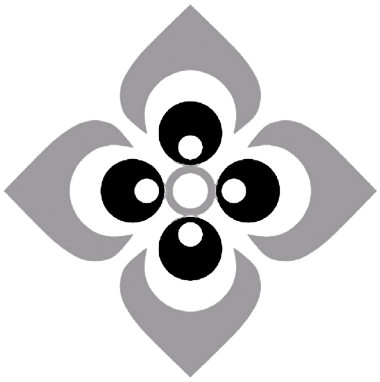

Consortium for Educational Communication

Module on

Biological Hazards in Foods and HACCP

By

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Introduction

A food safety hazard (fig 1) refers to any agent with the potential to cause adverse health consequences for consumers. Food safety hazards occur when food is exposed to hazardous agents (fig 2) which result in contamination of that food. Hazards may be introduced into the food supply any time during harvesting (fig 3), formulation and processing, packaging (fig 4) and labelling, transportation, storage, preparation, and serving. Food hazards may be biological (fig 5), chemical (fig 6), physical (fig 7), allergenic (fig 8), nutritional and/or biotechnology-related.

1. Biological Hazards

Biological hazards occur when hazardous or pathogenic organisms (fig 9) are introduced to food and thus pose a food safety concern to consumers. Biological hazards include bacteria (fig 10) , viruses (fig 11) and parasites (fig 12) of public health significance.

Biological hazards can be introduced to food from the environment (e.g. soil bacteria, agricultural run-off) or from inadequate sanitation practices and cross contamination during transportation, handling, processing, and storage (e.g., poor food hygiene practices). The type and magnitude of microbial growth is determined in part by the nature of the food, package conditions and storage environment.

1.1 Bacteria

Bacteria are single-celled microorganisms that exist in a range of habitats and can be free-living (e.g. in soil, air, water) or symbiotic (e.g. in intestinal tract or mucous membranes of animals and humans) and have a broad range of enzymatic, biochemical and/or pathogenic properties. The principal bacteria associated with food borne illnesses include:

- Bacillus cereus (fig 13)
- Clostridium botulinum (fig 14)
- Escherichia coli (fig 15)
- Listeria monocytogenes (fig 16)

- Salmonella spp. (fig 17)
- Staphylococcus aureus (fig 18)
- Vibrio cholerae (fig 19)

Ingesting food contaminated with pathogenic microorganisms and/or their toxic by-products (fig 20) can lead to food-borne illness. These illnesses can take the form of infection or intoxication, or both. Infectious microorganisms are detrimental to their host through mechanisms which crowd out beneficial microorganisms, use up host resources, and destroy host tissue. A food-borne illness caused by an infection can take days or weeks to manifest which often makes it difficult to identify the causative agent. On the other hand, illness caused by intoxication often occurs within hours of consuming the suspect food. Intoxications (fig 21) are caused by toxins that are produced by the microorganism, either in the food itself or after ingestion.

1.2 Viruses

In contrast to other microorganisms, active viruses consist of unique sections of DNA or RNA (fig 22) enclosed in a thin coat of protein, and cannot exist independently of their living hosts. Depending on the combination of DNA/RNA and the protein coating, viruses can be very infectious and often pathogenic. They reproduce by inserting themselves into a host cell and altering the function of that cell to replicate the component pieces that make up the virus. Viruses commonly associated with food safety issues include:

- Bacteriophage (fig 23)
- Enteric Virus (fig 24)
- Hepatitis A virus (fig 25)
- Norovirus (fig 26)
- Rota virus (fig 27)

Viruses are typically introduced into food either through poor handling practices by people infected with the virus (i.e.poor personal hygiene practices) or via contaminated food ingredients (i.e. wa-

ter).

1.3 Parasites

A parasite is any organism which obtains nourishment from its host organism in order to grow and reproduce. Unlike symbiotic organisms, parasites do not supply the host with any resources, usually to the detriment of the host. Parasites commonly associated with food-borne illnesses include:

- Cryptosporidium parvum (fig 28)
- Giardia duodenalis or intestinalis (fig 29)
- Taenia spp. (fig 30)
- Toxoplasma gondii (fig 31)
- Trichinella spiralis (fig 32)
- Entamoeba histolytica (fig 33)
- Entamoeba coli (fig 34)

Parasites enter food through similar means as viruses (i.e., poor personal hygiene practices and contaminated ingredients).

2 Chemical Hazards

Chemical hazards occur when chemicals are present in foods at levels that can be hazardous to humans. Contamination may occur through various pathways:

- The environment (air, soil, water),
- Intentional use of chemicals, such as pesticides and veterinary drugs,
- Manufacturing processes,
- Addition of food additives.

In the food industry, there are various types of chemical hazards, some notable ones include:

- Mycotoxins (fig 35)
- Natural Toxins

- Marine Toxins
- Environmental Contaminants
- Food Additives (fig 36)
- Processing-induced chemicals
- Pesticides/Agricultural Products and
- Veterinary Drug Residues

2.1 Mycotoxins

Mycotoxins are natural toxins which are produced by fungi and can be toxic to humans and animals. They are formed by moulds which grow on crops and foods under certain conditions. There are number of mycotoxins present in the environment but only a few are found in foods and they are usually associated with particular field crops like corn and cereals. The most prominent mycotoxins which cause health concerns in humans are aflatoxin, deoxynivalenol, ochratoxin, fumonisin and patulin, can cause chronic effects such as various cancers, immunosuppression, growth retardation, birth defects, and renal dysfunction.

2.1.1 Aflatoxin

Aflatoxin is produced by the mould Aspergillus flavus. Commodities which have a high potential for contamination with aflatoxin include tree nuts, peanuts, peanut butter, figs and corn. It should be noted that contaminated feed can lead to elevated levels in milk as well. The proliferation of Aspergillus and the corresponding production of aflatoxin are affected by drought during the growing season and high humidity during storage. Aflatoxin is a potential carcinogen associated with the development of liver cancer.

2.1.2 Deoxynivalenol (Vomitoxin)

Deoxynivalenol (DON) is produced by various species of mould, most notably, Fusarium graminearum and F. sporotrichioide. Fusarium species are widely dispersed and their toxins reportedly occur in a wide variety of cereals, grains and in animal feeds. DON is

not known to be carcinogenic. Symptoms observed as a result of human exposure to these toxins are vomiting, dermatitis, cough and rhinitis.

2.1.3 Ochratoxin A

Ochratoxin A (OTA) is a toxic metabolite formed by Aspergillus ochraceus, Penicillium verrucosum and other mould species. OTA has been found in corn, peanuts and decaying vegetation. It has also been found in mouldy cereals such as wheat, rye, barley, oats, and other commodities, including bread, flour, beans, peas, rice, and coffee and in samples of meat where the slaughtered animal may have consumed feed contaminated with OTA. Ochratoxin A is a human carcinogen which has also been found to cause lesions as well as teratogenic and neurotoxic effects.

2.1.4 Fumonisin

Fumonisin is a toxin produced by various species of mould, most notably Fusarium verticilloides and Fusarium proliferatum. Fumonisin is one of the most frequent mycotoxins found in corn. Fumonisin causes two animal diseases: porcine (pig) pulmonary edema and leukoencephalomalacia in horses. This mycotoxin is a concern for humans as there is evidence to suggest it may be carcinogenic, causing oesophageal and liver cancers, and may contribute to neural tube defects in babies.

2.1.5 Patulin

Patulin is a toxic chemical produced by various mould species including Penicillium spp., Aspergillus spp. and Byssochlamys spp. Patulin can be found in mouldy fruits (i.e. apples, pears, peaches, grapes), as well as mouldy vegetables and grains; however the major source of patulin contamination is from apples and apple products. The use of mouldy fruit increases the likelihood of patulin contamination in juices or ciders. Patulin is known to be genotoxic, causing damage to DNA and chromosomes, which may lead to carcinogenesis.

2.2 Natural toxins

Natural toxins are biochemical compounds produced by plants in response to certain conditions or stressors.

2.2.1 Glycoalkaloids

Potatoes can contain natural toxins called glycoalkaloids. The major ones found in potatoes are α-solanine and α-chaconine. These toxins are formed in response to stresses such as UV light and damage (such as bruising), and cannot be destroyed by cooking. Toxin concentrations are highest in the peel and sprout of the potatoes and can be seen as a characteristic green color on those parts. Exposure to glycoalkaloids can cause acute toxic effects such as burning in the mouth, diarrhoea, severe stomach ache, vomiting and gastrointestinal irritation.

2.2.2 Other Natural Toxins

Other natural toxins are listed in the Table 1 below.

Table 1: Some Natural Toxins in Food Plants

Food commodity	Toxin
Ackee fruit	hypoglycin
Cassa root, bamboo shoots, stone fruit	cyanogenic glycoside
Fiddlehead	unidentified
Green beans, red kidney beans, white kidney beans	lectin
Wild mushrooms	amanitins, gyromitrin, muscarine, phallotoxins
Parsnip	furocoumarins
Rhubarb	oxalic acid
Cabbage, cauliflower, broccoli, mustard, turnip	goitrogens

2.3 Marine Toxins

Marine toxins are a group of toxins that sometimes accumulate in fish and shellfish. There are two sources of marine toxins:

- decomposition
- microscopic marine algae (phytoplankton, including diatoms and dinoflagellates)

2.3.1 Decomposition

When certain fish, especially scombroid fish (i.e. tuna, bonito and

mackerel), start to decompose, histamine is formed. Histidine, a naturally-occurring amino acid, is converted into histamine by an enzyme produced by certain bacteria during decomposition. Histamine, in small doses, is necessary for the proper functioning of the human immune system. However, histamine in higher does may trigger severe reactions when consumed similar to those seen in allergic reactions such as rash, nausea, vomiting, diarrhoea, headache, dizziness, burning throat, stomach pain and itchy skin. The presence of high levels of histamine indicates that decomposition has occurred, even if the decomposition is not obvious. Toxic amounts of histamine can form before a fish smells or tastes bad. As this typically only occurs in scombroid fish, this is called Scombroid Poisoning.

4.2.3.2 Microscopic Marine Algae

Many marine toxins are produced by and can accumulate in fish and shellfish if they ingest certain types of algae.

Table 2 lists some common marine toxins and the seafood they are commonly associated with.

Table 2: Common Marine Toxins

Illness	Toxin	Seafood
Paralytic shellfish poisoning (PSP)	Saxitoxin	Oysters, clams, scallops, mussels, cockles, whelks
Amnesic shellfish poisoning (ASP)	Domoic acid	Bivalve molluscan shellfish, clams, mussels, oysters, scallops
Ciguatera poisoning	Ciguatoxin	Tropical fish such as barracuda, amberjack, red snapper, grouper
Diarrhetic shellfish poisoning (DSP)	Okadaic acid	Various shellfish, cockles, mussels, oysters
Tetrodotoxin poisoning	Tetrodotoxin	Pufferfish, California newt, parrotfish, octopus, starfish, angelfish, and xanthid crabs
Neurotoxic Shellfish Poisoning	Brevetoxin	oysters, clams, and mussels

4.2.4 Environmental Contaminants

Environmental contaminants are chemicals that accidentally or

deliberately enter the environment, often, but not always, as a result of human activities. Some of these contaminants may have been manufactured for industrial use and because they are very stable, they do not break down easily. If released to the environment, these contaminants may enter the food chain. Other environmental contaminants are naturally-occurring chemicals, but industrial activity may increase their mobility or increase the amount available to circulate in the environment, allowing them to enter the food chain at higher levels than would otherwise occur.

Some examples of environmental contaminants include lead, arsenic, bromates, dioxins, furans, mercury and polychlorinated biphenols (PCBs). Division 15 (Table 1) of the FDA contains maximum limits for some environmental contaminants in specific commodities.

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2.4.1 Arsenic

Arsenic is a naturally occurring element widely distributed in the earth’s crust and is generally found in trace quantities in soil, rock,

water and air. Arsenic can take two forms – organic and inorganic. Organic arsenic can be found in fish and shellfish and is the much less harmful form of arsenic. Inorganic arsenic compounds are found throughout the environment and can be released into the air through various processes such as volcanic action, mining of arsenic-containing minerals and ores and by industrial and commercial processes such as copper or lead smelting, wood treatment and pesticide application.

Inorganic arsenic is a carcinogen, and long-term exposure increases the risk of cancers of the skin, lungs, bladder, liver, kidney and prostate.

2.4.2 Cadmium

Cadmium is a rare element and is usually not found in nature in its pure state, but exists in combination with other elements, forming compounds such as cadmium oxide, cadmium chloride and cadmium sulphide. Cadmium is used in the manufacture of batteries, pigments, coatings, plating, stabilizers for plastics, ore processing and smelting, thus it finds its way into the environment through waste, waste water and soil uptake.

Most of the cadmium which enters the body is directly from plants grown in contaminated soil, or indirectly, from meat-producing animals which have eaten plants grown in contaminated soil. Cadmium and its compounds are highly toxic and are also suspected carcinogens.

2.4.3 Lead

Lead is a toxic heavy metal and is found in the environment in sources such as dust and soil. It can also be found in water and some food products (i.e. maple syrup and honey), that may have come into contact with older plumbing and cookware that contains lead-based solder. Lead may be found in older paint products as well.

Lead has been shown to cause neurological disorders, reproductive problems and diminished intelligence. Infants and young children are particularly at risk because they absorb a higher proportion of lead from food than adults, as they are still growing and developing. Pregnant women are also susceptible. Other

effects are impaired mental function, visual motor performance and anaemia. Symptoms of exposure to lead may also be subtle, such as irritability, headaches, insomnia, gastrointestinal upsets, learning, behavioural and kidney problems.

2.4.4 Mercury

Mercury is a heavy metal which occurs naturally in rocks and soils and can be found in lakes, streams and oceans. Combustion of fossil fuels, mining, pulp and paper industries and burning garbage can also release mercury into the environment.

There are traces of mercury in almost all foods, with very low levels in vegetables and fruits, and high levels in certain types of fish such as shark, swordfish, marlin, escolar and orange roughly, which absorb the mercury from the organisms they consume as well as the surrounding water in which they live.

Mercury exists in several chemical forms. Two types are 'inorganic' and 'organic' mercury. Methyl mercury ('organic' mercury) is the most common form of mercury found in the aquatic environment and most fish have trace amounts present. It has been found that larger and older fish tend to have the highest levels of mercury, due to bioaccumulation. Methyl mercury is suspected to be a human carcinogen.

Exposure to mercury may cause several health effects: damage to the nervous system, kidneys, and the developing foetus. Other effects include brain damage, irritability, tremors, memory problems, changes in vision and hearing. Children are more sensitive to mercury than adults.

2.5 Food Additives

A food additive is any chemical substance that is added to food during preparation or storage and either becomes a part of the food or affects its characteristics for the purpose of achieving a particular technical effect (See B.01.001 of the FDR for a definition of 'food additive').

Substances that are used in food to maintain its nutritive quality, enhance its keeping quality and make it attractive or to aid in its processing, packaging or storage are all considered to be food ad-

ditives. However, some substances that aid in the processing of food, under certain conditions, are considered to be food processing aids, not food additives. Examples of food additives include:

- food colours (natural and synthetic)
- pH adjusting agents
- preservatives
- bleaching agents
- food enzymes
- glazing and polishing agents
- emulsifiers
- gelling agents

A flavour enhancer is considered to be a food ingredient under the Food and Drug Regulations and is not currently regulated as a food additive in Canada for a number of reasons; the level of use of these substances is small, the history of use is well established and many international compendiums exist to substantiate their safe use.

Sometimes, food additives are found in food for which there is no provision in the FDR or at levels which exceed the prescribed levels. In these situations, the food may pose a risk to the consumer. Some examples of this type of situation include non-permitted synthetic colours (Sudan, Rhodamine and Gardenia Yellow).

2.6 Processing-induced Chemicals

Undesirable chemicals can be formed in certain foods during processing as a result of reactions between compounds that are natural components of the food. In some cases an undesirable chemical may be formed as a result of a food additive being intentionally added to food and then reacting with another compound in the food. When foods are heat-processed (baked, deep-fried, etc.), reactions occur between components of the food, resulting in the desired flavour, appearance and texture of the food. However, some of these reactions can lead to the production of undesirable compounds. Similarly, certain storage or processing condi-

tions may allow reactions to occur that could generate potentially harmful compounds. Such chemicals can be collectively referred to as processing-induced chemicals. Some of these chemical reactions involve naturally-occurring components in the food, while other reactions may involve food additives, ingredients, or food packaging materials that were intentionally used. For these reasons, the presence of processing-induced chemicals in food cannot always be avoided.

Examples of processing-induced chemicals include:

- acrylamide
- ethyl carbamate
- furan

2.6.1 Acrylamide

Acrylamide is a chemical that naturally forms in certain foods, particularly plant-based foods that are rich in carbohydrates and low in protein, during processing or cooking at high temperatures Asparagine (a natural amino acid) reacts with naturally occurring sugar (glucose) in the food and acrylamide is formed, but only if the temperature during the cooking process is high enough. The highest concentrations of acrylamide have been detected in potato chips and french fries, although it has been found in other foods as well including baked and roasted foods.

Acrylamide is a health concern as, based on studies, it is a probable human carcinogen.

2.6.2 Ethyl Carbamate (Urethane)

Ethyl carbamate (urethane) is a chemical naturally formed during food processing especially in alcoholic beverages such as wine, beer, whisky, fruit brandies, and fermented foods such as bread and yogurt. Its presence was first identified in 1985.

Ethyl carbamate is formed by the spontaneous reaction of urea and ethanol. Urea is either added to increase fermentation rates, or is excreted by yeast when the wine yeast metabolises. Ethyl carbamate formation builds up over time and is exponentially accelerated at elevated temperatures. Fermented products that are

also heated during processing (such as sherry "baking"), increases ethyl carbamate levels.

Ethyl carbamate is a health concern as it has been classified as a probable human carcinogen.

2.6.3 Furan

Furan is a colourless, volatile organic compound that is used in some chemical manufacturing industries and may also be found in low levels in some heat-treated foods, such as canned or jarred foods. Furan in foods can form through multiple pathways that involve different naturally-present starting compounds that undergo thermal degradation or chemical rearrangement during food processing. The presence of furan in food is a potential concern because of indications of liver toxicity, including carcinogenicity, in experimental animals that were exposed to furan in their diet over a lifetime.

2.6.4 Pesticides/Agricultural Products

A pesticide is any substance or organism (including organisms derived through biotechnology) that is used to control, destroy, repel or attract a pest or to mitigate the effects of a pest. A pest is defined as an animal, plant or other organism that is directly or indirectly injurious, noxious or troublesome (Pest Control Products Act, 2002)

Pesticides consist of insecticides, fungicides and herbicides. The following are examples of pesticides on certain crop groups:

- Azoxystrobin on peaches
- Captan on cherries
- Clethodim on beans
- Thiocarbamate on apples

Pesticides play an important role in Canada's food supply by protecting food from pests and diseases. When pesticides are used on food crops or when animals eat crops treated with pesticides, residues may remain on or in the food. Health Canada's Pest Man-

agement Regulatory Agency (PMRA) assesses the likelihood of health and environmental risks associated with each pesticide before it is allowed to be used in Canada. The PMRA also determines whether the ingestion of the pesticide residues that are most likely to remain on or in the food poses an unacceptable health risk, and establishes a maximum residue limit (MRL).

A major issue associated with pesticides is that they can accumulate in the food chain and may contaminate the environment. A classic example is dichloro-diphenyl-trichloroethane or DDT. This is one of the best known synthetic pesticides which has prevented many deaths by helping control the insect vector that spread malaria, but at the same time, its use was controversial. It was banned in 1972 due to the damage it caused to wildlife, especially birds, as it builds up in plants and in the fatty tissues of birds and other animals. DDT is believed to be carcinogenic to humans, and still remains in the environment today.

2.7 Veterinary Drugs

Veterinary drugs are often used in food-producing animals to control and/or prevent illness in the animal. If these drugs are used inappropriately or the withdrawal time prior to slaughter is not respected, residues from these drugs can be present in the food. These residues can be the drug itself or metabolites that are produced by the drug as it is digested by the animal and can be considered harmful to the consumer.

Veterinary drug residues are regulated under the Food and Drug Regulations. Table III in Division 15 lists the maximum residue limits (MRLs) of veterinary drugs for various foods. The MRLs are the maximum residue levels tolerated in food products and tissues of animals that have been treated with veterinary drugs. This residue level is considered to pose no adverse health effects if ingested daily by consumers over their lifetime.

2.8 Physical/Extraneous Material Hazards

Extraneous material covers all materials (excluding bacteria and their by-products (toxins), viruses and parasites) which may be found in a food that are foreign to that particular food. These materials are usually non-toxic but are associated with unsani-

tary conditions of production, processing, handling, storage and distribution of food. Some examples of extraneous materials that may be found in food are insects, hair, metal fragments, pieces of plastic, wood chips and glass.

Extraneous material can be considered hazardous due to its hardness, sharpness, size or shape. It may cause lacerations, perforations and wounds or may become a choking hazard. The sale of food contaminated with injurious extraneous material may be considered to be a violation of Section 4(1) (a) and/or Section 7 of the Food and Drugs Act.

Health Canada evaluates injurious extraneous material in food and it considers 2.0 mm or greater as the threshold size for consideration as a health risk. For infant food, any size of injurious extraneous material may be considered a risk. Besides size, the risk associated with extraneous material is further evaluated through an assessment of shape, hardness, material, source, target consumer groups, etc.

Extraneous materials can be differentiated into two categories: unavoidable and avoidable

Unavoidable extraneous material may occur in food as a by-product of the processing system or as something inherent to the product itself. Items such as stems in blueberries, microscopic airborne debris, dirt on potatoes, or minute insect fragments in figs are common examples of unavoidable extraneous matter.

Avoidable extraneous material is generally less tolerated than unavoidable because it is preventable. It consists of foreign matter which should not be present if proper GMPs are followed. Avoidable extraneous material may come in many different forms such as small glass fragments, pieces of plastic, chunks of rubber, pieces of jewellery, feather barbules, animal debris or any other unrelated foreign material.

Crystals, which appear to be glass, can sometimes form in certain food products such as tuna (struvite), processed cheese, soya sauce and fish sauce. These are not glass; they are mineral crystals. This can be verified by dissolving the crystals in heated vinegar or lemon juice.

2.9 Allergenic Hazards

An allergen is any protein that is capable of producing an abnormal immune response in sensitive segments of the population. Allergic reactions to food usually involve IgE antibodies. Symptoms of an allergic reaction can range in severity from a skin rash or slight itching of the mouth, to migraine headaches, to anaphylactic shock and death. The type and severity of an allergic response is determined by many factors, including dosage, route of administration, frequency of exposure, and genetic factors. This is not to be confused with a food intolerance which is an abnormal physiological response to a specific food. Symptoms of food intolerance may include cramps, diarrhoea and bloating.

Anaphylactic shock is the most severe adverse reaction to food and can be fatal if left untreated. It generally occurs within minutes of consumption, but occasionally the reaction may be delayed, with symptoms appearing several hours after the initial exposure. Initial symptoms of an IgE mediated allergic reaction are characterized by itching, hives, and/or swelling of the lips, palate, tongue, and throat. Once the food enters the stomach and intestine, symptoms may include cramping, nausea, pain, and diarrhoea. Subsequent systemic symptoms generally affect the pulmonary and cardiovascular system. The most dangerous symptoms include breathing difficulties and a drop in blood pressure or shock.

There is no cure for food allergies and the only successful method for sensitive individuals to manage food allergy is to practice complete avoidance of the specific allergen. These individuals therefore rely on accurate information (e.g. ingredient list) on food labels to manage food allergy. Inaccurate, undeclared or hidden allergens on food labels can pose a significant health hazard to these individuals. Cross contamination during processing, packaging, and storage can inadvertently produce products that contain allergens which may not be reflected in the ingredients list on the food label. Strict adherence to good manufacturing practices (GMP), Hazard Analysis Critical Control Points (HACCP), and allergen prevention plans will reduce the likelihood of cross

contamination.

HACCP (Hazard Analysis and Critical Control Point).

HACCP is an internationally recognized management system that ensures food safety by reduction of the risks of the physical, chemical and biological hazards in the production processes and bring them to a safe level.

The HACCP System helps identify and control the potential biological, chemical or physical hazards at critical points in the process. HACCP is an effective system of minimizing or eliminating food hazards, which can be adopted by organizations across the food chain.

Hazard Analysis with respect to Food Safety

Hazard analysis is the method of identifying the various food safety hazards which can arise from a process. The Hazard Analysis includes the documentation the undesired consequences of the hazards and analyzing their potential causes. Hazard Analysis is made up of two components – Hazard Identification and Hazard Evaluation.

CCP or Critical Control Point

The CCP or Critical Control Point is a step at which control can be applied in order to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

The Seven Principles of HACCP

To implement HACCP in your organization, the below mentioned seven principles are to be understood and followed effectively:

- Conduct a Hazard Analysis.
- Identify the Critical Control Points
- Establish Critical Limits
- Establish Monitoring Procedures
- Establish Corrective Actions
- Establish Record Keeping Procedures

- Establish Verification Procedures

Benefits of implementing HACCP

Below mentioned are some of the main long term benefits of implementing HACCP

- Improves food safety standards of your organization.
- Ensures that your organization's process produces food safe to consume.
- Provides positive image of your organization in the market.
- Prevents legal complications or lawsuits filed by the consumers for consuming unsafe food.
- By avoiding food related incidents and preventing the failure of food safety, HACCP saves cost in the long run
- Makes sure that you are compliant with the food laws and rules
- HACCP enables organizations in the food chain to compete in the world market by propagating its commitment to safe food.
- Reduces customer complaints
- Enhances the business prospects