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HACCP System – Conrad Algarve Hotel

•HACC Principles & Implementation

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Table of contents

Introduction

- The evolution of society and its broad development has enabled the expansion of numerous sectors. The catering or food industry sector was not indifferent to developments and, therefore, had to adopt new measures in order to become more advantageous and at the same time safe. Therefore, the adoption of food security plans became necessary and mandatory in several areas, and mainly in the food area.
- A system adopted in the food sector to ensure the well-being of employees and consumers is the HACCP System. HACCP is an internationally recognized acronym for Hazard Analysis and Critical Control Points. According to ASAE, the Food and Economic Security Authority, the HACCP system is based on a preventive methodology, with the aim of being able to avoid potential risks that could cause harm to consumers, through the elimination or reduction of hazards, in order to ensure that unsafe food is not made available to the consumer. The HACCP system is based on the application of technical and scientific principles in the production and handling of foodstuffs from "the farm to the plate".
- The applicability of this system is valid and necessary in all food sectors. This methodology is adaptable to each organization, being a good option for complying with essential good hygiene practices. Each organization that applies this HACCP System must adapt it to the organization's reality, developing specific plans that facilitate the management of methodologies specific to each sector in the organization.

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Terminologies

- **Code of good practices** – Set of good practices so as not to compromise the safety or safety of food.
- **Codex Alimentarius** – known as the "Food Code", is a collection of standards, guidelines and codes of practice adopted by the Codex Alimentarius Commission. Codex standards ensure that food is safe and marketable.
- **Contamination** – Unintentional presence of any foreign material in food, whether of chemical, physical or biological origin, which makes it unsuitable for consumption.
- **Corrective Action** – Action aimed at eliminating the occurrence of hazards or reducing their probability to acceptable levels.
- **Critical Control Point** – Any point, step, or procedure in a product manufacturing process where:
  i. By control action, a danger to consumer health can be avoided, eliminated, or reduced to an acceptable level.
  ii. Loss of control may result in an unacceptable risk to the health of the consumer.
- **Critical Limit** – Value above which the product is unacceptable, from a health point of view.
- **Cross-contamination** – Transfer of microorganisms from contaminated food (normally unprepared) to prepared food by direct contact, dripping or indirect contact through a vehicle such as hands, utensils, equipment, or clothing.
- **Danger** – Any biological, chemical, or physical property of a food that may cause unacceptable harm to the health of the consumer.
- **Danger zone** – Temperature range between 3 °C and 65 °C, in which microorganisms develop rapidly.

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Terminologies

- **Food handlers** – All those who, due to their professional activity, come into direct contact with food, that is, carry out the culinary preparation of food in facilities where meals are prepared and served.
- **Food Hazards** – Any biological, chemical, or physical property that may cause unacceptable harm to the health of the consumer.
- **Food Hygiene** – Set of rules, measures and conditions that ensure the safety and healthiness of food, at all stages of the food chain, production, preparation, packaging, transport, distribution, and sale, thus allowing the health of the consumer to be preserved.
- **Food Infection** – Results from the growth of microorganisms in the intestine after ingestion of contaminated food.
- **Food Safety** – Guarantee that food does not present a danger to the consumer when it is prepared and/or consumed in accordance with the use for which it was intended. Guarantee that food does not harm the consumer's health.
- **Forward march** – Circuit that food must follow, from the dirtiest area to the cleanest, so that food ready to serve does not cross paths with food that will be peeled, washed, etc.
- **Hand washing** – Removing dirt, food residue, dust, grease, or other undesirable material from your hands.
- **Health** – State of complete physical, social, and psychological well-being and not just the absence of disease.
- **Layout** – How the sequence of processes and equipment is arranged.
- **Microorganisms** – Very small beings that can only be seen under a microscope, which include bacteria, moulds, viruses, yeasts, and protozoa.

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Terminologies

- **Pathogenic microorganisms** – Microorganisms capable of causing infectious diseases.
- **Pests** – Any animal capable of directly or indirectly contaminating food.
- **Poisoning** – Illness that results from the ingestion of foods containing a certain number of pathogenic microorganisms capable of producing or releasing toxins after ingestion.
- **Preventative measure** – Action taken to avoid or reduce the occurrence of a hazard.
- **Preventive Action** – Action aimed at preventing the occurrence of hazards or reducing their probability to acceptable levels.
- **Record** – Provides objective evidence of activities carried out or results obtained.
- **Risk** – Probability of the occurrence of a danger to the health of the consumer.
- **Sanitation** – Set of cleaning and disinfection activities.
- **Surveillance** – Planned sequence of measurements and observations, to demonstrate that a critical control point is under control.
- **Toxins** – Chemical substances produced by some microorganisms present in food, susceptible to developing in the food or organism after consumption of contaminated food.
- **Unsafe food** – Food that may be harmful to human health or that in any way may be unsuitable for human consumption is unsafe.

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I. THE ORIGIN OF HACCP

- The Hazard Analysis and Critical Control Points (HACCP) system was first developed in the 1960s by a team of food scientists and engineers at the Pillsbury Company in the United States. The system was initially developed to ensure the safety of food for astronauts on NASA's Apollo space missions.
- The HACCP system was first implemented in the United States in the 1970s, and it quickly gained popularity as a food safety management system. In 1993, the Codex Alimentarius Commission, a joint food standards program of the United Nations Food and Agriculture Organization and the World Health Organization, adopted the HACCP system as an international standard for food safety.
- In Portugal, the implementation of the HACCP system began in the early 1990s, following the adoption of the system by the European Union. The Portuguese government passed legislation in 1995 requiring all food businesses to implement a HACCP-based food safety management system.
- The HACCP system is designed to prevent and control potential hazards in the food production process, including biological, chemical, and physical hazards. The system involves a series of steps, including hazard analysis, identification of critical control points, establishment of critical limits, monitoring procedures, corrective actions, and record-keeping.

I. THE ORIGIN OF HACCP

- The Hazard Analysis and Critical Control Points (HACCP) system was created to ensure food safety by identifying and controlling potential hazards in food production processes. It was initially developed by the Pillsbury Company, the U.S. Army Laboratories, and the National Aeronautics and Space Administration (NASA) in the 1960s.
- The NASA connection to HACCP stems from the need to provide safe food for astronauts during space missions. The rigorous requirements for food safety in space influenced the development of HACCP as a systematic approach to prevent foodborne illnesses.
- The main dangers that led to the need for HACCP implementation were microbial contamination, chemical hazards, and physical hazards in food production. These hazards could arise from various sources such as improper handling, cross-contamination, inadequate cooking or processing, and poor sanitation practices.
- The scientific basis of HACCP lies in its seven principles: conducting a hazard analysis, identifying critical control points (CCPs), establishing critical limits, implementing monitoring procedures, establishing corrective actions, verifying the system, and maintaining records.

I. THE ORIGIN OF HACCP

- The origin of HACCP can be traced back to the 1960s when the U.S. military and Pillsbury conducted a detailed study on food management in space. This study was commissioned by NASA to minimize the occurrence of foodborne illnesses during missions. The technique aimed to thoroughly evaluate food production processes. After numerous tests, this system expanded into the HACCP that we know today.
- In 1969, the Codex Alimentarius commission incorporated the guidelines of the HACCP system into its Codes of Food Hygiene Practices. However, it was only in 1971 that it was publicly presented during a national conference on food protection in the United States.
- As demand increased for procedures and the application of HACCP requirements, Pillsbury published a technical document explaining how to develop this analysis in detail.
- In 2001, the International Standardization Organization (ISO) established guidelines for the application of ISO 9001 specifically for the beverage and food industry through ISO 15161:2001. This norm fully considered the rules of HACCP.
- In 2003, the Codex Alimentarius revised its Codes of Food Hygiene Practices, incorporating some HACCP requirements. This increased the scope for inspection and application, making certain processes easier to understand.
- Finally, in 2005, ISO published ISO 22000, which outlined the requirements for Food Safety Management Systems applicable to any company operating in the food production chain. This standard considered elements of Quality Management Systems, prerequisites of Good Manufacturing Practices (GMP), and principles of the HACCP system.

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II. Legislation – HACCP

The legislation related to HACCP has evolved both at the international level and within individual countries. Here is a chronological overview of the legislation related to HACCP:

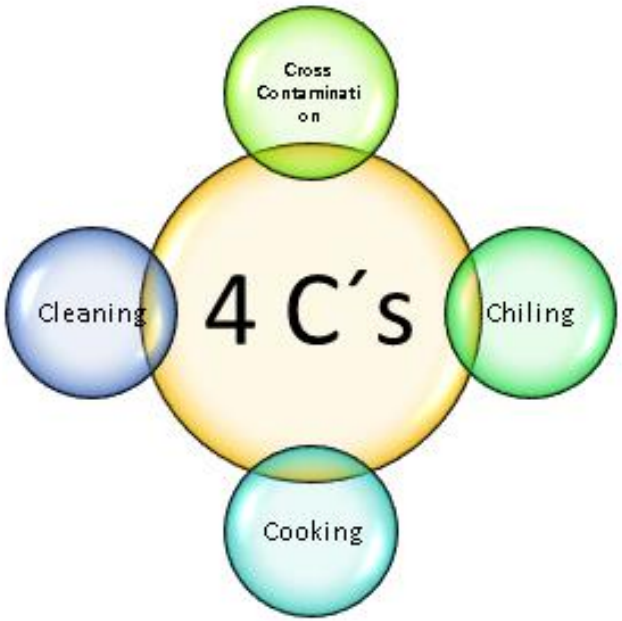
1. International Level:

- 1993: The Codex Alimentarius Commission adopted the HACCP system as an international standard for food safety.
- Codex Alimentarius Commission (1993). Recommended International Code of Practice - General Principles of Food Hygiene. Retrieved from https://www.dgav.pt/alimentos/conteudo/codex-alimentarius/

2. Portugal:

- 1995: Portugal transposed the European Union's food safety regulations, including the requirement for HACCP implementation, into national law.
- Decree-Law No. 67/98: This decree-law establishes the general principles and requirements for food hygiene and safety, including the implementation of HACCP.
- Decree-Law No. 147/2006: This decree-law establishes specific rules for the implementation of HACCP in food businesses.
- Decree-Law No. 113/2006: This decree-law establishes the legal framework for official controls on food safety. Retrieved from https://www.asae.gov.pt/seguranca-alimentar/haccp.aspx

II. Legislation – HACCP



European indications:

- **Directive 93/43/EEC of 14 June**
  - Transposed to DL 67/98 of March 18
- **Regulation 852/2004/EC**
  - Relating to Food Hygiene
- **Regulation 853/2004/EC**
  - Specific Hygiene Rules applicable to foodstuffs of animal origin
- **Regulation 854/2004/EC**
  - Specific Rules for the Official Organization and Control of Products of Animal Origin intended for Human Consumption

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II. Directive 93/43/EEC

COUNCIL

Directive 93/43/EEC, also known as the "Hygiene of Foodstuffs Directive," is an European Union legislation that sets out the general hygiene requirements for the production, processing, and distribution of foodstuffs. It aims to ensure a high level of protection for consumers' health and interests.

The directive establishes the following key provisions:

1. **General Hygiene Requirements**: It sets out the basic hygiene standards that must be followed by food business operators at all stages of the food production and distribution process.
2. **Hazard Analysis and Critical Control Points (HACCP)**: It requires food business operators to implement HACCP principles to identify and control hazards that could compromise food safety.
3. **Specific Hygiene Rules**: It provides specific hygiene rules for certain sectors or types of food, such as meat, fish, milk, and dairy products.
4. **Traceability**: It mandates the establishment of traceability systems to enable the identification of the origin and distribution of foodstuffs.
5. **Official Controls**: It outlines the responsibilities of competent authorities in conducting official controls to ensure compliance with hygiene requirements.
6. **Training and Supervision**: It emphasizes the need for appropriate training and supervision of personnel involved in food handling and production.

The directive was repealed by Regulation (EC) No 852/2004 on the hygiene of foodstuffs, which further consolidated and updated the hygiene requirements for food businesses in the European Union.

- Source: https://www.legislation.gov.uk/eudr/1993/43/adopted

II. Nationally - Portugal

Regulation 852/2004 of April 29th Repeals the Decree - Law nº 67/98

Regulation 852/2004 of April 29th is a European Union legislation that sets out the **hygiene requirements for food businesses**. It replaced the national legislation of the Member States, including Decree-Law nº 67/98 in Portugal, which was repealed by this regulation.

The regulation establishes the following key provisions:

1. **General Hygiene Requirements**: It sets out the basic hygiene standards that must be followed by food business operators at all stages of the food production and distribution process.
2. **Hazard Analysis and Critical Control Points (HACCP)**: requires food business operators to implement HACCP principles to identify and control hazards that could compromise food safety.
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6. **Training and Supervision**: It emphasizes the need for appropriate training and supervision of personnel involved in food handling and production.

The regulation aims to ensure a high level of protection for consumers' health and interests by establishing harmonized hygiene standards across the European Union.

II. Nationally - Portugal

Consequences of Failure to Comply with the Law:

In Portugal, failure to comply with Regulation 852/2004 of April 29th can result in penalties and legal consequences for food businesses. The competent authorities, such as the Food and Economic Safety Authority (ASAE), are responsible for enforcing the regulation and conducting inspections to ensure compliance.

If a food business is found to be in violation of the hygiene requirements, it may face fines, suspension or revocation of its license, and even closure. The severity of the penalty will depend on the nature and extent of the violation.

Additionally, non-compliance with food safety regulations can damage a business's reputation and lead to loss of consumer trust. In extreme cases, it can also result in foodborne illness outbreaks and harm to public health.

Therefore, it is essential for food businesses to comply with the hygiene requirements set out in Regulation 852/2004 to ensure the safety and quality of their products and avoid legal and reputational consequences.

Amount of fines and sanction measures:

The amount of fines and sanction measures for non-compliance with Regulation 852/2004 of April 29th in Portugal depend on the severity and nature of the violation. The competent authorities, such as the Food and Economic Safety Authority (ASAE), are responsible for determining the appropriate penalties.

- Application of fines of up to 44,890 euros.
- Closure of the establishment.
- Suspension of authorizations, licenses and permits.
- Deprivation of subsidies or benefits granted by official entities.

In cases where a food business's non-compliance with food safety regulations results in harm to public health, the penalties can be more severe. The business may face criminal charges and imprisonment, and the owners may be held personally liable.

III. The principles of HACCP

- The HACCP system is based on the identification of hazards related to food safety, for the consumer, that may occur throughout the production food processing chain, the assessment of these hazards and, for hazards considered significant, the establishment of control processes to ensure PRODUCT SAFETY.
- The Hazard Analysis and Critical Control Points System (HACCP) constitutes a systematic approach aimed at biological, chemical and physical hazards, instead of inspection and testing of final products, and is therefore a preventive system through which, by identifying of potential risks, preventive measures are established that make it possible to reduce the probability of occurrences that could jeopardize the safety of products and, consequently, consumers.
- HACCP is based on an engineering system known as AMFE's - Failure, Mode and Effects Analysis - FMEA, which identifies, at each stage of the process, errors that may occur, its probable causes and effects, and then establish the most appropriate control mechanisms. Therefore, the HACCP System is a management tool that establishes an effective methodology for controlling hazards. It is a rational, logical, integrated, continuous and systematic system. It is rational, as it is based on recorded data regarding the causes of foodborne illnesses. It is logical and integrated, as it considers the raw materials, the process and the subsequent use of the product in the subsequent risk analysis. As a continuous system, it allows potential problems to be detected before they occur, or as they arise, facilitating the immediate implementation of corrective actions. Finally, it is systematic, as it leads to a complete plan, resulting from an analysis methodology that covers all operations, processes and control measures.
- HACCP is compatible with other quality control systems. This means that safety, quality and productivity can be addressed together, resulting in benefits for consumers, which is expressed in the increasing benefits for the health of consumers and the development of organizations and the economy in general.
- The growing acceptance of the HACCP System around the world, by industries, governments and consumers, together with compatibility with quality assurance systems, allows us to predict that this system is one of the most used tools in the 21st century, we have as an example the ISO standard 22000 relating to Food Safety Management System.

III. The principles of HACCP – Codex Alimentarius

- The Codex Alimentarius Commission (CCA) was created in 1962, at a conference on legal standards for food organized by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO).
- The Codex Alimentarius is made up of a set of documents of a diverse nature, grouped into two large groups: Food standards and Provisions of an advisory nature

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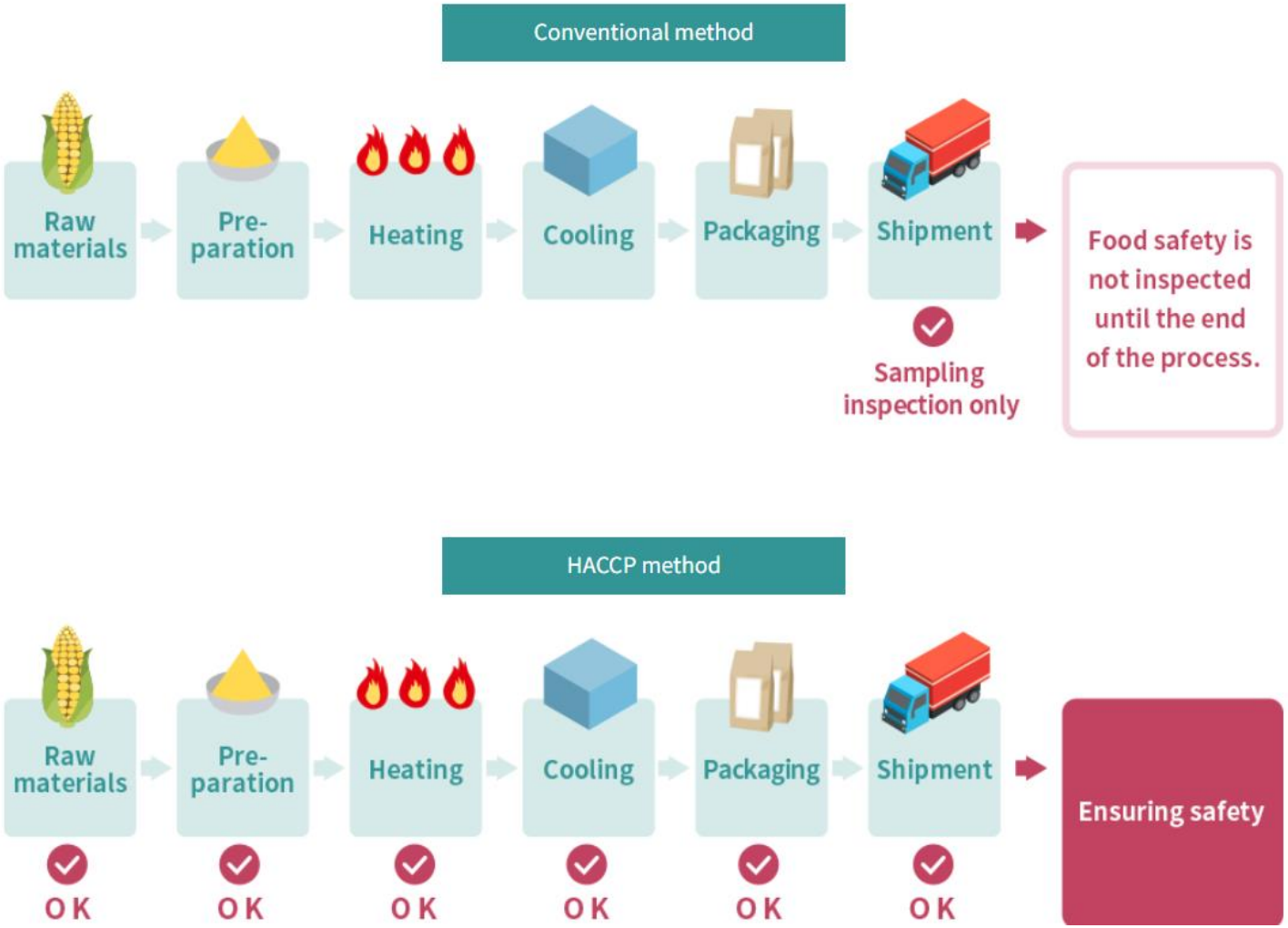
III. The principles of HACCP



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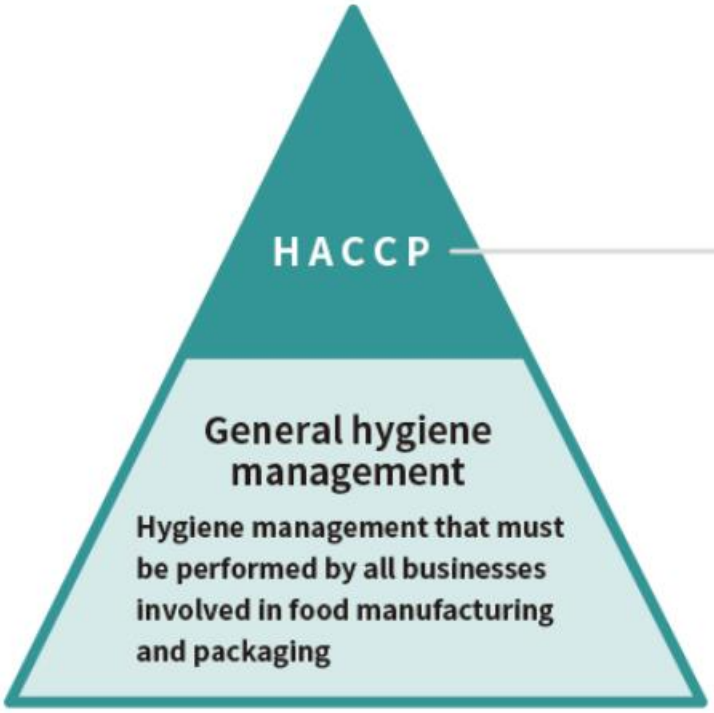
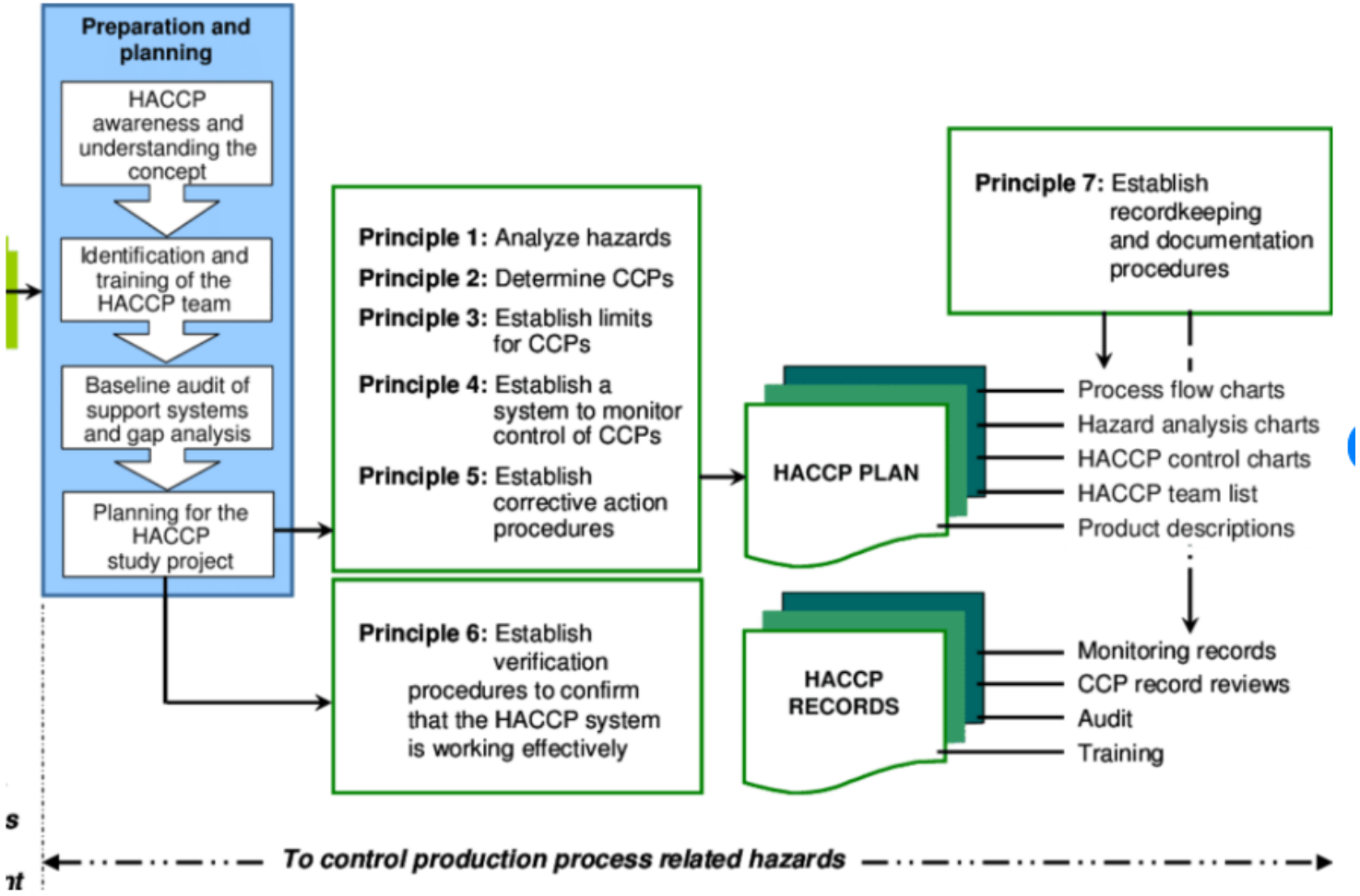
III. The 7 principles of HACCP



HACCP indicated by Codex Alimentarius
(Consists of 7 principles and 12 procedures)

Preparatory stage for hazard analysis	Step 1	Forming a HACCP team
	Step 2	Product description
	Step 3	Identify the intended use
	Step 4	Creating a manufacturing process list
	Step 5	On-site confirmation of manufacturing process list
Hazard factor analysis HACCP plan formulation	Step 6	Analysis of hazards (Principle 1)
	Step 7	Determining important control points (CCP) (Principle 2)
	Step 8	Setting management standards (Principle 3)
	Step 9	Setting the monitoring method (Principle 4)
	Step 10	Setting improvement measures (Principle 5)
	Step 11	Setting the verification method (Principle 6)
	Step 12	Keep records (Principle 7)

III. The 7 principles of HACCP



The complete structure of the HACCP system

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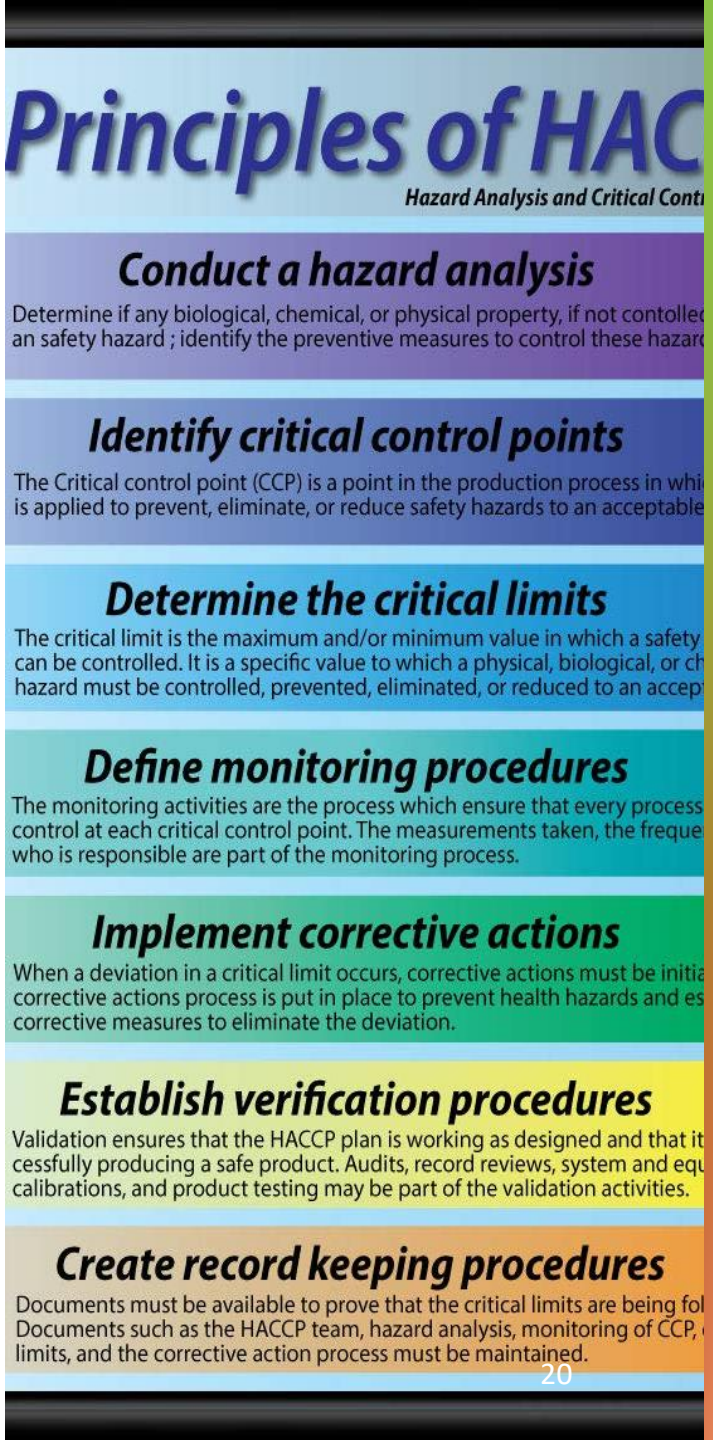
III. The 7 principles of HACCP

1. **Conduct a hazard analysis**: Identify any potential biological, chemical, or physical hazards that could occur during the food production process.
2. **Determine the critical control points (CCPs)**: Identify the points in the food production process where control measures can be applied to prevent, eliminate, or reduce the identified hazards to an acceptable level.
3. **Establish critical limits**: Establish the acceptable limits for each CCP, which are the maximum or minimum values that a parameter must meet to ensure food safety.
4. **Implement monitoring procedures**: Establish procedures to monitor each CCP to ensure that it remains within the established critical limits.
5. **Establish corrective actions**: Develop procedures to be followed if a CCP deviates from its critical limit, including identifying the cause of the deviation and taking corrective action.
6. **Implement verification procedures**: Establish procedures to verify that the HACCP system is working effectively, including reviewing records and conducting periodic audits.
7. **Establish record-keeping and documentation procedures**: Maintain records of all HACCP-related activities, including hazard analyses, CCPs, critical limits, monitoring procedures, corrective actions, and verification procedures.



- The source consulted for this slide was the Codex Alimentarius Commission's "HACCP Principles and Application Guidelines". Retrieved from: https://www.fao.org/3/Y1579E/y1579e03.htm

III. The 7 principles of HACCP

The 12 applications of the 7 principles of HACCP are as follows:

1. **Conduct a hazard analysis**: Identify potential hazards and assess their likelihood of occurrence and severity of impact.
2. **Determine critical control points (CCPs)**: Identify points in the process where control measures can be applied to prevent, eliminate, or reduce hazards to an acceptable level.
3. **Establish critical limits**: Set measurable parameters for each CCP that must be met to ensure food safety.
4. **Establish monitoring procedures**: Develop a system to monitor CCPs and ensure that critical limits are being met.
5. **Establish corrective actions**: Develop procedures to address deviations from critical limits and prevent unsafe food from entering the market.
6. **Establish verification procedures**: Develop procedures to verify that the HACCP system is working effectively, and that food safety is being maintained.
7. **Establish record-keeping and documentation procedures**: Develop procedures for documenting all aspects of the HACCP system, including hazard analysis, CCPs, critical limits, monitoring, corrective actions, verification, and training.
8. **Establish prerequisite programs (PRPs)**: Develop and implement programs that address general food safety practices, such as sanitation, pest control, and employee hygiene.
9. **Establish operational prerequisite programs (OPRPs)**: Develop and implement programs that address specific operational practices that could impact food safety, such as equipment maintenance and calibration.

III. The 7 principles of HACCP

10. **Establish a food safety management system**: Develop a comprehensive system for managing food safety that includes all aspects of the HACCP system.
11. **Conduct training**: Ensure that all employees are trained in food safety practices and understand their roles in implementing the HACCP system.
12. **Continually improve the HACCP system**: Monitor the system for effectiveness and make improvements as necessary to ensure ongoing food safety.

The implementation of these applications requires a thorough understanding of food safety principles, as well as knowledge of the specific hazards and risks associated with each food product. Strategies for implementation may include the use of statistical process control, hazard analysis techniques such as failure mode and effects analysis (FMEA) or hazard and operability (HAZOP) studies, and the application of Good Manufacturing Practices (GMPs) and Good Agricultural Practices (GAPs). The success of the HACCP system depends on the commitment of management to food safety, as well as ongoing monitoring and verification of the system's effectiveness.

IV. Features and advantages of HACCP

HACCP (Hazard Analysis and Critical Control Points) is a systematic approach to food safety management that identifies, evaluates, and controls hazards throughout the food production process.

Features and advantages of implementing HACCP:

1. **Proactive Approach**: HACCP takes a preventive approach to food safety by identifying and addressing potential hazards before they occur, rather than relying solely on end-product testing.
2. **Hazard Analysis**: HACCP requires a thorough analysis of potential hazards, including biological, chemical, and physical hazards, specific to each food production process.
3. **Critical Control Points (CCPs)**: HACCP identifies critical control points in the production process where control measures can be applied to prevent, eliminate, or reduce hazards to an acceptable level.
4. **Focus on Prevention**: By implementing control measures at critical control points, HACCP aims to prevent hazards from occurring or reaching unsafe levels, ensuring the production of safe food.
5. **Scientifically-based Approach**: HACCP is based on scientific principles and evidence, ensuring that control measures are effective and reliable in managing food safety hazards.
6. **Flexibility**: HACCP can be applied to various sectors of the food industry, including manufacturing, processing, packaging, and distribution.

IV. Features and advantages of HACCP

7. **Continuous Improvement**: HACCP promotes continuous improvement by regularly reviewing and updating the hazard analysis and control measures based on new information or changes in the production process.
8. **Compliance with Regulations**: Implementing HACCP helps food businesses meet regulatory requirements and demonstrate their commitment to food safety.
9. Can be applied to the entire food chain.
10. Increased confidence in the security of food products.
11. Can be used as evidence in legal actions.
12. Preventive method.
13. Reduction in the number of complaints.
14. It is complementary to company management systems quality as ISO 9000 standards.

Overall, HACCP provides a systematic and proactive framework for ensuring food safety, reducing the risk of foodborne illnesses, and maintaining consumer confidence in the food supply chain.

V. Drawbacks of HACCP

Drawbacks or challenges associated with implementing HACCP (Hazard Analysis and Critical Control Points):

1. **Complexity**: HACCP can be complex to implement, especially for small or less resourceful food businesses. It requires a thorough understanding of the process, identification of hazards, and implementation of control measures.
2. **Resource Intensive**: Implementing and maintaining HACCP can be resource-intensive in terms of time, money, and personnel. It may require additional training, equipment, and documentation.
3. **Lack of Flexibility**: HACCP is a standardized system, which means it may not be easily adaptable to unique or specialized processes. This can make it challenging for certain sectors or food businesses with diverse operations.
4. **Continuous Monitoring**: HACCP requires continuous monitoring and record-keeping to ensure that control measures are effectively implemented. This can be time-consuming and may require dedicated personnel.
5. **Limited Scope**: While HACCP focuses on identifying and controlling hazards related to food safety, it may not address other aspects of quality management or broader sustainability concerns.
6. **Reliance on Human Factors**: The effectiveness of HACCP relies on the knowledge, skills, and compliance of individuals involved in the food production process. Human errors or non-compliance can undermine the system's effectiveness.
7. **Lack of Standardization**: HACCP implementation and enforcement may vary across different regions or countries, which can lead to inconsistencies in food safety practices.

Despite these drawbacks, HACCP remains a widely recognized and effective system for ensuring food safety. It is important for food businesses to carefully assess their specific needs and resources before implementing HACCP and seek guidance from experts or regulatory authorities to ensure proper implementation.

VI. Difficulties of implementation in the Restaurant sector

A study identified two major barriers to the implementation of HACCP. The first barrier is the lack of prerequisite programs, which was ranked as the top barrier by 92.2% of respondents. The second barrier is the lack of knowledge about HACCP, ranked by 83.5% of respondents. Prerequisite programs, such as Good Hygiene Practices (GHPs), are essential before implementing an effective Food Safety Management System (FSMS) and HACCP.

Nowadays, prerequisite programs (PRPs) have expanded to include environmental criteria and operational procedures, encompassing the entire FSMS. However, the interdependence of HACCP and PRPs is often overlooked. Training and certification programs tend to focus more on HACCP rather than PRPs. Recognizing the significance of PRPs, a supplemental specification for PRPs was developed to complement the ISO 22000:2005 standard.

It is important to note that recalls related to foodborne pathogens are often caused by PRP failures, such as post-process cross-contamination and unsanitary production environments, rather than failures in critical control points (CCPs) in a HACCP plan.

Food and beverage cross-contamination can occur at various stages of the food processing chain, including transportation, processing, packaging, and storage. Identifying the root causes of contamination is crucial in preventing foodborne outbreaks and recalls. Foodborne illnesses can be caused by infectious agents (bacteria, viruses, parasites) or toxic substances entering the body through contaminated food or water.

A wide range of hazards (biological, chemical, physical) exists throughout the entire food supply chain, from farm to fork. Listeria monocytogenes (LM) is a particularly concerning pathogen that can cause severe illness, especially in vulnerable populations. LM is resilient and can survive in harsh conditions such as refrigeration/freezing temperatures and high salt concentrations. Ready-to-eat foods, cooked meat and fish products, and dairy products are considered high-risk mediums for LM.

Environmental hygiene, including proper waste disposal, adequate cleaning of equipment and facilities, and sanitary conditions in food processing areas, is crucial in preventing the decomposition and growth of spoiled and contaminated food. Poor sanitation practices during food handling, storage, and transportation can lead to the distribution of unhygienic and unsafe food, increasing the risk of contamination and spoilage.

Overall, addressing these barriers and ensuring proper implementation of prerequisite programs and HACCP is essential in maintaining food safety and preventing foodborne illnesses (Lee et al., 2021).

VI. Difficulties of implementation in the Restaurant sector

There are a number of challenges associated with implementing Hazard Analysis and Critical Control Points (HACCP) in the restaurant sector. Some of these challenges include:

- **Lack of knowledge**: Many restaurant owners and employees may not be familiar with HACCP principles and may not understand the importance of food safety.
- **Cost**: Implementing a HACCP program can be expensive, especially for small businesses. This may include the cost of training, equipment, and resources needed to monitor and maintain the program.
- **Time**: Developing and implementing a HACCP program can be time-consuming, which can be difficult for busy restaurant owners and employees who may not have the time to devote to the process.
- **Resistance to change**: Some restaurant owners and employees may be resistant to change, especially if they have been operating without a formal food safety program for many years.
- **Complexity**: HACCP can be a complex system to implement, especially for businesses that have a wide variety of menu items or that use many different ingredients.

Despite these challenges, implementing a HACCP program can help ensure that food is safe for consumers and can help protect the reputation of a restaurant.

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VI. Difficulties of implementation in the Restaurant sector

	SMALL	MEDIUM
ADVANTAGES	• Involvement of management & staff. • Commitment. • Tangible sense of responsibility to the consumer/customer. • Strong organisational culture. • Low labour turnover.	• Technical expertise • Money • Management skills • Clear organisational structure • Ability to operate internal verification scheme
DISADVANTAGES	• Lack of technical expertise. • Lack of money. • Lack of time. • Lack of management skills. • No clear management structure	• Lack of involvement • 3rd party audit driven • Distance from customer/consumer

VI. Difficulties of implementation in the Restaurant sector

Prerequisite Programs Include:

- Supplier/Vendor Selection and Approval;
- Good Manufacturing Practices (GMPs) and/or Good Agricultural Practices (GAPs);
- Receiving/Shipping Protocols;
- Product/Ingredient Specifications;
- Hold/Release Protocols;
- Sanitation;
- Preventive Maintenance;
- Equipment Selection;
- Pest Control;
- Allergen Controls;
- Training;
- Environmental Monitoring;
- Prevention of Foreign Objects;
- Product Tracking;
- Warehousing;
- Glass Policy;
- Calibration;
- Recall.

VI. Difficulties of implementation in the Restaurant sector

Key Issues

Supplier/Vendor Selection and Approval

- Assure that proper food safety information is gathered
- Utilize audits
- Do not select just because a well-known company uses them and therefore "they must be good"
- Have a means for rejecting them

Good Manufacturing Practices (GMPs) and/or Good Agricultural Practices (GAPs)

- Know what is contained in these guidelines
- Use them as a guide to develop Standard Operating Procedures (SOPs) and audit instruments for internal audits and supplier or co-packer audits
- Good employee practices are essential, especially handwashing

VI. Difficulties of implementation in the Restaurant sector

Receiving/Shipping Protocols

- Provide Receivers and Shippers with the proper training and tools to do their job. This includes items such as flashlights, calibrated thermometers, black lights, etc.
- Develop simple documents for recording findings
- Provide guidance and support for rejecting carriers and/or items

Product/Ingredient Specifications

- Keep them current
- Make them realistic-remember, you are usually paying for tests done by suppliers either as an add on or as part of the cost of the product

Hold/Release Protocols

- Develop documentation that requires the recording of the results of all of the activities
- Establish an area for product that is on Hold
- Establish a limited group of individuals that can release product that is on Hold

VI. Difficulties of implementation in the Restaurant sector

Sanitation

- Remember that this is key to all food safety issues
- Understand the difference between cleaning and sanitizing
- Keep hose nozzles off of the floor
- Hang up brooms and squeegees (no wooden handles or straw brooms)
- Measure and record the concentrations of sanitizers

Preventive Maintenance

- Have a written program
- Train maintenance personnel regarding cleanliness and cross contamination
- Keep tools clean
- Conduct activities in a manner that does not contaminate in-process product

Equipment Selection

- Make sure it can be cleaned

VI. Difficulties of implementation in the Restaurant sector

Pest Control

- Assure that the Pest Control Operators (PCO) license is current
- Pest Control company should be insured and provide the customer with a current insurance policy naming the customer as the certificate holder
- Insist on comprehensive reports when they visit the premises; use reports to trend activities
- Insect control devices can be a source of contamination. Select the location for their use carefully.

Allergen Controls

- Know what items are considered to be allergens
- Conduct an allergen review of ingredients and the operation
- Develop protocols to eliminate cross contamination with allergens
- Check labels for proper identification of allergens

Training

- Train new workers and current workers regarding food safety issues
- Reinforce training regularly (15-minute sessions on a topic)
- Be aware of language and literacy issues

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VI. Difficulties of implementation in the Restaurant sector

Environmental Monitoring

- Don't forget water, ice and air quality
- Have a plan for corrective actions

Prevention of Foreign Objects

- Metal detection is important. Use ferrous, non-ferrous and stainless-steel standards.
- Remove or repair damaged pallets
- Document programs such as filters, strainers, magnets, etc.

Product Tracking

- Be able to track finished products and ingredients. Don't forget packaging materials.

Warehousing

- Practice inventory control
- Practice Good Housekeeping
- Watch conditions so pest control is not negatively impacted
- Maintain temperature and humidity controls

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VI. Difficulties of implementation in the Restaurant sector

Glass Policy

- Have a written policy
- Dock inspection lights, forklift lights, etc. should be shatterproof or shielded
- A glass map is an excellent tool

Calibration

- Calibrate thermometers against a recognized standard or ice water or boiling water depending upon the temperature ranges for which they will be used
- Identify each thermometer with a unique designation (number)
- Keep scales calibrated
- Record all calibration activities

Recall

- Have a program in place
- Conduct mock recalls at least twice per year, once using the finished product and once using an ingredient that is used in a wide variety of finished products. Document the results.
- Have ways to contact essential personnel during non-business hours
- Take emergency numbers home with you

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VII. General HACCP prerequisites

The World Health Organization describes prerequisite programs (PRP) as, "essential food safety practices that need to be implemented prior to and during the installation of HACCP. These prerequisites include:

- **Good Manufacturing Practices (GMPs)**: GMPs are a set of guidelines that outline the proper procedures for handling, storing, and preparing food. These practices include maintaining a clean and sanitary facility, ensuring proper temperature control, and preventing cross-contamination.
- **Standard Operating Procedures (SOPs)**: SOPs are written procedures that outline specific steps for performing tasks, such as cleaning and sanitizing equipment or handling food.
- **Employee Training**: All employees should receive training on food safety and HACCP principles to ensure they understand the importance of food safety and how to follow proper procedures.
- **Documentation**: All HACCP-related activities should be documented, including hazard analyses, critical control points, and corrective actions.
- **Record Keeping**: Records should be kept for all HACCP-related activities, including monitoring and verification activities.

By implementing these general prerequisites, a business can create a strong foundation for a successful HACCP program that will help ensure the safety of their food products.

VII. General HACCP prerequisites

In 1995, the introduction of the seafood HACCP (Hazard Analysis and Critical Control Points) regulation in the US marked a significant milestone in the history of food safety. This regulation established that prerequisite programs (PRPs) could be used to address potential food safety hazards, which was a departure from previous HACCP plans that had numerous critical control points (CCPs). The seafood HACCP regulation defined six categories of PRPs, including preventive maintenance, product identification, product recall and traceability, establishment of Good Manufacturing Practices (GMP), development of necessary sanitation standard operating procedures (SSOP), and education and training. The regulation also defined eight specific areas where seafood processors needed to establish programs to ensure food safety.

This approach to food safety management systems (FSMSs) has since been adopted by the Global Food Safety Initiative (GFSI) audit schemes, the ISO 22000 food safety standard, and regulatory mandates for HACCP and the Food Safety Modernization Act (FSMA).

While PRPs have been used for more than two decades to ensure the production of safe food, they continue to create confusion worldwide. Prior to the enactment of FSMA and the release of GFSI standards, PRP failure was the leading cause of product recall. ISO 22000 addressed this issue by ensuring sites verified their PRPs. The standard established definitions for PRPs and for Operational Prerequisite Programs (oPRPs), which are PRPs identified as essential in controlling the likelihood of introducing food safety hazards.

The distinction between PRPs, OPRPs, and CCPs has been a bone of contention since the ISO 22000 standard was issued in 2005. The committee is working to clarify this distinction for potential users. One possible way to clarify this is to explain how each PRP, oPRP, and CCP is measured or reported. A CCP generally has a value such as time and temperature, flow rate, or belt speed, while PRPs and oPRPs often have a yes or no answer. This clarification can also be applied to Preventive Controls (PCs) in the Preventive Controls Regulation (21 CFR Part 117), where a CCP or process PC must be validated according to the regulation.

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VII. General HACCP prerequisites

PRP	oPRP	CCP
Horizontal; applies to all operations	Applies to a specific hazard and a specific product and process	Applies to a specific hazard and a specific product and process
May contribute to the reduction of a hazard but may not be essential for control	Is essential for the reduction of the hazard, but may work in the hazard conjunction with other controls	Provides absolute control over
Failure does not necessarily mean product is unsafe	Failure does not necessarily mean product is unsafe	Failure indicates product is unsafe
Is not measureable in real time	May or may not be measurable in real time— critical limits may be established	Measurable in real time with critical limits established

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VII. General HACCP prerequisites

VII. General HACCP prerequisites

In September 2005, ISO incorporated Hazard Analysis and Critical Control Point (HACCP) principles for food safety into the ISO 22000 quality management system. In this way there has been an integration of HACCP program and principles to quality management systems and prerequisite programs (PRPs) for the improvement of the quality and safety of the food chain in the food industry.

VII. General HACCP prerequisites

ISO 22000:2018 is a food safety standard that incorporates key elements such as interactive communication, systems management, prerequisite programs, and hazard analysis and critical control points. The standard applies to the seven principles and 12 application steps of the HACCP methodology, which is closely related to ISO 22000:2018. The standard requires organizations to conduct hazard analysis to identify significant hazards, and CCPs and PRPs are not limited to the sole use of the decision tree based on 4 questions. ISO 22000:2018 ensures safe food supply throughout the chain and provides a framework of internationally harmonized system. The implementation of management tools such as HAZOP, FMEA, Ishikawa, and Pareto is important for effective preventive controls, and correlation with microbiological criteria is discussed in the context of EU regulation 2073/2005.

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VII. General HACCP prerequisites

C. Wallace, T. Williams / Food Control 12 (2001) 235–240

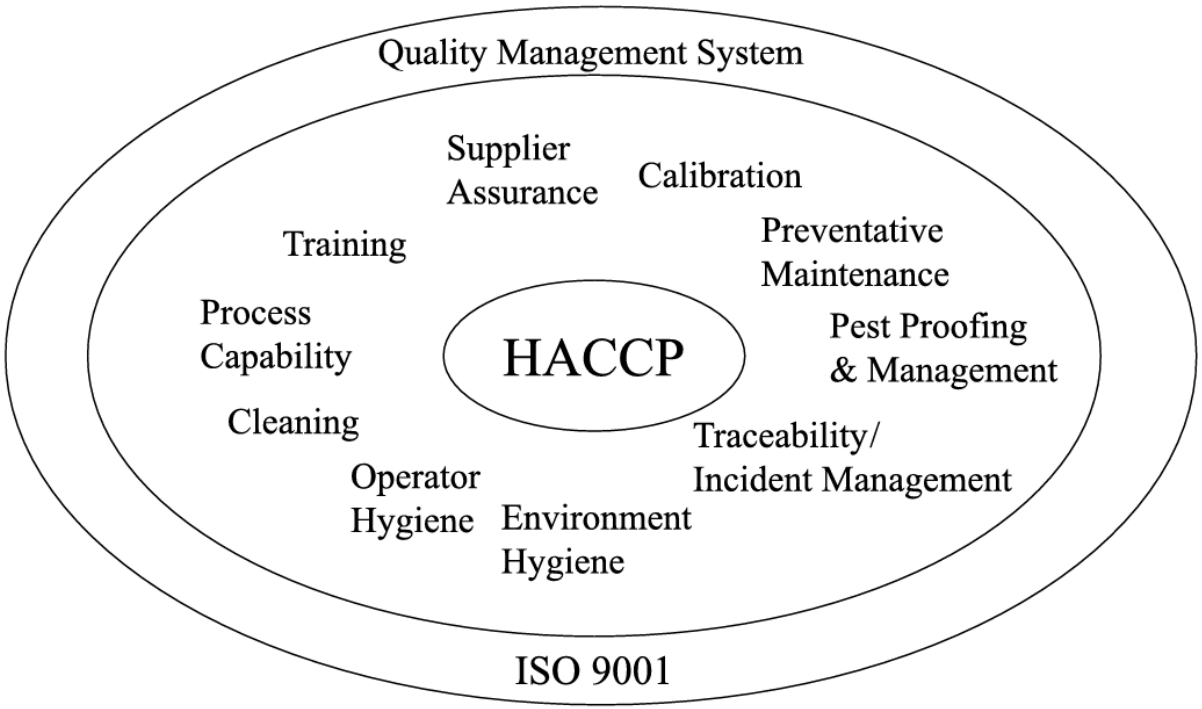

Fig. 3. Safety and quality management.

VII. Systems thinking

Prerequisite programs are considered the foundation/support upon which HACCP relies. “Systems thinking” can be used to help solve complex food contamination problems, and it can help deliver a structure to model solutions to urgent food safety matters. Systems thinking includes problem solving and critical thinking. Many challenges faced today are extremely complex, and cannot be looked at from one perspective only, but they can and should be approached by looking at the system within. Looking at the system within, and having the courage to do so, restructure of the system can take place. By using systems thinking, complex problems can be solved . The table describes food safety competencies along with safety knowledge and skills and systems thinking

Task	Required Food Safety Knowledge	Required Food Safety Skills
Systems Thinking “Includes”: • Problem Solving • “Critical Thinking”	Knowledge of: • Principles of systems thinking– • Identification of issues as part of an overall system, rather than reaction to specific parts • system improvement-special and common causes • the relationship of quality management and productivity to food safety	Ability to: • big picture thinking. Standing back and looking at the system as a whole, rather than just looking at the individual parts, • explain the inter-relationship between quality management, operations, productivity and food safety • Identify special and common causes

VII. Food Safety Management Systems

- PRPs (Prerequisite Programs) are considered the fundamental support system on which HACCP (Hazard Analysis and Critical Control Points) relies. They are essential components of a "world-class food safety program" and play a crucial role in supporting other core elements. While traditionally seen as the foundation for HACCP, PRPs also have an active role in food defense, food fraud prevention, and safe food process technology and engineering.
- PRPs and HACCP work symbiotically as a preventive control system. They are applicable at all stages of the global food supply chain and encompass good mitigation practices for various activities such as growing, harvesting, manufacturing, storage, distribution, retail, food service, and cottage industry.
- SSOP (Sanitation Standard Operating Procedures) and GMP (Good Manufacturing Practices) are important practices and programs within the food processing industry. GMP regulations are designed to control the risk of food contamination with various substances during food processing, including filth, dirt, allergens, chemicals, and microbial particulates.
- Core GMPs for FDA-inspected food processing sites include physical site maintenance, equipment cleaning and sanitizing, handling and storage of clean equipment and utensils, pest control management, proper use and storage of cleansing solutions, sanitizers, and pesticides, employee training, personal protective equipment (PPE), good hygiene practices (GHP), site and equipment design, and quality assurance audits.
- In addition to the core GMPs, specific GMPs are established for different sectors of the food industry such as meat, poultry, seafood, dairy, feed, and pet food processors. These processors are required to implement and maintain SSOP requirements enforced by regulatory bodies such as USDA (United States Department of Agriculture) or FDA (Food and Drug Administration). Understanding and adhering to GMPs is crucial for these processors as they serve as valuable guides when developing and implementing their SSOPs.

VIII.Implementing a HACCP plan

- Typically, when a food manufacturer develops a Hazard Analysis and Critical Control Points (HACCP) plan, they analyze the specific food products they produce and follow the steps involved in their production. However, this becomes more complex for restaurants that use multiple food products to create a final meal.

- Since food service and retail establishments handle a diverse range of products and menu items, each with its own unique process, it is necessary to adapt the traditional HACCP approach for practicality. Instead of solely focusing on the end product, a "process approach" is employed, which considers the entire flow of food within the establishment, from receiving ingredients to final sales.

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VIII. Implementing a HACCP plan

These processes outline the typical flow of food preparation in most establishments:

- **Receive - Store - Prepare - Hold - Serve**: This process does not involve a cooking step to eliminate potential bacteria that may cause illness.
- **Receive - Store - Prepare - Cook - Hold - Serve**: This process includes a cooking step that is sufficient to kill off potential pathogens, but the food passes through the temperature danger zone (between 40°F and 140°F) once.
- **Receive - Store - Prepare - Cook - Cool - Reheat - Hot Hold - Serve**: This process involves multiple steps, and the food passes through the temperature danger zone more than once.

Please note that these are just examples, and depending on your establishment's concept, additional steps such as packaging and food delivery may be included before final consumption. For fast-food restaurants, they may have a specific cook-serve process without a holding step.

- Given the complexity of these processes and the variety of menu items, it becomes evident why a modified and specific Process HACCP approach is necessary for ensuring food safety in restaurants. Instead of examining each individual food product, the focus is on assessing the entire process to identify potential risks to food safety.

VIII. Implementing a HACCP plan

A HACCP (Hazard Analysis and Critical Control Points) plan typically consists of the following stages:

1. **Flowchart** – The flowchart describes the food production process. It is crucial as it helps understand the path that the food will follow.
   - Tip: It is essential to have people familiar with the process review the flowchart at this stage. If possible, validate the flowchart on-site.
2. **Describe the process steps** – Provide detailed descriptions of what happens at each step. Often, hazards are indirectly identified during this step.
   - For example: "Raw materials weighed by operators with properly sanitized hands." This indicates a potential hazard if hand hygiene is necessary.
3. **Hazard identification** – In this stage, we identify hazards.
   - To facilitate the process, hazards are categorized into five categories: Biological, Physical, Chemical, Allergenic, and Radiological.
4. **Probability and severity of hazards** – Severity can be related to scientific data, while probability is more subjective.
   - To determine severity, we can easily find information in literature about how harmful a particular hazard is to health.
   - Probability, on the other hand, is more subjective. Tip: We can gather information from the company's hazard occurrence history. If the company is new and has no history, it can rely on established companies with similar products.

VIII. Implementing a HACCP plan

Company name:

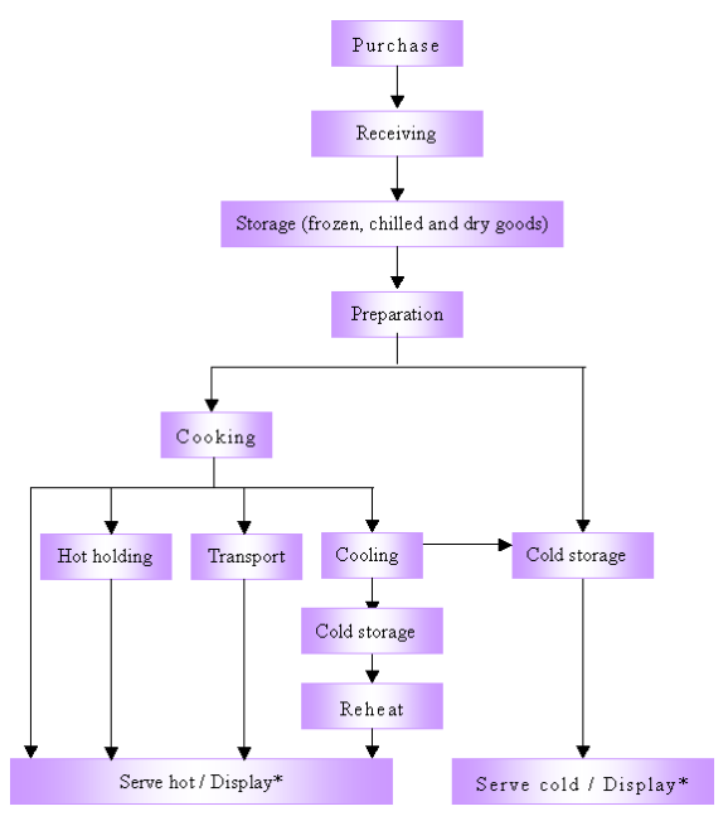
Date: _____ **HACCP Plan Template**

Critical Control Point (CCP)	Potential hazards (P) Physical (C) Chemical (B) Biological	Critical limits	MONITORING				Corrective action	Verification procedures	Record-keeping procedures
			What	How	Frequency	Who			
Cooking	(C) Unwanted allergens	No undeclared allergens in food	Check storage of food: allergens must be separated daily; Check labels of food deliveries daily; Check personnel hygiene daily; Check availability of separate utensils and equipment for allergen special orders daily; Check product allergen declarations; Check implementation of allergen controls daily	Visual check	Daily	Manager	Recall food that is suspected to have undeclared allergens; Dispose of food that has been exposed to cross-contact during storage; Re-train staff who are not practicing good personal hygiene; Dispose of food that is exposed to an allergen during cooking	Chemical analysis of raw materials and finished products that do not contain the allergen; Conduct internal audits; Records of third-party audits	Yearly audit; Results of Laboratory analyses
Cooking	(B) Multiplication and survival of spore-forming and toxin-forming bacteria: Staphylococcus aureus Clostridium perfringens Clostridium botulinum Bacillus cereus	Internal temperature 176 °F for 10 minutes is achieved	Check and record cooking temperatures following the required minimum temperatures using a calibrated thermometer	(1) Check the internal temperature of cooked food; (2) Use food probe thermometers that are properly calibrated	(1) Every batch; (2) Weekly	(1) Staff; (2) Manager	(1) Continue cooking until required temperature of 176 °F for 10 minutes is achieved; (2) Re-calibrate food probe thermometers	Manager must maintain record of cooking temperature and calibration; Manager confirms weekly that food probes are used, properly maintained, and calibrated	Cooking temperature log; Calibration record
Chilling	(B) Multiplication and survival of spore-forming and toxin-forming bacteria: Staphylococcus aureus Clostridium perfringens Clostridium botulinum Bacillus cereus	Chill food down from 135°F to 70°F within 2 hours (Record starting time); Then from 70°F to 41°F or lower within 4 hours; (Record finish time and temp); Total chilling time may not exceed 6 hours.	Marking starting time for the processed food; Avoid recontamination; Cover food during cooling	(1) Check the internal temperature of chilled food; (2) Use food probe thermometers that are properly calibrated	(1) Every batch; (2) Weekly	(1) Staff; (2) Manager	(1) Continue chilling until the required temperature of 70°F / 41°F is achieved; (2) Re-calibrate food probe thermometers; Review chilling procedure	The manager must maintain a record of chilling temperature and calibration; The manager confirms weekly that food probes are used, properly maintained, and calibrated	Cooking temperature log; Calibration record

5. **Risk** – Risk analysis depends on the probability and severity of the hazard.
   - If both probability and severity are low, the risk of the hazard will also be low.
   - If both probability and severity are high, the risk will also be high.
   - If one parameter is high and the other is low, the risk may be moderate.
6. **Acceptable level and justification** – This information relates to the amount of hazard in the food, meaning the limit of hazard allowed in the food. This information can be easily found in legislation.
7. **Control measures** – Once hazards have been identified and analyzed, the next step is to control them.
   - After defining control measures, they are identified and classified as CCP (Critical Control Point), PC (Control Point), PPRO (Operational Prerequisite Program), or PPR (Prerequisite Program).
   - We can use a decision tree or other methods for classifying control measures.
   - An example of a decision tree model can be found in Codex Alimentarius COMMISSION 45th Session 21 – 25 November and 12 – 13 December 2022.

VIII. Implementing a HACCP plan

8. **Raw materials and packaging hazard analysis** – In addition to analyzing hazards in the process as described above, it is also necessary to analyze hazards associated with raw materials and packaging:
   - Probability and severity of hazards.
   - Acceptable level of hazard in the food.
   - Identification.
   - Classification of control measures.
   - It is important to monitor CCPs and PPROs. We should observe and use measurement parameters to assess whether control measures are under control. In addition to monitoring, we shoul establish corrective actions to regain control.
   - According to Codex, Corrective Action addresses the cause and correction of unsafe products. On the other hand, ISO 22000 states that Corrective Action addresses the cause, while Correction defines the action to eliminate non-conformity.
   - We should also validate the HACCP plan and establish procedure for CCP verification.
   - Validation is necessary to ensure that plan elements are capable of controlling hazards. CCP verification is a process, in addition t monitoring, to ensure that control measures are functioning as intended.



- Retrieved from: https://www.cfs.gov.hk/english/programme/programme_haccp/popup_fspbookl et2002.html

VIII.Implementing a HACCP plan

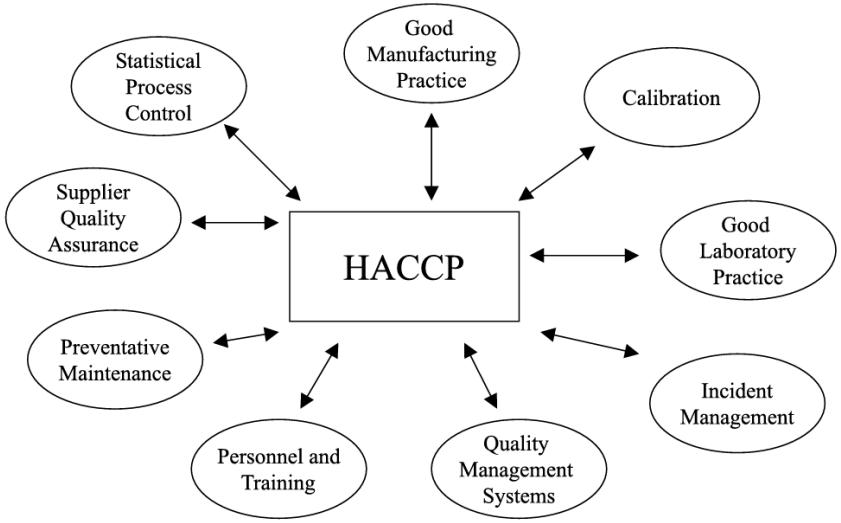
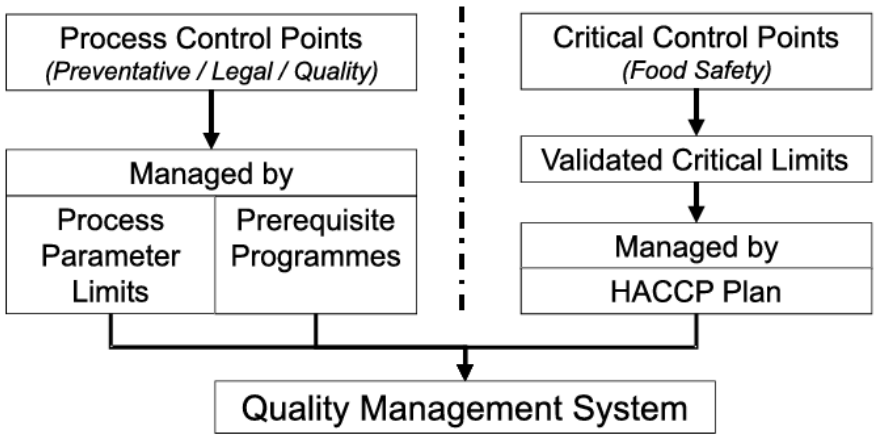


Fig. 1. The HACCP support network (reproduced with kind permission from Mortimore & Wallace, 1998).



VIII. Hazards in HACCP: Ensuring Food Safety

In this chapter, we will delve into the various types of hazards that can compromise food safety and discuss their significance in the HACCP framework.

1. **Biological Hazards**: The first group of hazards we will address is biological hazards. These hazards are caused by microorganisms and other living organisms such as bacteria, viruses, and parasites. They have the potential to transmit foodborne illnesses and pose a significant risk to food safety. It is important to pay special attention to these hazards as they can multiply and exceed acceptable levels during food processing and distribution. For instance, refrigerated products stored for a considerable time at temperatures suitable for the growth of psychrophiles can allow these microorganisms to multiply and reach levels that can cause illness.

    - **Examples of Biological Hazards**: Examples of well-known pathogenic bacteria include Clostridium botulinum, Salmonella spp., Listeria monocytogenes, Escherichia coli, Staphylococcus aureus, and Yersinia enterocolitica, which can transmit foodborne illnesses. Salmonella spp. and Staphylococcus aureus require temperatures of 7-10°C, which are typical refrigerator temperatures, to grow. Lower temperatures require more time for microorganism multiplication. For example, psychrophiles at 10°C require around 200 minutes, while at 25°C, this time reduces to 30 minutes. Toxins produced by bacteria or fungi found in food that cause infection are generally considered chemical hazards. However, if the microorganism is consumed and the toxin is produced within the organism resulting in an infection, it can be considered a biological hazard. It's important to note that this definition may vary. Understanding these pathogens is crucial as they can multiply and exceed acceptable levels during food processing and distribution.

    - **Control Measures**: Control measures for biological hazards include working with approved suppliers, using high-quality raw materials with low microbial counts, implementing thermal treatments to reduce microbial counts, acidification to inhibit microbial growth, proper cleaning and sanitation of equipment and utensils, eliminating areas where organic matter can accumulate, refrigeration, controlling process temperatures, among others.

VIII. Hazards in HACCP: Ensuring Food Safety

2. **Physical Hazards**: Moving on to physical hazards, these are foreign objects that can accidentally contaminate food. They include items like glass, metal fragments, stones, plastic, or any other foreign material that can pose a physical risk to consumers. Physical hazards are those that can cause physical harm to the consumer. It is common to think of adornments as a type of physical hazard that can be introduced into food due to carelessness. However, they are not necessarily physical hazards, as they are part of the Good Manufacturing Practices (GMP) program. It is not allowed to use adornments such as earrings, rings, hair clips, watches, or nail polish. GMP comes before HACCP in the food safety pyramid, so they must be followed first. If the conduct of using adornments is already being followed, the physical hazard ceases to exist.

- **Examples of Physical Hazards**: It is essential to be aware of potential physical hazards that can be encountered in food production and processing. These can include broken glass from equipment or packaging, metal fragments from machinery or utensils, stones or pebbles from raw materials, or even hair or personal belongings. We can list some examples, such as fragments of:

❖ **Wood**: from pallets or boxes used in storage.

❖ **Glass**: can come from the glass packaging itself or glass elements present in the production area, such as a broken bulb.

❖ **Metals**: can come from parts that have become detached from the equipment itself, so it is important to implement good preventive maintenance.

❖ **Hard plastic**: can come from the packaging itself or elements present in the production area. Therefore, a Hard Plastic and Glass Program should be implemented so that operators know how to deal with emergencies.

❖ **Insects**: good hygiene and pest control in the plant are necessary.

❖ **Human hair and fur**, so it is important to use caps and long-sleeved lab coats.

- **Control Measures**: To prevent physical hazards, control measures such as proper maintenance of equipment to avoid breakage or damage, effective inspection and sieving of raw materials to remove foreign objects, using metal detectors or X-ray machines for product inspection, and implementing strict hygiene practices to prevent contamination by personal belongings should be implemented. As control measures for these hazards, we have the implementation of some physical barriers to contain these fragments or equipment for detecting these hazards.

VIII. Hazards in HACCP: Ensuring Food Safety

3. **Chemical Hazards**: The third group of hazards we will discuss is chemical hazards. These hazards arise from chemicals or substances that can contaminate food and pose a risk to consumer health. It is important to know the application limit and waiting time. Strong disinfectants, such as hypochlorite, are a danger. Chlorine residues can react with organic matter forming toxic compounds such as dioxin. Therefore, just as cleaning is important, proper rinsing is also important. Examples include cleaning agents, pesticides, allergens, food additives, and naturally occurring toxins. Toxic pigments from packaging or equipment can also be transferred to food. It is important to remember the hazards related to auxiliary materials in production, such as gas used for heating, cooling liquids in heat exchangers, counter-pressure air, among others. Let's start with toxins, which can be produced in food by microorganisms. For example, histamine, produced by bacteria from histidine, has allergic potential and can cause intoxication in people. We can also mention mycotoxins, which are produced by fungi and are often found in grains. Now, considering the hazards that can come with raw materials, we can list heavy metals. They can be found in fish or in foods irrigated with water containing heavy metals. There are also foods that naturally contain toxins, such as certain types of mushrooms and cassava. For hazards that can be introduced in the raw materials before processing, in the case of animal-derived foods, antibiotics can be given to the manufacturer with limits above acceptable levels, presenting a chemical hazard. Therefore, it is important to pay attention to regulations such as IN Nº 51, of December 19, 2019, which establishes maximum residue limits (MRLs) in animal-derived foods. For hazards that can be introduced during processing, we can highlight chemicals from the production environment, such as non-food-grade lubricants or disinfectants used to clean equipment that may not be completely removed during rinsing.

- **Examples of Chemical Hazards**: Chemical hazards can include the presence of pesticide residues on produce, allergens such as peanuts or gluten in food products without proper labeling or cross-contamination, improper use of food additives leading to excessive levels, or the presence of harmful toxins produced by certain molds or bacteria.

- **Control Measures**: To manage chemical hazards effectively, control measures such as proper storage and handling of chemicals, regular testing for pesticide residues in raw materials, strict allergen control procedures including segregation and labeling, adherence to regulatory limits for food additives, and implementing measures to prevent mold and bacterial growth should be in place. Thinking about control measures for disinfectant residues, it is important to review the plant's sanitation plan. For the hazard of microorganism toxins, we can use the same line of reasoning as for biological hazards. And for chemical hazards that may come with raw materials, it is important to approve the supplier and establish quality standards upon receipt.

VIII. Hazards in HACCP: Ensuring Food Safety

4. **Allergenics** : Allergenic hazards pose significant risks to individuals with food allergies and can have severe consequences if not properly controlled. By implementing effective measures, we can ensure the safety of our products and protect the health of our consumers. Allergenic hazards refer to substances in food that can trigger an allergic reaction in susceptible individuals. These reactions occur when the immune system mistakenly identifies certain proteins as harmful, leading to an immune response that can range from mild discomfort to life-threatening anaphylaxis. Common allergens include peanuts, tree nuts, milk, eggs, fish, shellfish, soy, wheat, and sesame.

- **Identification and Labeling**: The first step in managing allergenic hazards is to accurately identify and label allergenic ingredients in our products. This includes conducting a thorough analysis of all ingredients used and verifying their allergen status. Clear and prominent labeling is essential to inform consumers about the presence of allergens, allowing them to make informed choices and avoid potential risks.

- **Preventing Cross-Contamination**: Cross-contamination is a significant concern when it comes to allergenic hazards. Even trace amounts of allergens can trigger a reaction in sensitive individuals. Therefore, it is crucial to implement strict protocols to prevent cross-contact between allergenic and non-allergenic ingredients during storage, preparation, and production. This may involve separate storage areas, dedicated equipment, and thorough cleaning procedures.

- **Training and Communication**: Effective communication and training are essential for ensuring that all staff members are aware of allergenic hazards and understand their roles in preventing cross-contamination. Training programs should cover topics such as allergen identification, proper handling procedures, cleaning practices, and emergency response protocols. Regular updates and refresher training sessions are also recommended to maintain awareness and reinforce best practices.

- **Supplier Control**: Working closely with suppliers is crucial in managing allergenic hazards. Establishing strong relationships with trusted suppliers who adhere to strict allergen control measures can help ensure the safety of our raw materials. Regular communication with suppliers regarding ingredient specifications, potential allergen risks, and any changes in their processes is essential for maintaining control over allergenic hazards.

In conclusion, managing allergenic hazards is a critical aspect of ensuring food safety in the HACCP system. By accurately identifying allergenic ingredients, preventing cross-contamination, providing clear labeling, and implementing robust training programs, we can effectively control allergenic hazards and protect the health of our consumers.

VIII. Hazards in HACCP: Ensuring Food Safety

- **Radiologic** : Radiological hazard arises from unstable substances known as radionuclides, which undergo internal changes to regain stability, emitting ionizing radiation in the process. This radiation can be emitted in the form of matter (alpha and beta particles) or electromagnetic waves (gamma radiation). Radiation can reach food through natural or accidental occurrences. Naturally, there are radioactive materials present in soil, water, air, the Earth's crust, and space. The accidents at Chernobyl and Fukushima have raised concerns about food safety. Even after some time, traces of radioactivity can be detected in food, as radionuclides can be transferred to the soil where crops are grown. Radiological hazards in the food industry are rare but carry high risks when they occur.

VIII. Hazards in HACCP: Ensuring Food Safety

6. **Irradiation** Regarding this topic, irradiation and radiation, some questions may arise. Radiation is the energy emitted spontaneously by a radioactive element from an unstable nucleus. Irradiation is when food or a substance receives ionizing radiation. It is a technology used to inhibit sprouting, delay ripening, reduce microbial counts, extend shelf life, and sterilize food, especially for people with compromised immune systems. It is important to remember that irradiation does not make the food radioactive. Another important point to clarify is that the radiation emitted by radio, cell phones, and microwaves is not ionizing. They are electromagnetic energies transmitted by waves but are not ionizing. Relevant tips regarding irradiation are that it cannot replace good manufacturing and agricultural practices. Sometimes, it is used to mask the lack of hygiene by applying doses higher than established, which can generate cancer-causing compounds. However, there is no evidence of the formation of these compounds. On the other hand, the applied dose may be respected, but it will not be enough to reduce microorganisms if the initial count is too high due to poor sanitary conditions. The advantage of using irradiation is that we can perform it on packaged food without causing sensory, appearance, or nutritional changes to the product. As measures to control this hazard, it is recommended that we know the origin of the packaging and raw materials to determine if they were grown in radiological risk areas. We should also verify the water supply, especially if it is from artesian wells.

VIII. Hazards in HACCP: Ensuring Food Safety

•Food Allergy:

- A food allergy is an abnormal immune response triggered by specific proteins in certain foods. When someone with a food allergy consumes the allergenic food, their immune system mistakenly identifies it as harmful and releases chemicals that cause allergic symptoms. These symptoms can range from mild, such as hives or itching, to severe, including difficulty breathing or anaphylaxis. Common food allergens include peanuts, tree nuts, milk, eggs, fish, shellfish, soy, wheat, and sesame.

•Food Intolerance:

- Food intolerance refers to difficulty digesting certain foods or substances found in them. Unlike a food allergy, which involves the immune system, food intolerance is typically caused by the body's inability to properly process or metabolize a specific component of the food. This can be due to enzyme deficiencies, sensitivity to food additives, or other factors. Symptoms of food intolerance can include bloating, gas, stomach pain, diarrhea, or headaches. Common examples of food intolerances include lactose intolerance (inability to digest lactose in dairy products) and gluten intolerance (inability to tolerate gluten found in wheat and other grains).

- It is important to note that while both food allergies and food intolerances can cause discomfort or adverse reactions, **food allergies can be life-threatening** and require strict avoidance of the allergenic food, while **food intolerances may be managed** through dietary modifications or enzyme supplements.

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Conclusion

- In conclusion, the identification and analysis of hazards are critical steps in the product quality and safety and ensure compliance with food safety regulation development and implementation of a HACCP plan. Hazards can arise from various sources, including the physical environment, the production processes, and the products themselves. The severity of the hazards can also vary, ranging from minor quality defects to life-threatening illnesses.
- It is important to consider all potential hazards and their associated risks when developing a HACCP plan. This includes assessing the production environment, processes, and products, as well as the organization's food safety culture. The HACCP plan should be tailored to the specific process and product being produced and should be regularly reviewed and updated as needed.
- Effective hazard analysis requires a multidisciplinary approach that involves collaboration between different departments and stakeholders within the organization. It also requires a thorough understanding of food science, microbiology, and food safety regulations.
- By implementing a HACCP plan that includes a robust hazard analysis process, organizations can reduce the risk of foodborne illness, improve s.

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