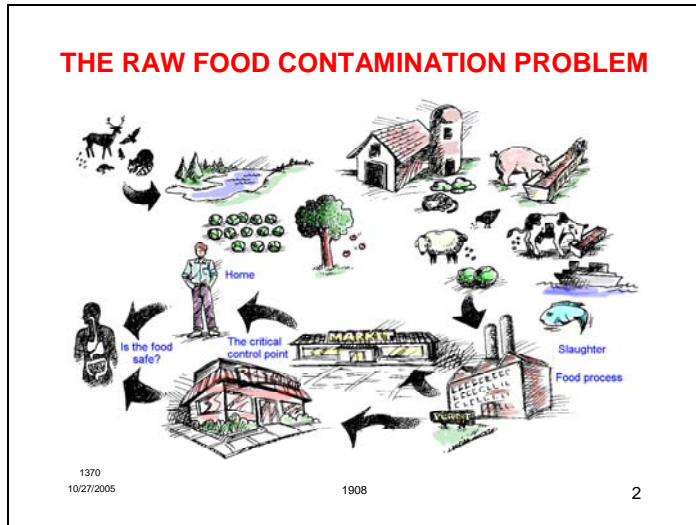


SECTION 1



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Raw poultry products are sources of *Salmonella* spp. and *Campylobacter jejuni*. Wild animals, horses, and pigs are carriers of *Trichinella spiralis* and other parasitic worms.

Raw milk products have been documented to be responsible for outbreaks of salmonellosis, listeriosis, and illness-caused *E. coli*.

All raw food must be considered to be contaminated with pathogenic bacteria and possibly other harmful chemical compounds. Therefore, raw food must be prepared in ways that reduce and control the amount of contamination (or risk of contamination) to a safe level that can be consumed by people without causing illness.

The Raw Food Contamination Problem

Unless the foodservice operator knows the actual food growing and processing conditions or buys certified safe products, incoming products must be considered contaminated with microorganisms and/or chemicals.

Streams, rivers, and lakes can become contaminated with pathogenic microorganisms (e.g., bacteria, viruses, protozoa, and parasitic larvae) and harmful chemicals such as mercury. This pathogenic material is then passed on to and by fish, animals, birds, rodents, insects, and humans. In turn, the pathogens are deposited in the soil in the form of human and animal waste. Plants and plant products grown in soil thus carry microorganisms of the environment from which they were produced.

A documented example of a contaminated raw product is that of raw cabbage as a source of *Listeria monocytogenes*. The cabbage had been fertilized with sheep manure from sheep infected with these pathogenic bacteria. The cabbage was grown, harvested, and was used to make coleslaw. People who consumed the coleslaw became ill with a "flu-like" illness. The illness had severe implications for pregnant women and their fetuses. The result was spontaneous abortions, stillbirths and babies born with symptoms of listeriosis.

There continue to be reports of *Escherichia coli* O157:H7 from consumption of raw or undercooked ground beef products, cider, apple juice, and well water. The source of these pathogenic bacteria is thought to be cattle. However, it is also found in wild animals. It is easily transferred between members of the same family and in day-care centers.

There are documented incidents of *Salmonella* spp. on the outside and interior of raw tomatoes, cantaloupe, and watermelon. *Shigella* spp. and *E. coli* on fresh lettuce have been found to be responsible for foodborne illness outbreaks. These incidents were traced to polluted irrigation water and failure of harvesting personnel to use or be provided with toilet facilities.

SELF-CONTROL (DUE DILIGENCE)

Driven by: lawyers, insurance companies, media

Can be used to prove that all reasonable precautions were exercised and all *due diligence* was taken to avoid the commission of an offense by management and employees.

Taking all reasonable precautions means setting up a pre-control / QA system to ensure that things do not go wrong. HACCP is an important component. Knowledgeable oversight and participation of top management are essential. Management must be able to say, "This food production operation is in control."

Due diligence means seeing that the system works properly at all levels, from the executive board level down to on-line employees. The system involves careful monitoring and recording at control points. There must be a system that strives for zero deviations using validated safe process procedures and standards. There must be pre-control.

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Self-Control (Due Diligence)

When hazards are correctly identified and controlled it is possible for the owner of the retail establishment to have a defense of *due diligence* in case there is an alleged foodborne illness. Due diligence means that all reasonable precautions were exercised, and all due diligence was taken to avoid the commission of an offense by management and associates. Taking all reasonable precautions means setting up a system to ensure that things do not go wrong. HACCP is such a system.

Due diligence is the responsibility of the owner / operator / manager in terms of seeing that the system works properly from the executive board downward and involves careful monitoring and recording at control points. There must be a system for striving for zero defects. This can be accomplished when owners / operators / managers:

1. Have a written food safety policy that allocates responsibility to designated people and ensures that the policy is monitored and enforced.
2. Provide adequate training and written instructions related to the degree of hazard.
3. Assess the potential risk to the consumer and take appropriate precautions to include occasional laboratory checks
4. Design HACCP recipes for each menu item and validate that the recipe procedures will produce safe food using the ingredients being purchased.
5. Only buy from suppliers that exercise due diligence.
6. Have a fault-finding system to analyze consumer complaints and take suitable corrective action.
7. Use existing codes of good practice and improve on them.
8. Verify that each prevention / corrective system works effectively.
9. Make sure that the system is comprehensive.
10. Report and handle all staff illnesses according to written policy.
11. Have an emergency plan that, when all else fails, deals with consumer notification and/or product recall, when appropriate.

All personnel in a food production establishment should show that they have taken all precautions necessary and have used "due diligence" to produce safe food. If this is done, there is

little fear of lawsuits, high insurance claims, and adverse attention from newspapers, television and radio.

To achieve self-control (due diligence), all employees, supervisors, and managers must follow the four-step QA (Quality Assurance) cycle. This cycle consists of

1. Analyzing and planning.
2. Organizing and training.
3. Operating and exercising self-control to prevent foodborne illness
4. Measuring performance and making improvements.

For example, if a person does not know how to do a food preparation task safely, he or she will stop, ask, and then learn to do the task correctly. In performing tasks, each manager and employee will first plan and organize to do each task correctly. They will do the task according to specified procedures and standards. They will take necessary action immediately in case of a mistake to assure that customers or employees are not injured. If there is ever any doubt about the safety of a food item, it must be brought to the attention of the immediate supervisor.

Finally, if at any time there is a problem or an opportunity to improve, employees will inform the supervisor at the earliest opportunity. The objective of the self control (due diligence) is zero errors in operating procedures and the production of safe and consistent food products.

An operations manual that contains precise information about the system is required. This operating manual can be used as both a HACCP manual and a quality assurance manual to demonstrate self-control of safety and quality in retail foodservice and food production operations.

HAZARD ANALYSIS-----HA

Hazards will always be present:

- Biological
- Chemical
- Physical



They are carried into the operation by:

- Employees, customers, visitors
- Food and supplies
- Water and air
- Insects, rodents, birds



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Hazard Analysis

HACCP (Hazard Analysis and Critical Control Points) is a scientifically correct way to study the safety of the food supply, food receiving and storage, food preparation, and food serving and leftover procedures and standards in retail food systems. Hazard analysis determines the biological, chemical, and physical hazards (hard foreign objects) and anticipates possible dangerous practices that may cause people to become ill. Controls are then developed that will assure that correct food handling procedures are used.

Hazards present in food include:

- **Biological.** These include bacteria, molds, viruses, and parasites, from raw meat, poultry and fish and fresh produce.
- **Chemical.** Excessive amounts of pesticides may be present in some raw fruits and vegetables. Cleaning and insect control chemicals may be added to food accidentally in the foodservice operation. Culinary chemicals may be used in excess.
- **Physical.** Physical or hard foreign object hazards include rocks, bay leaves that never soften in cooking, metal cuttings from sharp can opener blades, and pieces of broken glass.

Hazards are carried into the operation by:


- **Employees, customers, and visitors.** People bring in microorganisms on their hands; in their noses, ears, and mouths; and on their skin and clothing.
- **Incoming food and supplies.** Raw food carries many pathogens from growing and slaughtering operations.
- **Water.** Water processing plants (both municipal and bottled water operations) may not treat water adequately, thus allowing the presence of hazardous levels of pathogenic bacteria in the water supply. Many foodservice systems use well water that can become contaminated with animal and human fecal material.
- **Air.** The air carries many types of bacteria. Dust in the air can carry bacteria from farms and sewage treatment plants into food production facilities. When toilets are flushed, they aerosol fecal bacteria into the air of restrooms that will contaminate the air if there is not an effective exhaust system in the restroom. *Legionella* bacteria have been

found in poorly maintained air conditioner cooling towers and fresh vegetable water sprayers. *Listeria* spp., which is common to the soil, is often found on the floor and in floor drains. The air ducts have mold that blows down on the food and cause food to become toxic.

- **Insects, rodents, and birds.** These pests can carry pathogenic bacteria. In underdeveloped nations where there is very poor sewage control, these pests cause serious problems by transferring pathogens from raw sewage to food. In the United States the last recorded incident in foodservice due to flies occurred in 1945. (There have not been any due to rats or cockroaches.) The fly incident occurred in an Army camp during World War II when flies carried pathogenic bacteria from an open latrine pit to food. Today good sewage systems, coupled with American laws and technology, effectively control rodent and insect cross-contamination from sewage to food. The problem is not flies in the United States; it is customers who do not wash their hands and fingers properly before they touch food on display, on salad bars, or in any self-service situations in food markets where they can touch food.

CRITICAL CONTROL POINTS-----CCP
Prevent, eliminate, reduce hazard to a safe level.

- Owner has absolute command and control of safety and written Policies, Procedures, and Standards
- Employees are trained and coached
- Adequate supply of material and time
- Adequate facilities and equipment
- Safety-assured recipe procedures
- Personal hygiene



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Critical Controls

After food safety problems have been determined with hazard analysis, management must establish food handling policies, procedures, and standards for all employees that will control the hazards. Good controls are necessary because hazards are present most of the time on the food and in the people preparing the food. Only one foodborne illness incident can ruin a business financially. The following critical controls are necessary to assure food safety.

Owner / manager control. Owner(s) / manager(s) must know the hazards in the environment and the food and beverages being served. Owner(s) / manager(s) must develop and implement operating policies, procedures, and standards at the employee level that will control the contamination from the sources of supply and environment. Since the government's regulations do not provide complete hazard and control information, the manager must get this information for himself.

Employee training. Owner(s) / manager(s) must have a training and reinforcement program that trains employees how to do their jobs safely before they are asked to do them.

Adequate supplies and time. Owners and managers must provide the supplies, equipment, and time necessary for the employee to do his/her tasks safely with zero defects. This includes providing soap and fingernail brushes at hand sinks as well as cleaning chemicals, scrub brushes, and sanitizers for food contact surfaces such as cutting boards and knives.

Adequate facilities and equipment. There must be adequate refrigeration capacity to keep refrigerator temperatures at 41°F when hot food is cooled. The temperatures of food in walk-in and reach-in refrigeration units, and cold food preparation tables must stay at 41°F during all operating times.

Safety-assured recipe procedures. Food preparation times and temperatures must be specified for each recipe in order to assure the reduction of the pathogens to a safe level and prevent the dangerous multiplication of pathogenic microorganisms in food products. The use of chemical additives such as monosodium glutamate must be properly controlled through recipe standardization.

Personal hygiene. All foodservice employees must assume that they are shedding pathogens in their feces all of the time. To ensure safe food handling, each employee must wash his/her fingertips after using the toilet by using the double hand washing method that requires a lot of hot water, soap, and a fingernail brush. Good personal hygiene also includes the use of hair restraints, clean uniforms, personal cleanliness, and good grooming. These factors do not ensure the safety of food but are critical to customer satisfaction and perceived safety. The established and enforced use of good personal hygiene by all employees demonstrates that management has command and control of the foodservice operation.

RETAIL FOOD AMC-HACCP POLICIES, PROCEDURES AND STANDARDS MANUAL

What is AMC? Active Managerial Control (AMC) means simply that the operator uses HACCP to:

1. Identify hazards in the day-to-day operation.
2. Develop / implement food safety policies and procedures.
3. Train employees to control hazards and monitor their procedures.
4. Take corrective action.
5. Conduct in-house self-inspections of daily operations.

Purpose of manual. To guide managers as they prepare their HACCP food safety plans and programs.

1. Is continually updated.
2. Fits the complexity of the operation.
3. Provides consistent definitions of employee task performance / behavior.
4. Is a structured way to review methods for achieving quality and safety.

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What is AMC?

Active Managerial Control (AMC) means simply that the operator uses HACCP to:

1. Identify hazards in the day-to-day operation of the food establishment;
2. Develop and implement policies and procedures to prevent foodborne illness;
3. Train employees to control the hazards in the tasks that they do and monitor their procedures.
4. Take corrective action to keep processes in control.
5. Conduct in-house self-inspections of daily operations on a periodic basis to ensure that food safety policies and procedures are followed.

Retail Food AMC-HACCP Policies, Procedures, and Standards Manual

Purpose and Organization of Manual

Purpose of manual. The purpose of the policies, procedures, and standards manual is to guide owners/managers of food production and foodservice units and other retail food outlets as they prepare a HACCP-based food safety plan and program for assuring the safety and quality of food being prepared, served, and sold to consumers.

The goal is consistency of operation. Every task is done the same way until officially changed. This gives assured quality and assured safety. Writing this manual provides the opportunity for management to systematically analyze potential problem situations and plan to cope with or avoid less than ideal conditions. Written policies, procedures, and standards provide the training material for employees that assures consistent instruction for employee task performance. They also provide a structured way to review operational methods and to get employee suggestions for better methods to achieve the desired goals of food safety and customer satisfaction.

This manual is fully compatible with USDA, FDA, and processing HACCP. The difference is that the USDA and FDA processing have some of their own, unique food handling times and temperatures.

Continual update. The manual is never a finished document. Retail foodservice and food production operations are dynamic and changing (change in suppliers, equipment, ingredients,

recipes), and the manual must be up-dated continually because of these constant changes. One of the easiest ways to do this is to let entry-level supervisory employees review the manual as a part of their training and suggest revisions as they are trained to master their tasks. This review and update can also take place when new management personnel attend the two-day foodborne illness prevention manager certification course at HITM. Once the basic manual is written, additional details can be added in areas such as:

- Purchasing specifications.
- Management evaluation plans for recipe HACCP-controlled operating procedures.
- Policies for new operational procedures.

Writing the Manual

Responsibility for preparation. The owner/operator is accountable for safety and should write the manual. But, either or both of the two food safety program managers (FSPMs) can do most of the writing. They should also be responsible for keeping it up-to-date. Responsibility for preparing specific chapters, based on their training and ability can be delegated to key staff personnel. Accountability for any customer or employee illness will always remain with the owner.

What is an adequate manual? Each manual must be written to fit the complexity of each individual operation. All chapters of the manual should be covered. In some operations, the chapter may only be a sentence or two; in other operations, the chapter will require a number of pages. For example, a simple hamburger and hot dog temporary foodservice at a fair will require only a one- or two-page manual, while a policies, procedures, and standards manual for a large hospital foodservice facility operating under the USDA will require 100 pages or more.

Written policies, procedures, and standards must provide consistent definitions of employee task performance (also called behavior) and a structured way to review operational methods for achieving desired goals of quality and safety. The following is a brief summary of each chapter of the manual.

IMPLEMENTING A RETAIL FOOD SAFETY MANAGEMENT SYSTEM

System and Operations Description

System description
Organization and job responsibilities
Environment plan and pictures
Facilities plan and pictures
Equipment list and pictures

Management

Food safety policy
HACCP management planning
Security
Traceability
HACCP team operation
Training Program
Quality Assurance and Quality Control

Prerequisite Program

Personal hygiene
Facility and equipment cleaning,
sanitation, and pest control
Facility and equipment maintenance
Supplies / buying and storing

Food HACCP Program

Menu product HACCP control groups
Flow charts / HACCP plans
Mise-en-place
Washing / surface pasteurization
Cook, pasteurize, ferment, smoke
Hot hold (transport, serve)
Cool, cold hold, mix
Package / store

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Implementing a Retail Food Safety Management System

The following four-section outline is intended as a guide when writing a policies, procedures, and standards manual and implementing a food safety management system. Each system must include elements of all four sections.

System and Operations Description

The documents in this section enable the owner/manager to define the performance capabilities of the unit to management personnel and to regulatory officials.

Organization includes a diagram of management and employee food safety responsibilities. It indicates relationships between positions. All positions must work together within the plan in order to ensure the safety and quality of food. The organization plan enables each employee to know who his/her supervisor is, and hence, the person who is responsible for making it possible for each employee to perform each task using HACCP guidelines.

Management

This section establishes management commitment to product safety and quality. A policy statement must be posted on a bulletin board as a permanent commitment to safety. Good Manufacturing Practices are rules (employee behaviors) and standards defined by regulatory agencies and management to meet requirements for safe, high quality food products.

All new employees must be educated concerning foodborne illness prevention and given specific procedures to follow before they are asked to perform any task in food production and food service. All employees must be given continual AMC-HACCP training on a regular basis or any time an incident may justify a training session. Management personnel with a knowledge and training in HACCP and food safety must be responsible for these training sessions. Managers and supervisors must also coach employees by never allowing hazardous or poor employee job performance to continue, yet at the same time, must indicate to employees what is effective and good job performance. Management must also listen to employee's suggestions for improvement.

A continuing education training record can be used to document continuing education and training for all personnel.

The operation must perform self-inspections to assure that HACCP safety procedures are functioning and to find opportunities to improve. This section provides forms for the retail food operation to use to enable it to validate that its processes were in control at a specific time, when it is perhaps claimed that someone was made ill by the food. The Person In Charge uses a checklist to verify each day that the critical tasks are being performed correctly.

Once the HACCP program is implemented, an independent third party audit should verify the control of hazards in the food production system, on a yearly basis. Capability certification is demonstrated by showing that all employees are trained and know the hazards associated with their jobs, the controls used to prevent the occurrence of hazards and how their performance is monitored to assure that they do their tasks according to the policies, procedures, and standards manual.

Prerequisite Program

The operation's personal hygiene rules, including safe hand washing procedures, are part of the operation's prerequisite program.

This section provides a list of equipment / areas / surfaces to be cleaned and sanitized, and assigns the cleaning and sanitizing responsibilities to specified employees. This schedule must be posted (i.e., on a bulletin board, etc.) for all employees to see. Good cleaning schedules ensure that nothing is overlooked. The name of the person responsible for doing each cleaning task; the frequency the task needs to be done; type of cleaning chemical and sanitizer; and safety warnings should also be specified in this chapter. Material Safety Data Sheets for cleaning and sanitizing chemicals are also included in this chapter.

This section lists specific areas that must be monitored for chemical pesticide application or other measures to prevent infestations of insects and rodents. It is often better to contract a pest control service to maintain a pest-free facility, as professional pesticide workers are properly trained to use chemicals for this purpose. However, both management and employees in any food production and food dispensing facility must realize that when facilities are kept clean, exterminators are seldom required. Extreme precautions must be taken to prevent any pesticides from coming in contact with food.

This section also provides a list of equipment used in the facility. This maintenance list specifies when equipment should be checked; who should check the equipment; how it should be checked (if facility personnel check the equipment); and how to verify that the equipment is functioning correctly. Equipment must be maintained in order to have facilities operate safely and efficiently. Major pieces of equipment such as dishwashers, ranges, deep fat fryers, etc. should be repaired by approved appliance repair personnel.

Finally, the documents in the prerequisite program section can be used to confirm that suppliers are using HACCP programs for food items. Forms for ingredient specifications can be included.

HACCP Program

This section enables owners and managers to analyze the preparation / production of food items to ensure safe handling and holding temperatures for food. This section also describes the menu in terms of produce HACCP control groups. Recipe flow charts and HACCP plans are included. When the recipes or

formulations are written in a manner that specifies times and temperatures that must be used in the preparation, storage, and service of food products, the safety and quality of food products can be controlled and assured.

HACCP SUMMARY

1. Owner and all employees are committed to illness prevention.
2. HACCP responsibility is assigned, identified on an organization chart, and posted.
3. All operating tasks are inspected for hazards, and critical controls are applied.
4. HACCP operating policies, procedures, and standards (PP&S) are developed.
5. Job descriptions are updated, and employees are trained to perform accordingly.
6. Management coaches, counsels, and gives positive reinforcement to employees.
7. Management performs inspections and notes inadequate performance.
8. Management and employees work together through AMC-HACCP teams to prevent and correct problems.

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HACCP Summary

Owners / managers can confirm that they and their staffs are on the right path toward implementing their AMC-HACCP program when:

1. The owner and all employees are committed to foodborne illness prevention. The incentives for this include money, success, and the feeling of satisfaction that results when customers compliment the organization.
2. Quality assurance responsibility is assigned, identified on the organization chart, and posted.
3. All operating procedures are inspected and analyzed for hazards, and critical controls are applied.
4. Quality assurance operating policies, procedures, and standards are developed.
5. Job descriptions are updated, and employees are trained to perform accordingly.
6. Management coaches and counsels task performance. Employees receive positive reinforcement.
7. Management performs quality control inspections and notes inadequate performance.
8. Management and employees work together through the AMC-HACCP team(s) to prevent and correct problems.

HACCP IS THE FOUNDATION FOR QUALITY



- Customer complaints decrease
- Customers return often
- Less spoilage, fewer leftovers
- Inspections are almost perfect
- Good employee morale

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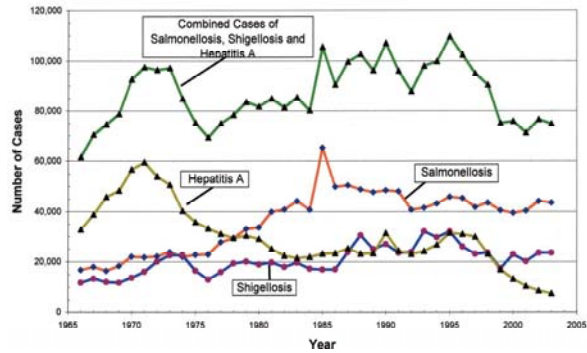
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QC Shows How QA Is Working

HACCP indicates QA success. Quality control, a part of HACCP, is the process of measuring performance against standards. If performance equals standards, then quality is assured (certain). Some QC indicators of QA success are:

1. There are essentially no customer complaints. The customers say, "This is the best restaurant (in its class) in town." If the compliment is simply that the meal was good, that is not enough. That does not indicate that this restaurant will be a first choice of the customer when he or she dines out again.
2. A check of names on credit card slips and checks indicates that there is a large group of regular, repeat customers.
3. There are very few leftovers, and there is essentially zero food spoilage.
4. The sanitarian's inspections find essentially no errors.
5. Employees are happy and proud of the work they do. Turnover is at a minimum.

REPORTED CASES OF FOODBORNE ILLNESS IN THE UNITED STATES (1966-2003)



Therefore, the only effective critical control point is the establishment by owner(s)/manager(s) of operating policies, procedures, and standards that will reduce the contamination to a safe level. Employees must be trained to prepare, store and serve food according to these safety-assured policies, procedures, and standards. Owners and managers should never allow any employee to work in a foodservice establishment until that employee knows the food hazards and controls associated with the tasks he/she does.

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Foodborne Illness

Foodborne illness can occur whenever and wherever food is prepared and served in homes, restaurants, institutions, fairs, and carnivals. Foodborne illnesses are a result of the lack of understanding of the hazards by the people who prepare and serve the food, and failure to use adequate controls.

Why is foodborne illness on the rise? The most significant reason foodborne illness outbreaks continue is that animals seem to be more diseased than in the past, and anyone can grow, process, and supply food without demonstrating knowledge and control of the hazards associated with the production of raw food. People rely on government inspection to assure food safety. Government inspection of processed and cooked food is very effective. However, government inspection of raw food (meat, fish, poultry, fruits, vegetables, grains, etc.) only detects a tiny fraction of the hazards and cannot be assumed to assure food safety. Most government inspections are for quality standards or animal diseases that do not make humans ill.

Immunity - Why More People Are Not Sick

Healthy people become tolerant to certain types and levels of pathogenic bacteria within their bodies and do not become ill if they consume food or food products containing moderate levels of these pathogens. Humans can also develop resistance and tolerance to certain levels of toxins and chemicals. This is called **immunity**. Immunity usually develops after a person has become ill with a specific microorganism and has recovered.

On the other hand, infants, young children up to 5 years, the elderly, and those in weakened conditions because of illness or consumption of antibiotics have a low threshold of immunity and are susceptible to low levels of bacterial pathogens and low levels of toxic compounds. For example, as few as 1 *Salmonella typhi* per 10 grams of food can make a susceptible person ill. Healthy people normally can consume food containing greater than 10,000 *Salmonella* spp. in a meal before becoming sick.

Prevention

Since FDA or USDA inspection of raw food does not assure safety, the most effective critical control point is to get food from suppliers who supervise or specify the growing and production conditions of the food and will certify to you the safety of their supplies. However, at this time there are virtually no suppliers of raw food who will certify their raw food as safe.

FACTORS THAT CONTRIBUTE TO OUTBREAKS OF FOODBORNE DISEASE

Prerequisite Food Safety Processes	Food Safety (HACCP) Processes
<ul style="list-style-type: none"> • * Colonized person handling implicated food • Contaminated water • Toxic containers / pipelines • Accidental additives (e.g., accidental addition of toxic chemicals) • Intentional additives (e.g., too much MSG, allergens, Yellow #5) • Hard foreign objects • * Improper cleaning of equipment / utensils / cross-contamination of food contact surface • * Obtaining food from an unsafe source / contaminated raw food 	<ul style="list-style-type: none"> • Improper thawing • Inadequate cleaning of fruits and vegetables • * Inadequate cooking / pasteurization • * Inadequate hot / cold holding • Cooling food too slowly • Lapse of more than 12 hours between preparation and service • Use of leftovers • Inadequate reheating <p style="text-align: center;">* FDA / CDC risk factors</p>

1270-9-8-05 Bryan, F.L. 1988. Risks of practices, procedures and processes that lead to outbreaks of foodborne diseases. J. Food Prot. 51(8): 663-673.
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Factors that Contribute to Outbreaks of foodborne Disease

The factors that contribute to foodborne disease and illness can be classified according to steps used in the production, preparation and service of food.

Prerequisite Food Safety Processes

Colonized person handled implicated food. People can be carriers of pathogenic microorganism. Risks of contamination of food are increased whenever persons who have infected skin lesions, diarrhea, sore throats, or jaundice handle foods. Even healthy employees are a potential source of pathogenic microorganisms. Each day, 1 out of every 50 employees sheds high level of infectious pathogens in their feces. These pathogens are usually transferred to food from cuts and infections on the hands, and from inadequate hand washing after using the toilet or blowing the nose. Therefore, it must be assumed that **all** employees are a potential source of contamination. **The only control is 100% effective hand washing.**

Contaminated water. Contaminated water can transfer pathogens to food when community water supply systems fail or when contaminated well water is used to wash fruits and vegetables. It can also occur when sewage-polluted water is used for irrigation.

Toxic containers / pipelines. Defective backflow valves on soft-drink machines and other conditions that lead to back siphonage have resulted in outbreaks of copper poisoning. Zinc poisoning has resulted from highly acid foods (e.g., lemonade) being stored in galvanized containers. Acid foods should never be stored in containers that contain toxic metals (e.g., copper containers, cadmium containing containers, and enamelware containing antimony or lead).

Accidental additives. This is the accidental addition of toxic compounds to food. This occurs when personnel do not read labels of cleaning and pest control products, and they mix these toxic chemicals with food.

Intentional additives. This is the excessive addition of chemical additives (e.g., monosodium glutamate or nitrates) to foods during preparation. Incidents occur when food preparation personnel do not follow formulations or recipes.

Hard foreign objects. Incidents and injuries result from ingesting physical / hard foreign objects in food (e.g., hair, jewelry, fingernail polish, glass, and staples from packing materials). Customers are offended when they find foreign objects in their food and may never return to the foodservice unit. Lawsuits result when ingestion of a hard foreign object causes injury.

Improper cleaning of equipment / utensils / cross-contamination of food contact surface. Effective cleaning / sanitizing procedures for utensils and equipment are well established, but, lack of training of personnel and supervision by managers, short cuts, sloppiness, and carelessness contribute to contaminants remaining on "clean" surfaces. Inadequate cleaning resulting in cross-contamination can be a major problem. For example, when raw chicken is cut on a cutting board, pathogens are transferred to the board. When cooked food is placed on the unsanitized cutting board, pathogens from the raw chicken are transferred to the cooked food. Any time an unsanitized pan, knife, or hand is used to prepare or serve food, the same result will occur. Washing a cutting board with a dirty, moist wiping towel or sponge can also add pathogens to the cutting surface.

Cross-contamination occurs when:

- 1) a contaminated raw food is handled by someone or it contacts surfaces of utensils or equipment;
- 2) hands or surfaces contaminated by raw food make contact with an uncontaminated or cooked food;
- 3) equipment and surfaces are not washed and sanitized between raw and cooked food handling; and
- 4) personnel do not wash hands in between handling raw and cooked foods.

Obtaining food from an unsafe source / contaminated raw food. Examples include shellfish taken from sewage-polluted waters; raw milk (including certified raw), cheese and other dairy products made from raw milk; and wild mushrooms.

Raw foods are sources of pathogenic microorganisms, bringing them into processing areas and kitchens. All raw produce, meat, fish, and poultry, including government-inspected items, must be considered as sources of pathogenic microorganisms and therefore, hazardous. Currently, there is no government legislation that guarantees the safety of raw foods.

Food Safety (HACCP) Processes

Improper thawing. If thawed foods remain at room temperature or in a warm water bath for a long time after they have thawed, microorganisms can multiply. Risks of illness as a result of improperly thawed raw foods are low, because the growth of spoilage microorganisms is usually sufficient to inhibit pathogen growth. Also, raw food will be cooked, which reduces pathogens to a safe level. However, if cooked foods are improperly thawed, there is a greater risk of foodborne illness due to the growth of pathogenic microorganisms and spore outgrowth, because large numbers of spoilage bacteria are destroyed during cooking, leaving too few to inhibit the growth of pathogens.

Inadequate cleaning of fruits and vegetables. Raw fruits and vegetables are sources of pathogenic microorganisms and chemical residues from pesticides and herbicides. If raw fruits and vegetables are not washed, or are inadequately washed, they can cause a foodborne disease / illness when consumed.

Inadequate cooking / pasteurization. Heat processing procedures must assure that vegetative cells of microorganisms introduced by workers, contaminated irrigation water, or poor slaughtering procedures are destroyed or are at a level that will not be a risk to any consumers of the product. Government inspection of raw foods does not detect the presence of pathogens in food. Unless foodservice operators use extraordinary care to specify the pathogenic microbiological levels in the food received, all food must be heated sufficiently to reduce at least 1,000 *Salmonella* spp. per gram to 1 per 100 grams.

Inadequate hot holding / cold holding. This occurs when foods are cooked and are then allowed to remain at temperatures that permit the outgrowth of spores and multiplication of pathogenic bacteria. Steam tables, bains marie, insulated containers, and hot-holding cabinets must keep hot, and cooked foods at or above 135°F.

For food to be of high quality, it must be served above 150°F (except beef). However, when food is kept on a steam table at 150°F for extended periods of time, it becomes overcooked and loses nutritional value. Food in this condition does not meet customers' expectations for freshly prepared food. To retain quality over long periods of time, some cooks turn down the heat in a steam table. However, when food is prepared too far ahead and is held at incubation temperatures for long periods of time, microorganisms can multiply. People eating such food will become sick.

After food is cooked, the vegetative pathogens such as *Salmonella* and *Listeria monocytogenes* have been reduced to a very low, safe level. However, there are spoilage vegetative cells and spore pathogens that must be controlled. Refrigerators are designed to operate at about 40°F; so, a practical temperature for cold holding is about 40°F, which prevents the outgrowth of the spore pathogens and gives a shelf life of a week to much longer for cooked, properly cooled food.

Cooling food too slowly. Conditions that cause improper cooling are responsible for over 20% of microbiological foodborne illnesses. This is predictable, because both cooked and raw foods in foodservice operations contain some pathogenic microorganisms and spores. When food becomes cross-contaminated after cooking or is cooled too slowly (particularly if food is cooled in a large container), spores outgrow and vegetative microorganisms multiply, given time and proper multiplication temperatures. When pathogenic microorganisms multiply to sufficient numbers in foods and/or produce sufficient amount of toxin in food, people become ill when the food is consumed.

Lapse of more than 12 hours between preparing and eating. Time is required for spores to germinate into vegetative cells, which then multiply, reach hazardous levels in food, and form toxins in some pathogens. At a minimum, the FDA gives 4 hours, which assumes that the food is at the fastest growing temperature for microorganisms, 95 to 105°F. While the FDA currently does not provide for it, growth will be longer at other temperatures, depending on pH, water activity, spices, and other inhibitors in the food, or temperature. Weeks are needed for some pathogens to multiply during cold storage. If there is a lapse of time between preparation and consumption, the food must be maintained at temperatures that minimize the growth of pathogenic bacteria. The FDA Food Code recommends that:

"Food will be held either cold (below 41°F) or hot (above 135°F), even while on display." However, to prevent multiplication of pathogenic bacteria, food must be kept below 29.3°F or above 130°F. If you do not want to keep food at 41°F or below or 135°F or above, then, the Food Code says, it can be held only for 4 hours before it is thrown away.

Use of leftovers. The FDA Food Code allows the use of leftovers, if they are cooled from 135 to 70°F within 2 hours followed by further cooling to 41°F (6 hours or less, total time), and if the food is reheated to 165°F or above for 15 seconds within 2 hours. This FDA directive is made to control the growth of microorganisms that may occur during cooling of food. USDA Guidelines for cooling are to continuously cool food, within 90 minutes after cooking, from 120°F to 55°F within 6 hours, followed by further cooling to 40°F (no time limit) before boxing.

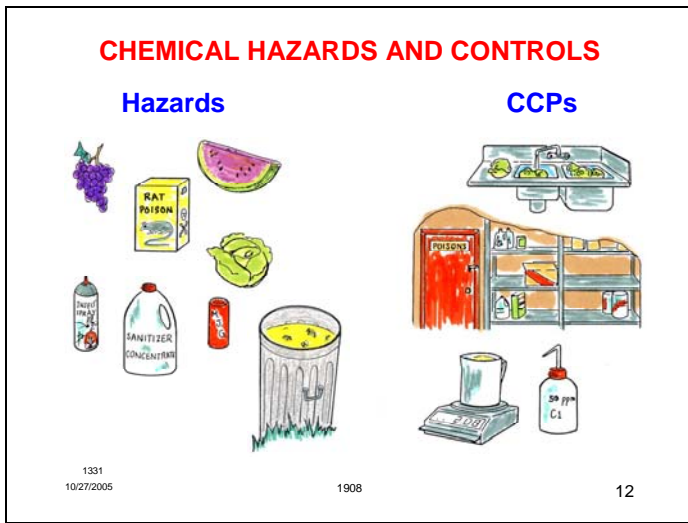
Inadequate reheating [to 165°F]. The FDA's recommendation to reheat cooked food to 165°F or above within 2 hours and holding it for 15 seconds as a way to control the safety of food is a false assumption. Many foods that are used in cold salads and sandwiches are never reheated after cooking. Furthermore, toxins produced by the growth of *Staphylococcus aureus*, *Clostridium botulinum* or *Bacillus cereus*, if present in the food, are not destroyed when food is heated to 165°F. In order to ensure the destruction of the toxin of *Clostridium botulinum*, food must be heated to 180°F for at least 5 minutes. Toxins formed by *Staphylococcus aureus* and *Bacillus cereus* remain unchanged when food is heated at boiling temperatures (212°F for 25 minutes or more). Because of these factors, reheating food to 165°F should only be used for customer satisfaction. After food is cooked, pathogenic bacteria in the food must be kept at a safe level with process control.

Summary

Food production facilities, foodservice units, and retail food operations must use HACCP-based programs to assess hazards and establish controls in order to diminish risks and prevent foodborne illness / disease and injury of customers. One cannot rely on government inspection programs and government information for accurate specification of safe food handling practices.

References

Bryan, F.L. 1988. Risks of practices, procedures and processes that lead to outbreaks of foodborne diseases. *J. Food Prot.* 51(8): 663-673.



Right-To-Know

All employees should be informed about the presence and use of any hazardous chemicals in the foodservice facility. They should know:

- What the chemical is.
- What its use is and how to mix and handle it.
- How it should be used.
- Where it should be used.
- Where it should be stored.
- What to do if contamination of a food product is suspected.
- What to do if they have been harmed by using the chemical product.

Pest Control and Materials Used

The key to pest control is cleanliness, not chemicals. The interior and exterior of the building should be maintained according to the cleaning schedule and doors must fit tightly. Open poison bait stations should not be used. Instead, trap rodents and insects so that the bodies can be disposed of properly. Vapona strips and automatic intermittent aerosol insecticide dispenser should not be used in foodservice facilities.

Chemical Hazards

The accidental or intentional addition of excessive amounts of toxic chemicals to food can cause illness or even death. No poisonous or toxic materials should be used that are not immediately necessary or appropriate for the maintenance of the establishment, the cleaning or sanitizing of equipment or utensils, or the control of insects or rodents. Chemicals must be used in accordance with manufacturers' recommended instructions. No poisonous or toxic materials should be used in a way that contaminates food or that constitutes a hazard to employees or others.

Chemical Contamination in Food

Chemical compounds that may contaminate incoming food products are herbicides, pesticides, growth-limiting chemicals (such as sprout retardant on potatoes), and fertilizers. The critical control procedure is to immediately wash all incoming produce to remove these chemicals and to dilute these chemicals to a safe level.

Cleaning Compounds

In-house cleaning supplies and pesticides are chemical hazards. Detergents, sanitizers, polishes, caustics, acids, and other cleaning supplies must be stored in an area, cupboard, or room that is separate from any food supplies.

Detergents, bleaches, etc., should never be stored in a food container nor measured in a food container. These products should always be labeled prominently and distinctly, clearly indicating the contents. Detergents, sanitizers, or related compounds should not be stored above sinks used for food preparation.

Culinary Chemicals

All chemicals used in food should be weighed or very carefully measured before being added to food products. People have become very ill when too much MSG (monosodium glutamate), nitrates, and sulfates have been added to food.

FOOD ADVERSE REACTIONS / CHEMICAL HAZARDS

Food intolerances

Fat, milk, gluten, caffeine, food colorings, fructose, nitrates, chili, glutamates

Food allergies

Milk
Egg
Fish (such as bass, flounder, or cod)
Crustacean shellfish (such as crab, lobster, or shrimp)
Tree nuts (such as almonds, pecans, or walnuts)
Wheat
Peanuts
Soybeans

Control

Listen to the concerns of the guest.
Check the recipes and labels of ingredients used in the recipe.
Do not substitute recipe ingredients.
Use clean utensils. Never use the same utensil for different foods in kitchen or serving.
Make sure food contact surfaces are clean to avoid cross-contamination.
Label dishes being served
Emergency: Call 911

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Adverse Reactions to Food

If you have a customer with a serious adverse food reaction, immediately call 911. Some adverse food reactions are due to **food intolerances**, which are genetic deficiencies. For example, lactose intolerance is caused by a deficiency of the intestinal enzyme, lactase. As a result, lactose, the predominant sugar in milk, cannot be broken into its two component sugars, glucose and galactose. Phenylketonuria is caused by an inability of some individuals to metabolize and clear the amino acid, phenylalanine. Too much phenylalanine in the blood affects the central nervous system and leads to mental retardation in infants and children. Individuals with phenylketonuria must control their intake of phenylalanine. Therefore, they must consume minimally required amounts of protein and must avoid food containing significant amounts of phenylalanine (e.g., foods containing aspartame).

Examples of ingredients that create food intolerances in some people include: acids, antioxidants, caffeine, food colorings, fructose, capsaicin, nitrates, phenolic substances, sorbitol / natural sugars, alcohol, benzoates, chili, aza dyes, glutamates, histamine, pepper, fat, milk, and gluten.

Idiosyncratic reactions to foods include celiac disease (occurs in some individuals when they ingest any food containing wheat gluten); asthma induced in some individuals as a result of ingesting sulfites or FD&C Yellow No. 5. Other idiosyncratic reactions to foods reported to occur are: hyperkinetic behavior in children as a result of the consumption of food coloring agents and sugar; migraine headaches due to consumption of chocolate or aspartame; and "Chinese restaurant syndrome" due to consumption of excessive amounts of monosodium glutamate.

An example of a drug-induced metabolic disorder occurs in individuals taking monoamine oxidase inhibitors (MAOI). These drugs interfere with the metabolism and clearance of tyramine. Too much tyramine in the blood can cause severe headaches, increased heartbeat, and elevated blood pressure. In severe situations, heart failure and intracranial hemorrhages have occurred. People taking monoamine oxidase inhibitors are instructed not to consume fermented or ripened foods (e.g., ripened cheeses, olives, pickles, sauerkraut, wine, beer, salami, and other fermented sausages).

Food allergy is a term that should be used to identify adverse reactions to certain foods that have an immunologic basis. These reactions are characterized by the presence of larger amounts of immunoglobulin E in individuals with allergies. Some reactions (e.g., anaphylactic shock) occur almost immediately following ingestion of offending foods and are of a severe, life-threatening nature. Anaphylactoid reactions include scombroid fish poisoning and reactions of individuals after consumption of certain types of cheeses, due to ingestion of large amounts of histamine in these foods. Some allergic reactions occur 4 to 6 hours after ingestion of a specific food, while other reactions may take more than 6 hours for the development of any adverse reaction or condition.

Allergic reactions are characterized by any one or a number of the following conditions: hives; red, inflamed skin; difficulty in breathing; cardiac seizure or arrest; increase in blood pressure; gastrointestinal disturbances; ear infections; dizziness; ringing of the ears; tearing of eyes; pain and swelling in muscles and joints; headaches; drowsiness; learning disorders; restlessness; hyperactivity; allergic epilepsy; chilling and fever (Jones, 1992).

Common Allergenic Foods

The following is a list of common allergenic foods that must be clearly listed on labels.

Milk: Includes ice cream; powdered milk; evaporated milk; yogurt; butter; cheese; cream and sour cream; non-dairy products and any other food products containing lactose, caseinate, potassium caseinate, casein, lactalbumen, lactoglobulin, curds, whey, milk solids.

Egg: Egg is present in most processed food and is present if the label indicates any of the following additions: constituent egg proteins or their derivatives (e.g., albumen, ovalbumen, globulin, ovomucoid, vitelin, ovovitelin, silico albuminate).

Fish (such as bass, flounder, or cod): Any type of fin fish; any food product containing fish.

Crustacean shellfish (such as crab, lobster, or shrimp): Also includes any food product containing these crustacea.

Tree nuts (such as almonds, pecans, or walnuts): Also includes any food containing tree nuts (e.g., salads, entrees, cookies, cakes, candies, pastries, or breads).

Wheat: All types of wheat flour; any baked products and any prepared products containing wheat flour, wheat gluten, or wheat starch.

Peanuts: Also includes any food product containing peanuts.

Soybeans: Also includes any food product containing soybeans.

Critical Control

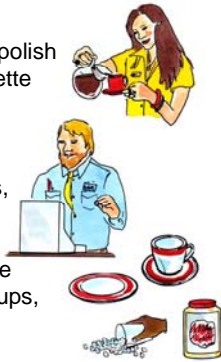
Listen to the concerns of the consumer. Have the cook check the recipe and labels of ingredients used in the recipe in order to determine if there are any ingredients that could be hazardous to the consumer. Do not substitute recipe ingredients without management approval and notification to all employees; change the menu, if necessary, based on any approved changes. Use clean utensils, and never use the same utensil for different foods. Make sure food contact surfaces are clean to avoid cross-contamination. Label dishes being served. Finally, in an emergency, call 911.

References:

- FDA. 2005. Food Code. U.S. Public Health Service, U.S. Dept. of Health and Human Services. Washington, D.C. <http://www.cfsan.fda.gov/~dms/fc05-toc.html>.
Jones, J.M. 1992. Food Safety. Eagan Press. St. Paul, MN.

PHYSICAL HAZARDS

- Hot food and beverages
- Hair, jewelry, ring settings, nail polish
- Bandages, chewing gum, cigarette ashes
- Beards, mustaches
- Coins, pencils, buttons, pockets, nametags
- Chipped drinking glasses, coffee pots, enameled pans, dishes, cups, food trays, glass containers



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Physical (Hard Foreign Object) Hazards

Liability

Hard foreign objects in food cost the retail food industry 5 times more in liability than all microbiological and chemical causes. The reason is obvious. When customers discover a foreign material in food, they have the food in their possession and there is no denial of the source.

When foodservice operations fail to keep hard foreign objects out of food, it is a violation of §3-101.11 of the FDA Food Code. If contamination is found in food products obtained from suppliers (e.g., grasshoppers in canned green beans), it is governed by §402 of the Food Drug and Cosmetic Act. Some examples of physical hazards in food are as follows.

Hot food and beverages

The quality temperatures for serving hot food such as soups and hot beverages when the customer eats it is 170°F or hotter, and for casseroles and vegetables is 150°F. Research by Moritz and Henriques (1947) has shown that if hot liquids at 170°F contact skin for as short a time as a few seconds, there can be severe skin burns.

Customer hot liquid skin burns have been a problem in food operations for a long time. At drive-through windows, cups of soup and beverages must have snug-fitting lids and a warning on the container, "CAUTION. Hot Liquid." They must be handed to the customer carefully.

When serving soup and hot beverages, servers must be careful not to spill hot liquid on the bare skin of a customer. When pouring hot coffee and refilling coffee cups, great care must be taken to not let the hot coffee spill on the customer.

Hair

A person may lose 100 hairs each day. Clean hair is not a microbiological hazard since it contains so few pathogens. However, hair does carry yeasts and molds, which can contaminate food and cause spoilage and reduced storage life. Although the presence of hair does not present a health hazard, customers become quite disgusted when hair is found in food. Most customers will not return to a foodservice operation after finding hair in one of the products. FDA regulations state that hair must be restrained and prevented from entering food. Hair restraints include the use of hats, scarves, hairnets, etc. Beard

bags are required to keep hair from mustaches and beards from falling into food.

Jewelry

In order to keep hard foreign objects out of food, service personnel should wear a minimum of jewelry. Food production employees should wear no jewelry. Jewelry settings can loosen and fall into food, causing hazards to customers. Bracelets, necklaces and watch bands can present hazards for employees if caught on equipment.

Fingernail Polish

Fingernail polish chips are not hazardous to customer's health. However, customers dislike finding this type of material in their food and may not return to the foodservice establishment if they find it in their food.

Small Items

Employees must be careful not to allow small items such as coins, buttons, and name tags to fall into food. Long neckties and scarves should be tied or restrained to prevent them from falling into food or catching in equipment.

Chipped Dishware

Chipped glasses, cups, and dishes present another physical hazard. Dishes and utensils must be inspected regularly to prevent this from occurring.

Ice Scoops

A metal ice scoop with a handle should be used to scoop ice. Glasses should never be used because they break in the ice and can create a very hazardous condition. Nor should hands, paper cups, bowls, or other non-approved items be used as ice scoops. Ice scoops are not a microbiological food safety problem if stored in the ice bin, in a clean place, or in an approved container. A container being filled with ice should be kept at least 6 inches off the floor on a clean surface so that the bottom of the container does not get dirty.

References:

Moritz, A.R. and Henriques, Jr., F.C. 1947. Studies of thermal injury: II. The relative importance of time and surface temperature in the causation of cutaneous burns. *Am. J. Pathol.* 23:695-720.

PHYSICAL HAZARDS (cont'd)

- Peppercorns, bay leaves, nut shells, raisin stems, fruit pits, pieces of wood and metal, stones, bones
- Worms, insects, dirt
- Metal can chips, staples, nails, paper and cardboard, plastic wrap
- Rat droppings, flies, cockroaches



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Physical Hazards from Animals and Other Sources

Animal Physical Hazards

Physical hazards often make their way into a foodservice facility in the food that is delivered. Rodents such as rats and mice in warehouses as well as in restaurant storage areas may contaminate food with feces and urine. All food, including incoming food, must be carefully inspected. Commercial flour products have flour weevil eggs, which hatch when these products are kept warm. Flour, mixes, and other cereal products should be stored in tightly covered, labeled containers after opening.

Fruits and vegetables are contaminated with insects (and possibly chemical spray) and should be washed.

Pest Control

Insect and rodent control in the foodservice operation must be accomplished by preventing their entry, quickly removing spills from the floor, and keeping food tightly covered. If the facility, including the floor, is not kept clean, pests cannot be kept out. Garbage cans must be emptied as often as necessary and kept clean and free from odors that attract insects and rodents. Use of chemical pesticides or a professional exterminator can eliminate an infestation problem quickly. Extreme caution should be used during extermination to prevent contamination of food with chemicals being used.

Insect Electrocution Devices

The FDA code allows insect electrocution devices if they are properly used. They must be installed in an area where food is not prepared or stored so that dead insects will not fall into exposed food, on food contact surfaces, or on clean equipment and utensils. The dead insects in the tray are a very concentrated source of bacteria. The bacteria continue to multiply on the dead insects. They must be discarded carefully so as not to cross-contaminate the facility.

Debris

Dirt, sand, small rocks, fruit pits, wood chips, and pieces of processing equipment can also enter the foodservice facility with the food. Products should be inspected and sorted when received so that debris, packaging materials, and unusable food components (rotted areas, cores, pits, outer leaves, etc.) can be separated and discarded.

Equipment Physical Hazards

Pieces of equipment within the foodservice facility are another physical hazard source. Metal chips from tin cans are created by the blade on a can opener after it has been used to open a number of cans and the blade has become sharp or notched. The blade must be checked frequently and replaced to keep it dull. Metal chips and other physical contaminants can be prevented from getting into food through preventive maintenance and continuous upkeep of equipment.

Other Physical Hazards

Whole spices, peppercorns, and bay leaves should be wrapped in cheesecloth bags before adding to food so that they can be removed. People choke on bay leaves and bay leaf stems and break their teeth on whole peppercorns. Big toothpicks with "pants" should be used in foods. Employees should watch for bones and bone chips in foods.

Staples from food packages such as take-out bagged sandwiches are physical hazards that can get into consumers' food. This hazard can be prevented by using a non-hazardous method of sealing the bags.

The only line of defense against packing materials (wood chips, staples, nails, wire) and glass jars is to carefully inspect food products from delivery to service, and to store foods that they are not contaminated by these objects. Metal scrub pads should not be used for cleaning pots and pans and other surfaces, because the fine pieces of metal may get into the food.

Food Defect Action Levels

The FDA has established acceptable limits for natural contamination of foods in manufacturing. These limits pose no threat to health.