. It is used by scientists and policymakers around the world. CSPI's Food Safety Program has been in the forefront of advocating for a unified food safety system and for tougher laws governing meat, poultry, and seafood production.

Our work doesn't stop at the border. In an increasingly global marketplace, the Food Safety Program represents consumers at many international food safety meetings, and we manage the work of the International Association of Consumer Food Organizations (IACFO), which represents consumers in every world region.

CSPI

After initial passage of the "sweeping," new law implementation was slow to move according to Gannett News: (http://www.usatoday.com/story/news/nation/2012/12/15/promise-of-food-safety-law-largely-unfulfilled/1772261/)

As the President of a food safety and sanitation consulting firm noted, "Sanitation is an attitude, not a process." "The bulk of sanitation cannot be done during production, that's the way the rule is and that's not going to change" (Van Milligen 2001).

Also, food companies may literally move "sanitation" tasks from the third shift to the first or second shift, reflecting different priorities and the adoption of a greater emphasis on sanitation and the safety of their food products. Perhaps it is insufficient to just say that a food is safe. Data must support the claim.

In an article entitled "Why can't scientists communicate science?—poor media coverage and a lack of consumer education feed fear about our nation's food supply," an important question was raised. It asks the question ". . .how can an industry that can produce such bounty have a problem when it comes to communicating safety and efficiency?" Perhaps safety is not sensational enough for some media reporters. Yet, there might not be anything wrong with "touting your own success" or "blowing your own horn" to tell the public how good things are in science and technology and food safety. "Our food supply is potentially the healthiest in the world. We should tell people how we do it" (Stier 2006).

*Consumer*s must ultimately be responsible for the consumption of safe foods that they themselves prepare or that are processed/prepared by others in the food supply. The consumer must be vigilant and become educated on matters concerning food safety because it may be literally in the hands of the food handler!

The large body of food and nutrition professionals, represented by The Academy of Nutrition and Dietetics, has stated the following:

> . . . the public has the right to a safe food and water supply. The Association supports collaboration among dietetics professionals, academics, and representatives of the food industry and appropriate government agencies to ensure the safety of the food and water supply by providing education to the public and industry, promoting technological innovation and applications, and supporting further research. (AND)

More specifically, "Clean, Separate, Cook, Chill" advice from previous chapters now follows with detail that is appropriate in this chapter.

Food Safety Advice

Clean: Wash Hands and Surfaces Often

Bacteria can be spread throughout the kitchen and get onto hands, cutting boards, utensils, counter tops, and food.

- Wash your hands with warm water and soap for at least 20 s before and after handling food and after using the bathroom or changing diapers.
- Wash your hands after playing with pets or visiting petting zoos.
- Wash your cutting boards, dishes, utensils, and counter tops with hot soapy water after preparing each food item and before you go on to the next food.
- Consider using paper towels to clean up kitchen surfaces. If you use cloth towels, wash them often in the hot cycle of your washing machine.
- Rinse fresh fruits and vegetables under running tap water, including those with skins and rinds that are not eaten.
- Rub firm-skinned fruits and vegetables under running tap water or scrub with a clean vegetable brush while rinsing with running tap water.
- Keep books, backpacks, or shopping bags off the kitchen table or counters where food is prepared or served.

Separate: Don't Cross Contaminate

Cross-contamination is how bacteria can be spread. When handling raw meat, poultry, seafood, and eggs, keep these foods and their juices away from ready-to-eat foods. Always start with a clean scene—wash hands with warm water and soap. Wash cutting boards, dishes, countertops, and utensils with hot soapy water.

- Separate raw meat, poultry, seafood, and eggs from other foods in your grocery shopping cart, grocery bags, and in your refrigerator.
- Use one cutting board for fresh produce and a separate one for raw meat, poultry, and seafood.
- Use a food thermometer, which measures the internal temperature of cooked meat, poultry, and egg dishes, to make sure that the food is cooked to a safe internal temperature.
- Never place cooked food on a plate that previously held raw meat, poultry, seafood, or eggs.

Cook: Cook to Proper Temperatures

Food is safely cooked when it reaches a high enough internal temperature to kill the harmful bacteria that cause foodborne illness. Use a food thermometer to measure the internal temperature of cooked foods.

- Use a food thermometer, which measures the internal temperature of cooked meat, poultry, and egg dishes, to make sure that the food is cooked to a safe internal temperature.
- Cook beef roasts and steaks to a safe minimum internal temperature of 145 °F. Cook pork to a minimum of 160 °F. All poultry should reach a safe minimum internal temperature of 165 °F throughout the bird, as measured with a food thermometer.

- Cook ground meat to 160 °F. Information from the Centers for Disease Control and Prevention (CDC) links eating undercooked ground beef with a higher risk of illness. Remember, color is not a reliable indicator of doneness. Use a food thermometer to check the internal temperature of your burgers.
- Cook eggs until the yolk and white are firm, not runny. Don't use recipes in which eggs remain raw or only partially cooked. Casseroles and other dishes containing eggs should be cooked to 160 °F.
- Cook fish to 145 °F or until the flesh is opaque and separates easily with a fork.
- Make sure there are no cold spots in food (where bacteria can survive) when cooking in a microwave oven. For best results, cover food and stir and rotate for even cooking. If there is no turntable, rotate the dish by hand once or twice during cooking.
- Bring sauces, soups, and gravy to a boil when reheating. Heat other leftovers thoroughly to 165 °F.
- Use microwave-safe cookware and plastic wrap when cooking foods in a microwave oven.

Chill: Refrigerate Promptly!

Refrigerate foods quickly because cold temperatures slow the growth of harmful bacteria. Do not overstuff the refrigerator. Cold air must circulate to help keep food safe. Keeping a constant refrigerator temperature of 40 °F or below is one of the most effective ways to reduce the risk of foodborne illness. Use an appliance thermometer to be sure the temperature is consistently 40 °F or below. The freezer temperature should be 0 °F or below.

- Refrigerate or freeze meat, poultry, eggs, and other perishables as soon as you get them home from the store.
- Never let raw meat, poultry, eggs, cooked food, or cut fresh fruits or vegetables sit at room temperature more than 2 h before putting them in the refrigerator or freezer (1 h when the temperature is above 90 °F).
- Never defrost food at room temperature. Food must be kept at a safe temperature during thawing. There are three safe ways to defrost food: in the refrigerator, in cold water, and in the microwave using the defrost setting. Food thawed in cold water or in the microwave should be cooked immediately.
- Always marinate food in the refrigerator.
- Divide large amounts of leftovers into shallow containers for quicker cooling in the refrigerator.
- Use or discard refrigerated food on a regular basis.

FDA, USDA, NOAA Statements on Food Safety

See http://www.fda.gov/newsevents/publichealthfocus/ucm248257.htm.

- The United States enjoys one of the world's safest food supplies. The U.S. Food and Drug Administration (FDA), the U.S. Department of Agriculture (USDA), and the National Oceanic and Atmospheric Administration (NOAA), working with the U.S. Customs and Border Protection, have systems in place to assure that our food supply, both domestic and imported, is safe to eat.

- If the government has any reason to believe that food coming into or produced in the United States has been tainted, we will keep it from entering into the stream of commerce.
- FDA has jurisdiction over 80 % of the food supply, including seafood, dairy, and produce. USDA regulates meat, poultry, and processed egg products, while FDA regulates all other food products.

FDA's Core Messages

- FDA has a team of more than 900 investigators and 450 analysts in the Foods program who conduct inspections and collect and analyze product samples.
- Altogether, FDA screens all import entries and performs multiple analyses on about 31,000 import product samples annually. During Fiscal Year (FY) 2010, the Agency performed more than 175,000 food and feed field exams and conducted more than 350 foreign food and feed inspections.
- FDA works to inspect imports that may pose a significant public health threat by carrying out targeted risk-based analyses of imports at the points of entry.
- If unsafe products reach our ports, FDA's imports entry reviews, inspections, and sampling at the border help prevent these products from entering our food supply.
- Although FDA doesn't physically inspect every product, the Agency screens shipments of imported foods products before they reach our borders. Based on Agency risk criteria, an automated system alerts FDA to any concerns. Then inspectors investigate further and, if warranted, do a physical examination of the product.
- FDA also works cooperatively with U.S. Customs and Border Protection and other agencies to help identify shipments that may pose a threat.

NOAA's Core Messages

- Less than 2 % of the seafood consumed in the United States is imported from Japan.
- Federal seafood safety experts, including FDA and NOAA, are working together to closely monitor the situation in Japan. These experts will continue to ensure that imported seafood remains safe.
- In the unlikely scenario that airborne pollutants could affect the US fishermen or fish landed in the United States, NOAA will work with the FDA to ensure frequent testing of seafood caught in those areas, and inspection of facilities that process and sell seafood from those areas.

USDA's Core Messages

- USDA ensures the safety of meat, poultry, and processed egg products both domestically and from countries approved to export product to the United States.
- Since April 21, 2010, Japan has not been eligible to export raw beef products, which have been the only USDA-regulated products they had exported to the United States prior to April 2010.
  - USDA issued an import alert that banned importation of commodities from Japan that could harbor Foot and Mouth Disease virus.

10 tips
Nutrition Education Series

be food safe

10 tips to reduce the risk of foodborne illness

A critical part of healthy eating is keeping foods safe. Individuals in their own homes can reduce contaminants and keep food safe to eat by following safe food handling practices. Four basic food safety principles work together to reduce the risk of foodborne illness—**Clean, Separate, Cook, and Chill**. These four principles are the cornerstones of Fight BAC!®, a national public education campaign to promote food safety to consumers and educate them on how to handle and prepare food safely.

CLEAN

1 wash hands with soap and water

Wet hands with clean running water and apply soap. Use warm water if it is available. Rub hands together to make a lather and scrub all parts of the hand for 20 seconds. Rinse hands thoroughly and dry using a clean paper towel. If possible, use a paper towel to turn off the faucet.

2 sanitize surfaces

Surfaces should be washed with hot, soapy water. A solution of 1 tablespoon of unscented, liquid chlorine bleach per gallon of water can be used to sanitize surfaces.

3 clean sweep refrigerated foods once a week

At least once a week, throw out refrigerated foods that should no longer be eaten. Cooked leftovers should be discarded after 4 days; raw poultry and ground meats, 1 to 2 days.

4 keep appliances clean

Clean the inside and the outside of applicances. Pay particular attention to buttons and handles where cross-contamination to hands can occur.

5 rinse produce

Rinse fresh vegetables and fruits under running water just before eating, cutting, or cooking. Even if you plan to peel or cut the produce before eating, it is important to thoroughly rinse it first to prevent microbes from transferring from the outside to the inside of the produce.

SEPARATE

6 separate foods when shopping

Place raw seafood, meat, and poultry in plastic bags. Store them below ready-to-eat foods in your refrigerator.

7 separate foods when preparing and serving

Always use a clean cutting board for fresh produce and a separate one for raw seafood, meat, and poultry. Never place cooked food back on the same plate or cutting board that previously held raw food.

COOK AND CHILL

8 use a food thermometer when cooking

A food thermometer should be used to ensure that food is safely cooked and that cooked food is held at safe temperatures until eaten.

9 cook food to safe internal temperatures

One effective way to prevent illness is to check the internal temperature of seafood, meat, poultry, and egg dishes. Cook all raw beef, pork, lamb, and veal steaks, chops, and roasts to a safe minimum internal temperature of 145 °F. For safety and quality, allow meat to rest for at least 3 minutes before carving or eating. Cook all raw ground beef, pork, lamb, and veal to an internal temperature of 160 °F. Cook all poultry, including ground turkey and chicken, to an internal temperature of 165 °F (www.isitdoneyet.gov).

10 keep foods at safe temperatures

Hold cold foods at 40 °F or below. Keep hot foods at 140 °F or above. Foods are no longer safe to eat when they have been in the danger zone between 40-140 °F for more than 2 hours (1 hour if the temperature was above 90 °F).

USDA United States Department of Agriculture
Center for Nutrition Policy and Promotion

Go to www.ChooseMyPlate.gov for more information.
Go to www.fsis.usda.gov for food safety information.

DG TipSheet No. 23
October 2012

  - Japan has not exported any beef products to the United States for nearly a year.
- Japan is not eligible to export any poultry products or processed egg products to the United States since USDA has not determined Japan to be equivalent in these two commodities.

Also see:

- ***FDA—Keep It Safe to Eat:***
  - Separate raw, cooked and ready-to-eat foods.
  - Do not wash or rinse meat or poultry. Wash cutting boards, knives, utensils and counter tops in hot soapy water after preparing each food item and before going on to the next one.
  - Store raw meat, poultry and seafood on the bottom shelf of the refrigerator so juices don't drip onto other foods.
  - Cook foods to a safe temperature to kill microorganisms. Use a meat thermometer, which measures the internal temperature of cooked meat and poultry, to make sure that the meat is cooked all the way through.
  - Chill (refrigerate) perishable food promptly and defrost foods properly. Refrigerate or freeze perishables, prepared food and leftovers within 2 h.
  - Plan ahead to defrost foods. Never defrost food on the kitchen counter at room temperature. Thaw food by placing it in the refrigerator, submerging air-tight packaged food in cold tap water (change water every 30 min), or defrosting on a plate in the microwave.
  - Avoid raw or partially cooked eggs or foods containing raw eggs and raw or undercooked meat and poultry.
  - Women who may become pregnant, pregnant women, nursing mothers, and young children should avoid some types of fish and eat types lower in mercury.—FDA

Keeping food safety in the mix is what product developers can and should do (Kuntz 2012).

Sanitizing in the Workplace

Having already discussed many aspects of food safety, in the following there will be an emphasis on proper sanitizing and its documentation in food production. It can be seen that proper temperature is crucial to food safety.

In addition to the importance of temperature control for food handling, it is also of great significance in warewashing. There are *manual* sinks for washing, rinsing, and sanitizing dishes and utensils with or without right or left drain boards off to one side. The sink is two- and three-compartment with hot water or chemical means of sanitizing (one-compartment sinks are more of a *prep* sink). As well, there are many sizes and styles of *automatic* dish machines—including both high-temperature and low-temperature dishwashers. There are also pot washing sinks, spray bottles, and buckets of sanitizing agents—all capable of cleaning and sanitizing jobs in the food preparation workplace. Each has its own strength, time, and temperature requirement.

The following are some examples of useful tools that may be utilized as a means of controlling disease in the important tasks of temperature regulation in cooking and cleaning. See Figs. 19.11 and 19.12.

It is crucial to move the food, especially phf's quickly through the food facility, and to follow the principle of proper stock rotation—first-in-first-out, or FIFO. Product "use-by" date stickers available in multiple languages and styles may adhere to a food product and easily dissolve to come off of the container when a food container is washed.

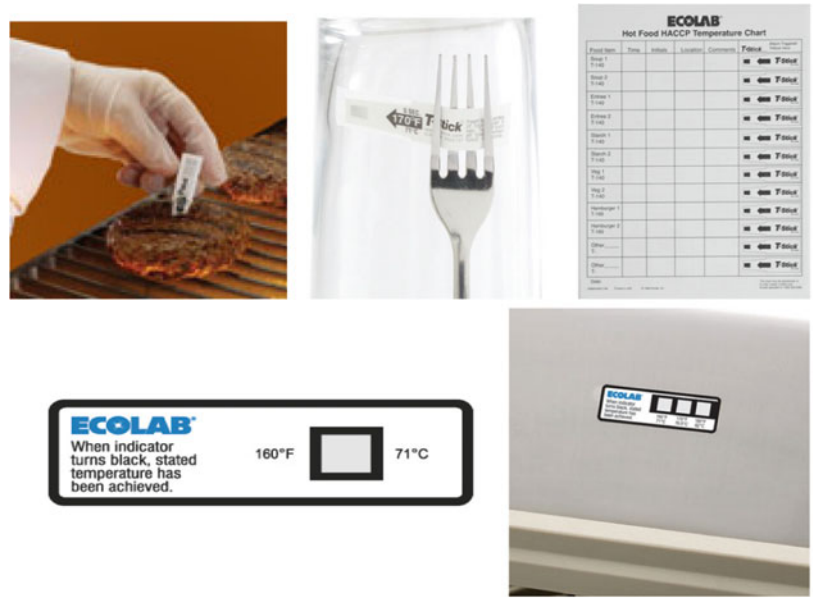


Fig. 19.11 Various means of temperature checks for controlling food safety. ECOLAB Eagan, MN. http://www.FoodSafetySolutions.com

Fig. 19.12 Example of paper thermometer (dishwasher temperature labels) to adhere to items in dish machine. Copyright © Paper Thermometer Company. All rights reserved

Labeling as a Means of Assuring Food Safety

Dating

Other than product dissolvable labels, placed by food-handling personnel, open dates may be placed by food processors on the food package. This provides the end user with information regarding optimum time periods to keep foods on hand. However, dating is not a guarantee against spoilage or harmful contamination. Personnel in processing and foodservice operations, as well as consumers, must observe foods for any possible deterioration and not use damaged products.

Open date labeling is *mandatory* for dairy products, but other foods may *voluntarily* have open date labeling. Foods may also display a *code date*, which can be read only by the manufacturer. Some examples of the types of dating that may appear on foods include the following:

- **"Best if used by" date**—informs consumers of the food's optimal period for retention of high quality.
- **Expiration date**—indicates a deadline for recommended use.
- **Pack date**—indicates when the food was packaged.
- **Pull date**—signifies the last day the food may be sold as fresh. All food products should be made available for use only within established time frames.

USDA Meat & Poultry Hotline 1-888-MPHotline (1-888-674-6854)

"The Food Safety and Inspection Service (FSIS) is the public health agency in the U.S. Department of Agriculture responsible for ensuring that the nation's commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged."

Food Safety Information USDA: FSIS

Food Product Dating

"Sell by Feb 14" is a type of information you might find on a meat or poultry product. Are dates required on food products? Does it mean the product will be unsafe to use after that date? Here is some background information which answers these and other questions about product dating.

What is dating?

"Open Dating" (use of a calendar date as opposed to a code) on a food product is a date stamped on a product's package to help the store determine how long to display the product for sale. It can also help the purchaser to know the time limit to purchase or use the product at its best quality. It is not a safety date. After the date passes, while not of best quality, the product should still be safe if handled properly and kept at 40 °F or below for the recommended storage times listed on the chart (see below).

If product has a "use-by" date, follow that date.

If product has a "sell-by" date or no date, cook or freeze the product by the times on the chart below.

Is dating required by federal law?

Except for infant formula (see below), product dating is not generally required by Federal regulations. However, if a calendar date is used, it must express both the month and day of the month (and the year, in the case of shelf-stable and frozen products). If a calendar date is shown, immediately adjacent to the date must be a phrase explaining the meaning of that date such as "sell by" or "use before." There is no uniform or universally accepted system used for food dating in the United States. Although dating of some foods is required by more than 20 states, there are areas of the country where much of the food supply has some type of open date and other areas where almost no food is dated.

What types of food are dated?

Open dating is found primarily on perishable foods such as meat, poultry, eggs and dairy products. "Closed" or "coded" dating might appear on shelf-stable products such as cans and boxes of food.

Types of Dates

- A "Sell-By" date tells the store how long to display the product for sale. You should buy the product before the date expires.
- A "Best if Used By (or Before)" date is recommended for best flavor or quality. It is not a purchase or safety date.

- A "Use-By" date is the last date recommended for the use of the product while at peak quality. The date has been determined by the manufacturer of the product.
- "Closed or coded dates" are packing numbers for use by the manufacturer.

Safety After Date Expires

Except for "use-by" dates, product dates don't always refer to home storage and use after purchase. "Use-by" dates usually refer to best quality and are not safety dates. But even if the date expires during home storage, a product should be safe, wholesome and of good quality if handled properly and kept at 40 °F or below.

See the accompanying refrigerator charts for storage times of dated products. If product has a "use-by" date, follow that date. If product has a "sell-by" date or no date, cook or freeze the product by the times on the chart below.

Foods can develop an off odor, flavor or appearance due to spoilage bacteria. If a food has developed such characteristics, you should not use it for quality reasons. If foods are mishandled, however, foodborne bacteria can grow and cause foodborne illness—before or after the date on the package. For example, if hot dogs are taken to a picnic and left out several hours, they might not be safe if used thereafter, even if the date hasn't expired.

Other examples of potential mishandling are products that have been: defrosted at room temperature more than 2 h; cross contaminated; or handled by people who don't use practice sanitation. Make sure to follow the handling and preparation instructions on the label to ensure top quality and safety.

Dating Infant Formula

Federal regulations require a "use-by" date on the product label of infant formula under FDA inspection.

What do can codes mean?

Cans must exhibit a packing code to enable tracking of the product in interstate commerce. This enables manufacturers to rotate their stock as well as to locate their products in the event of a recall. These codes, which appear as a series of letters and/or numbers, might refer to the date or time of manufacture. They aren't meant for the consumer to interpret as "use-by" dates. There is no book or website that tells how to translate the codes into dates. Cans may also display "open" or calendar dates. Usually these are "best if used by" dates for peak quality. In general, high-acid canned foods such as tomatoes, grapefruit and pineapple will retain best quality on the shelf for 12–18 months; low-acid canned foods such as meat, poultry, fish and most vegetables will retain best quality on the shelf for 2–5 years—if the can remains in good condition and has been stored in a cool, clean, dry place.

Dates on Egg Cartons

Use of either a "Sell-by" or "Expiration" (EXP) date is not federally required, but may be State required, as defined by the egg laws in the State where the eggs are marketed. Some State egg laws do not allow the use of a "sell-by" date. Many eggs reach stores only a few days after the hen lays them. Egg cartons with the USDA grade shield on them must display the "pack date" (the day that the eggs were washed, graded, and placed in the carton). The number is a three-digit code that represents the consecutive day of the year starting with January 1 as 001

and ending with December 31 as 365. When a "sell-by" date appears on a carton bearing the USDA grade shield, the code date may not exceed 45 days from the date of pack.

Always purchase eggs before the "Sell-By" or "EXP" date on the carton. After the eggs reach home, refrigerate the eggs in their original carton and place them in the coldest part of the refrigerator, not in the door. For best quality, use eggs within 3–5 weeks of the date you purchase them. The "sell-by" date will usually expire during that length of time, but the eggs are perfectly safe to use.

UPC or Bar Codes

Universal Product Codes appear on packages as black lines of varying widths above a series of numbers. They are not required by regulation but manufacturers print them on most product labels because scanners at supermarkets can "read" them quickly to record the price at checkout.

Bar codes are used by stores and manufacturers for inventory purposes and marketing information. When read by a computer, they can reveal such specific information as the manufacturer's name, product name, size of product and price. The numbers are not used to identify recalled products. . .." (**fsis.usda.gov**)

Regarding labeling, a "clean" label, on a product line is: ". . . its ability to offer a clean label and broad-spectrum solution without impacting the sensory characteristics of the target food or beverage." For example, in combating mold, yeast, and bacteria, applications of a natural antimicrobial ". . . proved a more effective shelf-life enhancer than sodium benzoate and potassium sorbate, while also improving the overall flavor profile of the tested formulas" (Food Product Design 2012).

Allergen-Free Labeling

Allergens are an issue that relates to food safety (Chap. 20). The FDA is responsible for ingredient labeling and has given notice to food processors that exemptions from ingredient labeling would not be tolerated. A food product must contain what it states on the label, and it should *not* contain an ingredient it does *not* disclose. Life-threatening allergens must be reported on the food label, and in uncertain cases, statements such as "may contain" are displayed as a safeguard.

The eight major foods to which people have allergies include milk, eggs, peanuts, tree nuts (e.g., almonds, cashews), soy, wheat, fish, and shellfish. These are responsible for 90 % of food allergic reactions and therefore represent ingredients that should thus be isolated in the production process. Severe allergic reactions can cause anaphylaxis or death (Food Allergy Network) (J Am Diet Assoc 2000). Food safety is being redefined to include allergen-free and pathogen-free (Higgins 2000).

If an allergen is detected following product distribution, product recalls may be necessary. Doing things right the first time is a more sensible alternative! Either an independent lab or allergen test kits may authenticate that products are allergen-free. Testing is part of industry's GMPs.

According to the Director of the Office of Scientific Analysis and Support at FDA's Center for Food Safety and Applied Nutrition, ". . . both FDA and food companies are looking harder for allergens. . .allergic consumers are becoming more aware of the allergens in foods, and . . . [there are] improved allergen-detection methods (FDA)."

Some of the best practices for allergen control relate to the following:

- R&D/product development
- Engineering and system design with dedicated production lines
- Vendor certification of raw materials and ingredients
- Production scheduling to include longer production runs
- Rework segregated
- Labeling and packaging with the right product going into the right package and ingredients listing to match the actual food product!
- Sanitation. An HACCP-like approach
- Training (Morris 2002)

Conclusion

"I just want to eat" says the consumer! The consumer expects safe food and protection from microbial, chemical, and physical hazards to the food supply. They do not expect to have food safety be an issue for them to experience. Yet, foodborne illness *may be* their experience. Unfortunately, illness could originate from bacteria, viruses, molds, parasites, and naturally occurring chemicals in food (such as toxins), accidental chemical contamination, toxic levels of additives or preservatives, and foreign objects. That illness may severely or fatally impact the health and welfare of a food company, hospital, restaurant, or them as the consumer—even at home.

The HACCP is a food safety system that focuses on foodborne disease prevention and ensures a greater likelihood of food safety. Various segments of the food industry apply the HACCP system of food protection to their handling of hazardous ingredients. HACCP team members promote food safety by assessing potential hazards in the flow of foods through their operation and by establishing limits or controls for the identified hazards. HACCP is applied to all steps of handling, including processing, packaging, and distribution. This same process may be followed by foodservice operations.

The CDC monitors and reports FBDOs. See Fig. 19.4. Open and code dating are utilized. Food allergens are monitored by the FDA. It is the consumer (the one who consumes!) who must ultimately be responsible for the consumption of safe foods.

Simulated food defense including training exercises with all levels of the government, non-government agencies, and the private sector allow better preparation for, and protection against, possible contamination of the food supply from terrorist threats. Bioterrorism preparedness training is crucial to food science and foodservice professionals (http://www.usda.gov/homelandsecurity). See more in chapter addendum.

The USDA FSRIO has created a website for the general public and food safety researchers. The site contains educational, professional, and foreign government links for food safety (http://www.nal.usda.gov/fsrio).

Addendum

Bioterrorism Threat to Food Safety

Responsibility for food safety has been discussed. Specifically, agencies related to food safety and emergency preparedness are American Red Cross, CDC, FEMA, FDA, OSHA, USDA, and state and local agencies. Several agency reports are cited below. Needless to say the agencies are no replacement for personal vigilance.

The Bioterrorism Preparedness and Response Act of 2002 ("the Bioterrorism Act") was issued and contained the following:

> The events of Sept. 11, 2001, reinforced the need to enhance the security of the United States. Congress responded by passing the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (the Bioterrorism Act), which President Bush signed into law June 12, 2002.

http://www.fda.gov/oc/bioterrorism/bioact.html

The Bioterrorism Act is divided into five titles:

The FDA is responsible for carrying out certain provisions of the Bioterrorism Act, particularly Title III, Subtitle A (Protection of Food Supply) and Subtitle B (Protection of Drug Supply).

In the interim final rule reported on September 28, 2005, registration of food facilities is required. The rule requires domestic and foreign facilities that manufacture, process, pack, or hold food for consumption in the United States to register with FDA.

The FDA answers some consumer questions on issues of food safety and terrorism, such as on September 11, 2001. The discussion appears in the following website:

- http://www.cfsan.fda.gov/~dms/fsterrqa.html

The USDA is also charged with the duty of protecting the nation's food supply from terrorist threats. Dr. Richard Raymond, USDA Undersecretary for food safety states "We remain steadfast in our commitment to work with our federal, state and private sector partners so that we can keep or agricultural commodities safe."

The USDAs FSIS celebrated 100 years of protecting consumers, "As we stand on the threshold of the second century of ensuring the safety of America's meat, poultry and egg products, we take pride in our achievements in public health protection and look forward to strengthening our commitment to safeguarding future generations." (Agriculture Deputy Secretary Chuck Conner. USDA)

The USDA has said:

- "Forming the USDA's Homeland Security Council was the first step in a series of organizational changes aimed at improving the Department's ability to perform homeland security-related activities."—former Secretary Ann M. Veneman, Statement—September 9, 2003

An interesting USDA article entitled "Keeping Food Safe During an Emergency" may be seen at the following address:

- http://www.fsis.usda.gov/fact_sheets/keeping_food_Safe_during_an_emergency/index.asp (Keeping Food Safe During an Emergency)

The CDC includes information on Biological and Chemical Terrorism:

http://www.bt.cdc.gov/agent/agentlist-category.asp

For various biologic agents, causes, systems affected, routes of transmission, and stages of clinical presentation, also in Spanish, locate agents alphabetically A–Z or by category A, B, and C:

- http://www.cdc.gov/mmwr/preview/mmwrhtml/rr4904a1.htm

The International Foodservice Distributors Association (IFDA, Mclean, VA) has the following to say regarding vigilance and food safety since September 11 attacks:

"The intent of those who store and deliver food for foodservice operations is to prevent or minimize the potential for attacks on the food supply. Their aim is to have a safe and secure system. Each individual program should be equipped to minimize threats "to the greatest extent possible."

For foodservice operations, deliveries and Memorandum of Understandings (MOUs) are significant. They greatly assist in emergencies.

MOU's are ... written agreements are used to specify what is transported, when, to where, and so forth. Foodservice Distributors serving the healthcare industry and/or others may provide arrangements for the provision of food and food related products (including bottled drinking water)."

Another reference for Bioterrorism threats and food safety is two bioterrorism training computer modules (UTHSCSA) related to food safety. The modules contain the following information:

"If/when disasters and emergencies happen, the foodservice operation must be prepared. As best as possible, all contamination should be prevented; the foods should be comforting, aligned with culture, ethnicity, religion, nutrition and so forth. Everyday practice of precautions, or "the right way" to do something in a non-emergency situation, lessens any panic in an emergency!" (University of Texas Health Science Center San Antonio (UTHSCSA))

> The professionals agree that even the best-laid plans and training will not address all situations. The key factor in addressing unexpected situations is to maintain a calm demeanor; make decisions, whether they are right or wrong; and be flexible in changing the decisions that do not work (Cody 2002)

Some relevant food science facts appear below:

Terrorism and Food Science

Relevant Food Science Facts

Government Agencies Protecting the Food Supply

- Emergency preparedness has been increased following 9/11.
- Students in Nutrition, Dietetics (RD), Food Science, and Culinary Arts are expected to "expect the unexpected" and follow all rules and regulations and current information of governmental agencies such as the FDA, USDA, FEMA, CDC, and health departments.

Food Processing

- Processors, both consumers at home and corporations, must protect foodstuffs that they are processing.
- Foods are protected against hazardous external conditions by canning, etc..

Food Safety and Spoilage

- Foods may become contaminated by hazards including biological, chemical, or physical. Prevention of hazards is a key to food safety.
- Microbiological hazards include bacteria, viruses, fungi, and parasites.
- Specific bacteria are listed in the CDC website.
- Control measures for bacterial hazards include proper temperatures for storage, cooking, and holding with avoidance of the TDZ, eliminating all cross-contamination; practice meticulous personal hygiene.
- Chemical hazards include intentional and unintentional substances and may be accidental, additives, toxic metals, or toxic substances.
- Physical hazards are foreign objects in food. They may harm health, cause psychological trauma or dissatisfaction, and must not be viewed merely as a manufacturing inconvenience. (University of Texas Health Science Center San Antonio (UTHSCSA))

Shelf Life of Foods for Storage (FEMA)

General guidelines for rotating common emergency foods:

Use within 6 months:

- Powdered milk (boxed)
- Dried fruit (in metal container)
- Dry, crisp crackers (in metal container)
- Potatoes

Use within 1 year:

- Canned condensed meat and vegetable soups
- Canned fruits, fruit juices, and vegetables
- Ready-to-eat cereals and uncooked instant cereals (in metal containers)
- Peanut butter
- Jelly
- Hard candy, chocolate bars, and canned nuts

May be stored indefinitely (in proper containers and conditions):

- Wheat
- Vegetable oils
- Corn
- Baking powder
- Soybeans
- Instant coffee, tea
- Cocoa
- Salt

- Noncarbonated soft drinks
- White rice
- Bouillon products
- Dry pasta
- Powdered milk (in nitrogen-packed cans)

Safety Considerations

- In a workplace that is equipped for emergency preparedness, there must be a constant check and consideration for safety.
- Safety may be threatened by accidental and intentional activities.
- In-house regulation by Safety Committee or an outside agency contributes to the regulation of safety in the foodservice
- Intentional bioterrorist attack may introduce foreign objects into the workplace.
- Questionable chemicals should not be used or handled, and suspect persons or packages should be reported." (University of Texas Health Science Center San Antonio (UTHSCSA))

Mildred M. Cody, PhD, RD, author of the American Dietetic Association's Food Safety for Professionals, agrees that adhering to basic food safety behaviors will help reduce the risk of foodborne illnesses. However, considering the fact that a bioterrorism attack would be silent and the effects might not be visible for several days, Cody also emphasizes following these additional standard food safety guidelines on a day-by-day basis (Cody 2002):

- Accept only food from reputable vendors to take advantage of public controls from regulatory agencies
- Check for intact packaging

Wash cans before opening to keep debris from can lids from falling into foods."

"In the case of water for drinking, cooking or cleaning, it is essential that it is safe. Some FEMA suggestions for purified water follow, however there may still be some dangerous chemical or physical residue.

- Boiling . . .
- Chlorination uses liquid chlorine bleach (5.25 % sodium hypochlorite as the only ingredient) to kill microorganisms. . .
- Purification tablets release chlorine or iodine . . . (FEMA)

"In addition to provisions for the work environment, Cody advises individuals to keep 3 days or more worth of food, water (One gallon of water [drinking] per person per day) and prescription medicine available, because while safe food and water will be made available after a bioterrorism emergency, the distribution of these items may take some time to coordinate and organize.

As reported by Puckett and Norton, ideas for training within the disaster plan of a foodservice operation include:

Review of plans and employee duties before, during and after an emergency
Security procedures
Location of water, food, emergency supplies, first aid supplies, fire fighting equipment, water purification system, key employees
Safe food handling
Sanitizing procedures
Record keeping
Physical layout of the foodservice area and entire facility
Physical security
ID badges
Important names and numbers, including vendor data" (Puckett and Norton 2003)

For More Information

- Congressional Inquiries: (202) 720-3897
- Constituent Inquiries: (202) 720-8594
- USDA Meat and Poultry Hotline: (800) 535-4555 or (202) 720-3333
- Consumer Inquiries: Call USDA's Meat and Poultry Hotline 1-800-535-4555.

In the Washington, DC, area, call (202) 720-3333. The TTY number is 1-800-256-7072.

Emergency Point of Contact:
U.S. Food and Drug Administration
5600 Fishers Lane
Rockville, MD 20857

If a food establishment operator suspects that any of his/her products that are regulated by the FDA have been subject to tampering or criminal or terrorist action, he/she should notify the FDA 24-h emergency number at 301-443-1240 or call their local FDA District Office. FDA District Office telephone numbers are listed at: http://www.fda.gov/ora/inspect_ref/iom/iomoradir. html. The operator should also notify local law enforcement.

Contact Us:

- Centers for Disease Control and Prevention
  Atlanta, GA 303331600 Clifton Rd
  800-CDC-INFO or (800-232-4636)

. . . . . .

Partnership for Food Safety Education: Fight BAC!® (http://www.fightbac.org)

- Academy of Nutrition and Dietetics (formerly American Dietetic Association)
- American Egg Board and Egg Safety Center
- Association of Food and Drug Officials
- Consumer Federation of America
- Food Marketing Institute
- Food Temperature Indicator Association
- Institute of Food Technologists
- International Food Information Council
- International Fresh-Cut Produce Association
- National Association of State Departments of Agriculture
- National Chicken Council
- National Pork Board
- National Turkey Federation
- NSF International
- Produce Marketing Association
- School Nutrition Association
- The Soap and Detergent Association
- United Fresh Fruit and Vegetable Association Federal Government Liaison
- U.S. Department of Agriculture
- U.S. Food and Drug Administration
- U.S. Department of Health and Human Services, CDC
- U.S. Environmental Protection Agency

Notes

CULINARY ALERT!

Glossary

Biological hazard Microbiological hazard from bacteria, viruses, fungi, and parasites.

Chemical hazard Toxic levels of a specific chemical that may occur by accident, use of toxic level additives, or toxic metals.

Contaminated Presence of harmful substances.

Cross-contamination Transfer of harmful microorganisms from one food to another by way of another food, hands, equipment, or utensils.

Emerging pathogens Pathogens whose incidence has increased within the last few years or which threaten to increase in the near future.

Foodborne illness Disease carried to people by food.

Fungi Microorganisms that include mold and yeast.

HACCP Hazard Analysis and Critical Control Point system of food safety.

Infection Illness that results from ingesting living, pathogenic bacteria such as *Salmonella*, *Listeria*, or *Shigella*.

Intoxication Illness that results from ingesting a preformed toxin such as that produced by Staphylococcus aureus, Clostridium botulinum, or Bacillus cereus.

Pathogenic Disease-causing agent.

Physical hazard Foreign object found in food; may be due to harvesting or manufacturing; may be intrinsic to the food (bone, shell, pit).

Potentially hazardous food Natural or synthetic food in a form capable of supporting the rapid and progressive growth of infectious or toxigenic microorganisms; the growth and toxin production of *C. botulinum* or, in shell eggs, the growth of *S. enteritidis*.

Spoiled Damage to the eating quality.

Spore Thick-walled formation in a bacterium that is resistant to heat, cold, and chemicals; it remains in food after the vegetative cells are destroyed and is capable of becoming vegetative cell.

Temperature danger zone (TDZ) Temperature range within which most bacteria grow and reproduce 40–140 °F (4–60 °C).

Toxin Poison produced by a microorganism while it is alive; may remain in food and cause illness after the bacteria is killed.

Toxin-mediated infection Infection/intoxication illness that results from ingestion of living, infection-causing bacteria that also produce a toxin in the intestine, such as *C. perfringens* or *E. coli* 0157:H7.

References

(2000) Dietitians face the challenge of food allergies. J Am Diet Assoc 100:13

(2000) Eye on Washington. Food Eng 72:16

(2012) All-natural sanitizers and preservatives. Food Prod Des 2012:54

Crawford LM, DVM (2000) Food irradiation's advantages will not escape public attention. Food Technol 52(1):55

HACCP Principles & Application Guidelines (1997) Adopted August 14, 1997. Page Last Updated: 03/15/2013

Food and Drug Administration. Department of Health and Human Services. Public Health Service

Higgins KT (2000) Food safety is being redefined to include allergen-free as well as pathogen-free. Food Eng 72(6):75–82

Higgins KT (2003) E-beam comes to the heartland. Food Eng 75(10):89–96

Higgins KT (2006) Beam me through, Scotty. Food Eng 78(1):107–112.0

Hussain SA (2000) ConAgra refrigerated prepared foods, technical services. Surak JG, Clemson University, Cawley JL, Northwest Analytical. Butterball integrates SPC with HACCP. Food Eng 72(10):82

Katz F (2000) Research priorities move toward healthy and safe. Food Technol 54(12):42–46

Kuntz LA (2012) Keeping food safety in the mix. Food Prod Des: 2–13

Morris CE (2002) Best practices for allergen control. Food Eng 74(3):33–35

National Advisory Committee for Microbiological Criteria for Foods (NACMCF). HACCP principles for food production. USDA—FSIS Information Office, Washington, DC

Pierson MD, Corlett DA (eds) (1992) HACCP principles and applications. Chapman & Hall, New York (reprint 2012)

Stier RF (2006) Why can't scientists communicate science? Food Eng 78(3):25

Van Milligen D (2001) Sanitation 101. Food Eng 73 (1):55–60

Addendum

CDC Table B 1-4 Guidelines for confirmation of foodborne-disease outbreaks. http://www.cdc.gov/mmwr/preview/mmwrhtml/ss4901a3.htm
Cody MM (2002) Food safety for professionals. The American Dietetic Association, Chicago, IL
Partnership for Food Safety Education—Fight BAC!® (http://www.fightbac.org)
Puckett RP, Norton LC (2003) Disaster and emergency preparedness in foodservice operations. The American Dietetic Association, Chicago, IL
University of Texas Health Science Center San Antonio (UTHSCSA)

Bibliography

CDC Surveillance for Foodborne Disease Outbreaks—United States (2009–2010)
Center for Science in the Public Interest (CSPI)
Centers for Disease Control and Prevention (CDC)
Current Good Manufacturing Practice and Hazard Analysis and Risk-Based Preventive Controls for Human Food Proposed Rule. (http://www.gpo.gov/fdsys/pkg/FR-2013-01-16/html/2013-00125.htm)
FDA, USDA, National Oceanic and Atmospheric Administration (NOAA) Statements on Food Safety
FDA Center for Food Safety and Applied Nutrition
Food Safety and Inspection Service (FSIS)
Food Seminars International
Grocery Manufacturers Assoc. http://www.gmaonline.org
http://producesafetyalliance.cornell.edu
http://www.cdc.gov/foodborneoutbreaks/outbreak_data.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6203a1.htm?s_cid=mm62031_w\
Institute of Food Technologists' Expert Panel on Food Safety and Nutrition. Scientific Status Summary, Foodborne illness: Role of home food handling practices
LaVella B, Bostik JL (1994) HACCP for food service. LaVella Food Specialists, St. Louis, MO
Medeiros LC, Kendall P, Hillers V, Chen G, DiMascola S (2001) Identification and classification of consumer food-handling behaviors for food safety education. J Am Diet Assoc 101(1326–1332):1337–1339
Model Food Code
National Restaurant Association (1992) The Educational Foundation. Applied Foodservice Sanitation, 4th edn. Wiley, New York
Texas A&M University—Center for Food Safety. College Station, TX
University of Idaho—http://www.webpages.uidaho.edu/foodtox/
USDA ChooseMyPlate.gov
USDA Food Safety Research Information Office (FSRIO)
Watson DH (1993) Safety of chemicals in food: chemical contaminants. Ellis Horwood, New York

Associations and Organizations

American Public Health Association (APHA). Washington, DC
Association of Food and Drug Officials (AFDO). York, PA
Cooperative Extension Service (CES), throughout the United States
Council for Agriculture Science and Technology (CAST). Ames, IA
Food Marketing Institute (FMI). Washington, DC
Gannett News
Institute of Food Technologists (IFT). Chicago, IL
International Association of Milk, Food, and Environmental Sanitarians (IAMFES). Des Moines, IA
International Council of Hotel, and Restaurant Industry Educators (CHRIE). Washington, DC
International Foodservice Distributors Association (IFDA). Mclean, VA
International Food Manufacturers Association (IFMA). Chicago, IL
National Center for Nutrition and Dietetics (NCND)
National Environmental Health Association (NEHA). Denver, CO
National Sanitation Foundation (NSF) International. Ann Arbor, MI
The Academy of Nutrition and Dietetics National Center for Nutrition and Dietetics (NCND). Chicago, IL
The Educational Foundation of the National Restaurant Association. Chicago, IL
United States Environmental Protection Agency, (EPA), Washington, DC
University of Texas Health Science Center San Antonio (UTHSCSA). San Antonio, TX