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Haccp in Retail and Food Service Operations

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ABSTRACT: There is an increase in the customer demand for safe food. This has lead food processing companies to develop food safety management systems, which are based on HACCP. In 2001, ISO has undertaken the development of an auditable standard, which further defines HACCP's role in a food safety management system. This standard is not intended to define the minimal regulatory requirement; however it is intended to define the requirements for companies that desire to exceed the regulatory requirements for food safety. HACCP has become synonymous with food safety. It is a worldwide-recognized systematic and preventive approach that addresses biological, chemical and physical hazards through anticipation and prevention, rather than through end-product inspection and testing. Hazard Analysis Critical Control Points (HACCP) is a systematic method that serves as the foundation for assuring food safety in the retail sector. The HACCP system is designed to be used to prevent the occurrence of food borne hazards from production through manufacturing, storage and distribution of a food product in retail and various food service operations. The HACCP technique does this by identifying the risks, establishing critical control points, setting critical limits, and ensuring control measures are validated, verified and monitored before implementation. The effective implementation of HACCP will enhance the ability of companies to: protect and enhance brands and private labels, promote consumer confidence and conform to regulatory and market requirements

KEYWORDS: HACCP ·ISO· food borne hazard· HACCP technique· implementation

I. INTRODUCTION

Food safety in the early twenty-first century is an international challenge requiring close cooperation between countries in agreeing standards and in setting up transnational surveillance systems. The lessons of the past two decades are plain to those engaged in the food industry. No longer can farmers grow just what they want or use technical aids to farming without taking into account the effect on the quality of the food produced (Rooney and Wall, 2003). The behavior of consumers has been gradually changing. They currently require not only much higher dietary quality, hygiene and health standards in the products they purchase, but they also look for certification and reassurance of products origins (national or geographical) and production methods. This heightened consumer awareness is reflected in the demand for products endowed with individual characteristics due to specific production methods, composition or origin (national or geographic; Anon, 2004). No matter how professional and effective a company may be, there is always the possibility of a serious problem arising which is unforeseen or eventually develops into a major crisis. However, thinking through the possible ramifications of such an eventuality and preparing responses and scenarios to deal with it, always ensures that an organization is better prepared for the unexpected (Doeg, 1995). The Hazard Analysis and Critical Control Point (HACCP) system is a science-based system created to identify specific hazards and actions to control them in order to ensure food safety and quality. It can be considered an efficient tool for both the food industry and health authorities in preventing food borne diseases (Vela and Fernandez, 2003). A 'hazard' is 'a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect' (Codex Alimentarius, 1997). A HACCP system should be developed for every food production line and adapted for the individual products and processes (da Cruz *et al.*, 2006). HACCP systems have become mandatory for food industry.

II. WHAT IS HACCP?

The HACCP system, which is science based and systematic, identifies specific hazards and measures for their control to ensure the safety of food. HACCP is a tool to assess hazards and establish control systems that focus on prevention rather than relying mainly on end-product testing. Any HACCP system is capable of

accommodating change, such as advances in equipment design, processing procedures or technological developments.

HACCP - "Hazard Analysis and Critical Control Point" is a *systematic method* to analyze food processing and to identify undesirable / hazardous inclusion of chemical, physical, or biological agents into foods.
HACCP has become synonymous with food safety. It is a worldwide-recognized systematic and preventive approach that addresses biological, chemical and physical hazards through anticipation and prevention, rather than through end-product inspection and testing. The effective implementation of HACCP will enhance the ability of companies to: protect and enhance brands and private labels, promote consumer confidence and conform to regulatory and market requirements.

2.1. DEFINING THE TERMS:
H stands for Hazard:

Know the potential hazards in your food service facility. A hazard is defined as any biological, chemical, or physical property that may cause an unacceptable consumer risk. From the first step of growing the food product to the end step of consumption, many potential hazards exist. During food preparation, for example, opportunities for contamination exist at every step, from receiving, storing, and preparing to holding and serving. Some of the common and serious hazards in a food service industry facility include:

- Improper hand washing.
- Improper food temperatures.
- Improper cleaning and sanitizing.
- Cross contamination.

A stands for Analysis:

Analyze and examine the flow of food through the system. Begin with purchasing and follow the food through the system until its service to the patron in your facility. Only then can each hazard be placed in its proper perspective.

C stands for Critical:

Important for preventing illness to patrons become the critical ones. Ask which processes or procedures are critical to serving a safe food product. For example, how critical is the storage of a dry soda cracker in the prevention of food borne illness? Not critical at all when compared to the storage of raw ground beef. Therefore, the processes which are important for preventing illness to patrons become the critical ones.

C stands for Control:

Determine how to set controls for these critical hazards to prevent illness to patrons. In the case of raw ground beef, many control points must be set from receiving to serving the finished hamburger to the patron.

P stands for Point:

Establish the point at which critical control begins. A CCP is where control is lost and a health risk can occur. The HACCP system can prevent this loss of control and move the food service industry one step closer to being a risk-free industry. All processes in a food service facility could be classified as either Critical Control Points (CCP) or Control Points (CP).

III. HISTORY

The HACCP system for managing food safety concerns grew from two major developments. The first breakthrough was associated with W.E. Deming, whose theories of quality management are widely regarded as a major factor in turning around the quality of Japanese products in the 1950s. Dr Deming and others developed total quality management (TQM) systems which emphasized a total systems approach to manufacturing that could improve quality while lowering costs. The second major breakthrough was the development of the HACCP concept itself. The HACCP concept was pioneered in the 1960s by the Pillsbury Company, the United States Army and the United States National Aeronautics and Space Administration (NASA) as a collaborative development for the production of safe foods for the United States space programme. NASA wanted a "zero defects" programme to guarantee the safety of the foods that astronauts would consume in space. Pillsbury therefore introduced and adopted HACCP as the system that could provide the greatest safety while reducing dependence on end-product inspection and testing. HACCP emphasized control of the process as far upstream in the processing system as possible by utilizing operator control and/or continuous monitoring techniques at

critical control points. Pillsbury presented the HACCP concept publicly at a conference for food protection in 1971(APHA, 1971, Pillsbury Company, 1973).
The original Pillsbury HACCP procedure contained three essential components (Pillsbury Company, 1973):

- The identification and assessment of all hazards associated with the final foodstuffs.
- The identification of steps or stages within food production at which these hazards may be controlled, reduced or eliminated, i.e., the Critical Control Points (CCPs).
- The implementation of monitoring procedures at these CCPs.

The use of HACCP principles in the promulgation of regulations for low-acid canned food was completed in 1974 by the United States Food and Drug Administration (FDA). In the early 1980s, the HACCP approach was adopted by other major food companies. The United States National Academy of Science recommended in 1985 that the HACCP approach be adopted in food processing establishments to ensure food safety. More recently, numerous groups, including for example the International Commission on Microbiological Specifications for Foods (ICMSF) and the International Association of Milk, Food and Environmental Sanitarians (IAMFES), have recommended the broad application of HACCP to food safety.

3.1. Date Highlights of HACCP

- 1959 The Pillsbury Company develops concept for NASA
- 1971 US national conference on food protection (1st mention of HACCP)
- 1972 The Pillsbury Company in the United States began the application of its HACCP concept to the manufacture of its consumer food products
- 1973 The Pillsbury Company published the first HACCP text in '*Food Safety Through the Hazard Analysis and Critical Control Point System*'
- 1980 WHO/ICMSF report on HACCP
- 1983 WHO Europe recommends HACCP
- 1985 National Academy of Science report on HACCP
- 1988 Formation of the National Advisory Committee on Microbiological Criteria for Foods (NACMCF)
- 1989 National Advisory Committee of Microbiological Specification for Food document endorsing HACCP approach
- 1990 Richmond Report advocated use of HACCP
- 1991 Codex HACCP draft
- 1992 The NACMCF system defined HACCP as 'a systematic approach to be used in food production as a means to assure food safety'
- 1993 EU Commission 93/43/ECC recommended use of 5 HACCP principles Codex'93 Guidelines
- 1995 5 HACCP principles mandatory in EU
- 1997 Codex Document on HACCP principles and application
- 1998 FAO/WHO provide guidance for regulatory assessment of HACCP
- 2003 FAO/WHO develop HACCP guidelines
- 2004 EC 852/2004 requirement for all food businesses to adopt HACCP principles in EU
- 2006 Legal requirements to apply HACCP in food businesses (other than primary production) across EU
- 2006+ Increased worldwide use of HACCP in food safety legislation
  (Adapted from Corlett (1998), Griffith (2006), Linton (2001), Sperber (2005).Plants (FSIS, 1996). Meat and poultry HACCP implementation was completed in January 2000 (FSIS, 2000a, b).)

IV. THE NEED OF HACCP

Motivations for adopting HACCP may include the need to:

- reduce the incidence of food borne disease
- ensure a safe food supply for the population
- promote (facilitate) trade in food products

(http://www.unido.org/userfiles/cracknej/fgfs1.pdf).

V. HAZARDS (PHYSICAL, CHEMICAL, BIOLOGICAL)

The regulation defines a food safety hazard as 'Any biological, chemical or physical property that may cause a food to be unsafe for human consumption' (USDA, 1997). The HACCP system addresses and controls all significant hazards associated with a particular product (Goodrich *et al*., 2005). There are three categories of hazards that are considered in a HACCP plan. These are physical, chemical and biological.

5.1. Physical hazards

Physical hazards include glass, metal, stones, wood, plastic, rubber or pests (typically larger pests). Sand may also be an undesirable foreign material in a prepared salad but it is not likely to cause human illness (Harris, 1999). However, foreign objects which cannot or do not cause illness or injury are not hazards, even though they may not be aesthetically pleasing to the consumers (USDA, 1997). Physical hazards commonly result from accidental contamination and poor food handling practices that can occur at various points in the food chain from harvest to consumer (McSwane *et al*., 2000). The Canadian Food Inspection Agency (CFIA) defines three classes of physical hazards depending on their likelihood and the severity of the consequences:

- Category I (high likelihood)

- Category II (moderate likelihood)means to enhance food safety and has indicated
- Category III (low risk)
  (http://www.gov.mb.ca/agriculture/foodsafety/processor/pdf/cfs02s74.pdf).

To prevent physical hazards, wash raw fruits and vegetables thoroughly and visually inspect foods that cannot be washed (such as ground beef). Food workers should be taught to handle food safely to prevent contamination by unwanted foreign objects. Finally, food workers should not wear jewelry when involved in the production of food, except for a plain wedding band (McSwane *et al*., 2000). Nowadays, there are various methods for the detection of foreign materials such as metal detectors, low-energy X-rays etc. which are used in the food industry.

5.2. Chemical hazards

Chemical hazards include cleaning chemicals, pesticides (including those not applied in or around food processing establishments), allergens, toxic metals, nitrites and nitrates (when added to the product), residues (when animals have been given drugs to treat disease in the animal, e.g. antibiotics treatments for mastitis in cows) and chemical additives (when added;Harris, 1999). Between 5 and 8% of children and 1–2% of adults are allergic to certain chemicals in foods and food ingredients. These chemicals are commonly referred to as food allergens (McSwane *et al*., 2000).

Chemical hazards fall into two categories:

- Naturally occurring poisons, chemicals or deleterious substances are those that are natural constituents of foods and are not the result of environmental, agricultural, industrial or other contamination (e.g. aflatoxins, mycotoxins, shellfish toxins).
- Added poisonous chemicals or deleterious substances are those which are intentionally or unintentionally added to foods at some point in growing, harvesting, storage, processing, packing, or distribution (e.g. pesticides, fungicides, insecticides, fertilizers, drug residues, antibiotics, food additives, lubricants, cleaners, paints, coatings; USDA, 1997).

Because it is impossible to provide a comprehensive list of contaminants, it would be much better to focus on purity of water, raw material supply, workers' poor hygiene and lack of GMP in order to reduce the probability of occurrence of chemical hazards.

5.3. Biological hazards

Biological hazards include food poisoning bacteria such as *Salmonella*, *E. coli* and *Bacillus cereus*, which are hazardous because they can survive inadequate cooking, grow to harmful levels in stored food given the right conditions and spread from raw foods to 'ready to eat foods' (cross-contamination) (www.cardiff.gov.uk/ObjView.asp?Object ID=3968). After World War II, serious food safety incidents occurred in the nascent food processing industry. These typically involved *Salmonella* contamination of dried egg or dairy products, *Campylobacter* spp. in canned meat or *Clostridium botulinum* growth or presence in canned foods. The most pressing food safety issues in the food industry nowadays are due to the presence of *E. coli* O157:H7 and salmonellae in raw meat and poultry products and in produce (Sperber, 2005). *E.coli* O157:H7 is usually transferred to foods like beef through contact with intestines of slaughtered animals. Apples used for juice from orchards where cattle or deer graze are also suspected (McSwane *et al*., 2000).

Biological hazards come from:

- low quality of raw materials
- poor personal hygiene
- environment (air, water and equipment)
- inadequate cooking
- improper storage/holding temperature
- improper reheating
- cross-contamination – improper segregation of raw and cooked foods (http://www.jphpk.gov.my/Agronomi/KAV/5HACCP1.pdf; Forsythe and Hayes, 1998).

VI. WHO CAN USE HACCP?

All businesses involved in the food supply chain from producers to retailers can use HACCP. It can be applied throughout the food chain from primary production to final consumption and its implementation should be guided by scientific evidence of risks to human health. As well as enhancing food safety, implementation of HACCP can provide other significant benefits. In addition, the application of HACCP systems can aid inspection by regulatory authorities and promote international trade by increasing confidence in food safety.

The following sectors/business can use HACCP:

- ✓ *Fruits & Vegetables*
- ✓ *Dairy Products*
- ✓ *Meat & Meat Products*
- ✓ *Fish & Fishery Products*
- ✓ *Spices & Condiments*
- ✓ *Nuts & Nut Products*
- ✓ *Cereals*
- ✓ *Bakery & Confectionary*
- ✓ *Restaurants*
- ✓ *Hotels*
- ✓ *Fast Food Operations etc.*

(http//www.National Centre for HACCP Certification.html)

VII. THE CODEX ALIMENTARIUS OF FOOD HYGIENE

Recognizing the importance of HACCP to food control, the twentieth session of the Codex Alimentarius Commission, held in Geneva, Switzerland from 28 June to 7 July 1993, adopted Guidelines for the application of the Hazard Analysis Critical Control Point (HACCP) system (ALINORM 93/13A, Appendix II). The commission was also informed that the draft revised General Principles of Food Hygiene would incorporate the HACCP approach. The revised Recommended International Code of Practice - General Principles of Food Hygiene [CAC/RCP 1-1969, Rev 3 (1997)] was adopted by the Codex Alimentarius Commission during its twenty-second session in June 1997. The Hazard Analysis and Critical Control Point (HACCP) system and guidelines for its application is included as its Annex.

The Codex General Principles of Food Hygiene lay a firm foundation for ensuring food hygiene. They follow the food chain from primary production through to the consumer, highlighting the key hygiene controls at each stage and recommending an HACCP approach wherever possible to enhance food safety. These controls are internationally recognized as essential to ensuring the safety and suitability of food for human consumption and international trade.

VIII. WHAT ARE THE SEVEN HACCP PRINCIPLES?

The 1997 National Advisory Committee for the Microbiological Criteria for Foods (NACMCF) recommendations updated the seven HACCP principles to include the following:

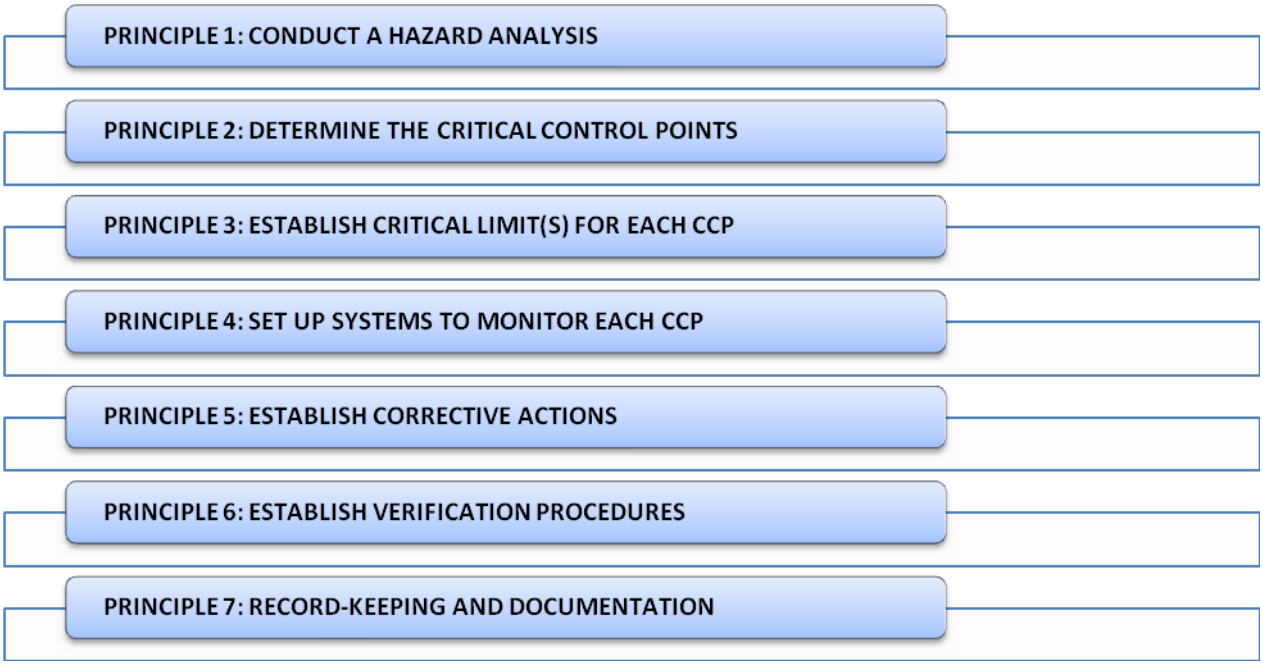

Figure 1: The HACCP principles.

[1] Conduct a Hazard Analysis: The first principle is about understanding the operation and determining what food safety hazards are likely to occur. The manager needs to understand how the people, equipment, methods, and foods all affect each other. The processes and procedures used to prepare the food are also considered. This usually involves defining the operational steps (receiving, storage, preparation, cooking, etc.) that occur as food enters and moves through the operation. Additionally, this step involves determining the control measures that can be used to eliminate, prevent, or reduce food safety hazards. Control measures include such activities as implementation of employee health policies to restrict or exclude ill employees and proper hand washing.

[2] Determine the Critical Control Points (CCPs): Once the control measures in principle no.1 are determined, it is necessary to identify which of the control measures are absolutely essential to ensuring safe food. An operational step where control can be applied and is essential for ensuring that a food safety hazard is eliminated, prevented or reduced to an acceptable level is a critical control point (CCP). When determining whether a certain step is a CCP, if there is a later step that will prevent, reduce, or eliminate a hazard to an acceptable level, then the former step is not a CCP. It is important to know that not all steps are CCPs. Generally, there are only a few CCPs in each food preparation process because CCPs involve only those steps that are absolutely essential to food safety.

[3] Determine the Critical Limits: Each CCP must have boundaries that define safety. Critical limits are the parameters that must be achieved to control a food safety hazard. For example, when cooking pork chops, the *Food Code* sets the critical limit at 145 ºF for 15 seconds. When critical limits are not met, the food may not be safe. Critical limits are measurable and observable.

[4] Establish Procedures to Monitor CCPs: Once CCPs and critical limits have been determined, someone needs to keep track of the CCPs as the food flows through the operation. Monitoring involves making direct observations or measurements to see that the CCPs are kept under control by adhering to the established critical limits.

[5] Establish Corrective Actions: While monitoring CCPs, occasionally the process or procedure will fail to meet the established critical limits. This step establishes a plan for what happens when a critical limit has not been met at a CCP. The operator decides what the actions will be, communicates those actions to the employees, and trains them in making the right decisions. This preventive approach is the heart of HACCP. Problems will arise, but you need to find them and correct them before they cause illness or injury.

[6] Establish Verification Procedures: This principle is about making sure that the system is scientifically-sound to effectively control the hazards. In addition, this step ensures that the system is operating according to what is specified in the plan. Designated individuals like the manager periodically make observations of employees monitoring activities, calibrate equipment and temperature measuring devices, review records/actions, and discuss procedures with the employees. All of these activities are for the purpose of ensuring that the HACCP plan is addressing the food safety concerns and, if not, checking to see if it needs to be modified or improved.

[7] Establish a Record Keeping System: There are certain written records or kinds of documentation that are needed in order to verify that the system is working. These records will normally involve the HACCP plan itself and any monitoring, corrective action, or calibration records produced in the operation of the HACCP system. Verification records may also be included. Records maintained in a HACCP system serve to document that an ongoing, effective system is in place. Record keeping should be as simple as possible in order to make it more likely that employees will have the time to keep the records.

APPLICATION

The application of HACCP principles consists of the following tasks as identified in the Logic Sequence for Application of HACCP as shown in Figure 2.

1. Assemble HACCP team

The food operation should assure that the appropriate product specific knowledge and expertise is available for the development of an effective HACCP plan. Optimally, this may be accomplished by assembling a multidisciplinary team. Where such expertise is not available on site, expert advice should be obtained from other sources. The scope of the HACCP plan should be identified. The scope should describe which segment of the food chain is involved and the general classes of hazards to be addressed (e.g. does it cover all classes of hazards or only selected classes).

2. Describe product

A full description of the product should be drawn up, including relevant safety information such as: composition, physical/chemical structure (including A_w, pH, etc.), microcidal/static treatments (heat-treatment, freezing, brining, smoking, etc.), packaging, durability and storage conditions and method of distribution.

3. Identify intended use

The intended use should be based on the expected uses of the product by the end user or consumer. In specific cases, vulnerable groups of the population, e.g. institutional feeding, may have to be considered.

4. Construct flow diagram

The flow diagram should be constructed by the HACCP team. The flow diagram should cover all steps in the operation. When applying HACCP to a given operation, consideration should be given to steps preceding and following the specified operation.

5. On-site confirmation of flow diagram

The HACCP team should confirm the processing operation against the flow diagram during all stages and hours of operation and amend the flow diagram where appropriate.

6. List all potential hazards associated with each step (SEE PRINCIPLE 1)

Conduct a hazard analysis, and consider any measures to control identified hazards

7. Determine Critical Control Points (SEE PRINCIPLE 2)

There may be more than one CCP at which control is applied to address the same hazard. The determination of a CCP in the HACCP system can be facilitated by the application of a decision tree, which indicates a logic reasoning approach as shown in Fig.3.

8. Establish critical limits for each CCP (SEE PRINCIPLE 3)

Critical limits must be specified and validated if possible for each Critical Control Point. In some cases more than one critical limit will be elaborated at a particular step. Criteria often used include measurements of

temperature, time, moisture level, pH, A_w, available chlorine, and sensory parameters such as visual appearance and texture.

9. Establish a monitoring system for each CCP (SEE PRINCIPLE 4)

Monitoring is the scheduled measurement or observation of a CCP relative to its critical limits. The monitoring procedures must be able to detect loss of control at the CCP. Further, monitoring should ideally provide this information in time to make adjustments to ensure control of the process to prevent violating the critical limits. All records and documents associated with monitoring CCPs must be signed by the person(s) doing the monitoring and by a responsible reviewing official(s) of the company.

10. Establish corrective actions (SEE PRINCIPLE 5)

Specific corrective actions must be developed for each CCP in the HACCP system in order to deal with deviations when they occur.

11. Establish verification procedures (SEE PRINCIPLE 6)

Establish procedures for verification. Verification and auditing methods, procedures and tests, including random sampling and analysis, can be used to determine if the HACCP system is working correctly. The frequency of verification should be sufficient to confirm that the HACCP system is working effectively. Examples of verification activities include:

- Review of the HACCP system and its records;
- Review of deviations and product dispositions;
- Confirmation that CCPs are kept under control.

Where possible, validation activities should include actions to confirm the efficacy of all elements of the HACCP plan.

12. Establish Documentation and Record Keeping (SEE PRINCIPLE 7)

Efficient and accurate record keeping is essential to the application of a HACCP system. HACCP procedures should be documented.
Documentation examples are:

- Hazard analysis;
- CCP determination;
- Critical limit determination.

Record examples are:

- CCP monitoring activities;
- Deviations and associated corrective actions;
- Modifications to the HACCP system.

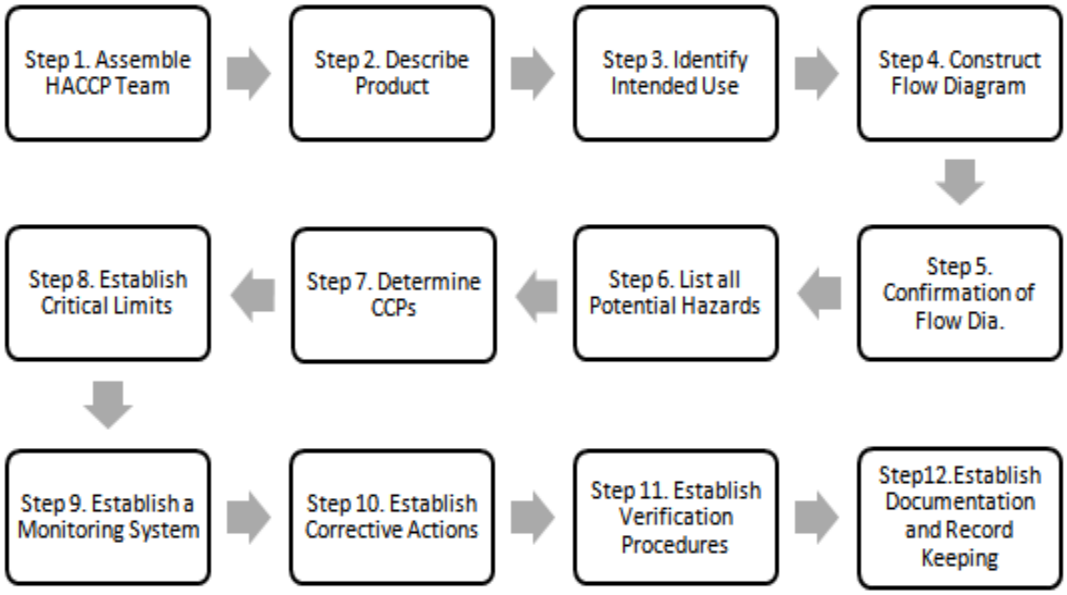

Figure 2: Logic sequence for the application of HACCP.

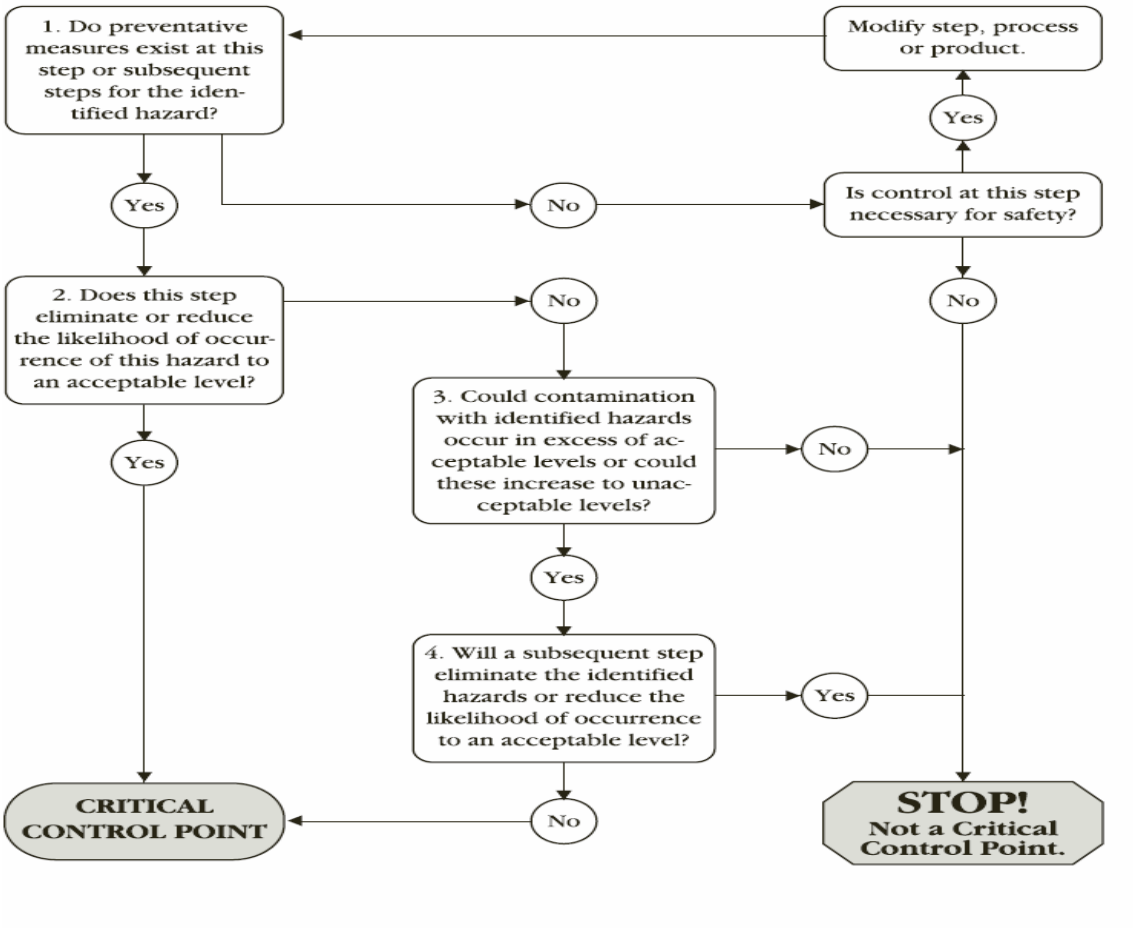

Figure 3: Example of decision tree to identify CCP_S (answer questions in sequence).

IX . HOW CAN HACCP PRINCIPLES BE USED IN RETAIL AND FOOD SERVICE OPERATIONS?

Within the retail and food service industries, the implementation of HACCP principles varies as much as the products produced. The resources available to help you identify and control risk factors common to your operation may also be limited. Due to this diversity, implementation of "textbook" HACCP is impractical in most retail and food service establishments. Like many other quality assurance programs, the principles of HACCP provide a common-sense approach to identifying and controlling risk factors. Consequently, many food safety management systems at the retail level incorporate some, if not all, of the principles of HACCP. While a complete HACCP system is ideal, many different types of food safety management systems may be implemented to control risk factors. It is also important to recognize that HACCP has no single correct application. Variations in the procedures presented in this Manual are appropriate as long as they are based on sound public health judgment.

X. APPLYING HACCP PRINCIPLES TO RETAIL AND FOOD SERVICE

What is the process approach?

Since the early 1980's, retail and food service operators and regulators have been exploring the use of HACCP in restaurants, grocery stores, and other retail food establishments. Conducting the hazard analysis by using the food preparation processes common to a specific operation is often more efficient and useful for retail and food service operators. This is called the "Process Approach" to HACCP. The process approach can best be described as dividing the many food flows in an establishment into broad categories based on activities or stages in the flow of food through your establishment, then analyzing the hazards, and placing managerial controls on each grouping.

What is the flow of food?

The flow of food in a retail or food service establishment is the path that food follows from receiving through service or sale to the consumer. Several activities or stages make up the flow of food and are called operational steps. Examples of operational steps include receiving, storing, preparing, cooking, cooling, reheating, holding, assembling, packaging, serving, and selling. Keep in mind that the terminology used for operational steps may differ between food service and retail food store operations.

What are the three food preparation processes most often used in retail and food service establishments?

Most food items produced in a retail or food service establishment can be categorized into one of three preparation processes based on the number of times the food passes through the temperature danger zone between 41 ºF to 135 ºF:

- Process 1: Food Preparation with No Cook Step Example flow: Receive – Store – Prepare – Hold – Serve
  (other food flows are included in this process, but there is no cook step to destroy pathogens)

- Process 2: Preparation for Same Day Service
  Example flow: Receive – Store – Prepare – Cook – Hold – Serve
  (other food flows are included in this process, but there is only one trip through the temperature danger zone)

- Process 3: Complex Food Preparation
  Example flow: Receive – Store – Prepare – Cook – Cool – Reheat – Hot Hold – Serve
  (other food flows are included in this process, but there are always two or more complete trips through the temperature danger zone)

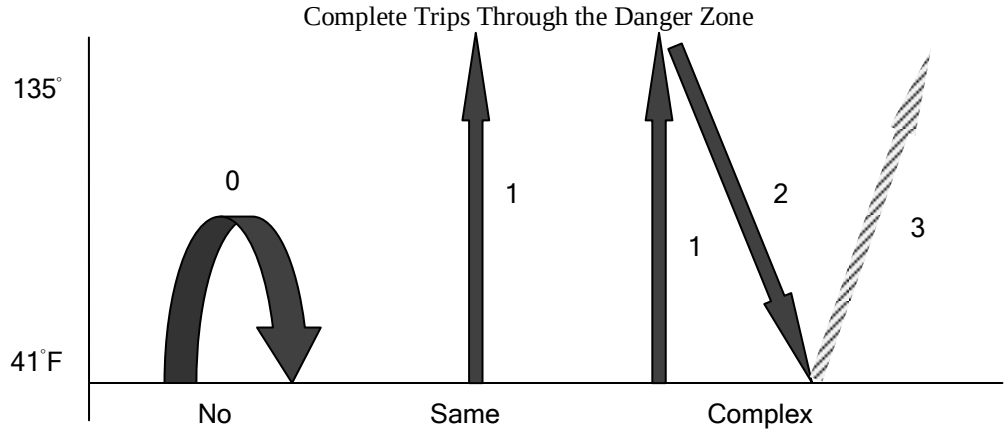

Figure 5: Danger zone diagram.

A summary of the three food preparation processes in terms of number of times through the temperature danger zone can be depicted in a Danger Zone diagram. Note that while foods produced using process 1 may *enter* the danger zone, they are neither cooked to destroy pathogens, nor are they hot held. Foods that go through the danger zone only once are classified as Same Day Service, while foods that go through more than once are classified as Complex food preparation. The three food preparation processes conducted in retail and food service establishments are not intended to be all-inclusive. For instance, quick service facilities may have "cook and serve" processes specific to their operation. These processes are likely to be different from the "Same Day Service" preparation processes in full service restaurants since many of their foods are generally cooked and hot held before service. In addition, in retail food stores, operational steps such as packaging and assembly may be included in all of the food preparation processes prior to being sold to the consumer. It is also very common for a retail or food service operator to have a single menu item(i.e. chicken salad sandwich) that is created by combining several components produced using more than one kind of food preparation process. It is important for you to remember that even though variations of the three food preparation process flows are common, the control measures – actions or activities that can be used to prevent, eliminate, or reduce food safety hazards – to be implemented in each process will generally be the same based on the number of times the food goes through the temperature danger zone.

XI. HACCP PLAN

FACILITY-WISE CONSIDERATIONS

In order to have active managerial control over personal hygiene and cross contamination, you must implement certain control measures in all phases of your operation. All of the following control measures should be implemented regardless of the food preparation process used:

- No bare hand contact with ready-to-eat foods (or use of an approved, alternative procedure)
- Proper hand washing
- Restriction or exclusion of ill employees
- Prevention of cross-contamination

In addition to the facility-wide considerations, a food safety management system
involving this food preparation process should focus on ensuring that you have active managerial control over the following:

- Cooking to destroy bacteria and parasites
- Cooling to prevent the outgrowth of spore-forming or toxin-forming bacteria
- Hot and cold holding or using time alone to inhibit bacterial growth and toxin Formation
- Date marking of ready-to-eat PHF held for more than 24 hours to control the growth of *Listeria monocytogenes*
- Reheating for hot holding, if applicable

DEVELOPING YOUR FOOD SAFETY SYSTEMS

The ideal progression of building a food safety management system is as follows:

Assemble Your HACCP Team-

- Procedural Step 1 (Develop Prerequisite Programs)
- Procedural Step 2 (Group Menu Items/Products)
- Procedural Step 3 (Conduct Hazard Analysis)
- Procedural Step 4 (Implement Control Measures and Establish Critical Limits)
- Procedural Step 5 (Establish Monitoring Procedures)
- Procedural Step 6 (Develop Corrective Actions)
- Procedural Step 7 (Conduct Ongoing Verification)
- Procedural Step 8 (Keep Records)
- Procedural Step 9 (Conduct Periodic Validation)

PROCEDURAL STEPS

PROCEDURAL STEP 1

Develop Prerequisite Programs

Before beginning to write your food safety management system, it is recommended that you develop and implement prerequisite programs. *Prerequisite programs may include such things as* –

• Vendor certification programs
• Training programs
• Allergen management
• Buyer specifications
• Recipe/process instructions
• First-In-First-Out (FIFO) procedures
• Other Standard Operating Procedures (SOPs)

Prerequisite Programs to Control Contamination of Food

These procedures ensure that –

- Soiled and unsanitized surfaces of equipment and utensils do not contact raw or cooked (ready-to-eat) food
- Workers with certain symptoms, such as vomiting or diarrhea, are restricted or excluded
- Raw animal foods do not contaminate cooked (ready-to-eat) food
- Effective hand washing is practiced
- Eating, smoking, and drinking in food preparation areas are prohibited
- Water in contact with food and food-contact surfaces and used in the manufacture of ice is potable
- Toxic compounds are properly labeled, stored, and safely used
- Contaminants such as condensate, lubricants, pesticides, cleaning compounds, sanitizing agents, and additional toxic materials do not contact food, food-packaging materials, and food-contact surfaces
- Food, food-packaging materials, and food-contact surfaces are not contaminated by physical hazards such as broken glass from light fixtures, jewelry, etc.
- An effective pest control system is in place
- Hair restraints are used
- Clean clothing is worn
- The wearing of jewelry (other than a wedding ring) is prohibited

Prerequisite Programs to Control Bacterial Growth

These procedures ensure that all potentially hazardous food is received and stored at a refrigerated temperature of 41 ºF or below. Note that the *Food Code* makes some allowances for specific foods that may be received at higher temperatures.

Prerequisite Programs to Maintain Equipment

These procedures ensure that –

- Food-contact surfaces, including utensils, are cleaned, sanitized, and maintained in good condition
- Temperature measuring devices (e.g., thermometer or temperature recording device) are calibrated regularly
- Cooking and hot holding equipment (grills, ovens, steam tables, conveyer cookers, etc.) are routinely checked, calibrated, and operated to ensure correct product temperature

- Cold holding and cooling equipment (refrigerators, rapid chill units, freezers, salad bars, etc.) are routinely checked, calibrated, and operated to ensure correct product temperature

• Ware washing equipment is operated according to manufacturer's specifications
• Toilet facilities are accessible to employees and maintained

PROCEDURAL STEP 2
Group Your Menu Items/Products

To begin grouping your menu items/products, you should review how your menu items or products flow through your operation. You should note whether they undergo a cook step for same day service, receive additional cooling and reheating following a cook step, or have no cook step involved.

PROCEDURAL STEP 3
Conduct a Hazard Analysis

In developing a food safety management system, you should identify the food safety hazards that exist in the flow of food in your operation from receiving to service or sale. By identifying the food safety hazards present in your system, you should then be able to determine the possible control measures that may be implemented to achieve active managerial control of the foodborne illness risk factors leading to out-of-control hazards.

PROCEDURAL STEP 4
Implement Control Measures in Prerequisite Programs or at CCPs in Your HACCP Plans and Establish Critical LimitsThe objective of this procedural step is to implement control measures in your food safety management system to prevent, eliminate, or reduce hazards to acceptable levels. Once control measures have been identified in Procedural Step 3 – Hazard Analysis, you should determine how you will achieve active managerial control. Control may be achieved at Critical Control Points (CCPs) in your HACCP plans or through prerequisite programs. Some of the operational steps which we use in food preparation and the control measures for them are as follows:

COMMON OPERATIONAL STEPS USED IN RETAIL AND FOOD SERVICE

The following information about the common operational steps conducted at retail is provided to assist in your decision-making as you move through the procedural steps presented in this document. Common operational steps conducted at retail include, but are not limited to, receiving, storing, preparing, cooking, cooling, reheating, hot and cold holding, assembly/set-up/packing, serving, and selling.

RECEIVING

Receiving is an important operational step to food safety. At receiving, your main concern is contamination from pathogens and the formation of harmful toxins. Two recommended control measures of importance during this operational step include –

• Receiving the food at proper temperatures and getting perishable food into cold storage quickly
• Obtaining food, ingredients, and packaging materials from approved sources (suppliers who are regulated and inspected by appropriate regulatory authorities)

STORAGE
When food is in refrigerated storage, your food safety management system should focus on –
• Maintaining temperature control to limit the growth of pathogenic bacteria that may be present in a ready-to-eat product
• Storing food so that cross-contamination of ready-to-eat food with raw animal foods is prevented

PREPARATION
At the preparation step, prerequisite programs can be developed to control some hazards and assist in the implementation of a food safety management system that minimizes –
• bacterial growth
• contamination from employees and equipment

Small batch preparation is an important tool for controlling bacterial growth because limiting the amount of food prepared minimizes the time the food is kept at a temperature that allows for growth. Pre-planning the volume of food and the time needed for preparation minimizes the time food is in the temperature danger zone at this operational step.

COOKING

Cooking to proper temperatures for a specified time will kill most harmful bacteria and parasites. Therefore, frequent monitoring of cooking temperatures is highly recommended. Checking the internal product temperature is the desirable monitoring method.

COOLING

One of the most labor-intensive operational steps is rapidly cooling foods to control bacterial growth. Improper cooling of potentially hazardous foods has been consistently identified as one of the factors contributing to food borne illness. Foods that have been cooked and held at improper temperatures provide an excellent environment for the growth of spore-forming bacteria. Commercial refrigeration equipment is designed to hold cold food at the proper temperature, not cool large masses of food. Some alternatives for cooling foods include:

- Using rapid chill refrigeration equipment designed to cool the food to acceptable temperatures quickly by using increased compressor capacity and high rates of air circulation
- Avoiding the need to cool large masses by preparing smaller batches closer to periods of service
- Stirring hot food while the food container is in an ice water bath

REHEATING

If food is held at improper temperatures for enough time, pathogens have the opportunity to multiply to dangerous numbers. Proper reheating provides an important control for eliminating some of these organisms. Remember that although proper reheating will kill most organisms of concern, it will not eliminate toxins such as those produced by *Staphylococcus aureus* and *Bacillus cereus* or food borne viruses. Special consideration should be given to the time and temperature in the reheating of cooked foods. To control biological hazards, it is recommended that reheating be managed either as a CCP in your HACCP plans or as a prerequisite program and be based upon the same level of safety established by the critical limits in the *Food Code*.

HOLDING (HOT, COLD, OR TIME)

All three processes may involve the holding of foods, i.e. hot and cold holding or use of time alone as public health control. When there is a cooking step to eliminate bacteria, all but the spore-forming bacteria should be destroyed. If cooked food is not held at the proper temperature or, absent temperature control, for the appropriate time, the rapid growth of these spore-forming bacteria is a major concern. When food is held, cooled, and reheated in a food establishment there is an increased risk from contamination caused by personnel, equipment, procedures, or other factors. Harmful bacteria that are introduced into a product that is not held at proper temperature have the opportunity to multiply to large numbers in a short period of time. Once again, management of personal hygiene and the prevention of cross contamination impact the safety of the food at this operational step. Keeping food products at 135 ºF or above during hot holding and keeping food products at or below 41 ºF is effective in preventing microbial growth. As an alternative to temperature control, the *Food Code* details actions when time alone is used as a control, including a comprehensive monitoring and food marking system to ensure food safety.

SET UP, ASSEMBLY, AND PACKING

Set up, assembly, and packing are operational steps used by some retail food establishments, including caterers [e.g., restaurant-caterers, interstate conveyance caterers, commissaries, grocery stores (for display cases), schools, nursing homes, hospitals, or food delivery services]. Set up, assembly, and packing may involve wrapping food items, assembling these items onto trays, and packing them into a transportation carrier or display case. An example would be an airline flight kitchen where food entrees are wrapped, assembled, and placed into portable food carts that are taken to a final holding cooler. Hospital kitchens would be another example where patient trays are assembled and placed into carriers for transportation to nursing stations. Food may be placed in bulk containers for transportation to another site where it is served.

SERVING/SELLING

This is the final operational step before the food reaches the customer. When employees work with food and food-contact surfaces, they can easily spread bacteria parasites, and viruses. Managing personal

hygiene is important to controlling these hazards. It is recommended that a management program for employee personal hygiene be implemented that addresses the following:
• Procedures for proper hand washing
• The appropriate use of gloves and dispensing utensils
• Control of bare hand contact with ready-to-eat foods
• Exclusion and restriction of ill employees

PROCEDURAL STEP 5
Establish Monitoring Procedures
Monitoring is observing or measuring specific operational steps in the food process to determine if your critical limits are being met. This activity is recommended to make sure your critical control points are under control. Monitoring will identify when there is a loss of control or a trend toward a loss of control so that corrective actions (discussed in Procedural Step 6) can be taken.

Consideration should be given to determining answers to the following questions:
- What will you monitor?
- How will you monitor?
- When and how often will you monitor?
- Who will be responsible for monitoring?

PROCEDURAL STEP 6
Develop Corrective Actions
You should decide what type of corrective action to take if a critical limit is not met by asking yourself the following questions:
- ✓ What measures do you expect employees to take to correct the problem?
- ✓ Do your employees understand the corrective action?
- ✓ Can the corrective action be easily implemented?
- ✓ Are different options needed for the appropriate corrective actions depending on the process and monitoring frequency?
- ✓ How will these corrective actions be documented and communicated to management so the system can be modified to prevent the problem from occurring again?

PROCEDURAL STEP 7
Conduct Ongoing Verification
Verification activities are conducted frequently, such as daily, weekly, monthly, etc.

PROCEDURAL STEP 8
Keep Records
As the manager of your operation, you may have several duties to perform in addition to making sure that the activities in your food safety management system are being performed at the proper frequency and with the proper method. Documenting these activities provides one mechanism for verifying that the activities were properly completed.

There are at least 5 types of records that may be maintained to support your food safety management system:
• Records documenting the activities related to the prerequisite programs
• Monitoring records
• Corrective action records
• Verification and validation records (discussed under Procedural Step 9)
• Calibration records

PROCEDURAL STEP 9
Conduct Periodic Validation
Once your food safety management system is established, you should periodically review it to determine whether the food safety hazards are controlled when the system is implemented properly. This review is known as validation. It is a review or audit of the plan to determine if –
- Any new product/processes/menu items have been added to the menu
- Suppliers, customers, equipment, or facilities have changed
- Prerequisite programs are current and implemented

- Worksheets are still current
- CCPs are still valid, or if new CCPs are needed
- Critical limits are set realistically and are adequate to control the hazard (e.g., the time needed to cook a turkey to meet the *Food Code* internal temperature requirement)
- Monitoring equipment has been calibrated as planned

Validation helps you to –

- Improve the system and HACCP plan by identifying weaknesses
- Eliminate unnecessary or ineffective controls
- Determine if the HACCP plan needs to be modified or updated

ADVANTAGES OF HACCP

The HACCP system, as it applies to food safety management, uses the approach of controlling critical points in food handling to prevent food safety problems. The system, which is science based and systematic, identifies specific hazards and measures for their control to ensure the safety of food. HACCP is based on prevention and reduces the reliance on end-product inspection and testing.

The HACCP system can be applied throughout the food chain from the primary producer to the consumer. Besides enhancing food safety, other benefits of applying HACCP include more effective use of resources, savings to the food industry and more timely response to food safety problems.

BENEFITS OF HACCP:

- Preventing possible hazards and supplying safe products.
- Minimizing risks of food poisoning.
- Making increase consumer confidence.
- Making increase industry authenticity.
- Supplying active Otto-control system.
- Minimizing product cost.
- Maximizing advantageousness.
- Making easier marketing.
- Increasing products' shelf life.
- Making solve product problems systematically.
- Making product export easy, due to its international acceptability.
- Increasing food safety and hygiene conscious of food industry stuff.

CONCLUSION

A well-designed and implemented HACCP plan will provide additional protection that these products are safe from potential microbiological, chemical, and physical hazards.In planning for HACCP, a special commitment to employee training, to assigning a responsible employee team, and to developing a thorough understanding of all food products and operations is imperative.Implementing a HACCP plan includes a detailed analysis and risk assessment of potential hazards, identification of areas in processing which are at most risk of contamination, establishing monitoring and inspection requirements and procedures to evaluate compliance, establishing measurable parameters which maintain process control, identifying process control limits, establishing corrective actions to be taken, establishing and implementing a thorough record-keeping system, and providing for update verification or validation that the plan is working in retail food services.

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