# UNIT 2 FOOD SAFETY SYSTEM

**Structure**



## 2.0 OBJECTIVES

After reading this unit, we shall be able to:

- understand the terms and definitions associated with food safety system;
- understand the need for food safety systems; and
- know how food safety relates to the entire food chain.

## 2.1 INTRODUCTION

Recent years have witnessed a very rapid growth in food industry and a resulting increased movement of foodstuffs around the world. This is evident from the variety of foods that are now available to us as consumer. Food grown in one country, processed and packaged in yet another is available for consumption virtually across the world. Our markets are flooded with products hitherto unknown to us. With few exceptions, most forms of fruits and vegetables can now be purchased throughout the year from food retailers throughout the world. It seems that growth seasons and location are no longer relevant to the consumer. The reasons for these changes have been attributed to the greater affluence of the population throughout much of the developed and developing world and emerging markets. Increased foreign travel for holidays or work purposes, and the growing cultural diversity in many countries has brought many people into contact with different cultures and their cuisines. The result has been a greater demand for more exotic food leading to new business opportunities for food traders and retailers.

However, this increased reach to different type of food articles has increased the risk for the consumers. For the food article coming from another country it is not known wheather it contain any chemical hazards like pesticide residues, antibiotic residues or

heavy metals or bio-chemical hazards like microbial toxins or pathogenic micro-organisms. Food contamination starts from the primary production level, processing procedures, transportation, storage, personnel, equipments, surroundings, waste disposal and water with the realization food may get contaminated. The current practices for ensuring food safety which are product oriented and have been built on inspection procedures are not adequate and are not sufficient to meet food safety requirements emerging due to scenario of world food trade. Therefore, organisations in the food sector need to manage risks, demonstrate good corporate responsibility and meet legal requirements if they want to remain competitive, protect their reputation and enhance their brand to achieve these goals they have to adopt an effective food safety management system based on a process standards.

## 2.2 CHANGES IN THE PATTERNS OF FOOD CONSUMPTION

Changes in life style of modern society are reflected by changes in consumer choice towards processed and convenience food that are readily available, easy to handle and require minimal time and effort to prepare. Currently food processing involves very large volumes of food, and these could be as ready to eat, frozen foods, semi processed foods, or even cleaned and cut fresh vegetables that are ready to be cooked without any further processing. All these processing operations are taking place in specific purpose built factories very much like any other engineering factory that we are more familiar with. Most of these processed foods largely chilled or frozen and ready to eat (RTE) can be purchased which require only heating prior to consumption.

However, we must understand that most of the convenience food contain high risk ingredients such as fish, meat and poultry and represent a new type of risk that can be realized during production, transport, storage, point of sale and preparation prior to consumption. It has been suggested that the continuing rise in incidence of food poisoning in many of the developed countries may be linked with this shift of emphasis towards convenience foods.

## 2.3 THE INCREASED RISKS OF FOOD BORNE INFECTION

Every year, the number of people at risk of food borne infections and related serious consequences are increasing. Opening up of trade in food from around the world offers far greater consumer choice but also increases the potential risk to human health. In spite of advances in scientific knowledge and stronger food regulations, food safety hazards in the form of prions, genetically modified foods, the incidence of bovine spongiform encephalopathy (BSE), and dioxin-contaminated foods are some of the new food safety concerns. Let us know about them.

Prions are one of the new sources of food borne diseases. A prion is the short form of proteinaceous infectious particle. Dr. Stanely Prusiner coined the word "prion" as a name for the infectious agent by combining the first two syllables of the words "proteinaceous" and infectious" while the infectious agent was named a prion, the specific protein that the prion was made of was named PrP, an abbreviation for "protease- resistant protein". The normal form of the protein is called PrPC, while the infectious form is called PrPSc, which stands for prion protein of scrapie. Prions are generally quite resistant to denaturation by protease, heat, radiation and formalin treatments, although potency or infectivity can be reduced.

Prions enter cells and apparently believed to infect and propagate by refolding abnormally into a structure which is able to convert normal molecules of the protein into the abnormally structured form. The proteins accumulate in the brain causing holes or plaques and the subsequent clinical symptom leading to death.

Prions diseases are grouped as transmissible spongiform encephalopathy (TSE). The diseases associated by prisons are: Creutzfeldt – Jakob Disease (CJD), Bovine spongiform encephalopathy (BSE- commonly known as "mad cow disease"), fatal familial insomnia and kuru (translated as "to tremble with fear").

**Bovine Spongiform Encephalopathy (BSE):** Bovine Spongiform Encephalopathy is commonly known as mad – cow diseases. It is a progressive neurological disorder ( brain disease ) of cattle that results from an infection by an unconventional transmissible agent. BSE is one of a transmissible Spongiform Encephalopathies (TSEs) that affect a number of different mammals.

**Creutzfeldt – Jakob Disease ( CJD):** It is one of the most commonly known diseases among humans. This is a rare and fatal form of dementia and mainly occurs in individuals between the ages of 40 and 80.

**Dioxin – Contaminated Foods:** Dioxin is the popular name for the family of halogenated organic compounds, the most common consisting of polychlorinated dibenzofurans ( PCDFS) and polychlorinated dibenzo-p-dioxins ( PCDDs). PCDD/ PCDFs are industrial pollutants that persist in the environment. They have been shown to bio-accumulate in humans and wildlife due to their lipophilic (fat loving) properties. Dioxins are carcinogen in higher amounts, and cause developmental and reproductive problems. They are absorbed primarily through dietary intake of fat, as this is where they accumulate in animals, including humans.

**Genetically Modified (GM) Foods:** The GM foods are produced from genetically modified organisms (GMO). A GMO means: an organism that has been modified (manipulation of DNA) by gene technology. Genetically modified (GM) crops and food are being grown and consumed by the public. The advantages associated are: increased yields from agriculture, more powerful control of pests and weeds, reduced use of some agrochemicals and enhancement of nutritional value or other characteristics of crops, etc. There are many things which people hold up as possible dangers of genetic modification: risk of transferring crop traits to wild species, negative impacts on wildlife from more powerful control of pests and weeds, increased use of some agrochemicals, increased corporate control of seed supply and; limited studies on food safety concerns on human health in form of toxins/allergenic reactions/ reduction in good micro flora of duct, etc.

## 2.4 INADEQUACY OF THE EXISTING METHODS TO CONTROL THE RISK

Potential for contamination of food starts from the primary production on account of plant and animal disease, drug / pesticide residues, farm processing procedures, storage and transportation, personnel, equipment / vessel, surroundings, waste disposal and water. Further during food processing potential for contamination and food safety hazards arises from layout and surroundings of the processing facility, raw materials and packaging material used, transportation, storage conditions, time, handling. Processing including packaging, machine and equipment, maintenance, personnel, water, steam, ice, chemicals – detergents, sanitizers, pesticides, pests – insects flying, crawling, rodents, birds and waste disposal. With this realization that food can get contaminated

at any stage in the food chain, the current practices for ensuring food safety which are product related and have been built on inspection procedures, do not appear to be adequate to control the food-related illnesses from occurring and may not be sufficient to meet the complexities and needs for food safety emanating from the changing scenario in food world trade, usage of vast numbers of ingredients and additives, complex processes, improved packaging and food processing technologies and emergence of new hazards.

The food manufacturing industry has seen many changes, including newly recognized pathogens, more sophisticated technologies, and increased automation. While GMPs can control many food safety problems, it is not clear that current GMPs adequately address these new developments.

**Check Your Progress Exercise 1**

**Note:** a) Use the space below for your answers.

b) Compare your answers with those given at the end of the unit.

1) How modern life style has changed the pattern of our food consumption?

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2) How the opening up of trade in food from around the world has increased the risk from food born infection?

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3) Why the existing methods of food safety are inadequate to meet the need of food safety?

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## 2.5 NEED FOR FOOD SAFETY MANAGEMENT SYSTEMS

Safe food is critical for consumers and business. Many of us have grown up trying to avoid various common hazards and try to protect our children from getting injured by

these despite our familiarity with food poisoning from microbiological and chemical causes, or injury from glass, wire and other dangerous physical objects, their control is difficult and occasionally they result in serious consumer safety exposures and expensive product recalls and retrievals for the food industry.

As we witness a tremendous growth in diversity of food products and processes, we must not lose sight of the associated enhanced risks of food borne illnesses. While much of our food supply is safe, several recent high profile cases around the world underline the potential danger of food borne illness to consumers, employees and damage to brand value. A few recent examples include BSE infected beef, the salmonella contamination of poultry and eggs and high levels of listeria in dairy products. For these reasons and others, global retailers, distributors, food manufacturers and food service companies are now concerned more about the safety of their food supply chain than ever before.

Organisations in the food sector need to manage risk demonstrate good corporate responsibility and meet legal requirements if they are to remain competitive, protect their reputation and enhance their brand. And hence an effective food safety management system based on a proven standard will help the food processing / food industry achieve these goals.

## 2.6 EMERGING TRENDS IN FOOD SAFETY

### 2.6.1 Food Safety Legislation

World Health Organization (WHO) and Food and Agriculture Organization (FAO) set up the "Codex Alimentarius" in 1963. The mission of the Codex Alimentarius is to set international food standards to help governments and business to achieve adequate consumer protection.

The Codex Commission helps to raise the awareness of governments on food safety issues, and serves as a reference for food safety standards and food regulations. It helps also facilitate international trade in foods by preventing unscientific restrictions while considering differences in tradition, culture and legal systems among countries.

An increasing number of governments are working with the Codex Alimentarius Commission and adopting to the concept of controlling food safety through legislation and regulation. For example, the model adopted for regulating food producers in US is based on the following five principles:

a) Only safe and wholesome foods may be marketed;

b) Regulatory decisions making in food safety is science based;

c) The government has enforcement responsibility;

d) Manufacturers, distributors, importers and others are expected to comply and are liable if they do not; and

e) The regulatory process is transparent and accessible to the public.

At home in India, the Government of India has recently enacted the Food Safety & Standards Act, 2006, stating its objectives as: "An act to **consolidate the laws** relating to Food and to establish Food Safety & Standards Authority of India for laying down **Science based standards** for articles of food and to regulate their manufacture, storage, distribution, sale and import, to ensure availability of **safe and wholesome** food for human consumption and for matters connected therewith or incidental thereto".

It is evident that most of the Governments frame food laws that have precautionary approaches embedded in them and are more often than not based on science-based risk analyses. Compliance to the law of the land which is binding on all producers of food is a means practiced for protecting and safeguarding the health of its citizens adequately from illness or injury caused by food, and providing an assurance that food is suitable for human consumption.

### 2.6.2 Customer Audits of Food and Food Products

Likewise large food organisations supplying food sourced from a wide number of countries, suppliers, including the large retail chains, are responsible for the safety and quality of food products supplied by them. For ensuring this they take the precaution of auditing their supplier's food hygiene arrangements and carry out testing of their products. These organisations recognize that they need to show due diligence in assuring themselves of the food safety and quality of the food products they supply to their customers. Failure to carry out appropriate testing can be interpreted as lack of due diligence and lead to prosecution if their food products are shown to be unfit for human consumption. But what is emerging from all these customer requirements and audits is a multiplicity of systems for ensuring food safety and thus an added burden on the food industry of complying with all such requirements.

Many organisations operate structured quality assurance systems to ensure that information regarding product quality and safety is available to them in the form of records. Food businesses generally require their suppliers to have similar quality assurance systems, and to make information from suppliers systems available to them as part of the due diligence approach to food safety. The system of checks of balances, which constitute quality assurance systems, will thus be a requirement at every stage of the food chain from primary producers through to the retailer. Although, it is generally accepted that precaution is a legitimate element if food safety decisions, disputes arise when such decisions adversely affect the economic performance of the agriculture and food industries.

### 2.6.3 Food Safety Management Systems

The Industry thus needs to deploy systems with a view to:

a) providing food which is safe and suitable for consumption;

b) ensuring that consumers have clear and easily-understood information, by way of labelling and other appropriate means;

c) enabling them to protect their food from contamination and growth/survival of food borne pathogens by storing, handling and preparing it correctly; and

d) maintain confidence in internationally traded food.

We are all aware that customer's requirements are often incorporated in specifications, but specifications may not in themselves guarantee that customer's requirements will be met consistently. Normally deficiencies in the organizational system to supply and support the products lead to inconsistency in meeting the customer's requirements.

The frontline defense against the growing and evolving threat of food borne diseases and illnesses is the application of a preventive risk assessment based food safety programme like Hazard Analysis Critical Control Points (HACCP) and ISO 22000 designed to prevent the occurrence of potential food safety problems. A common

foundation for building a food safety management system is based on HACCP, or Hazard Analysis and Critical Control Point methodology.

Today worldwide we are recognizing the importance of risk assessment in achieving food safety goals. Adoption of the recommendations of the Codex Alimentarius and the application of the excellent principles of risk assessment suggests that controversy should not be an issue with food safety.

Risk assessment on food safety is generally based on the best available scientific evidence which may reach the conclusion of reasonable certainty of no harm based on the available scientific data at the time. Unfortunately, this is no guarantee of safety, as it does not mean there is no risk. In practice, it is taken to mean that the risk is no greater than is socially acceptable. It is also the case that quantitative risk assessments are only valid where the data is good and well understood. It is suggested that risk assessors tend to discount risks where data is less than conclusive. There is a tendency to stress what is known and to overlook what is unknown, thus equating lack of proof of harm with proof of lack of harm.

The need for risk based food safety management systems is further fueled by the growing trend in the international trade for worldwide equivalence of food products and the Codex Alimentarius Commission's adoption of HACCP as the international standard for food safety. HACCP represents an important food protection tool which can be practiced by all companies and integrated into the existing system of any establishment, irrespective of their size.

To ensure that food safety risks are minimized, food sector businesses need to operate a food safety management system. With so many food safety regulations to comply along with demanding customer requirements, many businesses do not know where to start.

Today management systems need to take into account not only basic food regulations and acceptable workplace practices, but include contingency plans for potential crises such as product recall. All these types of practices form the basis of a food safety management system.

HACCP is a systematic, science based process that identifies hazards and the measures necessary for their control to ensure a safe food product. HACCP systems seek to prevent the expression of hazards rather than relying on end product testing. It can be applied throughout the food chain from primary production on the farm to consumption of food in the home, or restaurant. HACCP is a management tool that can be audited, which aids inspection by the regulatory authorities and engenders product confidence within the food industry. Codex HACCP propagates aspects of food safety management with the aim of ensuring that the organisation can time and again deliver the product that meet the customer's requirements. However, the design and implementation of the quality and food safety systems are influenced by the changing needs of the organisation, its objectives, products and services it provides. ISO 22000 is an International Standard on Food Safety Management Systems. ISO 22000 is a generic Food Safety Management Standard and can be used by any organisation directly or indirectly involved in the food chain. It applies to all organisations in the food chain. It doesn't matter how complex the organisation is or of what size it is, ISO 22000 can help ensure the safety of its food products.

The food chain consists of the entire sequence of stages and operations involved in the creation and consumption of food products. The food chain also includes organisations that do not directly handle food. These include organisations that produce feed for animals used as food. It also includes organisations that produce materials that will eventually come into contact with food or food ingredients as per details given below:

**a) Primary producers**

- Farms
- Ranches
- Fisheries
- Dairies

**b) Processors**

- Fish processors
- Meat processors
- Poultry processors
- Feed processors

**c) Manufacturers**

- Soup manufacturers
- Snack manufacturers
- Bread manufacturers
- Cereal manufacturers
- Dressing manufacturers
- Beverage manufacturers
- Seasoning manufacturers
- Packaging manufacturers
- Frozen food manufacturers
- Canned food manufacturers
- Confectionery manufacturers
- Dietary supplement manufacturers

**d) Food service providers**

- Grocery stores
- Restaurants
- Cafeterias
- Hospitals
- Hotels
- Resorts
- Airlines
- Cruise ships
- Seniors lodges
- Nursing homes

**e) Other service providers**

- Storage service providers
- Catering service providers
- Logistics service providers

- Transportation service providers
- Distribution service providers
- Sanitation service providers
- Cleaning service providers

**f) Product suppliers**

- Suppliers of tools
- Suppliers of utensils
- Suppliers of equipment
- Suppliers of additives
- Suppliers of ingredients
- Suppliers of raw materials
- Suppliers of cleaning agents
- Suppliers of sanitizing agents
- Suppliers of packaging materials
- Suppliers of other food contact materials

ISO 22000 shows organisations how to combine the **HACCP plan** with prerequisite programs (or programmes) and operational prerequisite programs into a single integrated food safety management strategy.

Today, it is widely recognized by the industry that meeting the business challenges through the implementation of quality and Food Safety Management Systems may be more effective and less costly than simply responding to concerns as they arise. The benefits associated with approaching quality and food safety issues in a proactive, rather than a reactive, manner are numerous. Needless to say that demonstration of implementation of these systems shall go a long way in achieving commercial business goals.

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### Check Your Progress Exercise 2

**Note:** a) Use the space below for your answers.

b) Compare your answers with those given at the end of the unit.

1) What is Food Safety Management System?

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2) What are the emerging trends in food safety?

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3) What are the five principles for regulating producers in the U.S.?

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4) What are the aims of Food Safety Management System?

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## 2.7 LET US SUM UP

We all know that food borne illness and food borne injury are at best unpleasant, at worst, they can be fatal. But there are also other consequences. Outbreaks of foodborne illness can damage trade and tourism, and lead to loss of earnings, unemployment and litigation. Food spoilage is wasteful, costly and can adversely affect trade and consumer confidence.

International food trade, and foreign travel, is increasingly, bringing important social and economic benefits. But this also makes the spread of illness around the world easier. Eating habits too, have undergone major change in many countries over the last few decades and new food production, preparation and distribution techniques have developed to reflect this. Effective hygiene control, therefore, is vital to avoid the adverse human health and economic consequences of food borne illness, food borne injury and food spoilage. Everyone, including farmers and growers, manufacturers and processors, food handlers and consumers, has a responsibility to assure that food is safe and suitable for consumption.

## 2.8 KEY WORDS

**Food Safety** : Assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.

**Food Chain** : Sequence of the stages and operation involved in the production, processing, distribution, storage and handling of a food and its ingredients from primary production to consumption.

**Food Safety Hazard** : A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.

**Flow Diagram** : Schematic and systematic presentation of the sequence and interactions of steps.

**Control Measure** : (food safety) Activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

## 2.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Your answer should include following points:

**Check Your Progress Exercise 1**

1) Creation of nuclear families in which both husband and wife are working has created a demand for convenience food and for health of consumers of the present day, customers has created the increased market for minimal processed food.

2) Opening of the trade in food from around the world has increased the risk of food hazards in forms of Bovine Spongiform Encephalitis, Avian flue, Listeria monocytogness and pesticides and antibiotic residues and heavy metals due to lack of control of the discharge of waste form industrial units and exercised use of pesticide and antibiotics in agriculture and animal husbandry.

3) The current practices for ensuring food safety which are product central and built on inspection procedures are not adequate to control the food related illness from the emergence of new hazards.

**Check Your Progress Exercise 2**

1) Food Safety Management System (ISO -22000) specifies requirements for a Food Safety Management Systems where an organisation in the food chain need to demonstrate its ability to control food safety hazards in order to ensure that food is safe at the line of consumption. It is integration of quality management system, food safety and environment management system.

2) Emerging trends in food safety are the new food safety legislations at international level like Codex Alimentarius raise the awareness of governments on food safety issues and serve as a reference for food safety standards and regulations. At national level the Government of India has recently enacted the Food Safety and Standards Act 2006 and established Food Safety and Standard Authority.

3)
- Only safe and wholesome food may be marketed.
- Regulatory decisions making in food safety is science based.
- The government has enforcement responsibility.
- All the players in food chain are expected to comply and are liable if they do not comply.
- The regulatory process is transparent and accessible to the public.

4)
- Providing food which is safe and suitable for consumption.
- Enabling the consumers to protect their food from contamination by storing, handling and preparing it correctly.
- To maintain confidence in international food trade.

## 2.10 SUGGESTED READING

Codex Alimentarius Commission - Recommended International Code of Practice, General Principles of Food Hygiene, CAC/RCP 1-1969, Rev. 4-20031