
UNIT 15 QUALITY ASSURANCE

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15.0 OBJECTIVES

After reading this unit you should be able to:

- learn about total quality management
- explain about good manufacturing practices in food processing
- importance of quality circles
- describe various food safety issues
- identify factors responsible for food adulteration, contamination detection and food quality assurance
- know about codex Alimentarius
- learn about testing of samples and residue analysis in food

15.1 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 and quality assurance should function closely. 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 it has to adopt international standards, guidelines and recommendations issued by FAO/WHO, Codex Alimentarius Commissions and food safety standards. The Government of India is building awareness among producers, processors and consumers about the advantages of foods quality, safety and assurance.

For a successful food-processing sector in India, various aspects such as quality control, quality system and quality assurance, the constituents of total quality management, should function in a horizontal fashion for total success. The process of quality control starts from raw materials, process design, product composition, packaging, storage, distribution, consumer preparation and feedback.

15.2 TOTAL QUALITY MANAGEMENT (TQM)

Total Quality Management is a process, which explores the formation of management and employees into a “term-concept” approach for production of quality products. It is a structured system for satisfying internal and external customers and suppliers by integrating the business environment, continuous improvement, and breakthroughs with development, improvement, and maintenance cycles while changing organizational culture.

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.
Quality	Customer’s expressed and implied requirements are met fully.
Management	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.

The implementation of TQM requires the help of the following eight key elements.

1. Ethics
2. Integrity
3. Trust
4. Training
5. Teamwork
6. Leadership
7. Communication
8. Recognition

Total Quality Management is built on a foundation of ethics, integrity and trust. It fosters openness, fairness and sincerity and allows involvement by everyone.

15.3 GOOD MANUFACTURING PRACTICES

Good manufacturing practices (GMP) provides quality assurances that off-the-shelf testing is not able to. It provides continual measures of quality that can uncover

problems and fluctuations as they occur before the product is shipped. The need for GMP takes on further importance because the issues involved in developing test methods for dietary supplements are many and complex. Until methods are further developed, standardized, and widely accepted, GMP serves as a primary vehicle for ensuring quality. GMP lies at the heart of quality and comprises a variety of practices that ensure quality including things such as:

1. Raw materials quality assurance
2. Record-keeping of substances throughout the manufacturing process
3. Standards for cleanliness and safety
4. Qualifications of manufacturing personnel
5. In-house testing
6. Production and process controls
7. Warehousing and distribution

Virtually every manufacturer adheres to an in-house GMP standard, which varies from producer to producer. In-house GMP, while often extremely effective, does not provide a means for outside verification of quality. In order to provide such verification, many are now embracing to industry-standard GMP that is usually subject to an independent outside audit for compliance.

15.4 QUALITY CIRCLES

A Quality Circle (QC) is a small group of employees from the same work area who voluntarily meet at regular intervals to identify, analyse and resolve work related problems by sharing progressive learning. This not only improves the working of any organisation, it also motivates and enriches the work life of employees. The philosophy behind quality circles is building people. The target is to involve all workers in the food safety and quality assurance programmes through their participation in QC activities. The advantage of this movement has been empowerment of grass root level workers and brings out realistic feed back towards greater activity. It motivates workers since they are able to appreciate the improvement brought about by the implementation of their recommendations. This term is used to bring in improvement in all direction in the organisation.

Quality circles preach to attain motivation, development, changes of attitude and happiness of individuals and development of team spirit. Thus there are improvements in the overall work culture and progressive changes in the organization, which result in production of excellent quality processed products.

15.5 FOOD SAFETY ISSUES

The safety of foods is of utmost significance and has gained a worldwide attention due to public awareness. People have the right to expect the food they eat to be safe and suitable for consumption. Food borne illness and food borne injury are at unpleasant; at worst, they can be fatal. But there are also other consequences. Outbreaks of food borne 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. Effective hygiene control 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, manufactur-ers and processors, food handlers and consumers, has 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 each specific code of hygienic practice. We should also practice clean habits in the handling, cooking and storage of food to ensure the complete food safety.

Food safety is defined as food preparation taking all safety measure into account starting from raw material procurement to consumers dining table. Safe means that nothing harmful happens when we consume a food. We have learned that exposure to certain toxicants can harm us years after the exposure; cancers induced by tobacco use are examples. Safety also means an absence of effect; that is, nothing harmful happens.

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.

Food safety is defined as food preparation taking all safety measures into account starting from raw material procurement to consumers dining table. Producing a good food product is not enough. It must necessarily be free from harmful, additives, pesticides, antibodies, microbes and remain good upto a period it is intended to be consumed. The food safety programme is designed to make sure that food products are safe to eat by quality control at all stages of procurement, processing, manufacture, storage and shipment. 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 labeling,
- Tampering

Food industry is mostly con-cerned 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. Food companies adhere to a code of manufacturing practice known as ‘Good Manufacturing Practice (GMP)’ and quality assurance system ‘Hazard Analysis and Critical Control points (HACCP)’ to make sure that there is no chance of contamination or error during processing

Check Your Progress 1

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

1. What do you understand by total quality management?

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2. What is food safety and write the main issues?

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3. What do you understand with food adulteration and contamination?

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15.6 FOOD ADULTERATION, CONTAMINATION AND THEIR DETECTION

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 or 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.

1. **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.
2. **Unintentional or Incidental adulterants:** We are eating foods daily laced with toxic pesticides, arsenic, lead and mercury from pesticides, effluents from chemical industries, tin from cans, droppings of rodents. The rodents & insects also introduce excreta, secretions and microorganisms responsible for food spoilage which cause incidental poisoning and intoxication.

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.

1. **Contamination by microorganisms (bacteria, moulds or viruses):** This is 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*, *Escherichia coli*, *Salmonella typhimurium* 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.

2. 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.

3. 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.

Detection of food adulteration : Few important food adulterants and simple tests to detect adulteration of foods are given below.

Substance	Adulterant	Tests
<i>Tur dal</i>	<i>Lakh dal</i> or metanil	1. <i>Lakh dal</i> is irregular in shape and of lighter, colour than <i>tur dal</i> 2. Add concentrated HCl to moisten dal. Yellow colour Will turn into magenta red if metanil yellow is present.
Dals	Kesari dal Clay, stones, gravels Lead chromate (yellow)	Add 50 ml of dilute HCl to dal and keep on simmering water for about 15 min. The development of pink colour indicates the presence of kesari dal. Visual examination detects these adulterants. Shake 5 g of dal with 5 ml of water and add a few drops of HCl. A pink colour shows the presence of colour.
<i>Bajra</i>	Fungus	Immerse in saline water, fungi will come on top
Wheat, bajra and other food grains	Ergot (a fungus containing a poisonous substance) Dhatura seeds	a. Longer size purple black grains in bajra show the presence of ergots. b. Put some grains in a glass containing 20% salt solution. Ergot floats over the surface, while sound grains settle down.

		Dhatura seeds resemble chilly seeds with blackish brown colour which can be separated out by close examination
Tea leaves	Exhausted tea or black or bengal gram dal husk with colour	a. Tea leaves sprinkled on wet filter paper would immediately release added colour b. Spread the little slaked lime on white porcelain tile or glass plate. Sprinkling a little tea dust on the lime will show the presence of coal tar dye. In the case of genuine tea, there will be only a slight greenish yellow colour due to chlorophyll, which appears after sometime.
Mustard seeds	Argemone seeds	Agremone seeds have no round structure, they are pointed and are mere blackish than mustard seeds.
Chilli powder	Saw-dust and red colour	Sprinkle on the surface of water. Sawdust floats. Added colour will colour the water
Edible oils	Argemone oil Mineral oil Castor oil	Add concentrated nitric acid to the sample and shake carefully. Red to reddish brown colour in acid layer would indicate the presence of argemone oil. Take 2 ml of edible oil and add equal quantity of N/2 alcoholic potash. Heat in boiling water bath for 15 min and add 10 ml of water. Any turbidity shows the presence of mineral oil. Dissolve some oil in petroleum ether in a test tube and cool in ice salt mixture. Presence of turbidity with in 5 min indicates the presence of castor oil.
Turmeric	Coloured saw dust, metanil yellow Starch	Take a teaspoon full of turmeric powder in a test tube. Add a few drops of concentrated HCl. There is instant appearance of violet colour which disappears on dilution with water. If the metanil yellow colour persists (an artificial dye) the presence of non- permitted coal tar is indicated. Add iodine solution to turmeric solution, it will turn violet if starch is present.
Coriander	Horse dung powder	Soak in water. Horse dung will float which can be easily detected
Ghee or Butter	Vanaspati Mashed potatoes, sweet potato and other starches.	Take about one teaspoonful of liquid ghee or butter with equal quantity of concentrated HCl in a test tube and add to it a pinch of cane sugar. Shake well for one minute and observe it after 5 min. Appearance of crimson colour in lower (acidic) layer shows the presence of 'vanaspati'. The presence of mashed potatoes and sweet potatoes in a sample of butter can easily be detected by adding a drop of tincture of iodine. The appearance of blue colour indicates the presence of mashed potato, sweet potato or other starches.
Black pepper	Dried seeds of papaya fruit Light berries	Papaya seeds can be separated out from pepper, as they are shrunken, oval in shape and greenish brown or brownish

		black in colour. The suspected papaya seed in black pepper sample is distinguishable by its characteristic repulsive flavour quite distinct from the bite of black pepper. Light berries float on spirit
Rice	Marble or other stones	Place a small quantity of rice on the palm of the hand and gradually immerse the same in water. The stone chips will sink.
Wheat flour (maida)	Atta from which maida suji has been extracted	When dough is prepared from resultant wheat flour, more water has to be used and chapattis prepared out of this will blowout. The normal taste of chapattis prepared out of wheat is somewhat sweetish whereas those prepared out of adulterated wheat flour will taste insipid.

15.7 FOOD QUALITY ASSURANCE

Quality assurance includes the planning and surveillance of everything to do with quality in 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 nonconformance. 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 general principles of food hygiene are aimed to:

- i) 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;
- ii) recommend a hazard analysis and critical control point (HACCP)- based approach to enhance food safety;
- iii) 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 re-quirements 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.

15.8 INSPECTION

The objective of inspection is to screen 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 which do not conform to specifications are reworked, or re graded, 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 sound raw materials 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 into human food. Containers and carriers (such as trucks or railcars) should be inspected to ensure that their condition has not contaminated raw ingredients

15.9 LABORATORY 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 products 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 ensure that the final products are disease free, within the legal and marketing standards established.

15.10 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 food-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.

15.11 CODEX ALIMENTARIUS

Codex Alimentarius Commission was established to implement the joint FAO/WHO Food Standard Program. About 150 countries including India are member of the commission. The commission has published a Codex Alimentarius either regional or worldwide standards after the acceptance by Governments and these are being used in international trade negotiations and also for setting of disputes by WTO.

Thus 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. These standards, guidelines and recommendations are recognized worldwide for their vital role in protecting the consumer and facilitating international trade. 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 implement 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 areas. The Codex contract Point in India is the Directorate General of Health Services (DGHS) in the Ministry of Health. Ministry of Food Processing Industries is also closely associated with the activities of Codex Alimentarius.

15.12 HACCP (HAZARD ANALYSIS AND CRITICAL CONTROL POINT)

Hazard Analysis and Critical Control Point (HACCP) is an important quality assurance system. This system ensures that the products are safe and have good quality. It 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. It is science based and systematic, identifies specific hazards and measures for their control to ensure the safety of food. HACCP is a tool to assess hazards and establish control systems that focus on prevention rather than relying mainly on end product testing. The system is capable of accommodating changes such as advances in equipment design, processing

procedures or technological developments. It can be applied throughout the food chain from primary production to final consumption and its implementation should be guided by scientific evidence of risk to human health. Food safety systems based on the HACCP principles have been successfully applied in food processing plants, retail food stores, and food service operations.

Advantages:

1. focus on identifying and preventing hazards from contaminated food is based on sound science
2. 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.
3. Places responsibility for ensuring food safety appropriately on the food manufacturer or distributor.
4. Helps food companies compete more effectively in the world market
5. Reduces barriers to international trade.

The HACCP is based on seven principles, which have been universally accepted by government agencies, trade associations and the food industry around the world. The details of principals is given below:

1. **Detection of hazards:** Each unit operation should be evaluated to identify potential source of microbial, chemical and physical hazards, which may be introduced into 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. **Analysis of 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. **Critical limits for each critical control point:** 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. **Procedures for Monitoring:** 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 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. **Record keeping:** 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 boxes harvested, etc.
- All critical control point monitoring records
- Storage and distribution records
- Temperature monitoring
- Truck cleanliness etc.

7. **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 ensure that HACCP program is functioning properly. This review should be done either on a monthly or quarterly basis.

Check Your Progress 2

Note: a) Use the spaces given below for your answers.
b) Check your answers with those given at the end of the unit.

1. What is the International standards for food safety?
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2. What do you understand by HACCP? How quality assurance is achieved through it?
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3. What is sanitation? What are its benefits in food industry?
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15.13 STANDARDS

ISO (International Standards Organization) 9000 and IS (Indian Standards) 14000 ISO prepared a document called ISO 9000 series in 1987 (modified in 1994) as a guideline for all organizations on managing quality and quality assurance standard. Its Indian equivalent is IS :14000 (1988) and are now being adopted by most of the companies in India. 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. It is the principle and criteria for a management system, which will improve a company’s performance. It covers quality, quality policy, quality management, quality system, quality control, quality assurance, quality improvement, product, service, process and customer.

There are four 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 Tractability, 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’.

International ISO-9000 Series and Corresponding Indian Standards IS-14000

International Standards	Corresponding Indian Standards	
ISO 9000-1,2,3,4	IS 14000 (Part 1,2,3)	Quality management and quality assurance
ISO9004-1	IS 14004 (Part 1)	Quality management and quality system elements subcontractor
ISO9004-2	IS 14004 (Part 2)	Guidelines for services
ISO9004-3	IS 14004 (Part 3)	Guidelines for processed materials
ISO9004-4	IS 14004 (Part 4)	Guidelines for quality improvement
ISO9004-5	IS 14005 (Part 5)	Guidelines for project management
ISO9004-6	IS 14006 (Part 6)	Guidelines for quality plans
ISO9004- 7	IS 14007 (Part 7)	Guidelines for configuration management
ISO 10011-1,2,3	IS 14011 (Part 1,2,3)	Guidelines for auditing quality system
ISO 10012-1,2	IS 14012 (Part 1,2)	Quality assurance requirements for measuring equipment
ISO 10013	IS 14013 (Part 1)	Guidelines for developing quality manual
ISO 10014	IS 14014 (Part 1)	Guidelines for economic effect of quality
ISO 10015	IS 14015(Part 1)	Continuing education and training guidelines

FPO (Fruit Product Order): 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 pro-cessing 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 stan-dards 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.

Milk and Milk Product Order (MMPO)

The Milk and Milk Product Order (MMPO), 1992, issued on June 9, 1992 seeks to ensure the supply of liquid milk, an essential commodity, to consumers by regulating its processing and distribution.

Salient features are:

- 1) Registrations for units handling up to 75,000 litres of milk per day are granted by the State Governments and units with more than 75,000 litres per day capacity are registered by the Central registering authority.
- 2) The certificate also specifies the milk-shed area, which, under the order is defined as a geographical area demarcated by the registering authority for the collection of milk by the registered unit.
- 3) Maintenance of specified hygienic conditions in the premises where milk and milk products are handled, processed, manufactured or stored.

The collection, transportation and processing of milk normally centers around the operations of a processing plant. The region from which the marketable surplus of milk production finds its way to a processing plant is called 'milk-shed'. The concept of milk-shed areas is pivotal to the MMPO. For an orderly development of the dairy industry, a proper assignment/allocation of milk-shed is important.

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

Indian Government promulgated Prevention of Food Adulteration Act, 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 (1964 and 1976) 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 entrusted 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. Under PFA, the Food Health Authority (FHA) is appointed at state level that is the Director of Public Health and Preventive Medicine. He is responsible for good quality and standards of foods available to the consumers. Under FHA is the Local Health Authority (LHA), which is appointed in each city in every state.

AGMARK

The word 'Agmark' is a derivative of Agricultural Marketing. The Government of India set up the Agmark standards 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, variety, weight, colour, moisture, and 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 is 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.

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

15.14 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 bans 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 Products Order, 1973.
10. Solvent Extracted Oil, De-oiled Meal and Edible Flour (control) order, 1967.
11. Milk and Milk Products 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

15.15 TESTING OF SAMPLING

The Food Health Authority (FHA) at State level is the Director of Public Health and Preventive Medicine. He 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 sampling. 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 and (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.

15.16 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 extracts → 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 for 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.

15.17 APPEALS IN CASE OF SAMPLE FAILURE

Food Inspector appointed by the Central Government or State Government may take the samples in triplicates of article of food or adulterant for analysis. One such sample is sent to Public Analyst whom the Central or State Government appoints for analysis and who shall deliver the report of the results of analysis to the Local Health Authority.

On receipt of the report to the effect that the article of food is adulterated or called sample failed, the local Health Authority shall after the institution of prosecution against the persons or persons, from whom the sample of the article of food was taken may inform such person or persons that if it so desired may make an appeal, to the court within a period of 10 days from the date of receipt of the copy of the report to get the sample of article of food kept by Local Health Authority may analysed by the Central Food Laboratory (CLF).

When appeal made to the court under sub-section the court shall require the Local Health Authority to forward the part or parts of the sample kept by the said Authority and upon such requisition being made, the said authority shall forward the part or parts of the sample to the court within a period of 5 days from the date of receipt of such requisition On receipt of the sample the court shall after ascertaining, the mark and seals are intact and the sample is not tampered, dispatch sample under its own seal to the Director of CFL, who will send the certificate to the court within one month specifying the results of the analysis. If the report still shows that the sample is adulterated food article or failure of sample, there is provision to appeal in the High Court of the jurisdiction again.

Check Your Progress 3

Note: a) Use the spaces given below for your answers.

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

1. What are the basic models of ISO-9000 series and its equivalent Indian Standards?

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2. What are the Indian foods acts, laws and orders dealing with food adulteration?

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15.18 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 and 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 generate confidence among consumers and customers. For introduction food safety and quality assurance systems in the food industry, total quality management, good manufacturing practices, quality circles and good environmental practices should be adopted. The application of national and international (ISO-9000 and IS-14000) standards should become essential for production of quality products in food industry. 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 such as PFA, MMPO, FPO and AGMARK 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.

15.19 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.
- Agmark** : Agricultural Marketing Act-1937 to ensure quality and purity of agricultural products.
- Codex Alimentarius** : It is collection of International standards for the safety and quality of food.
- 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)** : Any point or procedure in the process where loss of control may result in a health risk.
- Food safety** : A judgment of acceptability of the risk involved in eating a food, if the risk is low the food substance may be considered acceptable.

GMP	: Good manufacturing practices guidelines that a company uses to evaluate the design and construction of food processing plant and equipment.
HACCP	: A preventive food safety system.
PFA	: Prevention of Food Adulteration Act-1954, Govt. of India
Quality Circles	: A group of employees from the same organization to resolve work problems to enhance the quality and quantity of the product they are making.
Sanitation	: Cleanliness of worker, utensils, equipments, factory premises to save food from contamination.

15.20 SOME USEFUL REFERENCES

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15.21 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

Your answer should include the following points:

1.
 - It is a management approach to long-term success.
 - Everyone associated with the company is involved in continuous improvement.
 - Everyone in the organization is a customer.
2.
 - Food borne diseases
 - Microbial Contamination
 - Food Additives
 - Pesticides, Chemical & Fertilizers residues
 - Naturally accuracy food toxicants.
3.
 - International and unintentional adulteration
 - Physical, chemical and microbial contamination.

Check Your Progress 2

Your answer should include the following points:

1. • Codex Alimentations
 - ISO 9000
 - HACCP
2. • HACCP is an important quality assurance system.
 - Establish systems to control hazards
 - This system ensures that the products are safe and have good quality
 - Detection of hazards and their control through 7 principals: CCP, critical limits for CCP, corrective action etc
3. • Cleanliness conditions to minimize the contamination by workers, utensils, equipments and factory premises etc.
 - Good quality processed product.

Check Your Progress 3

Your answer should include the following points:

1. • Quality management and quality assurance internal standard
 - ISO: 9001, ISO: 9002: ISO: 9003, ISO: 9004 for design, production etc.
 - IS: 14001, IS: 14002, IS: 14003
2. • Prevention of food adulteration act; 1954
 - Agricultural Produce Act 1937
 - FPO (Food Products Order), 1955