
UNIT 14 QUALITY ASSURANCE: REGULATION, CODES, GRADES AND STANDARDS

Structure

- 14.0 Objective
- 14.1 Introduction
- 14.2 Food Safety Issues
 - Specific Safety Issues
- 14.3 Food Adulteration, Contamination and their Detection
 - Food Adulteration
 - Food Contamination
 - Food Quality Assurance
- 14.4 Quality Control
 - Inspection
 - Lab Tests
 - Sanitation
 - TQM (Total Quality Management)
 - Codex Alimentarius
 - HACCP (Hazard Analysis and Critical Control Point)
- 14.5 Grades
- 14.6 Standards
 - ISO (International Organization for Standardization) 9000 SERIES
 - Fruit Product Order (FPO)
 - Meat Products Order (MPO)
 - Cold Storage Order (CSO)
 - PFA (Prevention of Food Adulteration Act and Rules in India)
 - AGMARK
- 14.7 Enforcement of Food Laws
- 14.8 Testing of Samples
- 14.9 Residue Analysis
- 14.10 Let Us Sum Up
- 14.11 Key Words
- 14.12 Answers to Check Your Progress Exercises
- 14.13 Some Useful Books

14.0 OBJECTIVES

After reading this unit, you should be able to answer:

- food safety issues;
- food adulteration, contamination and their detection;
- quality control;
- grades;
- standards;
- enforcement of food laws;
- testing of samples; and
- residue analysis

14.1 INTRODUCTION

Food industry plays an important role in the national economy. For a successful food processing sector, various aspects of total quality management such as quality control, quality system and quality assurance should function for total success. In today's global market, quality and food safety have a competitive edge of enterprises producing foods and providing services to reach the global market. As a member of World Trade organization (WTO), India is signatory to the Sanitary and Phytosanitary (SPS) agreement, and hence has to adopt for international standards, guidelines and recommendations issued by FAO/WHO, Codex Alimentarius Commissions, adoption of food safety standards. The Ministry of Food processing Industries is building awareness among, producers, processors and consumers about the advantages of foods quality, safety and assurance.

14.2 FOOD SAFETY ISSUES

The safety of foods is of utmost significance and has gained a worldwide attention. People have the right to eat the safe and suitable foods. Food borne illness and injuries can be fatal to humans and can damage trade and tourism. Food spoilage is wasteful, costly and can adversely affect trade and consumer confidence. Effective hygiene control, therefore, is vital to avoid the adverse affect on human health and economic consequences of food borne illness, injury and food spoilage. Everyone, including farmers, growers, manufacturers and processors, food handlers and consumers have a responsibility to assure that food is safe and suitable for consumption. These general principles lay a firm foundation for ensuring food hygiene and should be used in conjunction with specific code of hygienic practices. Consumers should also practice clean habits in handling, cooking and storage of food to ensure complete food safety.

In order to understand "food safety" we must first know the terms *safe*, *hazard*, and *risk*. "Safe" means that nothing harmful happens when we consume a food. A hazard is the capacity of a thing to cause harm. We should first identify hazards related to foods or food components and then estimate the size of the risk that the hazard will cause. It is important to note that all foods have some degree of risk and that no food is absolutely "safe." The important consideration becomes the size of the risk and how the size of the risk can be reduced without eliminating the food source. The goal of food safety is to reduce the size of risks to the lowest reasonable level without severe disruption of the food supply.

14.2.1 Specific Safety Issues

Specific food safety concerns differ markedly and include:

- Additives, colours and flavours.
- Antibiotics and other food additives.
- Fertilizers and other growing aids.
- Irradiation.
- Microbiological contamination.
- Naturally occurring food toxicants.
- Nutrition.
- Pesticides.
- Pollutants.

- Processing, packaging and labelling.
- Tampering.

Consumers are most concerned about pesticides and additives as both are linked to cancer and not to microbiological contaminations, however food industry is most concerned about the microbiological safety of its products. In addition, many quality control checks are made to ensure that foods are free of extraneous matter such as glass, machine fillings and insect parts. Many food industries adopt 'Good Manufacturing Practice (GMP) and 'Hazard Analysis and Critical Control points (HACCP)'. Which assure that products manufactured under proper conditions and sanitation and hygiene will not have chance of contamination or error during processing.

14.3 FOOD ADULTERATION, CONTAMINATION AND THEIR DETECTION

14.3.1 Food Adulteration

Food adulteration is defined as the process by which the quality or the nature of a food product is adversely affected through the addition of a foreign or an inferior substance and the removal of a vital element. Adulteration of food may endanger health. Adulteration may be intentional or unintentional. The intentional adulteration is a willful act while the incidental adulteration is usually due to ignorance or lack of proper facilities.

Intentional adulterants: These adulterants are mixed with the food intentionally to increase the weight and quantity to make more money. Examples, sand, marble chips, stones, mud, other filth, talc, chalk powder, water, mineral oil and harmful colours.

Incidental adulterants: Pesticide residues, tin from can, droppings of rodents, larvae in foods. Some foods contain toxic pesticides, and the rodents & insects also introduce excreta, secretions and microorganisms responsible for food spoilage and intoxication.

14.3.2 Food Contamination

Food products are mostly contaminated with soil, air and water-borne microorganisms. Harvesting, processing, distribution and preparation generally contaminate the foods and food products which transmit certain food poisoning micro-organisms causing infections or intoxications or illness in humans. Food contaminations can be defined as the transference of any objectionable matter into or on the food. Following are 3 types of contaminations.

Contamination by microorganisms (bacteria, moulds or viruses): Generally occurs in raw foods such as vegetables grown on sewage, contaminated food premises, inadequate space and poor design. This type of contamination by microorganisms is the most serious and may result in food spoilage, food poisoning or even death.

Bacterial contamination is most significant as it results in large amount of spoiled food and large number of food poisoning cases. Bacteria are found everywhere: in soil, air, water, plants, animals, human and foods. Certain bacteria release toxins and cause death of persons consuming contaminated food. Some bacteria such as *Clostridium botulinum*, *Staphylococcus aureus*,

Salmonella bacteria and *Bacillus cereus* are the common causes of food illness in humans.

Mould spores are found in atmosphere, on damp surfaces and on mouldy food. If food is stored at the wrong temperature at high humidity and in excess of the recommended shelf life, there are chances of food contamination.

Viruses like Hepatitis A, Norwalk virus group and Rotavirus etc. are usually spread into food premises by food handlers who are carriers or on raw foods which have been grown in sewage polluted water and cause illness.

Yeasts grow best in the intermediate acid range, a pH of from 4.0 to 4.5. Food that is highly contaminated with yeasts will frequently have a fruity odour.

Physical contamination: Foreign bodies such as dust, dirt, stones etc. found in food may be brought into food premises with the raw materials or introduced during storage, preparation, service or display. Bolts, nuts, other pieces of metals, staples, cardboard string, polythene, rodent droppings, eggs and larvae of insects, cigarette butts, glass, wood splinters, paint or dust hair and fingernails, buttons and combs of persons handling the food are generally the sources of physical contaminations. Care should be taken that they do not contaminate the food.

Chemical contamination: Unwanted chemicals can enter the food during growth e.g. fertilizers, pesticides, environmental contaminants such as lead or dioxins; during processing e.g. oil, cleaning chemicals; during transport as a result of spoilage or leakage and during sale etc.

14.3.3 Food Quality Assurance

Quality assurance includes the *planning* and *surveillance* of everything to do with quality throughout the company. Quality assurance seeks to generate confidence both within the organization and externally, among its customers, that their requirements will be fulfilled. Among the additional features acquired in the progress from quality control to quality assurance are the following:

- The definition of a quality policy and objectives;
- The development of a quality manual;
- Ensuring competency of personnel;
- Conducting periodic internal audits;
- The elimination of the root causes of the problems found; and
- Periodic reviews of the system by top management.

Above all, there is a shift in emphasis from mere detection to prevention of non-conformance. For introduction quality assurance system in the food industry good hygienic practices, a good agricultural practices, and good environmental practices for various industries should be adopted. The standards should become essential for introduction of quality assurance system in food industry in the form of potential hazards, GMP, HACCP, ISO:9000, Codex Alimentarius standards etc.

The Codex Alimentarius general principles of food hygiene are aimed to:

- identify the essential principles of food hygiene applicable throughout the food chain (production to consumption), to achieve that food is safe and suitable for human consumption;
- recommend a hazard analysis and critical control point (HACCP)- based approach to enhance food safety;
- indicate how to implement those principles; and provide a guidance for specific codes which may be needed for – sectors of the food chain; processes; or commodities; to amplify the hygiene requirements specific to those areas.

These principles are recommended to Governments, industry (including individual primary producers, manufacturers, processors, food service operators and retailers) and consumers alike.

14.3.4 Commercial Item Description

Commercial item description is defined under FPO standards (Govt. of India) for each processed food product which consists code number, whether concentrated or unconcentrated, sweetened or unsweetened, pasteurized or unpasteurized, made from ripe fresh and good quality fruits or vegetables, added water or not, and details of preservative, emulsifying, stabilizing agents i.e. name, quantity and quality (food grade). It also includes the quantity of total soluble solids, sugars, vitamins and addition of salt, colour etc. A label has to be fixed on the processed products mentioning date of manufacture, date of expiry, total weight of product, and nutritive composition the product i.e. total carbohydrate, fats, proteins, fibre, name of additive etc. Following are the few examples:

FRUIT JUICE means the unfermented and unconcentrated liquid expressed from sound, ripe fresh fruit and with or without:

- a) sugar, dextrose, invert sugar, or liquid glucose, either singly or in combination;
- b) water, peel-oil, fruit essences and flavour, common salt, ascorbic acid, citric acid, and preservatives.

The acidity of the finished product calculated as citric acid shall not be less than 4% in the case of pure lemon juice or pulp and not less than 5% in the case of pure lime juice but shall not exceed 3.5%t in the case of other juices.]

The total soluble solids for sweetened fruit juice (except tomato juice) shall not be less than 10%. It may also contain permitted emulsifying and stabilizing agents as prescribed in rule 61 C. It may also contain fumaric acid certified by BIS to the extent of 0.3%.

Tomato Juice means canned or bottled, unconcentrated, pasteurized juice expressed from tomatoes with a proportion of the pulp, expressed with or without the application of heat by any method that does not add water to juice, from whole, ripe tomatoes from which all stems and objectionable portions have been removed and with or without (a) salt (b) sugar, or dextrose, or both added in dry form (c) citric acid, malic acid or ascorbic acid. Provided that canned tomato juice may also contain extraneous permitted colour. The total

Quality Aspects

soluble solids w/w shall be not less than 5 % ([free of salt). It may also contain permitted emulsifying and stabilizing agents as prescribed in rule 61-C. [It may also contain fumaric acid certified by BIS to the extent of 0.3 %.

Fruit Syrup means sweetened fruit juice containing, sugar, dextrose, invert sugar or liquid glucose either alone or combination, with or without:(a) water, peel-oil, fruit essences and flavours, common salt (b) citric acid, ascorbic acid.(c) permitted preservatives and colours. The total soluble solids w/w shall not be less than 65 %. The minimum percentage of fruit juice in the final product shall not be less than 25% w/w. It may also contain permitted emulsifying and stabilising agents as prescribed in rule 61-C.It may also contain fumaric acid (food grade) certified by BIS to the extent of 0.3 %.



Check Your Progress Exercise 1

- Note:** a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1. What are the food safety issues?

.....
.....
.....
.....
.....

2. Name the most common bacteria to cause food borne illness.

.....
.....
.....
.....
.....

3. What are good hygiene practices and standards for food safety?

.....
.....
.....
.....
.....

14.4 QUALITY CONTROL

Quality control (QC) is a means of detecting whether quality has been achieved and of taking action to correct any deficiencies. QC activities include:

- Establishing the specifications of the parameters to be controlled;
- Preparing quality plans for control;
- Performing checks or inspections;
- Diagnosing and taking action on the variations observed; and
- Checking that the variations have been corrected.

The fundamental purpose of a quality control program is to acquire dependable information on all the attributes of a product which affects its quality. Quality control ensures that raw materials meet set standards, processing methods should be performed as designed, finished products meet company standards and consumer confidence in the enterprise remains high. The basic functions of a quality control programme are:

- Physical and chemical evaluation of raw materials and processed products.
- Control of
 - a) Raw materials, ingredients and packaging supplies.
 - b) Processing parameters.
 - c) Finished products.
- Microbiological analysis and control of raw materials and finished products.
- Control of storage and handling conditions.
- Sanitation and waste products control.
- Assurance that final products are within the legal and marketing standards established.

Quality control in fruits and vegetables begins in the field with the selection of proper time of harvest for maximum quality. Each subsequent step after harvest is to maintain quality and include the following step:

Operation	Procedures
Harvesting	Check maturity of commodity with respect to colours size, firmness etc.
Preparation for market	<ul style="list-style-type: none"> • Monitor various steps such as washing, sorting, waxing, sizing, post harvest treatments etc. • Check shipping containers for compliance with grade, size and weight regulations.
Cooling	Monitor product temperature at key points in the handling system, especially before and after cooling.
Transportation	Check transit vehicle for cleanliness, before loading, loading pattern, load immobilization etc.
Destination markets	Check quality and condition of the product and shipping containers at destination market.

Quality Aspects

Quality control personnel should devote full time and attention to their duties and make needed changes in the harvesting and handling operation as and when required to maintain the desired quality.

Quality control within a food manufacturing industry demands constant vigilance at all stages in processing, so that any necessary adjustments can be made at the appropriate time. The specific responsibilities of quality control is to ensure that the system used produces a standard product with acceptable quality in respect to nutrition, purity, wholesomeness and palatability. The specific responsibilities of quality control assigned to a department or to an individual include:

- Standardizing procedure for sampling and examining raw materials. Development of test procedures.
- Establishment and implementation of quality standards for fresh and processed products.
- Setting up preventive quality control methods for in-plant liaison between manufacturing section and test laboratories.
- Examination of finished products.
- Storage controls.
- Research and development into new products and their packaging.

Quality control leads to:

- Raw material control
- Process control
- Inspection of finished products
- Sensory evaluation or evaluation of the acceptability of the final product.
- Packaging
- Labelling and storage

14.4.1 Inspection

The objective of inspection is product conformance by screening out conforming products from nonconforming products, which is done by visual checks/ measurements; then testing and reporting. Under a simple inspection-based system, one or more characteristics of a product are examined, measured or tested, and compared with specifications to assess conformity. Products that do not conform to specifications are reworked, or regraded, or accepted with concessions, or rejected. This system is used for inspecting incoming goods, checking a product at intermediate stages, or inspecting a product ready for delivery to the customer. Using inspection to improve quality is too late, too costly and ineffective. In processing fruits and vegetables for export continuous inspection is applied. The inspection of raw materials should be carried out at the commencement of each processing run to ensure that only good quality fruits or vegetables of sufficient maturity are used for processing. Sampling checks of raw materials should be carried out frequently. Raw material and ingredients must be inspected and sorted to insure that they are clean, wholesome and fit for processing. Containers and carriers (such as trucks or railcars) should be inspected to assure that their condition has not contaminated raw ingredients

14.4.2 Lab Tests

The laboratory tests used in quality control are usually standard scientific tests for physical, chemical, microscopic and microbiological analysis. By adopting these tests one should be in a position to reproduce same results by any trained quality control technician. Physical tests include product characteristics such as size, weight, colour, texture and adulterants like, glass, stone, filth and insects. The processed products should be of prescribed size, weight, colour, texture etc and devoid of physical adulterants. The chemical tests for the estimations of moisture, protein, carbohydrates, minerals, fats, vitamins and fibre contents should be standards practice from the raw material and processed products for the prescribed quality. Microscopic and microbial tests are used to determine the presence of moulds, microbes and insect fragments or foreign materials, spoilage or disease microorganisms from the raw and finished products to obtain disease free foods. The tests assure that the final products are disease free, within the legal and marketing standards established.

14.4.3 Sanitation

The raw produce, processed foods, processing units and persons working in food processing units must be kept in good sanitary conditions to minimize the possibilities of contamination by microorganism, chemicals and physicals adulterants. The persons working in food units should not have any disease and must wear clean clothes, maintain a high degree of personal cleanliness and must wash or sanitize hands thoroughly before starting work and at any other time when the hands have become soiled. The food processing plant must be free from litter, waste or refuse; potential for foot-borne filth or breeding places for insects or microorganisms.

The processing units must be kept in good sanitary condition to minimize the possibility of contaminating foods or equipment that contact food. Pesticides, insecticides and rodenticides may be used to prevent contamination by pests, insects and rodents respectively. All utensils and equipment surfaces that contact food must be cleaned and sanitized before use to prevent food contamination. When utensils or equipment are used in a continuous production operation, they must be cleaned and sanitized on a predetermined schedule. The water which comes into contact with food or processing equipment must be safe and of good sanitary quality. The disposal of sewage water should be proper so that it must flow into sewage system or disposed of through other adequate means. Toilets and hand-washing facilities must be provided inside processing centres for workers. Raw materials must be washed or cleaned to remove soil and other contamination by sanitary quality water. Food processing equipment must be kept in a sanitary condition through frequent cleaning and, when necessary, sanitizing. If ice is used and comes in contact with food products, it must be made from potable water and be in a sanitary conditions.

14.4.4 TQM (Total Quality Management)

TQM requires the creation and continual improvement of processes, along with other quality assurance activities. Companies or organizations aspiring to quality management are characterized by the widespread application of the concept that everyone in the organization has customers and that their satisfaction should be enhanced; in this way, everyone is committed to continually improving their part of the operation.

Quality Aspects

- a) TQM is a process designed to focus external/internal customer expectations preventing problem building, commitment to quality in the work force and promoting open decision-making.
- b) TQM is an effective system for integrating quality development, quality maintenance, and quality improvement efforts of various groups in the organization so as to enable products and services at the most economical level, which allows customer satisfaction.
- c) TQM is a building, housing the quality assurance system, quality consciousness of employees as the foundation, employee's involvement and commitment as the walls, the quality policy of the management as the roof.
- d) TQM is an integrated organizational approach in delighting customers by meeting their expectations on a continuous basis through every one involved with the organization, working on continuous improvement in all products/services/processes along with proper problem solving methodology.
- e) Meaning of Total Quality Management

<i>Total</i>	Every one associated with the company is involved in continuous improvement, in all functional areas, at all levels.
<i>Quality</i>	Customers expressed and implied requirements are met fully.
<i>Management</i>	Executives are fully committed Effective utilization of resources Decision in a planned way To maintain existing level of quality To improve existing level of quality.

14.4.5 Codex Alimentarius

The Codex Alimentarius is a collection of international standards for the safety and quality of foods as well as codes of good manufacturing practice and other guidelines to protect the health of the consumer and remove unfair practices in International trade. This is based on the recommendation of FAO and WHO, a worldwide conference for food standards and guidelines that would protect consumer's health and ensure international fare trade practices. Codex standards comprise standards for processed frozen fruits and vegetable, fruit juices, fats and oils, milk products, cereals and pulses, fish and poultry products, coca products and standards methods of analysis. Codex has also brought a list of more than 1000 food additives along with their permitted levels for use in different foods. The Codex general principles of food hygiene are aimed to: a) identify the essential principles of food hygiene applicable throughout the food chain to achieve the goal of ensuring that food is safe and suitable for human consumption. b) recommend a HACCP based approach as means to enhance food safety. c) indicate how to implements those principles and d) provide a guidance for specific codes which may be needed for – sectors of food chain; process; or commodities; to employ the hygiene requirements specific to those area.

14.4.6 HACCP (Hazard Analysis and Critical Control Point)

HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product. Food safety systems based on the HACCP principles have been successfully applied in food processing plants, retail food stores, and food service operations.

Advantages

- Focus on identifying and preventing hazards from contaminated food is based on scientific principles.
- Permits more efficient and effective monitoring at government level, primarily because the record keeping allows investigators to see how well a firm is complying with food safety laws over a period rather than how well it is doing on any given day.
- Places responsibility for ensuring food safety appropriately on the food manufacturer or distributor.
- Helps food companies complete more effectively in the world market
- Reduces barriers to international trade.

The HACCP is based on 7 principles, which have been universally accepted by government agencies, trade associations and the food industry around the world. These include:

1. **Assessment of hazards:** Each unit operation should be evaluated to identify potential source of microbial, chemical and physical hazards, which may be introduced into the produce. Areas, which should be evaluated, are growing and harvesting operations, packing shed operations, packaging material and storage as well as distribution. This process is best accomplished by a team of both management and production personnel.
2. **Determine critical control points (CCP) to control the identified hazards:** The next step in developing a HACCP program is to draw a flow diagram for your specific operation and then determine where each of the identified hazards may be monitored. Each point that will be monitored to control specific hazard is now designed a critical control point.
3. **Establishment of CCO limits:** Once CCP have been identified, tolerance limits must be set to determine when corrective action needs to be taken. Tolerance must be observable and measurable.
4. **Established of CCP monitoring procedures:** How often monitoring will be done, how measurements will be taken and what documentations will be prepared must next be clearly defined.
5. **Corrective action when deviations from CCP limits occur:** When a deviation from the prescribed limits occurs corrective action must be taken to eliminate the potential contamination. All deviations and corrective actions must be noted in written form.

6. HACCP record keeping system: All paper work related to the HACCP system must be kept in an orderly and accessible manner. Records that should be kept include:

- Production Records
- Supplier audits
- Pesticides usage and testing results
- Irrigated water test results etc.
- Harvesting Records:
 - Harvest dates and lot numbers
 - Total number of boxed harvested, etc.
- All critical control point monitoring records
- Storage and distribution records
 - Temperature monitoring
 - Truck cleanliness etc.

7. Deviation file: HACCP deviations and corrective actions taken.

HACCP verification: Periodic HACCP plan review including review of CCP records, deviations and random sampling to verify that the HACCP program must be done to assure that HACCP program is functioning properly. This review should be done either on a monthly or quarterly basis.

14.5 GRADES

The quality of agricultural produce, cereals, spices, oil seeds, legumes, fruits and vegetables has criterion for the categorization into various grades depending upon the degree of purity in each case. The grades incorporated are grades 1,2,3 and 4 or special, good, fair and ordinary.

Grading of some commodities like vegetable oils, *atta*, spices and honey is voluntary. The grading of commodities like tobacco, walnuts, spices, basmati rice, essential oils, onions, potatoes meant for export is compulsory under government acts to ensure the quality of produces. Grading add extra cost and hence the graded products are priced slightly higher. The grading of agricultural commodities has three main purposes. Firstly, it protects the consumer from exploitation. By knowing the quality and grade of his produce, he is in better bargaining position against the trader. Secondly, it serves as a means of describing the quality of the commodities to be purchased or sold by the buyers and sellers all over the country and abroad. This establishes a common trade language and avoids the need for physical checking and handling at many points. Thirdly, it protects the consumer by ensuring the quality of products he purchases

Check Your Progress Exercise 2

**Quality Assurance:
Regulation, Codes,
Grades and Standards**

- Note:** a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1. What are the basic functions of quality control programme?

.....

.....

.....

.....

.....

2. Why inspection and grading are required in food processing?

.....

.....

.....

.....

.....

3. What is codex Alimentarius?

.....

.....

.....

.....

.....

4. Write the seven principles of HACCP.

.....

.....

.....

.....

.....

THE PEOPLE'S
UNIVERSITY

ignou
THE PEOPLE'S
UNIVERSITY

ignou
THE PEOPLE'S
UNIVERSITY

ignou
THE PEOPLE'S
UNIVERSITY

ignou
THE PEOPLE'S
UNIVERSITY

14.6 STANDARDS

Food standards for ensuring the quality and safety of raw and processed foods for human consumption have been formulated and enforced by law in India. Food standards have been also prescribed based on the International Codex Alimentarius with suitable modification to suit Indian conditions thus in India food processing and allied industries are governed by following different standards.

14.6.1 ISO (International Organization for Standardization) 9000 SERIES

ISO 9000 series are quality management and quality assurance standards. The principal of these standards is, 'if the system (input, process, output) through which the product is produced, is perfect then the product coming out of system will also be perfect'. This series of standards for quality assurances is now being adopted by most of the companies in India and abroad. More and more companies are in the queue for achieving this quality System Certificate. ISO 9000 series of standards are available which provide the guidelines for the establishment and management of quality system in the organization.

There are 4 basic models for classification of ISO 9000 Series:

ISO 9001 : Model for design, development, production, installation and servicing.

ISO 9002 : Model for production, installation and servicing.

ISO 9003 : Model for final inspection and testing.

ISO 9004 : Model for quality management and quality system element.

There are laid down guidelines on how to develop and follow systems as per the requirement of this series: The series covers the following major clauses: Management responsibilities, Quality systems, Contract review, Design control, Document control, Purchase, Purchaser supplied product, Product Identification and Traceability, Process control, Inspection and testing, Inspections and testing of measuring equipments control of nonconforming product, Corrective preventive action, Handling, storage, packaging and delivery: Quality records, Internal Quality audit, Training, service and statistical techniques

The main principal of achieving this certification is 'SAY what you Do and Do what you SAY'

14.6.2 Fruit Product Order (FPO)

Central Govt. formulated Fruit Product Order (1955 and 1961) which lays down statutory minimum standards in respect of the quality of various fruits, vegetables products and processing facilities. Packaging fruits and vegetables to standards below the minimum prescribed is an offence and punishable by law. Periodic inspection by inspectors is carried out to ensure conformity of standards by processors. Every manufacturer of fruit and vegetable products must obtain a license for manufacture and conform to the sanitary requirements and standard of quality specified. The inspectors are empowered to collect samples and inspect the factory and send the coded samples to Central

Laboratory. The order has laid down limits for the presence of poisonous elements. The act has laid down the standard specifications for the food products and food additives.

14.6.3 Meat Products Order (MPO)

This order regulates manufacture, quality and sale of meat and all meat products. Provisions are meant to control production, quality and distribution of raw and processed meat. This makes it illegal to transport meat unless it has been prepared and processed according to the provisions of the order and carries the mark of inspection. It provides means to (a) detect and destroy meat of diseased animals (b) ensure that the preparation and handling of meat and meat products is conducted in a clean and sanitary manner (c) Prevent the use of harmful substances in meat foods. (d) See that every piece of cut meat is inspected before sale to ensure its wholesomeness. The order also lays down the rules and conditions for procedure to be adopted for the selection of disease free animals, slaughterhouse practices and further treatment of the meat so as to maintain the meat in a wholesome manner, devoid of pathogens.

14.6.4 Cold Storage Order (CSO)

The cold storage order (CSO), 1980, promulgated under the Essential Commodities Act, 1955, has the objective of ensuring hygienic and proper refrigeration conditions in a cold store, regulating the growth of cold storage industry and rendering technical guidance for the scientific preservation of food stuffs in a cold store and prevent exploitation of farmers by cold storage owners. Agricultural Marketing Advisor to the Government of India is the licensing officer under this order.

14.6.5 PFA (Prevention of Food Adulteration Act and Rules in India)

Indian Government promulgated Prevention of Food Adulteration Act of 1954 to ensure that food articles sold to the customers are pure and wholesome. It also intended to prevent fraud or deception and encourages fair trade practices. The act was amended twice to plug the loopholes of escape and to ensure stringent punishment. The act prohibits the manufacture, sale and distribution of not only adulterated foods but also foods contaminated with toxicants and misbranded foods. A central food laboratory at Calcutta was established for the purpose of reporting on the suspected food products. A Central Committee for food standards has been constituted under the Act and has been charged with the function of advising the Central Government on matters relating to Food Standards. Provisions have been made in the Act for the appointment of Food Inspectors by the state Governments and their powers have been defined. The State Governments set up food testing laboratories and appoint Public Analysts with adequate staff to report on suspected foods. Standards have been laid under the PFA Act for various categories of food and according to PFA Act, a food shall be deemed to be adulterated if it does not meet the specified conditions mentioned in the Act.

14.6.6 AGMARK

The word 'Agmark' is a derivative of Agricultural Marketing. The Agmark standards were set up by the Government of India by introducing an Agricultural Produce Act in 1937. The Agmark seal ensures quality and purity. The quality and grade of product is determined with reference to the size,

Quality Aspects

variety, weight, colour, moisture, fat content and other factors. The Act defines the quality of cereals, spices, oil seeds, butter, ghee, legumes and eggs and provides criterion for the categorization of commodities into various grades. The grades incorporated are grades 1,2,3 and 4 or special, good, fair and ordinary. The standards also specify the types of packaging to be used for different products. The physical and chemical characteristics of products are kept in mind while formulating the Agmark specifications. The Central Agmark Laboratory at Nagpur carrying out research and development work. The Certificate of Authorization is granted only to those in the trade having adequate experience and standing. The staff of the Directorate of Marketing and Inspection or of the State Government is generally present at the time of selection of goods, their processing, grading and packing before applying the appropriate AGMARK labels.

- Agmark products are free from adulteration and conform to the scientifically laid down principles of purity. It ensures consumer protection.
- Each batch of Agmark products is pre-tested for quality by quality control and trained chemist.
- Agmark products are always packed in food grade material never to be sold loose.
- Agmark products bear Agmark label or replica as an identification mark, date of manufacturing and expiry period.
- Free of cost replacement provided in the rules if Agmark products are found not conforming to the quality standards.
- They are not mandatory, any body can use them.

14.7 ENFORCEMENT OF FOOD LAWS

Food standards for ensuring the quality and safety of raw and processed foods for human consumption have been formulated and enforced by law in India. The laws and regulations exist to deal with food safety and consumer concerns about food contamination and adulteration, penalizing the seller of diseased, unwholesome and corrupted food products. The law defines foods, food preservatives and artificial colour, and ban the sale of food prepared under unsanitary conditions or containing any deleterious or unsafe substances. These also specify standards of quality for various classes of foods and outline the conditions under which a food would be regarded as adulterated or misbranded. Finally, there are statutory or legal obligations, which need to be fulfilled for safeguarding the health and well being of people and the establishment.

There are number of food laws being implemented by various Ministries/Departments of Indian Government. These are primarily meant for 1) Regulation of Specifications of Food, and 2) Regulation of Hygiene conditions of Processing and Manufacturing. The Government of India has also empowered several agencies and promulgated a number of acts and orders to ensure food safety. Agencies and institutes have also been created to lay down standards for quality of foods. The manner in which the food is processed and packed is also covered by a number of regulations. Some of

these food quality assurance laws are voluntary and some are mandatory. The following are various food laws operating in India.

1. Prevention of Food Adulteration Act, 1954 and Rules 1955.
2. Agriculture Produce Act 1937 (AGMARK) Grading and Marketing.
3. Bureau of India Standards (BIS).
4. Environment Protection Act 1986 & Rules 1989.
5. Export Quality Control and Inspection Act, 1963.
6. Essential Commodities Act, 1955.
7. Insecticide Act, 1968.
8. Fruit Product Order, 1955.
9. Meat Food Product Order, 1973.
10. Solvent Extracted Oil, De oiled Meal and Edible Flour (control) order, 1967.
11. Milk and Milk Product Order, 1992.

PFA are enforced by the Department of Health. Under the law, slaughter houses, markets, factories, warehouses and other establishments involved in food trade may be inspected to ascertain that the raw materials as well as processing, packaging and storage facilities are sterile and ingredients meet the minimum standards prescribed by the law. Adulterated and misbranded products may be seized by inspectors, destroyed and legal action be taken depending upon the nature of the offence.

Food laws came into existence for a number of reasons:

- i) To maintain the quality of food produced in the country;
- ii) To prevent exploitation of the consumer by the sellers;
- iii) To safeguard the health of the consumers;
- iv) To establish criteria for quality of food products, since more and more foods were eaten in processed, rather than natural forms. This has resulted in the inability of the consumer to identify the quality of the contents that could be identified easily.

The legislation which is directly concerned with the protection of the health of consumers and the quality of food products marketed is the Prevention of Food Adulteration (PFA) which states that an article of food shall be deemed to be adulterated. The PFA Act, thus, lays down the guidelines for setting up standards for various food items like cereals and cereals products, pulses, ghee, etc. All processed items which, are mass-produced for public use, are expected to conform to these standards.

In addition to the mandatory acts and orders cited above, agencies such as Bureau of Indian Standards (BIS) and Directorate of Marketing and Inspection have also laid down quality standard for foods.

Operating quality systems as per quality system standards leads to doing right things on time, all the time and always to the customer's satisfaction

14.8 TESTING OF SAMPLING

The Food Health Authority (FHA) at State level is the Director of Public Health and Preventive Medicine. It is responsible for the good quality and standards of foods available to the consumers. Under FHA, the Local Health Authority appointed in each city of every State is responsible for testing of samples. The food inspector is appointed by the Central or State Government and they are trained in food inspection and sampling and have the powers to take sample of any food article from 1) any person selling such article 2) any person who is in the course of delivering or preparing to deliver such article to a purchaser or consignee 3) a consignee after delivering of any such article to him, and to send such samples for analysis to the Public Analyst (PA) of local area. When the Food Inspector wants to lift the suspected food, the shopkeeper must first be informed and there should be a witness present also. 150 g of sample is necessary to be sent for analysis but usually 600 g of sample is collected and sent to Central Food Laboratory Calcutta, and Central Food Technological Research Institute, Mysore. There is a recommended procedure to collect the sample and seal it in a bottle. The sealed bottle has a label on it in which the code number of the inspector, address of the shop, date and time of collection are written. When individuals doubt adulteration in foodstuffs they have to inform the Food Health Authority. Samples can be sent for analysis only after getting order from Food Health Authority. If the persons are found guilty of selling adulterated food, the persons involved can be convicted. A vendor found adulterating the food with ingredients injurious to health is liable for a much heavier sentence than a vendor involved in only mixing an inferior ingredient not injurious to health.

14.9 RESIDUE ANALYSIS

The foods require the absence of harmful substances like pesticides that are harmful for human health. The estimation of pesticides residues in foods is very important and the declaration of pesticides qualitatively or quantitatively has become inevitable for export and import. About 176 pesticides are listed which come into foods from their intentional or unintentional use on the crops. The maximum residue limits vary with the type of commodity. Use of many pesticides is restricted by law and the maximum residue limits commonly used pesticides are fixed by national (PFA in India) and international (Codex Alimentarius Commission) agencies.

Analysis of pesticides in foods is very cumbersome job and requires standards procedures and specific instruments. The basic steps for sampling and analysis of pesticides are given below:

Sampling → Sample preparation → Extraction of pesticides →
 Partitioning → Cleanup, Concentration of extract → Dilution with
 appropriate solvent → Identification & estimation of pesticides
 (GC, HPLC, Mass Spectrometer, GC-MS, UV-VIS Spectrometer, TLC etc.)

The sampling procedures and quantity for sampling varies with the commodity and type of sample. The sample should be drawn as uniform as possible from whole lot of produce.

Residue analysis consists of a chain of procedures. The analyst should be an experienced and competent in residue analysis. The laboratory requires an adequate range of reference standard pesticide of high purity. The range should cover all parent species and their metabolites. Chemical reagents, adsorbents and solvents should be high purity and not to interfere in the analysis. All glassware, reagents, solvents and water should be checked from contaminants before use. In a routine laboratory monitoring for compliance with national tolerances, standardized methods will be used and these should be validated periodically.

A number of instrumental procedures for estimation/confirmation are used in residue analysis. Gas chromatography (GC) is the commonly used instrument for qualitative and quantitative determination of pesticides residues. The specific columns and detectors are used for different groups of pesticides. Thin layer chromatography (TLC) is also used in some instances, confirmation of gas-chromatographic findings and identification most conveniently achieved by TLC. The advantages TLC are speed, low cost and applicability to heat sensitive materials but it has lower sensitivity than GC. High performance liquid chromatography (HPLC) can be used advantageously for the confirmation of residues initially found by gas chromatography or by other techniques and may be in certain circumstances the preferred quantitative technique. Mass spectrometers (MS) are generally sensitive at the nanogram level.

Check Your Progress Exercise 3

- Note:** a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1. What is ISO 9000 and write it's basic models?

.....
.....
.....
.....

2. What is AGMARK and the advantages of AGMARK?

.....
.....
.....
.....



3. Name the different Acts and Orders to enforce the quality of food in India.

.....

.....



14.10 LET US SUM UP

The safety of foods is of utmost significance as people have the right to eat the safe and nutritious foods. Adulteration of food may be intentional or unintentional it endangers the health of consumers. Food products are mostly contaminated with microorganisms, (bacteria, moulds or viruses), and physical (dust, dirt, stones etc) & chemical (fertilizer, pesticides) contaminants. Quality assurance includes the *planning* and *surveillance* of everything to do with quality throughout the company and it generates confidence among consumers and customers. For introduction of quality assurance system in the food industry, good hygienic practices, good agricultural practices, and good environmental practices for various industries should be adopted. The standards should become essential for introduction of quality assurance system in food industry. Quality control ensures that raw materials meet set standards, processing methods perform as designed, finished products meet company standards and consumer confidence in the enterprise remains high. The specific responsibility of quality control is to ensure that the system used produces a standard product with acceptable quality in respect to nutrition, purity, wholesomeness and palatability. The objective of inspection is product conformance by screening out conforming products from nonconforming.

The raw produce, processed foods, processing units and persons working in food processing units must be kept in good sanitary conditions to minimize the possibilities of contamination by microorganism, chemicals and physical adulterants. Total Quality Management requires the creation and continual improvement of processes, along with other quality assurance activities. The Codex Alimentarius is a collection of international standards and codes for the safety and quality of foods. HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product. Food standards for ensuring the quality and safety of raw and processed foods for human consumption have been formulated and enforced by law in India. The laws and regulations exist to deal with food safety and consumer concerns about food contamination and adulteration, penalizing the seller of diseased, unwholesome and corrupted food products. The estimation of pesticides residues in foods is very important and the declaration of pesticides qualitatively or quantitatively has become inevitable for export and import foods. Identification & estimation of pesticides residues is done by GC, HPLC, Mass Spectrometer, GC-MS, UV-VIS Spectrometer, TLC etc.

14.11 KEY WORDS

- Adulterated** : The deliberate addition of inferior or cheaper material to a supposedly pure food product in order to stretch out supplies and increase profits.
- Bacteria** : Single celled microscopic organism.
- Chemical sanitizers** : Products used on equipment and utensils after washing and rinsing to reduce the number of disease – causing microbes to safe levels.
- Contamination** : The unintended presence of harmful substances or conditions in food that can cause illness or injury to people who eat the infected food.
- Critical control point (CCP)** : means a point or procedure in a specific food system where loss of control may result in an unacceptable health risk.
- Codex alimentarius** : Is a collection of international standards and codes for the safety and quality of foods.
- Disinfect** : destroy harmful bacteria.
- Food borne illness** : An illness caused by consumption of a contaminated food.
- Grade standards** : Principally standards of quality to help producers, wholesalers, retailers, and consumer's in marketing and purchasing food products.
- HACCP** : called *hassip* is a management system in which food safety is addressed.
- Juice** : the aqueous liquid expressed or extracted from one or more fruits or vegetables or any concentrations of such liquids.
- Sanitation** : maintenance of conditions which are clean and promote good health.

14.12 ANSWERS TO CHECK YOUR PROGRESS EXERCISES



Check Your Progress Exercise 1

1. Your answer should include the following points:
 - Additives, colour and flavour.
 - Microbiological contamination.
 - Pesticides, fertilizers, food toxicants, pollutants etc.

Quality Aspects

2. Your answer should include the following points:

- *Clostridium botulinum*.
- *Salmonella*.

3. Your answer should include the following points:

- Good Manufacturing Practices
- HACCP
- Codex Alimentarius
- ISO : 9000

Check Your Progress Exercise 2

1. Your answer should include the following points:

- Physical and chemical evaluation of raw & processed material.
- Control of raw material, processing parameter and finished products, storage and handling conditions.
- Microbiological analysis.

2. Your answer should include the following points:

- Product conformance.
- Grading is done for purity and quality of product.
- Fetch better price.

3. Your answer should include the following points:

- Collection International standards and codex for quality and safety foods.
- Recommended HACCP to enhance food safety.
- Identify principles of food safety.

4. Your answer should include the following points:

- Assessment of hazards.
- Determine Critical Control Points (CCP).
- Established of CCP limits.
- Established of CCP Monitoring procedures.
- HACCP record keeping system.
- Deviation file.
- HACCP verification.

Check Your Progress Exercise 3

1. Your answer should include the following points:

- Quality management and quality assistance international standards.
- ISO:9001, ISO:9002, ISO:9003, ISO:9004 for design, production, inspection and testing and quality management etc.

2. Your answer should include the following points:
 - Agricultural Produce Act, 1937.
 - Derivative of Agricultural Marketing.
 - Products are free from adulteration.
 - Pre-tested product quality and bear AGMARK seal.
3. Your answer should include the following points:
 - Prevention of Food Adulteration Act, 1954 and Rules 1955.
 - Agriculture Produce Act 1937 (AGMARK) Grading and Marketing.
 - Bureau of India Standards (BIS)
 - Fruit Product Order, 1955
 - Meat Food Product Order, 1973.

14.13 SOME USEFUL BOOKS

1. Arora, K.C. (1998) TQM and ISO 1400. S.K. Kataria & Sons, Publishers, Delhi.
2. Askar, A. and Treptow, H. (1993) Quality assurance in tropical fruit processing, Springer Verlag, New Delhi.
3. Bolton, A. (1996) Quality Management Systems for the Food Industry, A guide to ISO 9001/2, Aspen Publishers, U.S.A.
4. Mc Swane, D., Rue, N. and Linton, R. (1995) Essential of Food Safety and Sanitation, Prentice Hall, New Jersey, USA.
5. Potter, N.N. and Hotchkiss, J. H. (1996) Food Science (5th Edition), CBC Publishers, New Delhi.
6. Sharma, R.N. (1997) Standards India.
7. The codex Alimentarius standards (1997) Codex Alimentarius Commission, Rome, Italy.