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FICSI
Food Industry Capacity and Skill Initiative

Partcipant Handbook

Sector
Food Processing

Sub-Sector
Fruits & Vegetables

Occupation
Processing

Reference ID: **FIC/Q0203, Version-1.0**
NSQF Level: 3

Pickle and Paste Making Technician

Published By

Food Industry Capacity and Skill Initiative

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Website: www.ficsi.in

First Edition, March 2022

ISBN####

Printed in India at

Food capacity and Skill Initiative

New Delhi

> Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

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Food Industry Capacity and Skill Initiative

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Skill Development
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Certificate

**COMPLIANCE TO
QUALIFICATION PACK – NATIONAL OCCUPATIONAL
STANDARDS**

is hereby issued by the

FOOD INDUSTRY CAPACITY AND SKILL INITIATIVE SECTOR SKILL COUNCIL

for Food Processing

SKILLING CONTENT - PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/Qualification Pack: **Pickle and Paste Making Technician** QP Nos **FIC/Q0203 Level 3**

Date of Issuance: 24/02/2022

Valid up to : 23/02/2025

**Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)*

Authorised Signatory
(Food Industry Capacity and Skill Initiative)

Acknowledgements

FICSI is thankful to all organizations and individuals who have helped us in preparation of this practical guide.

We also wish to extend our gratitude to all authors who reviewed the content and provided valuable inputs for improving the quality, coherence, and content presentation in chapters.

The preparation of this participant Handbook would not have been possible without the support of the Food Processing Industries. The Industry feedback has been extremely encouraging from inception to conclusion & it is with their inputs that we have tried to bridge the skill gaps existing today in the Industry.

This participant handbook is dedicated to all the aspiring youth who desire to achieve special skills which would be a lifelong asset for their future endeavors and help them make a bright career in the Food Processing Sector.

About this Book

This Participant handbook is designed to enable training for the Qualification Pack (QP) for Pickle and Paste Making Technician with Reference ID: FIC/Q0110 published by Food Industry Capacity Industry and Skill Initiative (FICSI).

This course encompasses all National Occupational Standards (NOS) of the Qualification Pack, Pickle and Paste Making Processing, Reference ID: FIC/Q0110. Each NOS is covered across one unit/s. This book is designed for upgrading the knowledge and skills for working as a 'Pickle and Paste Making Technician' in the Food Processing Industry. This book will provide the necessary knowledge and skill inputs for a Pickle and Paste Making Technician to work in an organized and the disciplined manner and following safe working practices, effective communication, documentation, and work ethics as well as production work, ensuring preparation and maintenance of work area along with the required machinery. Upon successful completion of this course the participant will be able to:

1. FIC/N9026 : Prepare for production
2. FIC/N0135 : Carry out production of various types of pickles and pastes
3. FIC/N9901 : Implement health and safety practices at the workplace
4. FIC/N9902 : Work effectively in an organization
5. SGJ/N1702 : Optimize resource utilization at workplace

Symbols Used


Key Learning Outcomes


Unit Objectives


Tips


Notes

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1. Introduction to Food Processing Sector and the Job of Pickle and Paste Making Technician

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Unit - 1.1 Introduction to Food Processing Industry
Unit - 1.2 Roles and Responsibilities of Pickle and Paste Making Technician

FIC/N0204

Key Learning Outcomes

At the end of this module, the trainee will be able to:

1. Describe the food processing sector in brief
2. Discuss the career opportunities available within the food processing sector

Unit 1.1 Introduction to Food Processing Industry

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Discuss the size and scope of the food processing industry in brief
2. Discuss the future trends and career growth opportunities available for Pickle and Paste Making Technician in the food processing industry

1.1.1 Food Processing

Agriculture is India's mainstay industry. The majority of the products from various agricultural occupations are consumed within the country and exported to different countries around the world. Agriculture produce is also used as a raw material in the food processing industry. Food processing is the process of transforming raw materials into finished goods. They could be processed foods, ready-to-eat foods, food additives, or ingredients used to make other foods. The following figure explains the different levels of food processing.

Primary Food Processing

- Primary Processing relates to the conversion of raw agricultural produce, milk, meat, and fish into a commodity that is fit for human consumption
- It involves steps such as cleaning, grading, sorting, packing, etc.

Secondary Processing

- Secondary food processing is the conversion of ingredients into edible products -
- This involves combining foods in a particular way to change properties. E.g. - Preparing of orange juices from oranges

Tertiary Food Processing

- Tertiary food processing is the commercial production of what is commonly called processed food
- These are ready-to-eat (RTE) or heat-and-serve foods.

Fig 1.1.1 Levels of Food Processing

1.1.2 Journey of food from Harvest to Consumer

The flowchart below explains the process by which food material becomes a final, consumable product for various customers.

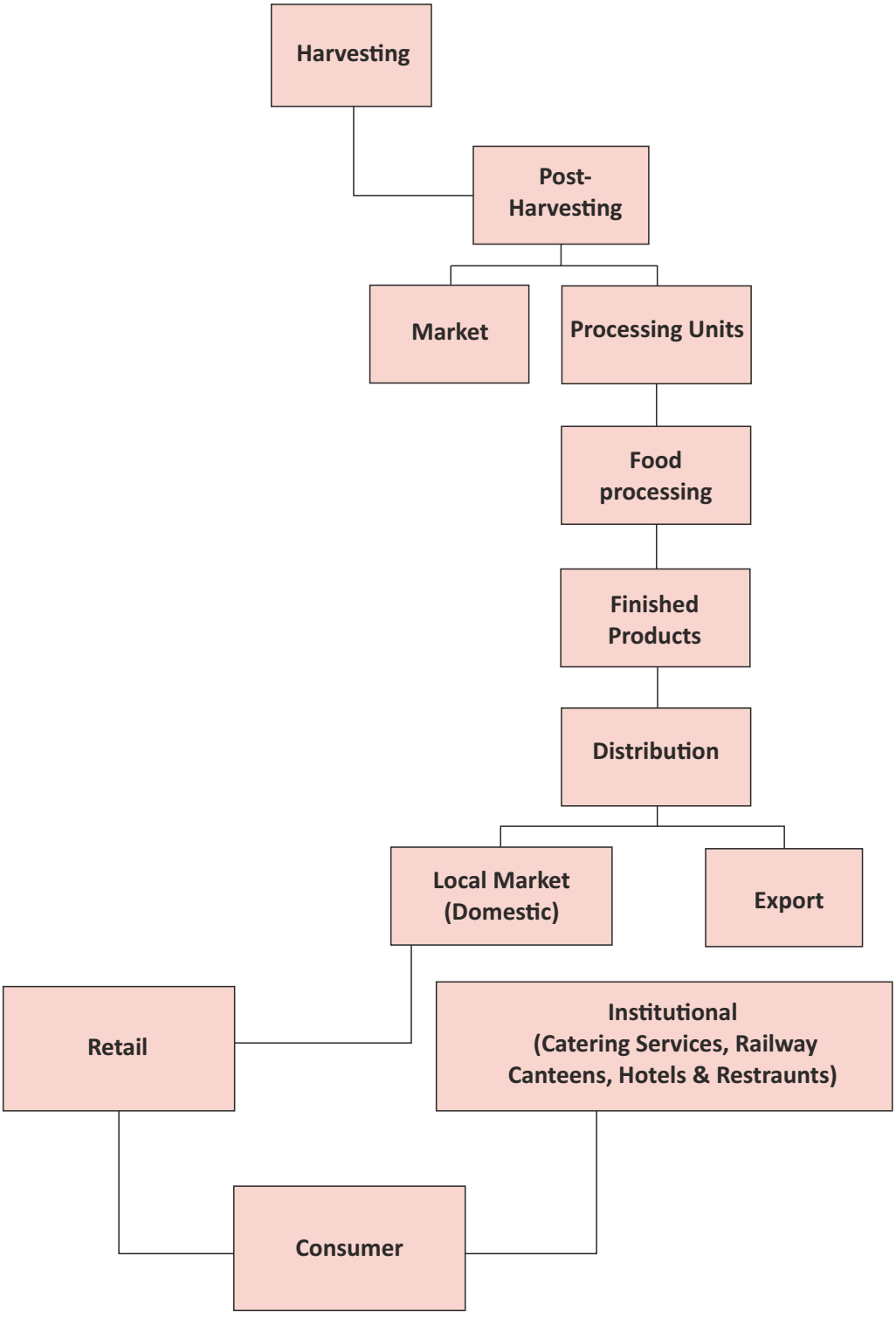

Fig.1.1.2 Journey of Foods from Farm to Consumer

1.1.3 India's Food Processing Industry

- The major segments in the Food Processing sector comprise of Fruits and Vegetables, Dairy, Edible Oils, Meat and Poultry, Non-alcoholic beverages, Grain-based products, Marine products, Sugar and sugar-based products, Alcoholic beverages, Pulses, Aerated beverages, Malted beverages, Spices, and Salt.
- In India, the food processing industry is divided into several sub-sectors.

Dairy	• Whole milk powder, skimmed milk powder, condensed milk, ice-cream, butter and ghee, cheese etc.
Fruit and Vegetable Processing	• Beverages, juices, concentrates, pulps, slices, frozen and dehydrated products, potato wafers, pickles and pastes etc.
Grains and Cereals	• Flour, bakeries, starch glucose, cornflakes, malted foods, vermicelli, beer and malt extracts, grain-based alcohol etc.
Fisheries	• Fish oil, frozen and canned products
Meat and Poultry Processing	• Frozen and packed meat,egg powder, etc.
Bread and Bakery	• Biscuits, breads, buns, cakes, confectionery, pastries, cookies, etc.
Consumer Foods	• Snack foods,namkeen, biscuits, ready-to-eatfoods, alcoholic and non-alcoholic beverages

Fig.1.1.3 Sub-Sectors of the Food Processing Industry

Scan the QR Code to watch the related video

1.1.3 India's Food Processing Industry
https://youtu.be/wMu0EpUgCd4

1.1.4 Overview of the Fruit and Vegetable Sector

The fruit and vegetable processing sub-sector deals with processed foods, semi-processed foods, and packaged foods that are made from fruits and vegetables. This includes:


Frozen foods


Confectionaries


Pickles


Jams


Juices


Jellies


Pulps


Concentrated foods

Fig.1.1.4 Various Processed and Semi-Processed Food Products

Certain parameters are important to consider when selecting a fruit/vegetable for processing. They are:

1. **Demand for processed food made from that vegetable/fruit**
2. **High quality produce**
3. **Continuous supply**

These parameters are critical for ensuring that raw materials can withstand the processing and preservation processes.

Scan the QR Code to watch the related video

1.1.4 Overview of the Fruit and Vegetable Sector
https://youtu.be/iacTHJtrXIE

Certain parameters are important to consider when selecting a fruit/vegetable for processing. They are:

1. **Demand for processed food made from that vegetable/fruit**
2. **High quality produce**
3. **Continuous supply**

These parameters are critical for ensuring that raw materials can withstand the processing and preservation processes.

1.1.5 Market trends of Pickle and Paste Processing

- Pickles are preserved relishes made from vegetables or fruits that are widely consumed and have a ready market. Pickles are also recommended by health experts for consumption, even though in moderation, due to their high concentration of essential nutrients such as iron, vitamins, potassium, and calcium.
- As a result, growing awareness about the health benefits of these anti-oxidant-rich products, such as preventing insulin resistance, aiding weight management, improving digestion, and reducing ulcers and muscle cramps, is expected to expand the segment in the near future.
- In recent years, a surge in promotional activities by manufacturers of packed pickles across multiple platforms has piqued consumer interest.
- This is also supported by an increase in demand for multi-cultural cuisines. The rising demand for non-GMO (genetically modified organisms) and organic pickles is expected to propel the global pickles market during the forecast period.
- Furthermore, the thriving food-service sector is contributing to the increasing demand for pickles around the world, which is expected to drive market growth.
- The global packed pickles market was worth USD 7.9 billion in 2018 and is expected to grow at a CAGR of 3.5 percent between 2019 and 2025. Pickles are primarily a domestic product that is consumed on a daily basis by nearly all Indian households. This is a global trend among the Indian diaspora. The Middle East and Africa are expected to grow at a CAGR of 6.6 percent from 2019 to 2025, making them the fastest-growing regional market.
- The rising popularity of online grocery shopping apps in both developing and developed countries will be the driving force behind segment growth.
- Amazon and Walmart have made inroads into the online grocery business, gaining significant

popularity among urban consumers.

- In 2019, the fruit segment dominated the packed pickles market, accounting for more than 45.0 percent of the market.
- Mangoes, pears, olives, grapes, apples, peaches, currants, plums, and tomatoes are some of the most popular pickled fruits worldwide.
- Without a smidgen of pickles, no Indian meal is complete. Pickles are eaten as both savory items and as side dishes with main courses, particularly in Indian cuisine. Aside from the domestic market, Indian pickles are in high demand abroad. Pickles are becoming increasingly popular around the world as a result of their high quality.
- On the basis of product types, the market can be segmented into fruits, vegetables, meat, seafood, relish, etc. As per taste, the market is segmented into sweet, salty, and sour pickles. On the basis of distribution channels, the market is divided into grocery retailers, hypermarkets, supermarkets, food services, online retailers, etc.
- The global pickle market has been segmented into jars, bottles, pouches, tubs, and others based on packaging type. During the assessment period, the jars segment is expected to dominate the global pickles market because jars are easy to transport and store and are cost-effective. The pouches segment is expected to grow at the fastest rate due to their ease of storage and use as refill packs. Furthermore, using Tetra Pak pouches results in longer shelf life.

1.1.6 Methods of Processing Fruits and Vegetables

The following are some common methods of processing fruits and vegetables:

Drying

Concentration

Washing

Fermentation

Sterilization

Pasteurization

Blanching

Canning

Fig.1.1.5 Different Food Processing Methods

Exercise

Answer the following questions:

1. Explain different levels of food processing.

_____
_____
_____

2. Write a short note on market and future trends of pickle and paste making industry.

_____
_____
_____

3. List different methods of food processing.

_____
_____
_____

4. Give any two examples of processed food products.

_____
_____
_____

Choose the correct answers:

1. _____have made inroads into the online grocery business, gaining significant popularity among urban consumers.
   a. Flipkart b. Amazon
   c. Pharmaeasy

2. The global pickle market has been segmented into
   a. As per population b. As per taste
   c. As per packaging

3. Important parameters to consider when selecting a fruit/vegetable for processing:
   a. Demand b. High quality produce
   c. Both a & b

4. _____processing is related to the conversion of raw agricultural produce into a commodity that is fit for human consumption.
   a. Primary b. Secondary
   c. Tertiary

Unit 1.2 Roles and Responsibilities of Pickle and Paste Making Technician

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Summarise the key roles and responsibilities of 'Pickle and Paste Making Technician'
2. List the various terminologies used in the process of making pickle and paste
3. Discuss the various organisational procedures and processes for making pickles and pastes
4. Discuss the standards to be followed for handling hazards and ensuring a clean work area

1.2.1 Roles and Responsibilities of Pickle and Paste Making Technician

The following table explains the roles and responsibilities of Pickle and Paste making technician.

Roles	Responsibilities
Handle raw material from post-harvest storage to process line	• Check raw material for quality • Ensure fruits and vegetables are free from dirt, • debris, foreign matter, glass and insects • Ensure minimum loss of material
Record-keeping and documentation	• Document and maintain records of production Schedule and process • Document and maintain records of finished Products
Hygiene and sanitation maintenance	• Adopt safety- and sanitation-related measures • Follow food safety norms and practices
Inspect machines and troubleshoot issues or escalate them to the supervisor	• Ensure smooth operation of machinery to complete • production line • Optimize the use of machinery • Attend to minor repairs of tools and machinery when required • Ensure that safety rules and regulations are observed • Prevent accidents
Plan and execute pickling process, examine products at different stages of pickling	• Adhere to Good Manufacturing Practice (GMP) • Ensure the products meet the quality standards set by the organization

Inspect intermediate as well as finished products	• Check cured fruits and vegetables, fermented pickles, and finished products for quantity, quality, and salt equilibriumEnsure conformance of quality as per organizational
Follow storage and packaging norms	• Ensure safe and proper storage of raw material, packing material, and finished goods

Table 1.1 Roles and Responsibilities

Scan the QR Code to watch the related video

1.2.1 Roles and Responsibilities of 'Pickle and Paste Making Technician
https://youtu.be/GlvfUzTXAdg

Notes

1.2.2 Various Terminologies used in Pickle and Paste making

The following table explains various terms used in pickle and paste making.

Terminology	Meaning
Brine	It is the salt solution used in the curing process.
Brine strength	It is the weight of salt in proportion to the weight of the solution.
Degree salinometer	It is the tool for measuring the percentage of salt in the brine.
Salt equilibrium	It is the strength of salt in the brine. For pickling process, it has to be maintained between 12 to 14% of the volume of the final produce. At this strength, the pickle can be preserved for a long time.

Table 1.2 Common Terminology in Pickle and Paste Making

1.2.3 Types of Pickles and Pastes

There are various types of pickle and paste available in the market. The following table 1.3 list the different types of pickles and the places in India where they are most popular.

Types of Pickle	Example	Popular in
Chutney /Paste	Gongura, Tomato	South India
Dry	Lemon, Mango	UP. Bihar
Stuffed	Chilies	North India
Oil	Mango, mixed	Throughout India
Fermented	Cucumber, onion	Outside India
Non-Vegetarian	Chicken, mutton, pork	HP, Uttarkhand, Punjab

Table 1.3 Types of Pickle

1.2.4 Organizational Processes for Making Pickles and Pastes

Pickling is a food preservation method used to make pickles. This method extends the shelf life of a specific food. Pickling food is done by immersing it in a salt solution or vinegar. The preservative quality of salt, combined with the acidic nature of the solution, prevents spoilage. This combination also produces lactic acid. It is done in a controlled environment where the temperature, storage conditions, and humidity in the air are all monitored. The resulting product has a salty and sour flavor that people refer to as “Pickle."

Pickles are foods made from fruits or vegetables. They are spice-flavored and preserved in salt solutions or vinegar to prevent spoilage. Pickles are traditionally made in every Indian home. However, increased demand for reputable brand pickles in recent years resulted in pickle-making companies entering the market to meet domestic and international pickle demand. Pickles are produced using cutting-edge technology and higher-quality ingredients to ensure that they last longer. They are made with high-quality edible oils to increase the shelf life by more than a year.

However, there are other types of pickles made from local produce that have a shorter shelf life.

Pickles are processed in two ways: Curing and Fermentation.

1. **Curing Process**
   Step 1: Fruits and vegetables are washed, cleaned, and cut.
   Step 2: After this, they are kept in 12% salt solution, also called as brine.
   Step 3: The cured fruit or vegetable is stored in barrels.
   Step 4: Later, the cured fruits and vegetables are mixed with spices and ingredients.
   Step 5: Then, the mixture is covered with oil to make oil pickles.
2. **Fermentation:**
   Step 1: Cured fruits and vegetables are mixed with vinegar or acetic acid and are kept for fermentation.
   Step 2: In this process, the fermentative bacteria produce acids necessary for the preservation process. These bacteria also generate flavor compounds. This helps to enhance the taste of fermented pickles.

The following figure gives an overview of the pickle-making process. It demonstrates how raw materials are processed to make pickles.

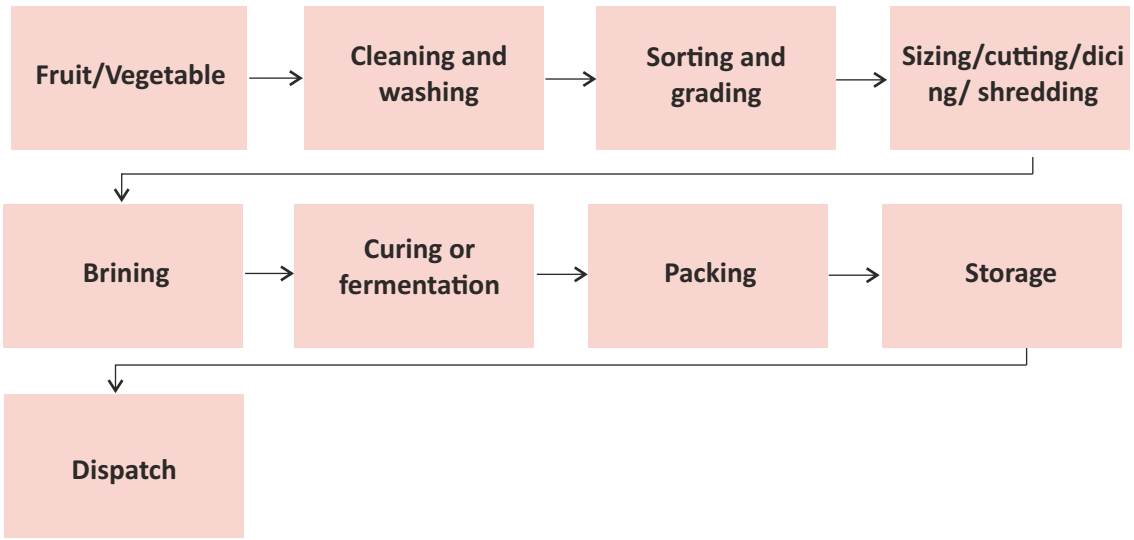

Fig.1.1.6 Standard Procedure for Pickle Making

1.2.5 Standard Practices for Handling Hazards and Cleaning Work Area

Every employee is concerned about their health and safety. As a result, following safety guidelines is required to avoid hazards and accidents. Similarly, sanitization and hygiene are the most important factors to consider when working in the food processing industry. The figure below depicts the standard practices for dealing with hazards, risks, and cleaning work areas:

- Maintain high standard personal hygeine and cleanliness among the staff. For example: trimming of nails, clean uniforms, cover hair etc.
- Washing and sanitizing hands and feet regularly before entering the production area at the designated wash station.
- Wear Personal Protective equipment (PPE) such as apron, mask, head cover, gloves during work hours.
- Minimise direct hand contact with raw food by using appropriate utensils and safe use of disposable gloves
- Clean and clear your work station at regular basis.
- Ensure the work area is dust and pest free.
- Always read manufacturer's instructions before handling any equipment and machinery.
- Avoid direct spilling of water on electrical components.
- Clean and maintain the tools and equipment after each operation.
- No smoking, spitting, chewing , sneezing or coughing at the time of food production
- Provide appropriate containers and suitable waste storage areas.

Fig.1.1.7 Standard Practices for Handling Hazards and Cleanliness

Scan the QR Code to watch the related video

1.2.5 Standard Practices for Handling Hazards and Cleaning Work Area

https://youtu.be/j9HIFj-g2x4

Summary

- Food processing is the process of transforming raw materials into finished goods. They could be processed foods, ready-to-eat foods, food additives, or ingredients used to make other foods.
- There are three types of food processing – primary, secondary and tertiary processing.
- In India, the food processing industry is divided into several sub-sectors such as dairy fruit and vegetable processing, grains and cereals, fisheries, meat and poultry processing, bread and bakery and consumer foods.
- The fruit and vegetable processing sub-sector deals with processed foods, semi-processed foods, and packaged foods that are made from fruits and vegetables. For Example – juices, jellies, pulps,
- Food processing is the process of transforming raw materials into finished goods. They could be processed foods, ready-to-eat foods, food additives, or ingredients used to make other foods.
- There are three types of food processing – primary, secondary and tertiary processing.
- In India, the food processing industry is divided into several sub-sectors such as dairy fruit and vegetable processing, grains and cereals, fisheries, meat and poultry processing, bread and bakery and consumer foods.
- The fruit and vegetable processing sub-sector deals with processed foods, semi-processed foods, and packaged foods that are made from fruits and vegetables. For Example – juices, jellies, pulps, concentrated foods
- The important parameters to consider when selecting a fruit/vegetable for processing are demand for processed food made from that vegetable/fruit, high quality produce and continuous supply
- Pickles are recommended by health experts for consumption, albeit in moderation, due to their high concentration of essential nutrients such as iron, vitamins, potassium, and calcium.
- The rising demand for non-GMO (genetically modified organisms) and organic pickles is expected to propel the global pickles market during the forecast period.
- The thriving food-service sector is contributing to the increasing demand for pickles around the world, which is expected to drive market growth.
- The global packed pickles market was worth USD 7.9 billion in 2018 and is expected to grow at a CAGR of 3.5 percent between 2019 and 2025.
- Amazon and Walmart have made inroads into the online grocery business, gaining significant popularity among urban consumers.
- Mangoes, pears, olives, grapes, apples, peaches, currants, plums, and tomatoes are some of the most popular pickled fruits worldwide.
- Aside from the domestic market, Indian pickles are in high demand abroad. Pickles are becoming increasingly popular around the world as a result of their high quality.
- The pouches segment is expected to grow at the fastest rate due to their ease of storage and use as refill packs. Furthermore, using Tetra Pak pouches results in longer shelf life.
- The roles and responsibilities of Pickle and Paste making technician includes -handle raw material from post-harvest storage to process line, record-keeping and documentation, hygiene and sanitation maintenance, plan and execute pickling process to follow storage and packaging norms etc.
- Brine is the salt solution used in the curing process whereas brine strength is the weight of salt in proportion to the weight of the solution.
- Degree salinometer is the tool for measuring the percentage of salt in the brine.
- Pickling food is done by immersing it in a salt solution or vinegar.
- Pickles are processed in two ways: Curing and Fermentation.

Exercise

Answer the following questions:

1. List the roles and responsibilities of pickle and paste making technician.

   _____

   _____

2. Name any two types of pickle.

   _____

   _____

3. What is brine strength.

   _____

   _____

4. Write a short note on standard procedure for pickle making.

   _____

   _____

Fill in the Blanks:

1. _____and _____ are the most important factors to consider when working in the food processing industry.
2. _____is done by immersing it in a salt solution or vinegar.
3. _____is the tool for measuring the percentage of salt in the brine.
4. _____attend to minor repairs of tools and machinery as per requirement.

2. Prepare for Production

Unit 2.1 - Plan for Production

Unit 2.2 - Cleaning and Maintenance

FIC/N9026

Key Learning Outcomes

At the end of this unit, the trainee will be able to:

1. Discuss the standard practices to be followed for production
2. Demonstrate the tasks to be performed at the workplace for planning the production

Unit 2.1 Plan for Production

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Discuss the significance of supervisor's work instructions with regards to the production requirements
2. Describe the relevance of planning and prioritizing the production work
3. State the importance of planning and arranging the estimated resource requirement
4. Explain the various factors to be considered while allocating responsibilities to the team
5. Estimate the resource requirement as per the production requirement
6. Discuss the capacity utilization of machinery with respect to the processing time, production order, and batch size for each product

2.1.1 Significance of Supervisor's Work Instructions

Supervision is an amalgamation of the word super means 'from the above' and vision means 'to see'. In general, supervision means managing the activities of others. The Production supervisors are mainly concerned with overseeing and managing the performance of employees under their control. They play a significant role in the pickle and paste manufacturing process, where the overall aim is to maintain and improve the production processes of an organization through managing teams and other resources. To accomplish this goal, they must analyze production requirements and suggest constructive improvements to enhance production output. Also, they must ensure all production goes effortlessly and efficiently by thoroughly monitoring workers and their workflows. The Production Supervisors fulfill the following responsibilities:

- **Set daily objectives and communicate them to employees**
- **Organize workflow by assigning responsibilities**
- **Preparing production schedules**
- **Ensure the safe use of equipment and schedule regular maintenance**
- **Check production output according to specifications**
- **Submit reports on performance and progress**
- **Identify issues in efficiency and suggest improvements**
- **Provide training to the employees on regular basis**
- **Enforce strict safety guidelines and company standards**
- **Assist in the recruitment and onboarding of new hires**

Ensure optimum efficiency

Ensuring the flow of raw materials and other resources

Fig.2.1 Responsibilities of Supervisor in Production

Supervisors' work instructions are vital for pickle and paste making production or manufacturing process. It provides instruction and guidance for work tasks in day-to-day operations, non-standard tasks, and emergencies. When the production team is supported with good work instructions, the company saves tons of money and time and delivers high-quality products.

- Provide clear guidlines for day to day operation
- Enforce consistency in production performance
- Reduce variation in production
- Avoid production mistakes and prevent accidents
- Assist in emergency situations
- Produce high quality product
- Complete the production on time
- Reduce loss and saves money

Fig.2.2 Significance of Supervisors' Work Instructions

2.1.2 Planning and Prioritizing Production work

Production refers to the transformation of inputs into finished goods/ or the creation of services to satisfy the customer needs. Production involves applying processes by which the inputs can be transformed into the desired product (output) of potential utility while improving properties and adding economic value through the best method without compromising on quality. So it is that activity whereby resources, flowing within a defined system, are combined and transformed in a controlled manner to

add value, following the policies communicated by management. A simplified production system is shown below:

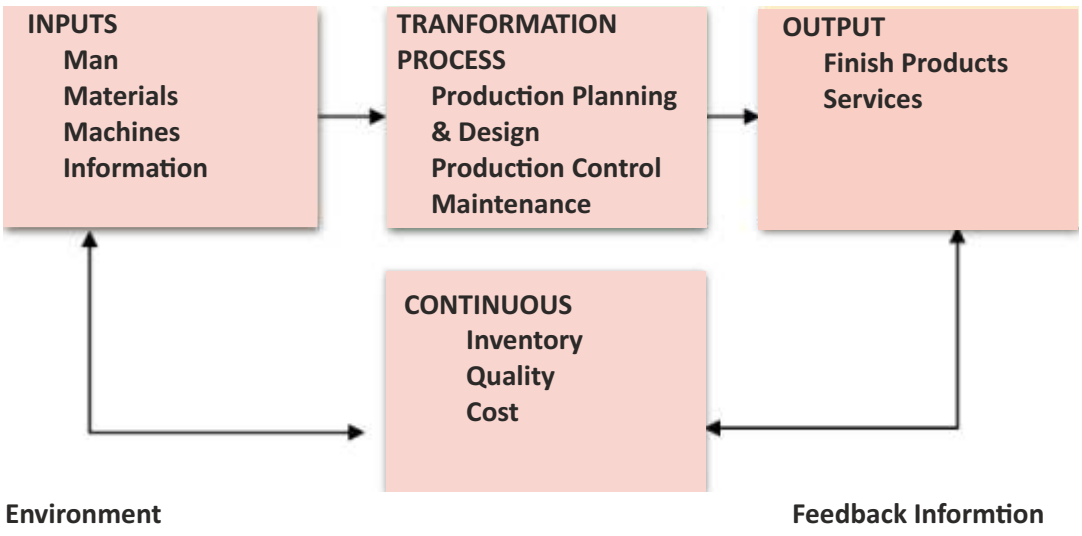

Fig.2.3 Schematic Production System

2.1.2.1 Production Planning

Production planning is a process that is necessarily required to ensure efficient and economical production. Therefore, planned production is an essential feature of the food processing industry. It is an instrument to coordinate and integrate the entire manufacturing activities in a production system. It develops the requirements for storage and production capacity needs based on food processing. The production planning for pickle and paste making consists of various plans related to routing, selection of vendors, selection of desired vegetables and fruits for pickle and paste preparation,availability of other raw materials that are required in producing pickle and paste like desired oil, spices filling the inventory with desired packaging material, inspection of production line for any maintenance etc.

The production process planning is rarely linear. Often new ideas and unforeseen possibilities surface. This creative problem-solving process may lead to considering a previously deemed unacceptable option, or it may reveal a solution that was not thought about in any previous plans. These back and forth developments ultimately lead to the best solution for expanding, refurbishing or constructing a new food plant.

The Production Plan for pickle and paste making begins with collecting data on any current or proposed food processing and storage operation. It consists of various charts, manuals, production budgets, etc., based on information received from management. These production plans and charts provide practical form by carrying different features under production control. Production planning is based on the following crucial elements:

Raw Material Procurement of raw material, component and spare parts of machines or equipment in the right quantities and specifications at the right time from the right source at the right place.	**Method of Processing** It includes determining the best sequence of operations (process plan) and planning for tooling, jigs and fixtures etc.	**Machine & Equipment** It involves facilities planning, capacity planning, allocations, and utilization of plant and equipment, machines etc
Manpower Planning for manpower (labour and managerial levels) having appropriate skills and expertise.	**Routing** It determining the flow of work material handling in the plant, and sequence of operations or processing steps.	**Estimation** It involves deciding the quantity of the product which needs to be produced and cost involved in it on the basis of sale forecast.
Utilization It is the process assigning specific jobs to machines, men, or work centers based on relative priorities and capacity utilization.	**Scheduling** It provides a timetable for production activities.	**Dispatching** It is a release of orders and instructions for starting of production in accordance with routing sheet and scheduling charts.
Inspection It is related to maintenance of quality in production and of evaluating the efficiency of the processes, methods and labours to achieve the quality standard	**Evaluation** It is to improve performance. Performance of machines, processes and labour is evaluated to improve the same.	**Cost control** It is controlled by wastage reduction, value analysis, inventory control and efficient utilization of all resources.

Fig.2.4 Elements of Production Planning

2.1.2.2 Prioritizing Workload

Prioritizing the production workload assist in taking control of time and ensures to meet important deadlines. Knowing daily priorities reduces stress, helps employees to focus, and improves their productivity. It also allows the employees to set better boundaries, eliminate distractions, and improve their work-life balance.

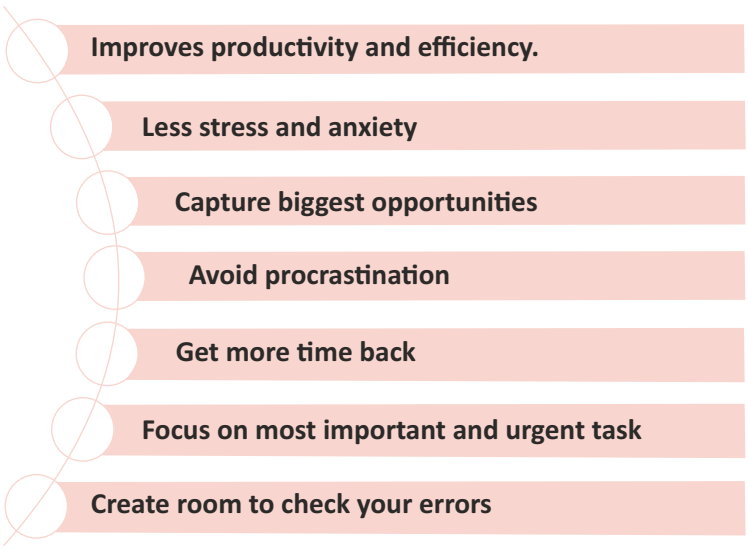

Fig.2.5 Significance of Prioritizing Production Workload

2.1.2.3 Allocation of Work or Responsibility to the Team

Work allocation needs to be done fairly to operate the team based on equality. The primary responsibility of a supervisor is to allocate tasks to each person in the team. This requires making decisions about who is capable of performing specific tasks for successful production. Following are the factors to keep in mind when distributing work:

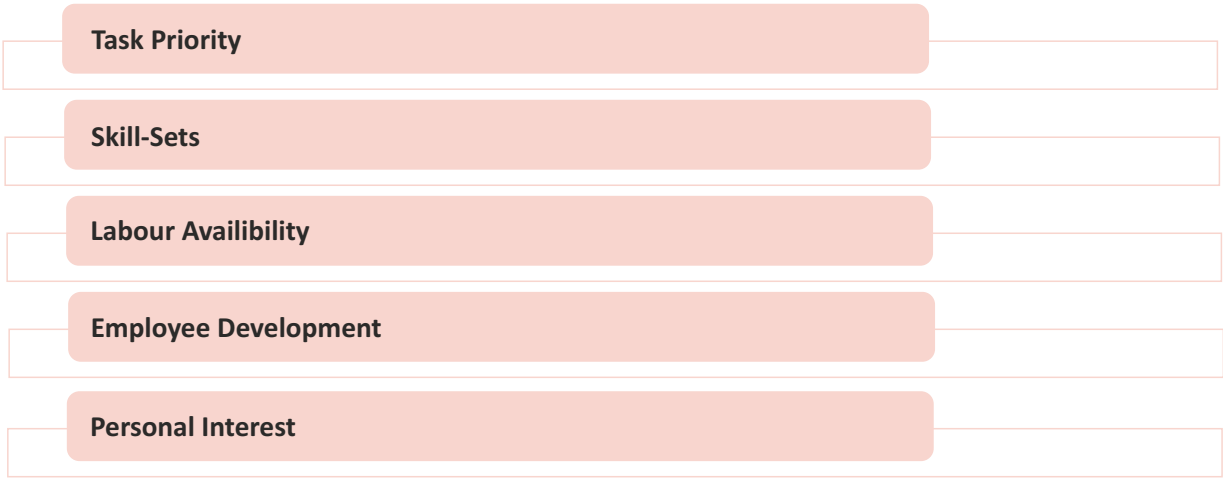

Fig.2.6 Criteria for the Work Allocation

The following chart explains the planning and allocation of work:

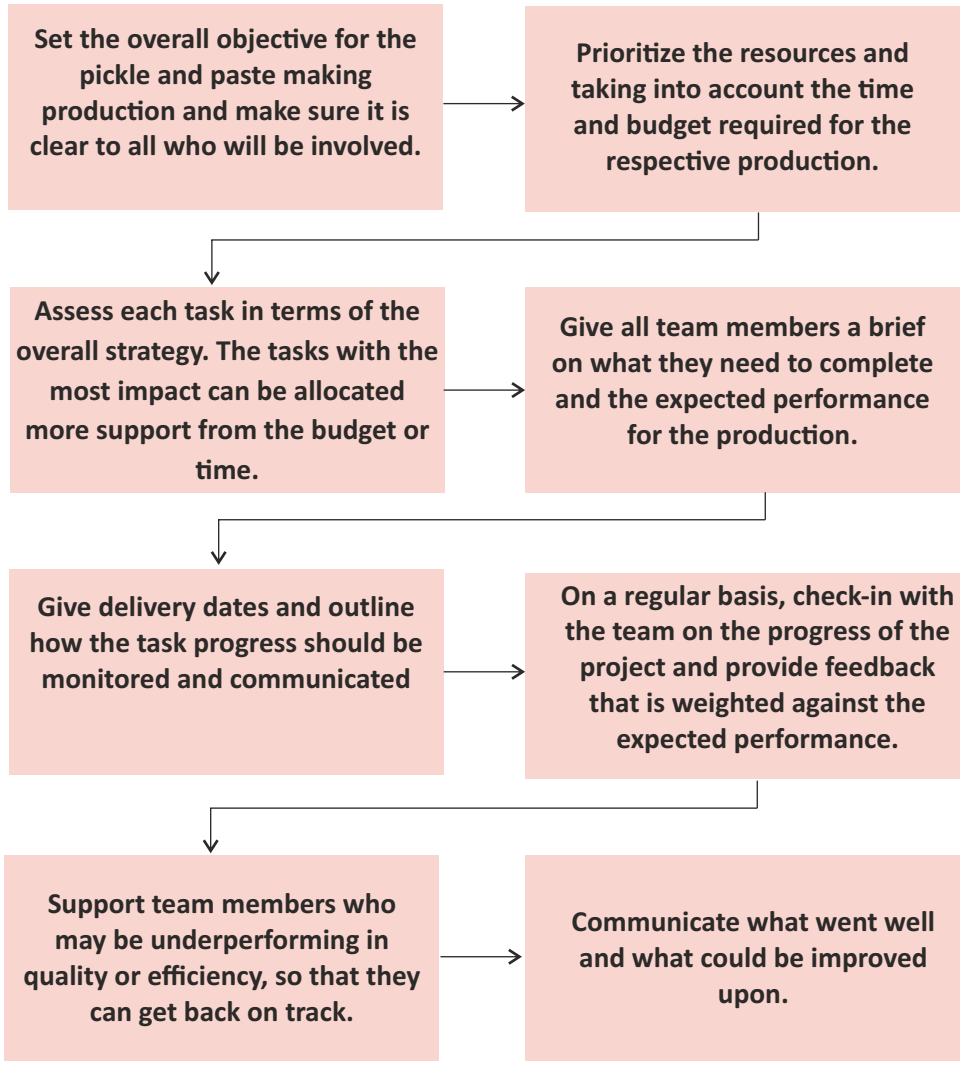

Fig.2.7 Planning and allocation of work for Pickle and Paste Making Production

2.1.3 Significance of Resource Planning and Estimation

Resource management is the process of pre-planning, scheduling, and allocating resources to maximize optimization and efficiency. It determines which resources are needed, in what quantities, and when to complete the production. This process not only helps to determine how the production process will be completed but also helps to estimate the costs and timeline associated with it.

Below are the steps for creating an effective resource management plan for pickle and paste making.

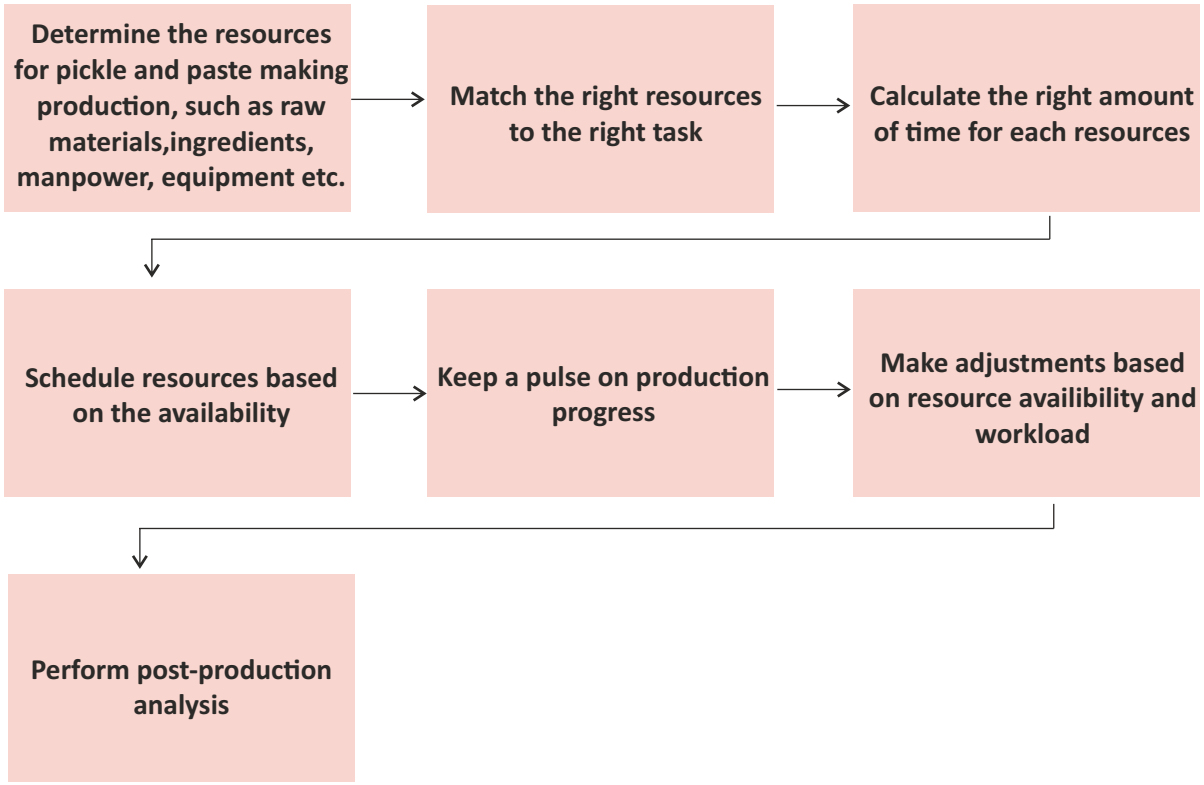

Fig.2.8 Process of Resource Planning for Pickle and Paste Making Production

2.1.3.1 Importance of Resource Planning

Wastage of resources can be fatal in production; therefore, every food production industry needs effective Planning. Here's why resource planning is vital for the pickle and paste making production process.

- The resource plan is prepared according to the product's delivery timelines and helps keep the production on track.
- Effective Resource planning lays the foundation of a successful production process.
- It set realistic expectations for the production deliverables among clients and other stakeholders.
- It helps to estimate production costs and profit margins accurately.
- Resource planning offers improved insight into actual costs and the overall profitability of the production.
- It prevents over-working or under-utilizing of the manpower ,which leads to increased employee satisfaction.
- It leads to optimal utilization of resources to prevent over-burdening and at the same time ensures that the food processing industry makes the most of the resources.
- Hiring decisions taken based on resource planning analysis are usually in the benefit to the production.
- A successful resource plan can be treated as a fool-proof formula for future production.

2.1.3.2 Raw Material and Manpower Estimation

The raw material is something that is used to produce a product. The availability of raw materials affects the production process which in turn affects the revenue of an organization. Raw material's availability assists manufacturing units in conducting production processes following the requests and wishes of the consumer. Raw material inventories are fundamental in pickle and paste making processing because the uncertain demand and availability of raw materials due to seasonal reasons can cause complications over costs incurred. Moreover, raw materials is an investment that affects the financial stability and listed as a current asset on a company's balance sheet. So, it is important to apply best practices for managing raw material inventory. There are two subdivisions of raw materials:

a. **Direct Materials** are those resources that are part of or incorporated into the finished product. For example in pickle and paste industry vegetables, oil, spices etc

b. **Indirect Materials** are those resources consumed during the manufacturing process but are not part of the finished product. For example disposable tools, protective equipment, cleaning supplies, fuel, light bulbs etc.

It is important to determine the value of opening and ending inventory for estimating raw materials for pickle and paste making as per production requirements. It is calculated as follows:

Raw Materials Inventory = Beginning Inventory + Raw Materials Purchased - Cost Of Goods Sold

1. **Beginning/opening inventory value -** The value is obtained from the previous accounting period balance sheet as the closing inventory.

Opening Inventory = (Cost Of Goods Sold + Ending Raw Materials Inventory) - Raw Materials Purchased

2. **Closing/ ending inventory value –** It is the inventory on hand at the close of an accounting period. The value is revealed on the balance sheet.

Ending Inventory = (Raw Materials Purchased + Beginning Raw Materials Inventory) - Cost Of Goods Sold

3. **Raw material Purchased –** it is calculated as:

Raw Materials Purchased = (Ending Inventory – Beginning Inventory) + Cost Of Goods Sold

4. **Cost of goods sold (COGS) –** It appears as an item in the income statement during the accounting period.

Cost of goods sold = Begining inventory + Purchases – ending inventory

Note:-

- **Beginning Inventory -** Value of a company's inventory at the start of an accounting period.
- **Ending Inventory -** Value of goods still available for sale and held by a company at the end of an accounting period.
- **Raw Materials -** Vegetable, fruits, ingredients, spices, oil etc.
- **Good Sold -** Accumulated total of all costs used to create a product which has been sold.

To calculate manpower requirements for pickle and paste production, divide the value of goods and services produced by the total hours worked by employees over a specified period. Here are the steps to estimate manpower for production.

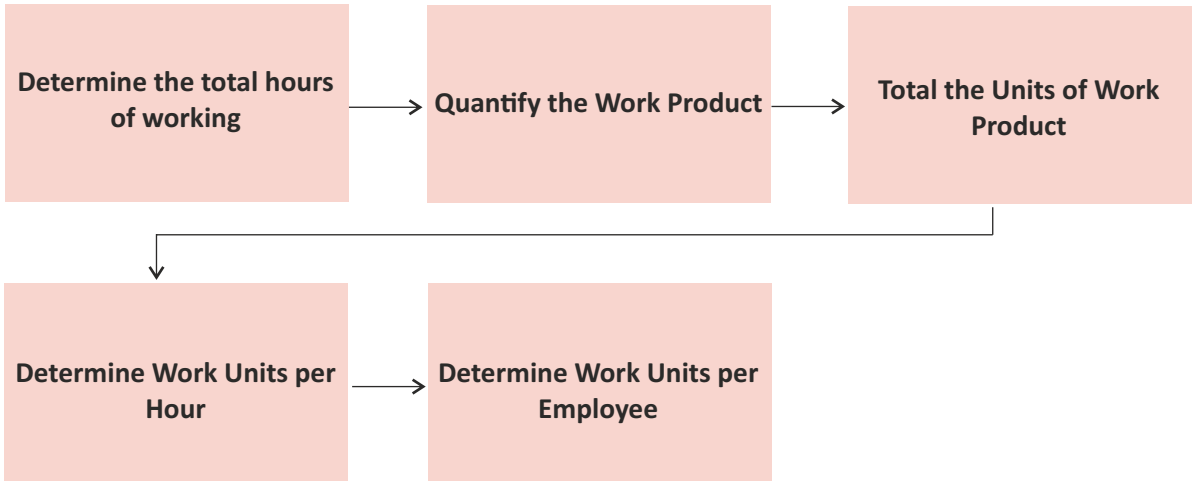

Fig.2.9 Steps to Calculate Manpower Estimation for Production

2.1.4 Capacity Utilization

Capacity utilization is a relationship between the actual and potential production output, using its capacity of machinery and available resources. The capacity utilization percentage provides an insight into a food processing industry's operational efficiency and can vary based on consumer and market demand.

1. Following are the steps to calculate the capacity utilization of production:

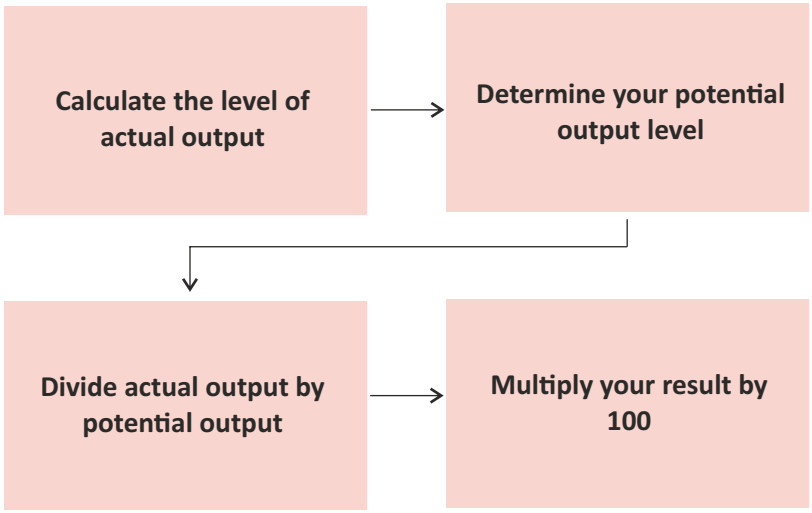

Fig.2.10 Steps to calculate Capacity utilization

The capacity utilization formula gives you the capacity utilization rate:

Capacity utilization = (actual output level / potential output) x 100

In the above formula, the actual output level represents the number of units a manufacturing unit produces within a specific period. The potential output means the maximum capacity that companies and economies can operate at when they use all resources without incurring additional operational expenses.

2. Each machine in the production line operates at a particular cycle time. Therefore, the efficiencies of a production operation in a manufacturing system can be measured based on the utilization of production resources such as machines in a particular cycle.

   Machine capacity = operating hours x operating rate x the number of machines

3. We can calculate the capacity of a process with respect to the batch size, using the following formula:

   Capacity = (batch size) / (set-up time + batch size * time per unit)

Unit 2.2 Cleaning And Maintenance

Unit Objectives

At the end of this unit, the trainee will be able to:

1. List the materials and equipment used in cleaning and maintenance of the work area
2. List the sanitizers used in cleaning work area and machineries
3. Identify different kinds of waste material and comprehend the ways to dispose them safely
4. Specify the inspection procedure for inspecting the tools, equipment, and machinery used in the job
5. State the importance of reporting information such as faulty tools and equipment to the concerned authority

2.2.1 Cleaning and Sanitizing Work Area and Machinery

The cleaning and sanitizing process are one of the most essential programs in the food processing industry. It has always been a critical element for ensuring food safety and quality. Pickle and paste-making industries need to be kept spotlessly clean to ensure compliance with standard regulations and prevent contamination. Everything from random debris to flakes of rust and paint needs to be kept clear from foodstuff to make sure the product is entirely safe for consumption, so frequent cleaning is vital to pickle and paste processing operations.

Though the entire process is quite tricky because of the complexity of the machinery and equipment used for pickle and paste making, it can also introduce additional difficulty by creating a wet environment. The equipment for pickle and paste making must be designed and built to withstand these environments, like using only food-grade stainless steel, but the complexity doesn't end there. High-pressure washers used to clean equipment can also strip the coatings on machines and cause injuries to employees. Also, if there is oil on the floor, perform cleaning on time to avoid slips or falls. The wet environment often poses a slip-and-fall hazard as well as food contamination.

Cleaning and sanitizing (disinfecting) are usually two separate processes. Effective cleaning must be carried out before sanitizing the work area and machinery, as sanitizers may not work as well if the work area or machinery has not had all visible contamination removed. Cleaning is often done using the correct proportion of detergent and water. Detergents are chemicals that eliminate dirt and grease. However, it does not kill bacteria and other microorganisms. Microorganisms may be removed during the cleaning process but they can't be destroyed properly. Hence, sanitizing is required for this purpose.

The primary reasons for cleaning and sanitizing the work area and machinery used for pickle and paste making are:

Fig. 2.11 Reasons for Cleaning and Sanitizing

The food processing industry follows standard procedures for cleaning the work area to ensure no bacterial growth due to the presence of leftover food particles. For cleaning purposes, the pickle and paste making work area are divided into two categories:

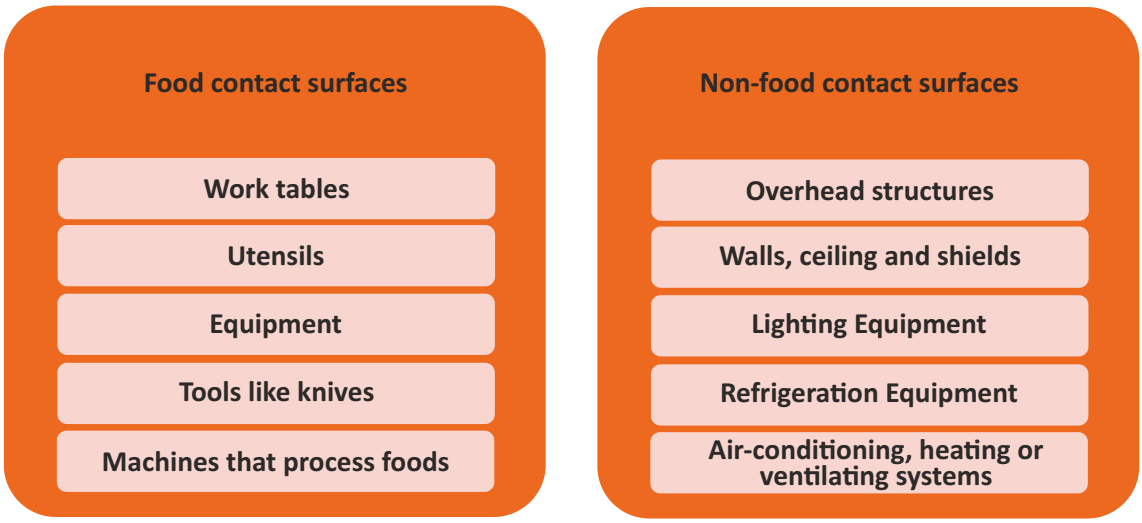

Fig. 2.12 Cleaning Work Area Categories

Proper and regular cleaning of the work areas protects food from any contamination. The cleanliness of the ambient air should also be controlled in the workplace, where contamination of any infectious material will be dangerous. The surfaces used for producing and storing pickle and paste products should always be dry and hygienic during use. When wet cleaning is required, these surfaces must be sanitized and thoroughly dried to use. The entire work area in wet applications must be cleaned and sanitized absolutely before use or at the risk of contamination. Pickle and paste-making equipment and tools when not in usage should be stored properly to avoid any contamination risk.

2.2.1.1 Types of Cleaning Equipment & Materials for Work Area & Machinery

Cleaning equipment is divided into two sub-categories:

1. **Manual cleaning equipment –** Depends upon operation and energies of the employees and requisite the staff's maximum effort and techniques for cleaning.
2. **Automatic cleaning equipment –** Requires electricity or battery power for the operation. These cleaning machines ease labor and save a lot of time.

Microfiber Cloth

Abrasives

Different types of cleaning brushes - e.g. hard and soft floor brushes, scrubbing brushes.

Brooms

Vaccum Cleaner

Polishing Machine

Floor Scrubber

Steam Vapour Machine

High Pressure Sprays

Fig. 2.13 List of Equipment and Materials for Cleaning Work Area

2.2.1.2 Cleaning Agents and Sanitizers Used for Cleaning

There are several common cleaning and sanitizing agents that can be used to clean the food-contact and non-food contact surfaces. Select the right kind of cleaning agent or sanitizer based on the variation of soils, water hardness, the temperature of the method, plant surfaces, machinery, equipment, and tools.

Detergent suppliers usually have a range of detergents to be employed in varying and specific circumstances. The range of products will include:

Alkalis: • Caustic soda • Caustic potash • Coronate • Silicate, • Phosphate	**Acids:** • Phosphoric • Nitric • Citric • Glycolic	**Chelates:** • EDTA • NTA • Gluconate • Glucoheptonate, citrate • Polymeric	**Solvents:** • Isopropanol • Propylene • Butyl diglycol • Ethers	**Surfactants:** • Anionic • Cationic • Non-ionic • Amphoteric
Inhibitors: • Organic • Inorganic	**Enzymes:** • Protease • Lipase • Amylase	**Oxidising agents:** • Hypochlorite • Isocyanurates	**Stabilisers**	**Viscosity modifiers**

Fig. 2.14 Various Ranges of Detergents

There are three acceptable types of sanitizer solutions for use in the food processing industry.

Chlorine (Bleach) Concentration: 50 to 100 ppm	• They are inexpensive and commonly used sanitizers that are effective against all bacteria. • Bleach is less effective in hot water and works best at a temperature range of 12.78°C-23.89°C. • Do not use splashless, scented or non-chlorine/color safe bleach.
Quaternary Ammonia (QUAT, QAC) Concentration: As per manufacturer's instruction	• These come in diluted form and are odourless, colorless and nontoxic. • They are stable at high temperatures, and are more effective in the presence of organic materials than chlorine. • It takes longer time to sanitize against some common spoilage bacteria.
Iodine Concentration: 12.5 to 25 ppm	• Iodine compounds or iodophors are fast-acting and effective against all bacteria. • They are relatively nontoxic, non-irritating to skin, and stable.

Fig. 2.15 List of Sanitizers for Work Area and Machineries

2.2.1.3 Effective Practices for Sanitization and Cleaning

It is compulsory to follow the manufacturer's instructions provided on the label for effective and safe use of a sanitizer.

- Some sanitizers are toxic to people, and the residue must be rinsed off, while other sanitizers are food-safe and do not require rinsing. So, the manufacturer's instructions shall always be followed for the sanitizer to ensure safe use.
- Sanitizers work best at the correct dilution. If they are too weak, they do not work effectively, and money is being wasted if they are too strong.
- Sanitizers need time to work. The contact time varies depending on the job.
- Check the dilution, contact time, safety precautions, shelf life, and storage of all chemicals before use.

Cleaning and sanitization take time and cost money. However, well-designed and organized food processing businesses can reduce the time needed for thorough cleaning with proper planning. In some cases, the combined operation of cleaning and sanitization are performed using a sanitizer which has the features of both detergent and sanitizer. Still, the two-stage approach is more consistent and effective than the single-stage sanitizer approach. In the pickle and paste-making processing industry, non-scented chemicals are used in operations due to the risk of taint. When cleaning and sanitizing work areas and equipment, the following practices must be followed:

There are three acceptable types of sanitizer solutions for use in the food processing industry.

Plan the cleaning sequence to avoid re-soiling the cleaned area	Implement and display a cleaning schedule so all staff know their cleaning and sanitizing responsibilities.	Wear personal protective equipment required for the cleaning methods and materials being used
All items must be stored off the floor. Allowing clearance from the floor gives plenty of room for cleaning beneath shelving and equipment.	All the machinery used for processing is "SWITCH OFF"	Keep only what you need at the food processing premises.
Use the right materials for cleaning while considering risk, time, efficiency and type of stains	Wipe out the chemical spill properly in the work area, with care and caution	Use a high volume, low pressure hose for equipment and surfaces. High pressure hoses can splash and spray dirt onto surfaces and create aerosols that may contain and spread pathogens.
Use a vaccum cleaner or at least a damp cloth to clean the dust from surfaces around the work area	Remove the residues, coarse dirts oily substances and scraps from the surface area	Undertake regular maintenance, for example filling holes and replacing damaged tiles.
Wipe down tools, equipment and surfaces as per specified standards	Dispose any waste or chemicals used in an appropriate manner	

Fig. 2.16 Standard Practices for Cleaning the work area and equipment

Cleaning and sanitization is a complex process. A defined and systematic approach should be followed to ensure it is conducted appropriately that considers several factors. This approach takes the form of a procedure, which is usually a legal and a fundamental requirement of global food standards. A collection of these cleaning procedures forms a Cleaning Plan or Program, which is plant-specific. The correct sequence of a general cleaning procedure for surfaces in a pickle and paste-making processing facility is:

Fig.2.17 Steps for Cleaning Work Area

The following chart explains workflow process of cleaning and maintenance of pickle and paste-making machinery and equipment.

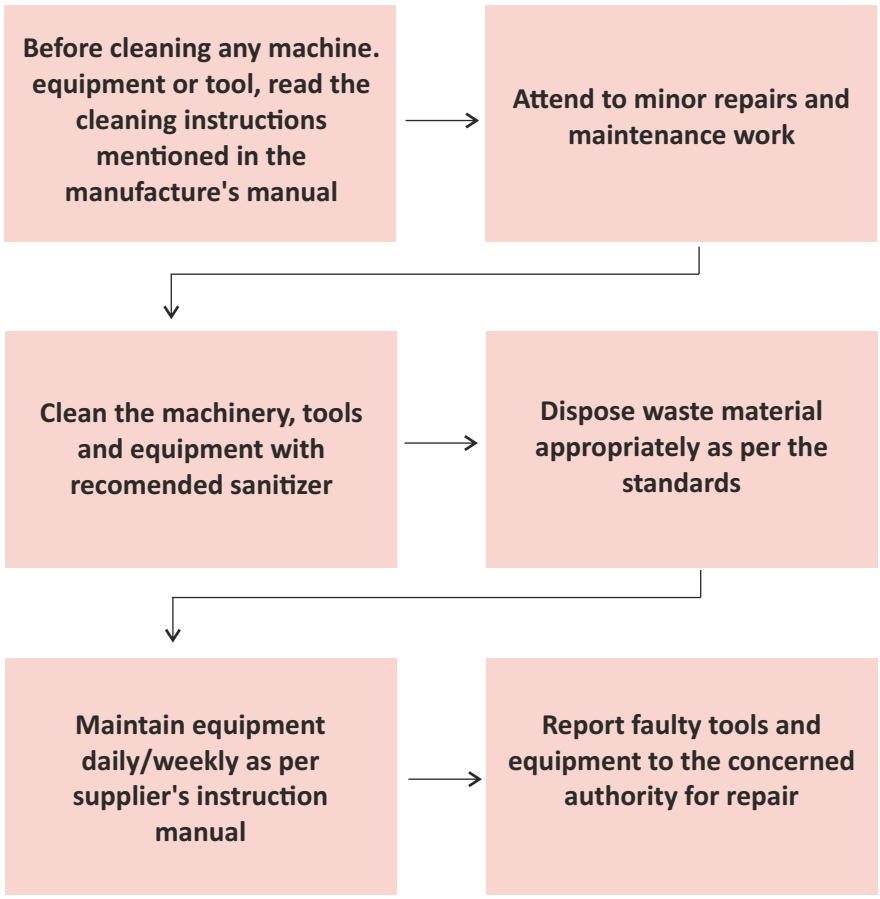

Fig.2.18 Cleaning Process for Pickle and Paste-making Machinery and Equipment

It is important to report faulty tools and equipment to the concerned authority, as it minimizes the possible risks and hazards related to equipment and prevents major failures and serious injuries or mishaps. The following figure explains the significance of reporting to the concerned authority:

Fig.2.19 Importance of Reporting Faulty Tools and Equipment

2.2.2 Maintenance and Check

In food manufacturing, maintenance supports various key objectives, many of which are unique to food production. Maintenance plays the following roles in food manufacturing:

1. It keeps the production running smoothly.
2. It helps to prevent any contamination and ensure food safety.
3. It reduces product losses.
4. It maintains regulatory compliance.

An effective maintenance routine ensures that operations are continued, repair costs are minimized, and downtime is reduced.

Following are the types of maintenance that are carried out in a food processing unit:

1. **Reactive Maintenance** is a method where machines run until they fail. It's a hands-off approach, and the significant benefit is that it keeps routine maintenance costs low.
2. **Predictive Maintenance** uses advanced technology such as infrared and ultrasound equipment during the routine inspection of machines. This process can stop unpredicted breakdowns, and using advanced technology and the industrial unit can reduce the amount of time needed to inspect equipment piece by piece. This type of maintenance is expensive, but this method accurately stays a step in front of faults.
3. **Proactive Maintenance** is a systemic issue-focused maintenance program. Rather than examining equipment, this approach considers how to control the problems that lead to machine wear and tear instead of the deterioration itself.

4. **Preventative Maintenance** is the checking of machines and equipment on a planned, regular basis. The purpose is to prevent costly downtime and minimize the probability of faults. It requires more planning and effort than other techniques. However, it has long and short-term benefits in cost-reduction and efficiency of machine performance. Preventative checks are done before a machine breakdowns and while it is still in running condition. Generally, the strategy leads to good food hygiene and prevents foreign materials from entering food produce.

It is essential to have a schedule for preventative maintenance of each piece of machinery and equipment used in the production. This consists of:

- Time schedule stating when and how frequently maintenance should be done
- Maintenance activities list for each item

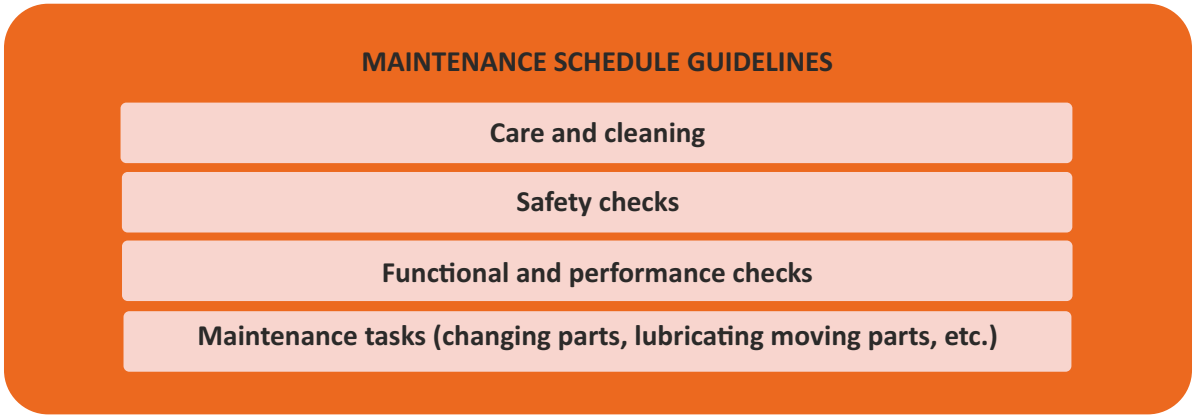

Fig.2.20 Maintenance Schedule Guidelines

Checklist for Planning Maintenance

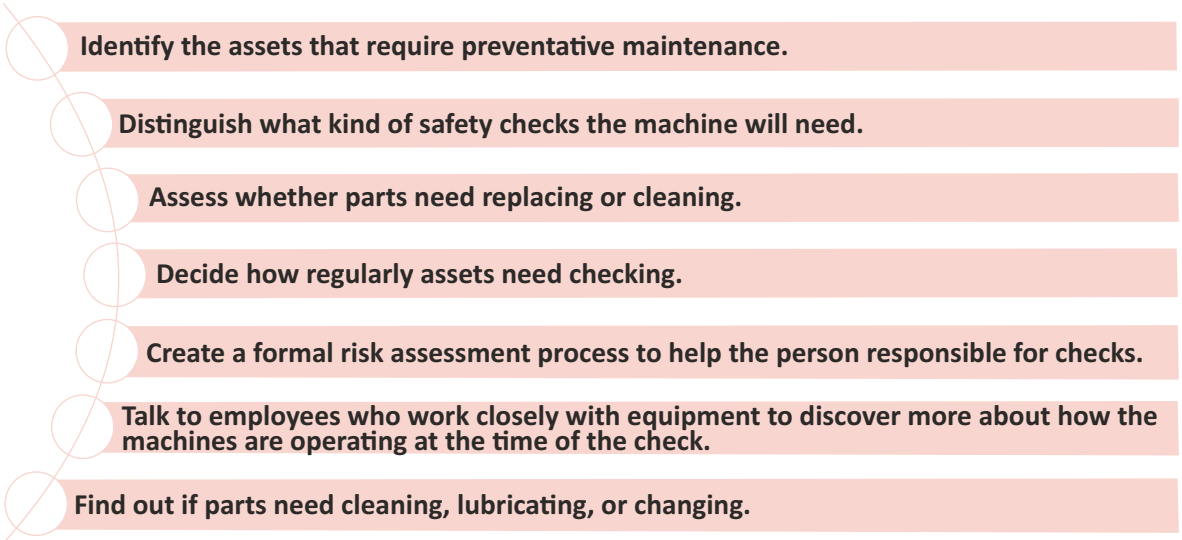

Fig.2.21 Maintenance Checklist

After completing any maintenance, the technician must keep a log for maintenance. This log entry should include a description of the work carried out, who carried it out, and the date and time it happened.

Document Maintenance Procedures. Every piece of equipment and machinery should have detailed descriptions, drawings, and photographs of how and when each machinery should be maintained or serviced. It includes:

- Maintenance procedures
- Lubrication procedures
- Tool reconciliation procedures
- Procedures for temporary repairs
- Procedures for emergency repairs
- Spare parts inventory program
- Training procedures
- Handover procedures
- Audit Procedures

Note:-

An **annual maintenance contract(AMC)** is an agreement between an organization and a service provider that specifies the ongoing maintenance of machinery or property purchased from the provider. Therefore, ensure periodic maintenance by AMC(Annual Maintenance Contract) personal.

2.2.3 Inspection Methods for Tools, Equipment, and Machinery

Regular inspections ensure the safety of your workers. The inspection occurrence should be determined through risk assessment and calculation, taking justification of the manufacturer's recommendations, industry advice, and your own experience. Machinery and equipment that is exposed to conditions causing deterioration, could result in a dangerous situation should be inspected at suitable intervals, and after every event, liable to jeopardize its safety.

Following are the inspection methods for tools, machinery, and equipment:

1. **Start-up Inspection:** An excellent countermeasure to avoid start-up risk is thorough and continuous inspection along with condition monitoring. Respect all potential areas of danger. Examine as many of these hazards as possible until operational stability is reinstated. These include:

- Temperature (all critical zones, components, and surfaces)
- Vibration
- Balance and alignment
- Gauge readings (based on temperature, pressure, vacuum, flow, speed, proximity, etc.)
- Differential filter pressure
- Magnetic plug collections
- Oil level, color, and clearness at all sight glasses
- Leak zones

2. **Stop Inspection:** Stop inspections allow accessing the hard-to-reach machine conditions and frictional surfaces. Also, avoid all unnecessary invasions that can introduce a root cause for failure.
3. **Repair inspection:** Repair inspections present a valuable opportunity that too often goes untapped. It is to assess what failed, why it failed and what can be observed while performing the inspection.

Checklist for inspection

- **Inspect tools for any damage prior to each use.**
- **Inspect cords, plugs and switches for defects**
- **If a tool is defective, remove it from service, and tag it clearly "Out of service for repair".**
- **Replace damaged equipment immediately – do not use defective tools "temporarily".**
- **Have tools repaired by a qualified person – do not attempt field repairs.**
- **Inspect the machinery after installation and before first use, and after reassembly at any new site / location**

Fig.2.22 Inspection Checklists

Equipment inspection can be carried out by someone who has adequate knowledge and experience of it to enable them to know:

- **What to look at**
- **What to look for**
- **What action to be taken incase of a problem**

The inspection is varied according to the necessary level of equipment's competence and its types, and how / where it is used. The nature of these inspections does not have to be determined by the same individual who commences them, provided that person is competent. This can often be done in-house by an experienced team, taking into account of:

- **The manufacturer's recommendations**
- **Industry advice**
- **Experienced Staff who has sufficient knowledge of machine operations**

2.2.4 Waste Disposal

Waste generation is often a natural consequence of food processing plants. As environmental regulations become increasingly severe, appropriate management of food wastes has become a vital part of present food processing management. The amount of waste generation and the manageability of waste generated by a process have become benchmarks for assessing the applicability of the process.

The most common wastes generated in pickle and paste industries are vegetable peel, wastewater, soil, etc. Various types of food waste are generated in many steps of the production process, packaging, and distribution.

1. Solid Waste - Plastic, Paper, Metals, Glass, etc.
2. Liquid Waste - Waste water, Organic liquids, Rainwater, etc.
3. Organic Waste - Food shells and residue, Spoil food products, etc.
4. Hazardous Waste - Chemical and toxic solutions, Filter oil, Flammable products

That is where the concept of waste minimization becomes a must for every employee to understand. There are several ways to explain waste minimization. In its broadest sense, waste minimization all practices including waste prevention, reuse, and recycling that reduce the amount of waste entering the environment.

Utilization of Resources	**Reuse/Recycle of the Waste Material**	**Quality Control improvemnt and Process Monitoring**	**Exchanging waste**	**Supply chain**

Fig.2.23 Waste Minimization

Waste Segregation

In general, waste is segregated as dry and wet waste. Dry waste includes wood, paper, plastic, glass, etc., related products that can be recycled, and wet waste refers to organic and biodegradable waste. The waste can be segregated using color-coded dustbins.

1. Green Bin

The green-colored bin is used to dump biodegradable waste. In addition, this bin is used to dispose of wet/organic material, including cooked food/leftover food, vegetable/fruit peels, eggshell, rotten eggs, chicken/fish bones, tea bags/coffee grinds, coconut shells, and garden waste, including fallen leaves/twigs or the puja flowers/garlands.

2. Blue bin

The blue-colored bin is used for segregating dry or recyclable left over. This category includes waste like plastic covers, bottles, boxes, cups, toffee wrappers, soap or chocolate wrappers, and paper waste, including magazines, newspapers, tetra packs, cardboard cartons, pizza boxes, or paper cups/plates, metallic items like tins/cans, foil paper, and containers.

Fig 2.24 Dry &Wet Waste Bins

The most commonly used methods of waste disposal are:

Landfill

Incineration

Waste Compaction

Biogas Generation

Composting

Vermicomposting

Fig 2.25 Waste Disposal Methods

Summary

- The Production supervisors play a significant role in the pickle and paste manufacturing process, where the overall aim is to maintain and improve the production processes of an organization through managing teams and other resources.
- Supervisors' work instructions are vital for pickle and paste making production or manufacturing process as it provides instruction and guidance for work tasks in day-to-day operations, non-standard tasks, and emergencies.
- Production is that activity whereby resources, flowing within a defined system, are combined and transformed in a controlled manner to add value, following the policies communicated by management.
- The production planning for pickle and paste making consists of various plans related to routing, selection of vendors, selection of desired vegetables and fruits for pickle and paste preparation, availability of other raw materials that are required in producing pickle and paste like desired oil, spices filling the inventory with desired packaging material, inspection of production line for any maintenance etc.
- The Production Plan for pickle and paste making begins with collecting data on any current or proposed food processing and storage operation. It consists of various charts, manuals, production

budgets, etc., based on information received from management.

- Work allocation needs to be done fairly to operate the team based on equality.
- Resource management is the process of pre-planning, scheduling, and allocating resources to maximize optimization and efficiency. It determines which resources are needed, in what quantities, and when to complete the production.
- The resource plan is prepared according to the product's delivery timelines and helps keep the production on track.
- There are two subdivisions of raw materials: direct and indirect materials.
- Beginning inventory value is obtained from the previous accounting period balance sheet as the closing inventory whereas closing inventory value is the inventory on hand at the close of an accounting period. The value is revealed on the balance sheet.
- To calculate manpower requirements for pickle and paste production, divide the value of goods and services produced by the total hours worked by employees over a specified period. Here are the steps to estimate manpower for production.
- The capacity utilization percentage provides an insight into a food processing industry's operational efficiency and can vary based on consumer and market demand.
- Pickle and paste-making industries need to be kept spotlessly clean to ensure compliance with standard regulations and prevent contamination.
- Cleaning and sanitizing (disinfecting) are usually two separate processes.
- Detergents are chemicals that eliminate dirt and grease. However, it does not kill bacteria and other microorganisms.
- For cleaning purposes, the pickle and paste making work area are divided into two categories: food contact surfaces and non-food contact surfaces.
- Cleaning equipment is divided in to two sub-categories: manual and automatic cleaning equipment.
- It is important to select the right kind of cleaning agent or sanitizer based on the variation of soils, water hardness, the temperature of the method, plant surfaces, machinery, equipment, and tools.
- It is important to report faulty tools and equipment to the concerned authority, as it minimizes the possible risks and hazards related to equipment and prevents major failures and serious injuries or mishaps.
- An effective maintenance routine ensures that operations are continued, repair costs are minimized, and downtime is reduced.
- It is essential to have a schedule for preventative maintenance of each piece of machinery and equipment used in the production.
- After completing any maintenance, the technician must keep a log for maintenance. This log entry should include a description of the work carried out, who carried it out, and the date and time it happened.
- Regular inspections ensure the safety of your workers. The inspection occurrence should be determined through risk assessment and calculation, taking justification of the manufacturer's recommendations, industry advice, and your own experience.
- In general, waste is segregated as dry and wet waste. Dry waste includes wood, paper, plastic, glass, etc., related products that can be recycled, and wet waste refers to organic and biodegradable waste. The waste can be segregated using color-coded dustbins such as green bin for bio-degradable waste and blue bin for segregating dry or recyclable left over.
- The most commonly used methods of waste disposal are landfill, incineration, waste compaction, biogas generation, composting and vermicomposting.

Exercise

Answer the following questions:

1. Why is it important to follow the supervisor's work instructions during production?

_____
_____
_____
_____

2. Write a note on

   A. Estimation of raw material

_____
_____

   B. Capacity utilization

_____
_____

   C. Allocation of Work

_____
_____

   D. Prioritization of Workload

_____
_____

3. What is resource planning?

_____
_____
_____

4. Explain cleaning and sanitization process of the work area.

_____
_____
_____

5. What is waste disposal?

_____
_____
_____

6. Explain planning and allocation of work.

_____
_____
_____

7. List down any two methods for inspecting equipment, machinery, and tools.

_____

_____

_____

3. Carry out Production of Various Types of Pickles and Pastes

Unit 3.1 - Standard procedure for rinsing and drying the fruits and vegetables
Unit 3.2 - Mechanism of peeling and slicing fruits and vegetables
Unit 3.3 - Identify spoilage in fruits and vegetables
Unit 3.4 - Method of preparing pickle, paste, and murabba using essential machine
Unit 3.5 - Packaging and post-production activities

Key Learning Outcomes

At the end of this module, the trainee will be able to:

1. Discuss the process for preparing different types of pickles, pastes, and murabba from fruits and vegetables
2. Demonstrate the standard work practices followed to produce various types of pickles and pastes

Unit 3.1 Rinse And Dry The Fruits And Vegetables

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Recall the procedure of sampling to test the water quality and verifying the water level
2. Discuss the significance of drying line conveyor and sorting line conveyor

3.1.1 Check the Water Quality and Verify Water Level

Potable water is essential in all fruit and vegetable processing, as an ingredient in some products, and for washing the equipment. It is recommended to carry out water testing from a reputed testing laboratory before setting up a food processing facility. Nowadays, RO (reverse Osmosis) plants are installed to meet the water requirement of the food processing industry.

Fig.3.1 Reserve Osmosis System

The quality of water is determined by making measurements or taking samples of water and testing them for acidity (pH, TDS and hardness), color, dissolved oxygen, and turbidity (a measure of the suspended particles in the water). Such tests give a water utility operator a basic, and general interpretation of the conditions of a water source.

Fig.3.2 Water Testing

A pressure transmitter is used to determine the water level in a tank. The pressure at the bottom of a liquid-filled vessel is directly related to the height of the liquid. The transmitter measures this hydrostatic head pressure and provides the result of the liquid level.

Fig.3.3 Pressure Transmitter

3.1.2 Wash, Sort & Dry the Fruits and Vegetables

- **Wash** - Fruit and vegetables are generally washed with water to remove dust, dirt, and adhering surface micro-flora. Different washing methods include soaking or agitating in water, washing with cold or hot water sprays, etc.

Fig.3.4 Pressure Cleaning

1. Mechanical washers comprise stirring or tumbling the products on moving belts or rotating screens while they are absorbed in water or subjected to water sprays.
2. Washing using high-pressure sprays is most satisfactory.
3. Detergents are frequently used in the wash or rinse water.
4. Vegetables may be soaked in a dilute solution of potassium permanganate or chlorine (25-50 ppm) for disinfection.
5. The water temperature should be kept low to keep the fruit firm and to reduce leaching losses.
6. High-pressure sprays should not injure the fruits.


Fig.3.5 Washing Fruits & Vegetables

- **Sort -** Sorting, and grading ensure the removal of an inferior or damaged commodity. For sorting, an inspection belt can be used, in addition to trained staff who detect poor quality produce unsuitable for pickle-making. Automatic colour sorters can be used for sorting to reduce labour costs. After the preliminary sorting process, the fruit and vegetables are graded to get consistent quality for size, color, etc. Grading process can be performed either manually or with the help of grading machines. For machine-driven grading, the fruit and vegetables are passed over screens with holes of different diameters.


Fig.3.6 Sorting Fruits & Vegetables

- **Dry -** Drying refers to the removal of a small amount of moisture from a solid or nearly solid material by evaporation to a predetermined level. Drying involves heat and mass transfer operations—and complete removal of moisture content to bone dry condition.

3.1.3 Drying Line and Sorting Line Conveyor

Drying line Conveyors - Drying line conveyors are used for drying fruits and vegetables. In its simplest form, fruits and vegetables are placed on a conveyor that passes through a series of hot air zones. The conveyor is designed to let the air be blown upward or downward through the conveyor and product. Multiple passes through different conveyor/band driers are standard, and the product may be piled into deeper beds as the moisture content drops.

Fig.3.7 Drying line conveyor for fruits and vegetables

- **Impact of drying line conveyor in the food processing industry**

Fast drying speed and high evaporation	**Suitable for drying for fruits and vegetables in bulk**	**Eliminate or minimize manual labour**
Reduce the risk of accidents	**Increase efficiency and productivity**	**Ensure food safety and maintain quality standards**
Fully automatic and adjustable functions to control the water content and temperature according to the requirement.	**Continuous operation and easy to clean**	**Removal of fine contaminants**

Fig.3.8 Impact of Drying Line Conveyor

Sorting Line Conveyor- Sorting Line Conveyor is used to separate fruits and vegetables from the in-feed conveyor line. The sorting of products based on weight, shape, line capacity, and more is easily achieved and can significantly increase the output.

Fig.3.9 Sorting line conveyor for fruits and vegetables

- **Impact of sorting line conveyor in the food processing industry**

Less walking and double-handling of orders	**Overall reduced labor costs**	**Optimized picking strategy**	**Improved order accuracy**
Faster order processing	**Increased order volumes without adding proportional**	**Fewer accidents**	**Less broken or**
More efficient use of floor space	**Possibility of reclaiming unused vertical space (depending on model)**	**Higher productivity**	**Lower production costs.**

Fig.3.10 Impact of Sorting Line Conveyor

The simple chart below depicts the process of washing and sorting fruits/vegetables in the drying line and sorting line conveyor.

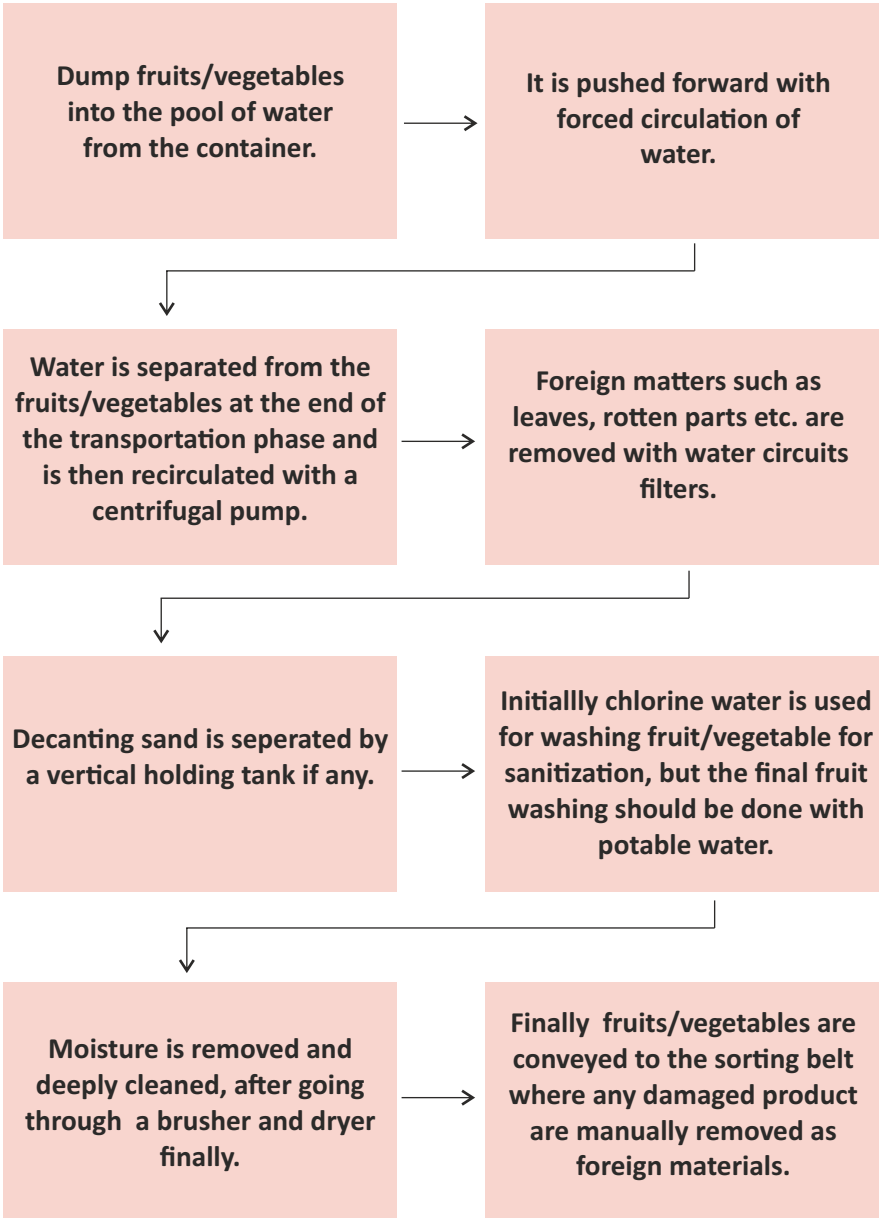

Fig.3.11 Process of drying and sorting line conveyor

Unit 3.2 Mechanism of Peeling And Slicing Fruits and Vegetables

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Explain the mechanism of peeling and slicing fruits and vegetables
2. Describe the operation of a peeling machine

3.2.1 Peel and Slice Fruits and Vegetables

- **Peeling** – Peeling is the primary unit of operations for preparing fruit and vegetables for the pickle-making process. Depending upon the type of commodity, peeling and coring methods are selected, such as:

1. by hand or knife
2. by machine
3. by heat treatment
4. by using lye solution. Cores and pits in fruits like apple, mango, peach, apricot, etc. are removed by hand or machine (de-corer).

Knife Peeling

Mechanical Peeling

Steam Peeling

Lye Peeling

Coring

Slicing

Fig.3.12 Peeling, Coring and Slicing Fruits and Vegetables

- **Slicing** - After peeling, the fruits/vegetables are halved or cored manually or with the help of machines. However, peeled fruit should always be submerged in either water, containing 1-2 % salt solution or acid to avoid enzymatic browning.

Notes

3.2.2 Operation of Peeling Machine

- A peeling machine is used for peeling various kinds of ball-shaped fruits and vegetables for pickle and paste making. It is equipped with rotating soft and hard brushes which thoroughly clean and peel the fruits and vegetables.
- **Operation -** Peeling machine works on the principle of conversion of electrical energy from the electrical motor into mechanical energy in terms of the rotating shaft. A 2 HP motor is used to rotate the shaft at 900 rpm, around which approximately 70 rubber pads are fixed. These machines are high in performance and can be modified as per the requirements. Furthermore, it is very easy to clean and maintain.

Fig.3.13 Peeling Machine

The following flow-chart shows process of the peeling machine:

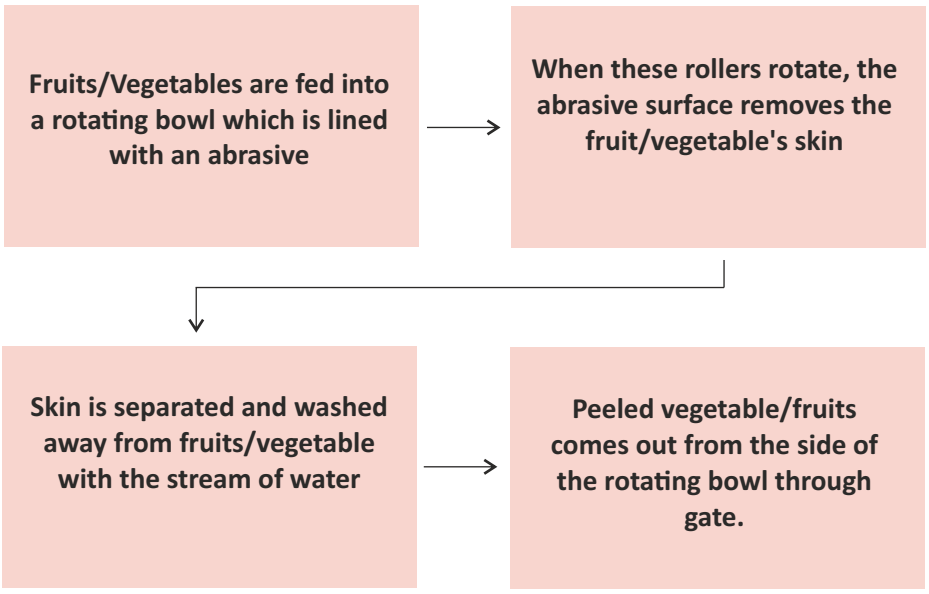

Fig. 3.14 Process of Peeling Machine

Unit 3.3 Identify Spoilage in Fruits and Vegetables

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Explain how to inspect the vegetables and fruits to identify spoilage

3.3.1 Identify Spoilage in Fruits and Vegetables

Fruits and vegetables being a part of fresh produce, contain high moisture which makes them highly perishable foods and hence more prone to spoilage. Microorganisms gain entry into fruits/vegetables from various sources. These sources include:

- Soil
- Water
- Diseased plant
- Harvesting and processing equipment
- Food Handlers
- Packaging and packing material
- Contact with spoiled vegetables

Because of the spoilage, it becomes harmful and unsuitable for human consumption.

Fig. 3.15 Spoiled Fruits and Vegetables

3.3.2 Types of Spoilage in Fruits/Vegetables

Fruit and vegetable spoilage is predominantly of the following types:

Types of Spoilage	Description
Microbial Spoilage	
Spoilage due to pathogens	Infect stem, leaves, roots, flowers, and other parts of the fruit/vegetables themselves.
Spoilage due to saprophytes	Organisms under certain conditions grow on these fruits/vegetables and spoil them
Bacterial Soft Rot	Breaks down pectin, giving rise to a soft, mushy consistency, sometimes a bad odour and water-soaked appearance.
Fungal spoilage	Caused by *Botrytis cinera* in vegetables. Favoured by high humidity and warm temperature
Chemical Spoilage	Caused by Pesticide residue, detergents, etc.
Physical Spoilage	Damage to Fruits and Vegetables from Mechanical Parts of the Machines etc.

Table 3.1 Types of Spoilage

3.3.3 Process of Fruit/Vegetable Spoilage

The following process chart shows how fruits and vegetable spoilage take place:

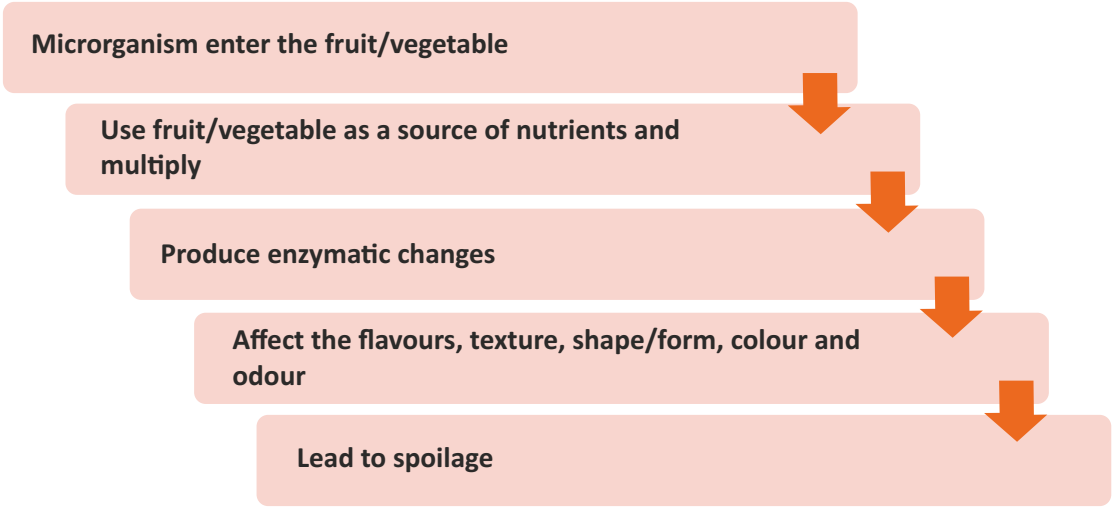

Fig. 3.16 Process of Spoilage

3.3.4 Criteria to Check Fruits/Vegetable Spoilage

The following chart shows the parameters to check the spoilage in fruits and vegetables:

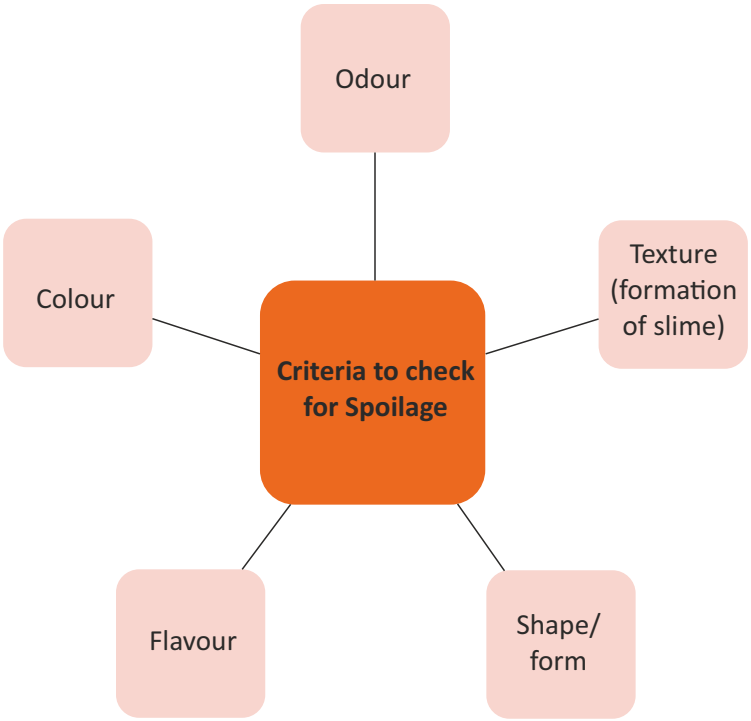

Fig. 3.17 Parameters to check Spoilage

Notes

Unit 3.4 Prepare Pickle, Paste, And Murabba Using Essential Machines

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Elucidate the need for brine solution and fermentation process
2. State the importance and use of vinegar, brine, and oil solution for pickle making
3. Demonstrate the process of preparing pickle, murabba, and paste using necessary machines

3.4.1 Process of Pickle Making

Pickling is the process of preserving fruit and vegetables in salt and vinegar. Pickles may be prepared in two ways; without fermentation or with partial or complete fermentation. Spices, edible oil, sugar/jaggery, etc. are also added to improve the taste and palatability of the product. Pickles are a good appetizer and help in digestion by stimulating the flow of gastric juices.

The manufacturing of pickles has developed as an industry in the country. Mango pickle, cauliflower, turnip, carrot (mixed vegetable), amla, lime/lemon pickle, etc., are the commercial products available in the market.

Pickling is the process of fermentation by lactic acid-forming bacteria, present on the surface of commodities. Lactic acid bacteria (active at 30 degrees Celsius) convert fermentable sugar in the food to lactic acid and volatile acids. The acid and brine act upon vegetable tissues to produce a distinctive taste and aroma of a pickle. The salt and lactic acid are formed to preserve the pickle by preventing the growth of putrefactive bacteria, provided oxygen is excluded. Common examples of fermented pickles are cucumber and olive pickles.

The following process is needed for the preparation of pickle making.

1. **Curing or Fermentation with Dry Salting –** The dry salt is added to the prepared vegetables, extracts the juice from the vegetables, and forms the brine. The brine is subsequently fermented by bacteria that produce lactic acid, which serves the purpose of pickling. This method is called dry salting.
2. **Fermentation in a brine solution -** The vegetable or unripe fruits like mangoes are immersed in salt-solution of known concentration for a certain length of time is called brining. Brining is generally used for pickling cucumber, olives, raw mangoes, and similar other vegetables, which do not contain sufficient juice to form brine with dry salt. Preparation of brine is done by dissolving common salt in water and filtering through a muslin cloth. The amount of brine required to cover the vegetable is approximately equal to about half the volume of the material to be fermented. Example: - For each barrel of 100 liters, about 50 liters of brine is required. Brining might take up to 4-5 weeks.
3. **Salting without fermentation -** In this method, vegetables/fruits like raw mango slices are packed with a large quantity of salt to inhibit fermentation. Generally, 25 kg salt is mixed with 100 kg of prepared vegetable/fruit The excess salt is removed from the cured vegetables by soaking them in cold or warm water. After the removal of salt, the vegetables are stored in plain vinegar with 10% (100 grain) strength. This treatment lowers the tendency of the vegetable to shrivel when packed in sweetened and spiced vinegar and also aids in the absorption of vinegar by the vegetable tissues.

Notes

3.4.2 Raw Material used in Pickling

Salt	Free from impurities and salts such as lime, iron, magnesium, and carbonates.
Vinegar	Good quality should contain at least 4% acetic acid. Synthetic vinegar or low-quality vinegar is not suitable for pickle preparations. Usually, malt or cider vinegar is used. To ensure good keeping quality pickle, the final concentration of acetic acid in the pickle should not be less than 2%. Acetic acid is also used because it is highly concentrated.
Sugar	It is used in the preparation of sweet pickles and should be of high quality.
Spices	These are added practically to all pickles. The quantity depends upon the kind of fruit or vegetable taken and the kind of flavour desired. The spices generally used are bay leaves, cardamom, chilies, cinnamon, cloves, coriander, dill herb, ginger, mace, mustard, black pepper, cumin, turmeric, garlic, mint fenugreek, asafoetida, etc.
Water	Only potable water should be used for the preparation of brine. Hard water contains salts of Ca, Na, Mg, etc., which interfere with the standard salt curing of the vegetable. If hard water is to be used, a small quantity of vinegar should also be added to the brine to neutralize its alkalinity. Iron should not be present in the water in any appreciable amount as it causes the blackening of the pickle.
Cooking utensils	Metallic vessels should be non-corrodible. A vessel made of iron or copper is not suitable. Glass-lined vessels and stainless steel vessels are preferred. The ladles, spoons, and measuring vessels should also be made on non-corrodible materials. At present pickles are prepared with salt, vinegar, oil or with a mixture of salt, oil, spices, and vinegar.

Table 3.2 Raw materials used in pickling

3.4.3 Types and Methods of Pickle Making

1. **Preservation with salt:** Salt improves the taste and flavour, hardens vegetables' tissues, and controls fermentation. Vegetables do not ferment when packed with a large quantity of salt, bringing their final concentration in the material from 15-20%. Mould and even lactic acid-producing bacteria cannot thrive at this high salt concentration. This preservation method applies only to vegetables that contain very little sugar because sufficient lactic acid cannot be formed by fermentation to act as a preservative. Some fruits, such as lime, mango, etc., are also preserved using salt for pickle making.

The following flow chart shows the process of preparing lime pickles with the preservation of salt.

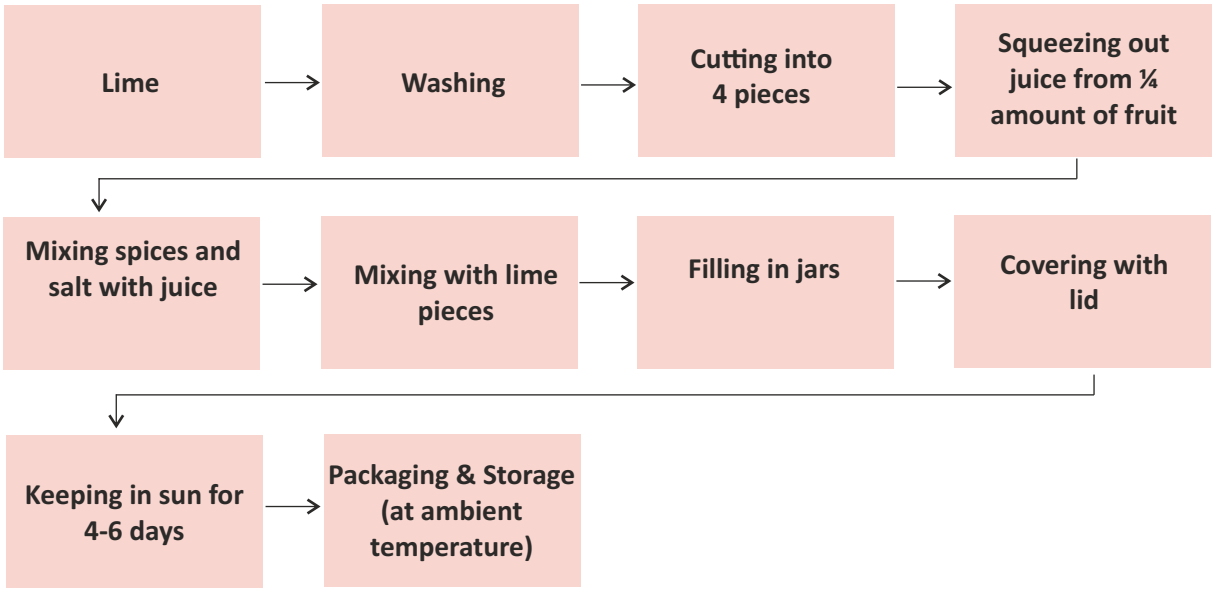

Fig. 3.18 Preparation of lime pickle

2. **Preservation with vinegar:** In vinegar pickles, vinegar acts as a preservative. The final acid concentration should be no less than 2% in the finished pickle. To prevent vinegar dilution below this strength by the H2O liberated from the tissues, the vegetables or fruits are usually placed in strong vinegar of around 10% acidity for several days before the final packing. This treatment aids in the removal of gases trapped in the intercellular spaces of vegetable tissues. Papaya, pears, onion, garlic, chili, mango, and cucumber pickles are prepared using the vinegar preservation method.

The following flow chart shows the process of preparing cucumber pickles with the preservation of vinegar.

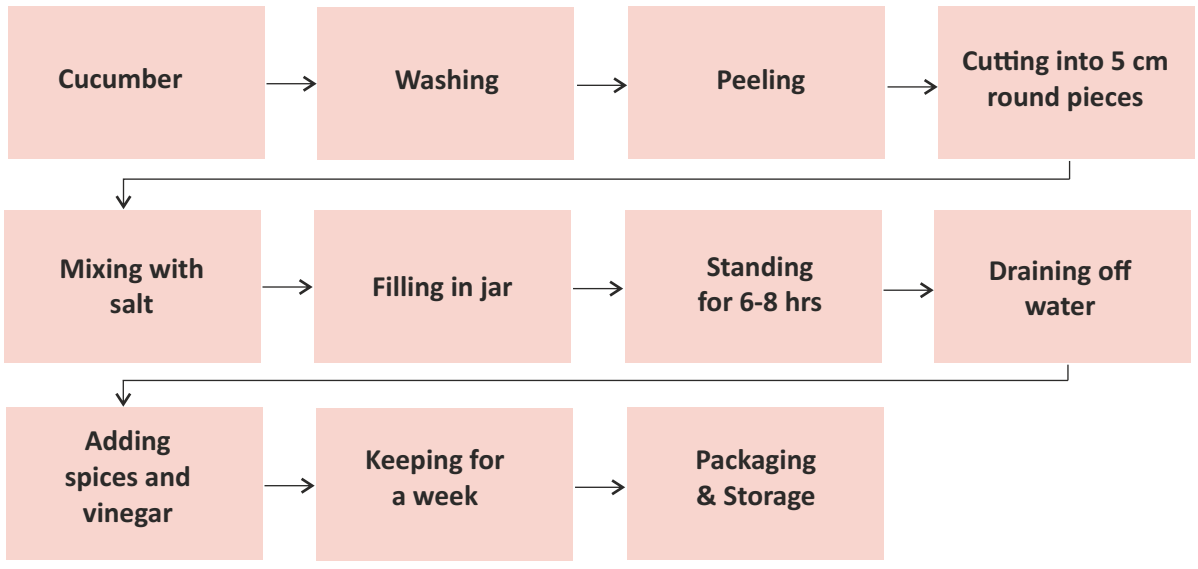

Fig. 3.19 Preparation of cucumber pickle

3. **Preservation with oil:** In oil-based pickles, oil acts as a barrier for air and creates an anaerobic condition that is utilized by the native bacteria for the production of lactic acid. Oil also prevents the growth of spoilage yeasts and moulds. Generally, mustard oil is used. It helps the seasonings adhere better to the fruits and vegetables. The fruit or vegetable should be wholly immersed in the edible oil. Cauliflower, lime, mango, amla, karonda, bitter gourd, brinjal, turnip pickles are prepared from this method.

The process of preparing chilli pickle with the preservation of oil is shown below:

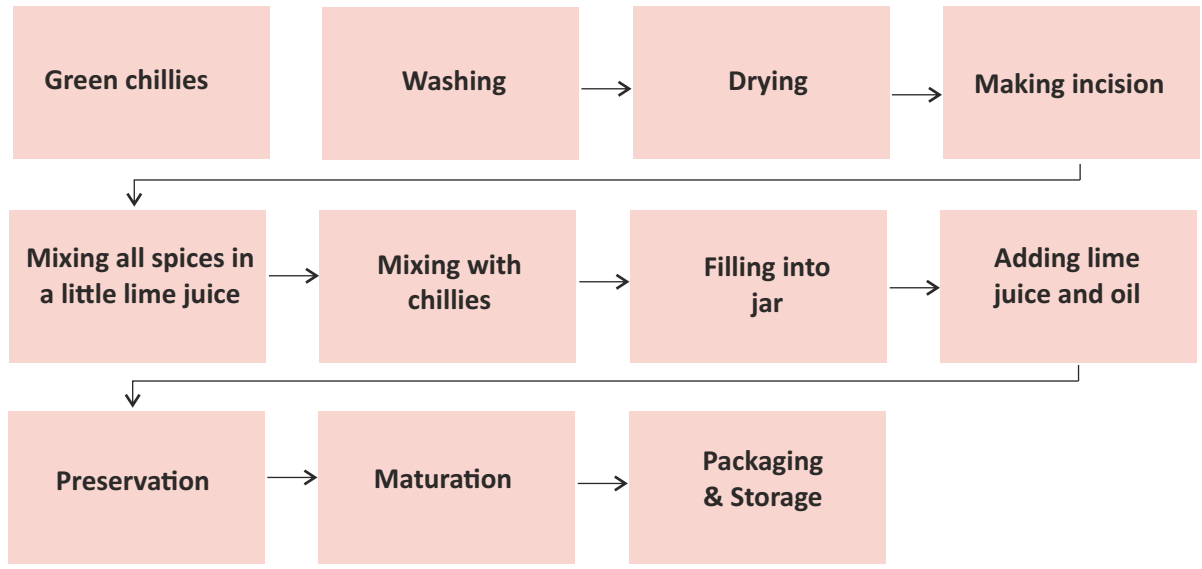

Fig. 3.20 Preparation of chili pickle

3. **Preparation with a mixture of salt, oil, spices, and vinegar:** E.g., Cauliflower, carrot, jackfruit, mixed vegetable pickle, etc.
   The process of preparing tomato pickle with the mixture of salt, oil, spices, and vinegar is shown below:

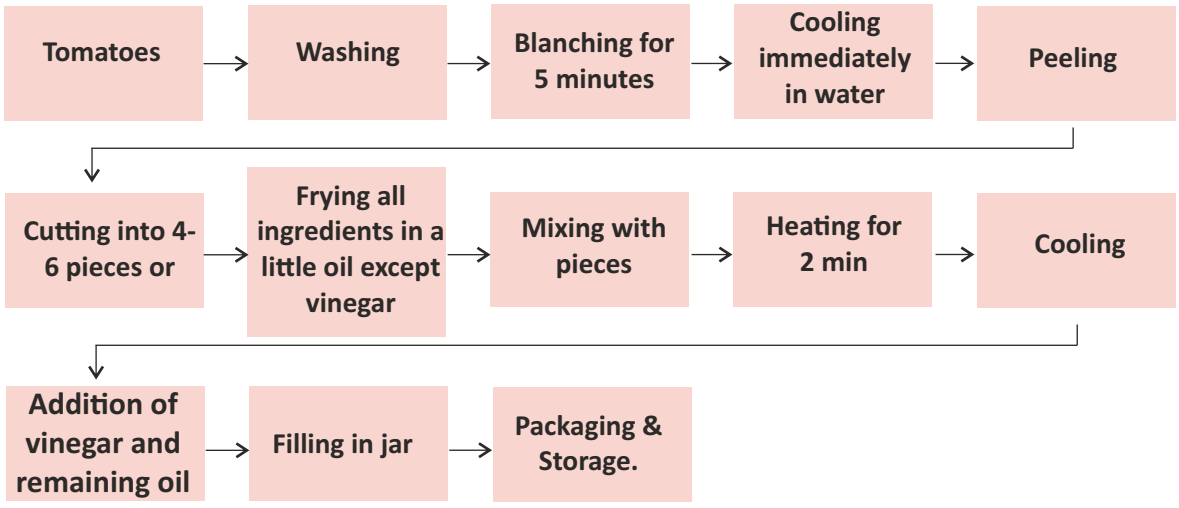

Fig. 3.21 Preparation of tomato pickle

Please note: Blanching is a food preparation method in which food is briefly immersed in hot liquid, for e.g. boiling water, often but not always as a prelude to cooking it further. Fruits, vegetables, are frequently blanched for pickle and paste making. Sometimes it is used for softening, or to loosening of the skin to make peeling it easier, or simply to brighten its color of it.

Fig. 3.22 Blanching

3.4.4 Preparation of Murabba and Pastes

- Murabba - In India, preserves or murabba of various kinds are used for taste as well as for medicinal purposes. It is acclaimed to impart energy to the heart, brain, and liver. It is also reported that it stops diarrhea and is helpful as a remedy for giddiness. The below chart explains the preparation in brief.

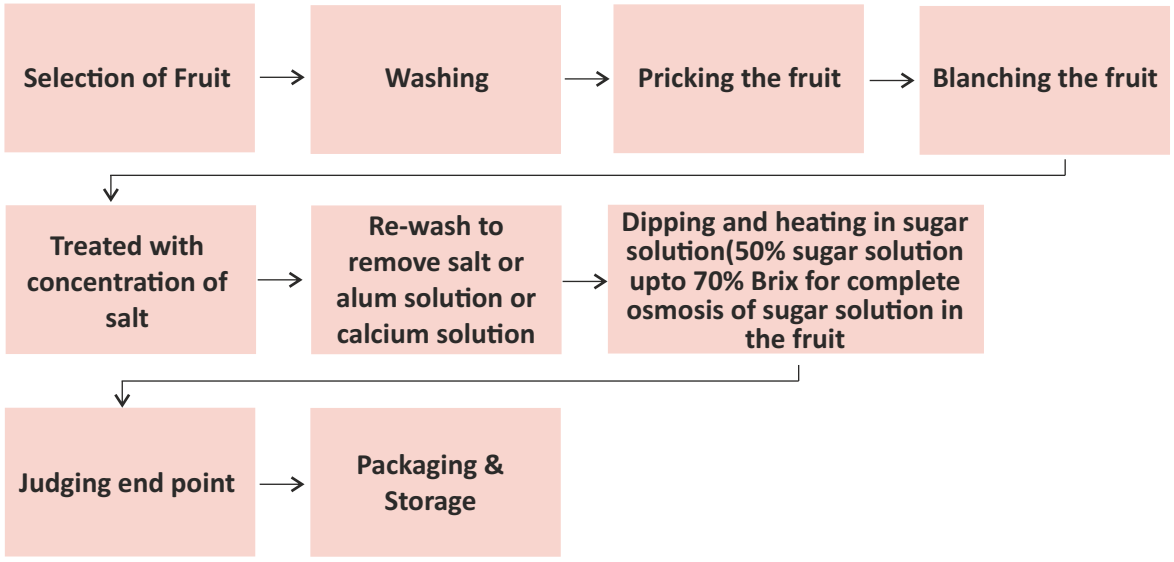

Fig.3.23 Preparation of Amla Murabba

Please note:

Brix is a measure of the number of dissolved solids in a liquid via its specific gravity and is used specially to measure dissolved sugar. One-degree Brix is 1 gram of sucrose in 100 grams of solution. Brix

measurement is commonly used in the food industry for measuring the approximate amount of sugars in fruits, vegetables, juices, wine and soft drinks.
Osmosis refers to the movement of fluid through a membrane in response to different concentrations of solutes on the dual sides of the membrane. Osmosis has been used since ancient times to preserve foods by dehydration with salt or sugar. The elimination of water from the tissue by salt was referred to as imbibition.

Below are a few pictures of Amla Murabba's preparation for a better understanding.

Sorting and grading of Amla

Washing of the Amla fruit with high pressure spray

Final Amla sorting

Tray dryers

Pricking the fruit with punching machine

Blanching the fruit

Preparation of sugar syrup

Dipping the Amla fruits in Sugar syrup

Fig.3.24 Visual Representation of Amla Murabba Preparation

- Pastes- The busier lifestyle has prompted the consumer to use ready-to-cook paste for cooking. Also, with the changing purchase dynamics and the growing need for quality branded products, many food manufacturing companies have forayed into the cooking paste segment.

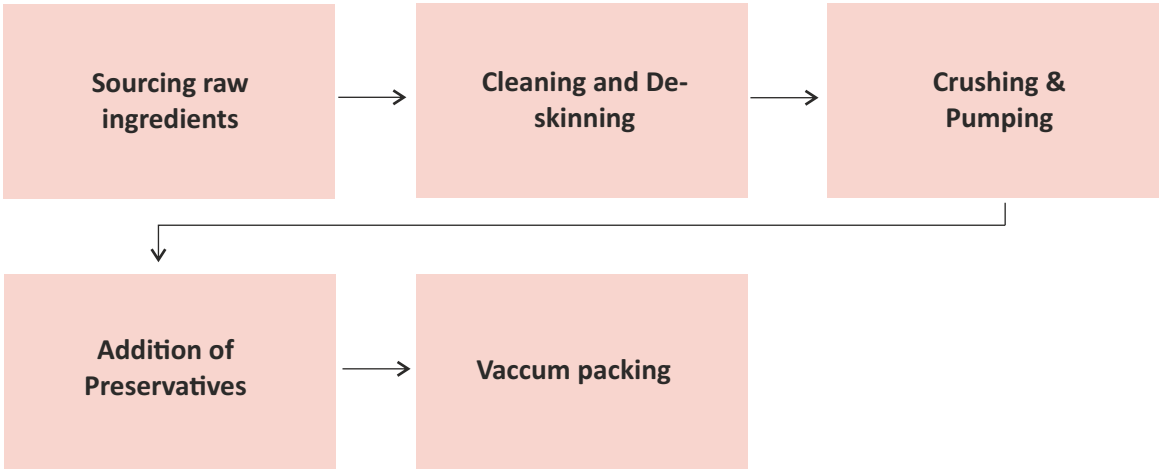

Fig.3.25 Preparation of fruit/vegetable pastes

Please note:

- **Vacuum packing** is a method of packaging in which the air is removed from the product before it gets sealed. This method comprises (manually or automatically) placing items in a plastic film package, extracting air from inside, and sealing the package.

Fig.3.26 Vacuum Packing

3.4.5 Finished Product Analysis

It is an optimum standard maintained continuously as per the company standard norms to produce a quality product and specific guidelines as per the government. If the quality standards are not maintained, then it could lead to fatal consequences. Processed food free from contamination will not cause any harm to the customers.

Every step involved in the process requires monitoring, inclusive of food safety and personal hygiene. For example, in pickles and pastes a quality check is done based on technical specification and organoleptic, which differ from fruit to fruit. Following are the parameters for quality check:

- **PH –** a numeric scale to check acid levels in pickles. Each fruit or vegetable has its own acidity level. The processing company maintains it as per their requirement.

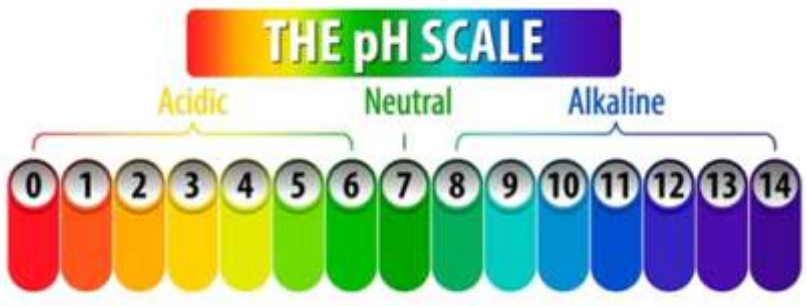

Fig.3.27 pH Scale

- **TSS (Total Soluble Solids) –** It is the extracted mass of fruit, which contains fibers and fruit sugar. Each fruit or vegetable has its own Brix ratio. It is maintained as per company's requirement.
- **Viscosity -** Viscosity is a measure of a fluid's resistance to flow. It is measured by refractometer as per the need.

Fig.3.28 Refractometer

- **Taste/flavour, colour, and texture –** it is checked by tasting the product.
- **Determination of drained weight -** The sample is drained on a standard mesh sieve. The weight of the material remaining on the sieve is expressed as percentage of the total weight of the can.

Fig.3.29 Sieve and Weighing Scale

- **Determination of sodium chloride in brine -** Direct titration of sodium chloride in brine with standard silver nitrate solution is adequate for routine analysis.

Unit 3.5 Packaging And Post-Production Activities

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Explain the packaging and postproduction activities
2. Describe the standard practices to replace defective material and to follow the process of disposing them safely
3. Discuss the impact of various kinds of hazardous material on the production process

3.5.1 Steps for Packaging of the Processed Food

Level of Packaging -The finished product is filled in a container meant for packaging. Depending on the demand, the market and size of the industrial packaging are categorized as follows:

Primary Packaging

- **It is the type of packaging that comes in direct contact with food. E.g. Pouches, bottles, sachets, drums**

Secondary Packaging

- **It is the type of packaging that comes in contact with the primary packing. E.g. Cartons(filled with bottles)**

Tertiary Packaging

- **It is the type of packing that used to protect the secondary packaging. Eg. shipping box**

Fig.3.30 Level of Packaging

- **Selecting Packaging material –** When selecting the packaging material to pack the finished products, one must ensure that the packaging material is:

Non-toxic and compatible with food	Offers sanitary protection	Protect the product from moisture, gas, and odor
Protects the product from light, temperature, humidity, and rain	Protects the product from insects, mites, bacteria, rodents, and birds	Is transparent and tamper-proof
Offers ease of opening, pouring, resealing, and disposing	Is compatible with the size, shape, and appearance standards set by the organization	Is low on cost

Fig.3.31 Tips for Packaging Material Selection

- **Methods of Storing Finished Products –** The pickle processing industry follows the JIT (Just-In-Time) system. Here, the finished product is dispatched to the distributor, retail Industry, or institution as soon as the products are ready. A carton of processed pickles can be stored for a maximum of 2 days in the storehouse. In the case of cured pickles, where the flavors and oils are mixed as and when the demand arises, stock rotation systems Ike FIFO and FEFO are applied.

1. FIFO (First In First Out) is a stock rotation system that dispatches processed food depending on the order in which is produced.
2. FEFO (First Expired-First Out) is a stock rotation system wherein products that need to be consumed earlier are shipped first.

3.5.2 Post Production Cleaning and Maintenance

Cleaning and sanitization are extremely important for every food-handling operation. Every organization in the food processing industry follows a weekly, monthly, or yearly cleaning schedule. There are several common types of cleaners and sanitizing agents to clean the food contact and non-food contact surfaces. The table below lists the typical cleaning agents and their appropriate usage, risks, and safety measures that should be taken while using these agents.

Cleaning agents	Used for	Risk	Safety measures
Hypochlorite like · **potassium hypochlorite,** · **sodium hypochlorite, and** · **calcium hypochlorite**	Cleaning stainless steel food contact surfaces	Leads to corrosion	Ensure pH and concentration levels are maintained
Liquid chlorine	Internal cleaning of stainless steel equipment and vessels	Leads to corrosion	Ensure concentration levels are maintained
Hydrogen peroxide	Killing bacterial spores, pathogens, spoilage organisms, and other microorganisms	Has a strong odor	Use in well-ventilated and open spaces
Ozone	Cleaning food-contact and on-food-contact surfaces like equipment, walls, doors, drains, conveyors, tanks, and other containers; Killing microbes	No risk involved since it leaves no residue	Safe to use

Table 3.3 Different types of cleaning agents, related risk factors, and safety measures

1. **Clean-In-Place (CIP)**
   CIP is a method used for the internal cleaning of machinery. It is done without dismantling pipes, vessels, process equipment, filters, or fittings. In this process, a sanitizing agent is circulated through the whole processing unit with the assistance of a twig ball. The turbulence created removes soil, ensuring the removal of bacteria and chemical residues.

Fig 3.32 Tips for conducting an effective CIP process

2. **Clean-Out-Place (COP)**

   COP is conducted at a cleaning station. This method generally includes the dismantling of the equipment. In this process, equipment and Units are scrubbed with soap in COP tanks. After this, to remove residual detergent or chemicals the tanks are rinsed again. Heat treatment or sanitizing agents are used to sanitize again the reassembled equipment and units.

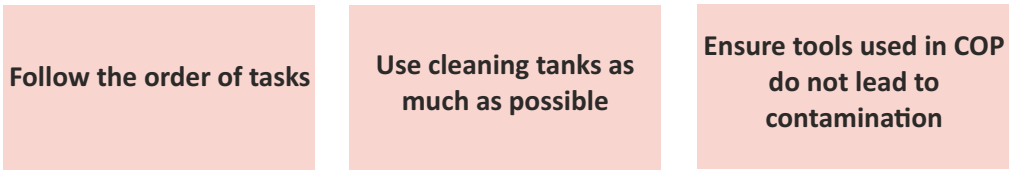

Fig 3.33 Tips for conducting an effective COP process

Fig 3.34 Food processing equipment and Units that undergo the COP process

3. **Sterilizing-In-Place (SIP)**

   SIP is the process through which equipment is sanitized after the CIP process. It helps in eliminating any residual microbiological contamination. SIP is an amalgamation of three processes viz. sterilization, disinfestation, and sanitization.

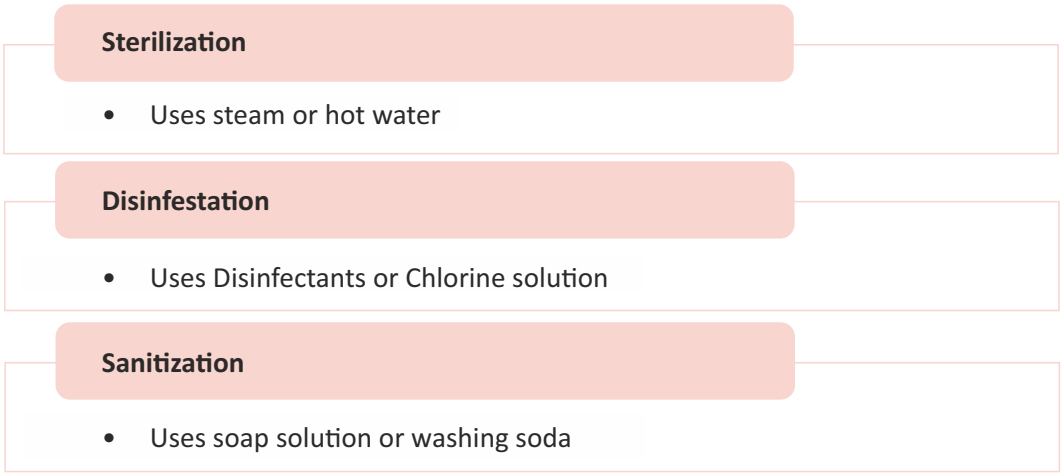

Fig 3.35 Sterilizing-in-place (SIP) process

The following chart explains the process of cleaning after production:

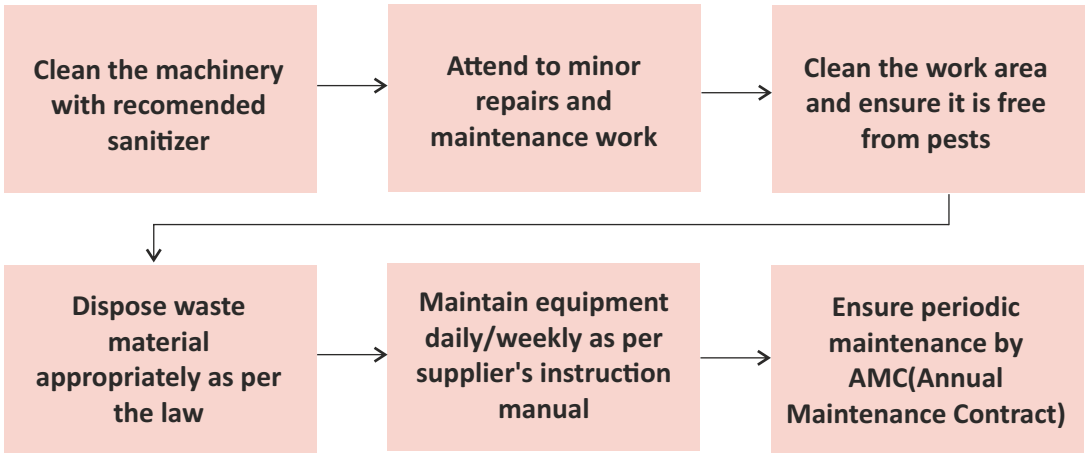

Fig 3.36 Post-Production Cleaning Process

3.5.3 Standard Practices and Procedures of Waste Disposal

Large quantities of both liquid and solid wastes are produced every year by the pickle and paste processing industry. These waste materials contain predominantly biodegradable organic matter and disposal of them creates severe environmental problems. Systems should be placed in such a way that the waste materials are identified, collected, removed, and disposed of in a manner that prevents contamination of products or production areas.

Below are the standard practices of waste disposal safely in the food processing industry.

- Provision shall be made for the segregation, storage, and removal of waste.
- Provide wheel based dustbin of adequate size and with a cover and foot operated opening mechanism in the premises for collection of waste with a mechanism for opening it without having to touch it.
- Have the dustbin emptied and washed daily with disinfectant and dried before next use
- Separate liquid and solid waste at the time of placing them in the bins.
- Accumulation of waste, non-edible by-products, and other refuse shall not be allowed in food- handling or storage areas.
- Labelled products, or printed packaging designated as waste shall be disfigured or destroyed to ensure that trademarks cannot be reused and removal shall be carried out by approved disposal contractors.
- Keep all waste in covered containers, get it removed at regular intervals as per local law.
- Follow the rules and regulations including those for plastic wastes and other non environment friendly materials.
- Ensure that stored waste and inedible material does not contaminate potable water, equipment used for food preparation, or building/premises.
- Ensure there is no pest and rodent access to waste of inedible material.
- Mark waste trolleys and bins with defining symbols or have different colours for biodegradable and non-biodegradable waste/refuse bins.

Fig.3.37 Standard practices for Waste Disposal

Fig.3.38 Colouful Coded Dustbin for Waste Segregation

3.5.4 Impact of Various Kinds of Hazardous Material on Production Process

Hazardous materials are substances or property which may cause a food to become unsafe for human consumption in the absence of its control. These dangerous materials or substances can affect badly the whole manufacturing process.

Following are the impact of various hazardous material on the production process:

Increase Food risk and contamination	**Substandard food quality and defective products**	**Certain hazardous substances also have the potential to explode or cause a fire**
Possible injuries and illness among the workers	**Possible damage of equipment and machinery**	**Low productivity**
Material and resources wastage	**Loss of time, money and goodwill**	**Economic consequences of recall and outbreak**

Fig.3.39 Impact of Hazardous Material in Production Process

Manufacturers of hazardous substances must provide warning labels and safety guidelines with their products. Employers must ensure that the safety guidelines for each hazardous substance used in the workplace are available to employees and warning labels on hazardous substances should feature:

- Hazard Pictograms
- Signal Words (e.g. Danger and Warning)
- Hazard Statements (e.g. Fatal If Swallowed)
- Precautionary Statements (e.g. Wear Protective Gloves).

The Safety guidelines must include important information on handling the product safely, including:

- Potential Health Effects
- Precautions for Use
- Safe Storage Suggestions
- Emergency First Aid Instructions
- Contact Numbers for Further Information.

Summary

- Potable water is essential in all fruit and vegetable processing, as an ingredient in some products, and for washing the equipment and is recommended to carry out water testing from a reputed testing laboratory before setting up a food processing facility.
- The quality of water is determined by making measurements or taking samples of water and testing them for acidity (pH, TDS and hardness), color, dissolved oxygen, and turbidity (a measure of the

suspended particles in the water).

- A pressure transmitter is used to determine the water level in a tank.
- Different washing methods include soaking or agitating in water, washing with cold or hot water sprays, etc.
- Drying refers to the removal of a small amount of moisture from a solid or nearly solid material by evaporation to a predetermined level.
- Sorting, and grading ensure the removal of an inferior or damaged commodity. For sorting, an inspection belt can be used, in addition to trained staff who detect poor quality produce unsuitable for pickle-making.
- Drying line conveyors are used for drying fruits and vegetables where, fruits and vegetables are placed on a conveyor that passes through a series of hot air zones.
- Sorting Line Conveyor is used to separate fruits and vegetables from the in-feed conveyor line. The sorting of products based on weight, shape, line capacity, and more is easily achieved and can significantly increase the output.
- Peeling is the primary unit of operations for preparing fruit and vegetables for the pickle-making process and are done by various method such as by using knife, machine, heat, and steam peeling treatment.
- Ensure that peeled/sliced fruit are always submerged in either water, containing 1-2 % salt solution or acid to avoid enzymatic browning.
- Peeling machine is equipped with rotating soft and hard brushes which thoroughly clean and peel the fruits and vegetables.
- Fruits and vegetables being a part of fresh produce, contain high moisture which makes them highly perishable foods and hence more prone to spoilage.
- Pickling is the process of fermentation by lactic acid-forming bacteria, present on the surface of commodities.
- There are various method of pickle making such as curing or fermentation with dry salting, fermentation in brine solution, salting without fermentation.
- The various raw materials used in pickling includes vinegar, sugar, spices and salt etc.
- Blanching is a food preparation method in which food is briefly immersed in hot liquid, for e.g. boiling water, often but not always as a prelude to cooking it further.
- Brix is a measure of the number of dissolved solids in a liquid via its specific gravity and is used specially to measure dissolved sugar.
- Vacuum packing is a method of packaging in which the air is removed from the product before it gets sealed.
- The finished product is filled in a container meant for packaging. Depending on the demand, the market and size of the industrial packaging are categorized into primary, secondary and tertiary packaging.
- The pickle processing industry follows the JIT (Just-In-Time) system. Here, the finished product is dispatched to the distributor, retail Industry, or institution as soon as the products are ready.
- CIP is a method used for the internal cleaning of machinery whereas COP is conducted at a cleaning station.
- SIP is the process through which equipment is sanitized after the CIP process.
- Standard practices for safe disposal must be followed and proper systems should be placed in such a way that the waste materials are identified, collected, removed, and disposed of in a manner that prevents contamination of products or production areas.

- Hazardous and dangerous materials or substances can affect badly the whole manufacturing process.
- Manufacturers of hazardous substances must provide warning labels and safety guidelines with their products.

Exercise

Answer the following questions:

1. How do you check the quality of water?

   _____

   _____

2. Explain the operation of the peeling machine.

   _____

   _____

3. Explain any two types of pickles and their method of preparation.

   _____

   _____

4. What are the criteria for checking spoilage in fruits and vegetables?

   _____

   _____

5. Explain the following terms:

   (1) Sorting line conveyor

   _____

   _____

   (2) Fermentation in a brine solution

   _____

   _____

   (3) Tertiary packaging

   _____

   _____

Practical-1

1. Demonstrate the process of preparing pickle, murabba and paste using necessary machines.

   _____

   _____

2. Demonstrate how to analyse the quality of the finished product as per the standards of the organization.

   _____

   _____

Scan the QR Code to watch the related video

https://youtu.be/C-6kF52qtOA
Machinery in Pickle and Paste Making

https://youtu.be/AIWN5rTf9RI
Pickle making Process

https://youtu.be/-Wrk4zAANpo
Pickle Packaging and Storage

https://youtu.be/FS5MMx4uI6Q
Steps in Murrabba Making

4. Ensuring Food Safety and Personal Hygiene

Unit 4.1 - Introduction to Food Safety

Unit 4.2 - Schedule IV requirements of FSSAI

Unit 4.3 - Personal Hygiene

Unit 4.4 - Health Safety

FIC/N9901

Key Learning Outcomes

At the end of this unit, the trainee will be able to:

1. Identify the hazards, types of hazards (Physical, chemical, biological and Allergenic) and risks at workplace
2. HACCP , TACCP, VACCP , Control measures , CCP, Critical limit
3. Explain the preventions of product contamination
4. Discuss the factors affecting food spoilage and food storage techniques
5. Describe Schedule IV requirements of FSSAI
6. Discuss cleaning and sanitization process, needs and importance and storage of sanitizing materials
7. Discuss health and safety policies and procedures
8. Discuss Employee health do's and don'ts, Food borne illness and preventive health checkups

UNIT 4.1: Introduction To Food Safety

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify types of hazards and risks at workplace

4.1.1 Food Safety

Food safety refers to routines in the preparation, handling and storage of food meant to prevent food borne illness and making food safe for human consumption. Safe food handling practices and procedures are thus implemented at every stage of the food production life cycle in order to curb these risks and prevent harm to consumers.

4.1.2 Food Safety Hazard and Risk

Hazard is a factor or agent which may lead to undesirable effects like illness or injury in the absence of its control, whereas, risk refers to the probability that the effect will occur.

Hazard is that part of food which somehow entered in the food and which is non-consumable.

Types of hazards and risks at work place

There are two types of hazards: one is food safety hazard and second is health safety hazards.

Food Safety Hazard

There are four major hazards that may be introduced into the food supply any time during harvesting, processing, transporting, preparing, storing and serving food. These hazards may be microbiological, chemical, physical and allergens.

Microbiological hazards

When harmful microorganisms are found or grown on food it is called microbiological hazards. Food which contains harmful or pathogenic bacteria when eaten can make people ill.

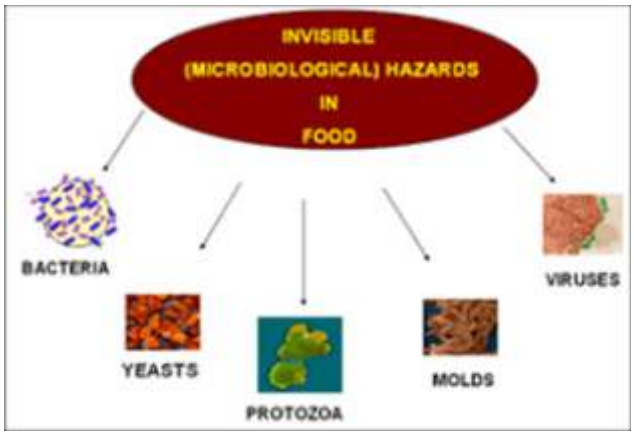

Fig. 4.1: Microbiological Hazards

Food spoilage and deterioration is no accident. It is a naturally occurring process. To understand how to maintain the quality of food and prevent spoilage, we need to know what can cause it.

Food spoilage: The microorganisms that can cause food-borne illness are called pathogenic microorganisms. These microorganisms grow best at room temperatures (25-30°C), but most do not grow well at refrigerator or freezer temperatures. Pathogenic microorganisms may grow in foods without any noticeable change in odor, appearance or taste. Spoilage microorganisms, including some kinds of bacteria, yeasts and molds, can grow well at temperatures as low as 4°C. When spoilage microorganisms are present, the food usually looks and/or smells awful.

Fig. 4.2: Food Spoilage

FAT TOM- This is a term used commonly in food industry to describe the six favorable conditions required for the growth of the food borne pathogens/micro-organisms.

Fig. 4.3: FATTOM Food Safety

Physical Hazards

These include any foreign material, which you would not expect to find in your food. Hair, finger nails, pieces of wood, metal, plastic, glass and insect debris are examples of what can find their way into food as foreign matters.

Fig. 4.4: Physical Hazards

Chemical Hazards

Chemical hazards include, food contact materials, cleaning agents, pest control substances, contaminants (environmental, agricultural and process e.g. acrylamide), pesticides, biocides and food additives. They are naturally occurring, intentionally added or unintentionally added.

- Preservatives
- Colours and dyes
- Flavour enhancers
- Water additives
- Packaging materials
- Processing aids

Allergen

An allergen is any protein that is capable of producing an abnormal immune response in sensitive segments of the population.

A known component of food which causes physiological reactions due to an immunological response (e.g.- nuts, gluten, egg, ,milk etc, identified in legislation relevant to country of production or sale)

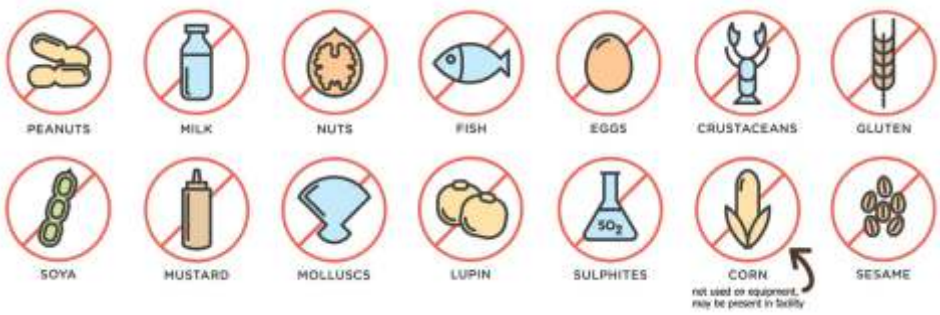

Fig. 4.5: Allergens

It is important to be aware of food allergens in food industry as this is the risk associated with the unintended presence of allergen due to cross contamination and should take this a matter of serious concern. Food allergies can cause serious and even deadly reactions.

What Are the Most Common Food Allergens?

There appears to be eight common allergens accounting for most food allergic reactions. They stand to be- milk, eggs, peanuts, soya, wheat, tree nuts (like walnuts and cashews), fish and shelfish (such as shrimp).

What Are the Signs & Symptoms of a Food Allergy?

The common sign and symptoms are: trouble breathing; coughing; hoarseness; throat tightness' belly pain' vomiting' diarrhea itchy, watery, or swollen eyes; red spots; swelling, a drop in blood pressureand is capable of happening because a person can't digest a substance, such as lactose.

Handling of Allergenic Foods:

1. Allergen-containing ingredients should be kept separate from non-allergen-containing products. Also, finished products containing that ingredient should be kept separate from non-allergenic products.
2. Allergen-containing products should be run at the end of the day or shift or isolated to a specific production line to avoid contact with non-allergen products.
3. Post-production, effective cleaning, and sanitizing must be performed to remove all allergen-containing products.
4. Sampling and testing of food products should be performed by the quality assurance staff or specially trained personnel to detect allergens in food products and on equipment surfaces.
5. Ensure that appropriate and correct information is provided in the labeled packaging of the food product.
6. Proper employee training should be given to to prevent allergen contamination.

4.1.3 Contamination, Cross Contamination and Prevention

Contamination: The presence of unwanted materials such as dust and particles during the manufacturing and transportation time is called contamination. The term contaminants include any unwanted matter that is found in the product. These contaminants affect the quality of the product or the process.

The most common types of contaminant include:

- Physical contaminant Examples: fiber material, particles, chips from your pill press tooling.
- Chemical contaminant. Examples: vapor, pesticides, grease. detergents, and so on.
- Biological contaminant Examples: fungus, bacteria, virus.

Cross contamination is possible when the unwanted matter is introduced or brought from one process to the next during manufacturing.

A leak in the holding containment would contaminate the product inside it, this would be an example of physical contamination.

Certain metals standing to be more advantageous to health, like iron, appearing to be globally added to some foods, involving infant formulas as well as breakfast cereals, to highlight their dietary advantages.

For biological contamination, bacteria may thrive if the container is not properly cleaned and dried. The contaminated container will then affect the product and microbes may thus be introduced to the batch.

Prevention of Contamination:

Determine the cause of the contamination

Anticipate the effect

Eliminate the source material

- To remove the contaminant carrier:
  - Reduce human involvement
  - Regulate the use of the equipment
  - Regulate the use of air
  - Regulate the use of water
- To reduce human carrier risk:
  - Ensure that proper attire is worn when coming and going from the production area
  - People frequently touch their eyes, nose, and mouth without even realizing it. Germs can get into the food through their contaminated unwashed hands.
- To reduce water as carrier:
  - As water is the number one source for cross contamination, it is important to reduce and prevent water contamination
  - Water borne contaminants: particulates (such as minerals) and pathogens (e. coli, salmonella, etc.)
  - Use of preventive measure such as filtration devices, distillation or reverse osmosis, UV treatments
- To reduce air as carrier:
  - Control air flow through AHUs (Air Handling Unit)
  - Use of air locks
  - Installation of HEPA (High Efficiency Particulate Absorbing Filters) filters
  - Ultra-Low Particulate Air

4.1.4 Storage (Importance of Storing Food at Specified Temperature)

Storage temperature is one of the most important factors in the preservation of food because microorganisms have been found to grow in almost all temperature.

Food storage is a major issue when keeping food safe. Food which is not correctly stored can spoil or become contaminated, which can make people sick. There are very specific rules regarding the temperatures that food must be stored at, cooked to and reheated to and if not followed, the risk of becoming ill as a result of contamination increases.

Room Temperature Food Storage

Keep dry storage areas clean with good ventilation to control humidity and prevent the growth of

Keep dry storage areas clean with good ventilation to control humidity and prevent the growth of mold and bacteria. 21°C is adequate for dry storage of most products. One of the first things to check regarding food which has been stored in the 'use-by' or 'best-before' dates printed on the packaging.

These dates will give you the most accurate indication of a food's shelf life, however, when a packet or can is opened, the expiry date almost always changes.

Refrigerating and Freezing Food

To reduce the risk of bacterial contamination, many foods must be stored in the refrigerator and thus kept below 5°C. These foods are often classified as 'high-risk foods' and include – meat, poultry, dairy, seafood, eggs, small goods and cooked rice and pasta. This also refers to ready-to-eat foods that have high-risk foods as ingredients and include – quiche, pasta salad, pizza, sandwiches and many cakes.

By keeping these high-risk foods under 5°C it stops them from entering the 'danger-zone' – temperatures between 5°C and 60°C. The danger-zone is the temperature zone which provides bacteria with the perfect environment to rapidly grow and multiply to numbers that cause food poisoning.

By freezing food its longevity is increased because the water content of the food freezes – this prevents bacteria from multiplying and food spoiling. Food should be kept frozen at –18°C; when thawing, it should be stored in a refrigerator that reaches no more than 5°C until it is ready to be prepared.

4.1.5 Transportation

Selling fresh and high-quality produce is essential in groceries and retail food businesses. That's why the transport and storage of foods is so important, and refrigerated transport is essential to achieve this.

Refrigerated Transportation

Refrigerated transportation is a shipping cargo with advanced temperature adjustment features. It is built and designed mainly for climate-sensitive goods such as vegetables, fruits, meat, all-prep meals, bread, etc. in which the freight is loaded with ice and salt to maintain the food's quality at a particular temperature.

Fig. 4.6: Refrigerated Transportation

Ambient Temperature for Shipping

When it comes to cold chain logistics, maintaining ambient temperature tends to mean maintaining a temperature between 15°C to 25°C or 59°F to 77°F. These temperatures fall in the range of comfortable room temperature instead of being on one extreme and of temperature ranges.

4.1.6 HACCP, TACCP, VACCP, Control Measures, Critical Control Point, Critical Limit

HACCP (Hazard Analysis Critical control point): It is a systematic approach in identification, evaluation and control of food safety hazards and it's written documented plan based on HACCP principles known as HACCP Plan. It has 12 steps and 7 principles as:-

- Assembly of HACCP Team
- Describe Product
- Identify indent use
- Draw Flowchart / Diagram
- Verify Flowchart/ Diagram
- Conduct a hazard analysis (Principle 1)
- Determine critical control points (CCPs) (Principle 2)
- Establish critical limits (Principle 3)
- Establish monitoring procedures (Principle 4)
- Establish corrective actions (Principle 5)
- Establish verification procedures (Principle 6)
- Establish record-keeping and documentation procedures (Principle 7)

VACCP (Vulnerability Analysis Critical control points):

It focuses on food fraud as well, and widens the scope to include systematic prevention of any potential adulteration of food, whether intentional or not, by identifying the vulnerable points in a supply chain. It is especially concerned with economically motivated adulteration (EMA). Examples include product substitutions, unapproved product enhancements, counterfeiting, stolen goods and others.

TACCP (Threat Analysis Critical control points): generally requires a wider range of employee involvement than HACCP, as it covers issues such as manufacturing plant and transportation security, IT security, and employee background checks. Some points will overlap with HACCP, such as tamper-proof seals and various quality control checks.

Reduce the likelihood (chance) and consequence (impact) of a deliberate attack;

Protect organizational reputation;

Reassure customers and the public that proportionate steps are in place to protect food;

Demonstrate that reasonable precautions are taken and due diligence is exercised in protecting food.

Control: It means to prevent, eliminate, or reduce hazard.

Control measures: It is means of any action or activity that is used to prevent, reduce to acceptable levels, or eliminate a hazard.

Critical limit: it means a point, step, or procedure in a food process at which a control measure can be applied and at which control is essential to prevent, reduce to an acceptable level, or eliminate an identified food hazard.

UNIT 4.2: Schedule IV Requirements of FSSAI

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify requirements in Schedule IV in FSSAI

4.2.1 Schedule IV Requirements of FSSAI

To provide assurance of food safety, Food businesses must implement an effective Food Safety Management System (FSMS) based on Hazard Analysis and Critical Control Point (HACCP) and suitable pre- requisite programmes by actively controlling hazards throughout the food chain starting from food production till final consumption.

As per the condition of license under FSS (Licensing & Registration of Food Businesses) Regulations 2011, every food business operator (FBO) applying for licensing must have a documented FSMS plan and comply with schedule 4 of this regulation. Schedule 4 introduces the concept of FSMS based on implementation of Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) by food businesses and is divided into five parts as under:.

Schedule 4	General Requirements
Part 1	General hygienic and sanitary practices to be followed by food business operators applying for registration - Petty food operators and Street food vendors
Part 2	General hygienic and sanitary practices to be followed by food business operators applying for license- Manufacturing/ processing/ packaging/storage/distribution
Part 3	General hygienic and sanitary practices to be followed by food business operators applying for license- Milk and milk products
Part 4	General hygienic and sanitary practices to be followed by food business operators applying for license- Slaughter house and meat processing
Part 5	General hygienic and sanitary practices to be followed by food business operators applying for license- Catering

Table 4.2.1: Five Parts of Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP)

Part II: General hygienic and sanitary practices to be followed by food business operators applying for license- Manufacturing/ processing/ packaging/storage/distribution

- **Location and Surroundings**
- Location shall be:
  - away from environmentally polluted areas
  - away from industrial activities which produce:
  - Disagreeable or obnoxious odor,
  - Fumes
  - Excessive Soot
  - Dust

Well Guarded Entrance of the plant

Demarcation of the area

Fig. 4.7: Location and Surrounding factors

- Smoke
- Chemical or biological emissions
- Pollutants
- Layout and Design of Food Establishment Premises

Facility in good condition leads to clean, pest free environment	• Repaired or replaces holes, broken tiles missing ceiling panel etc. • Sealed/grated sewer grids less than 1/4 inch
Hole free exterior walls	• Louvers in exterior wall fans that close tightly when turned off • Screened pipes & windows • Sealed outside pipe
Striped or sealed gaps around all doors	• Use of screen door, air curtains & other mechanisms • Sealed cracks to prevent insect harborage

Fig. 4.8: Layout and Design factors

- **Equipment and Containers**
  - made up of non-corrosive / rust free material
  - smooth, free from any grooves
  - easy to clean and maintain
  - non-toxic and non-reactive
  - of food grade quality

Fig. 4.9: Equipment and Container factors

- **Facilities**
  - **Water supply**
    - Only potable water meeting BIS (Bureau of Indian Standards) standards
    - Appropriate facilities for storage and distribution of water
    - Periodic cleaning of storage tanks and its record
    - Non-potable water, if used, only for cooling of equipment, steam production, fire fighting
    - Distinguished non-potable water pipes

Colour coding of water pipes to avoid contamination

Fig. 4.10: Water Supply

- Drainage and waste disposal
  - Disposal of sewage and effluent in conformance with the requirements of Factory
  - Designed and constructed to reduce risk of contamination to food and potable water
  - Separate waste storage area
  - Covered containers for waste storage
  - No accumulated waste in food handling, food storage or other working areas
  - Periodic disposal of waste/refuse
  - Pedal operated adequate size bins for waste collection
  - Waste bins emptied and washed daily with a disinfectant and dried before next use

Sr. No.	Material	Dustbin Colour	SYMBOL
1	Oily Cotton Waste	Red	
2	Paper	Green	
3	Plastic Jars, Sampling Bottles	Blue	
4	Plastic Bags	Yellow	
5	Polish Filter	Grey	
6	Food Waste	Orange	
7	Glass Bottles	Black	

Fig. 4.11: Waste Disposal

Fig. 4.12: Drainage System

- Personnel facilities and toilets
  - Facilities for washing and drying hands
  - Supply of hot and cold water
  - Separate lavatories of appropriate hygiene design for males and females separately
  - Suitably located Changing facilities for personnel
  - No direct opening of such facilities in food processing, service or storage area

Fig. 4.13: Personal facilities

- **Ventilation and Lighting**
  - Air quality and ventilation:
    - Natural / mechanical ventilation system including air filters, exhaust fans
    - Designed and constructed as such air does not flow from contaminated areas to clean areas
  - Lighting
    - Adequate Natural /artificial lighting
    - Protected lightings to avoid contamination by breakages

Fig. 4.14: Ventilation and Lighting

- **Food Operations And Controls**
  - **Procurement of raw materials**
    - Quality raw materials (free of parasites, micro-organisms, pesticides etc.)
    - Raw material conforming to the regulations under the act
    - Records of raw material as source of procurement

Fig. 4.15: Procurement of raw materials

  - **Storage of raw materials and food**
    - Adequate food storage facilities to protect food from contamination
    - Cold storage facilities according to requirement
    - Segregation of storage area for raw and processed food, recalled materials, packaging materials, stationary, cleaning materials/ chemicals
    - Separate cold storage of raw food like meat/poultry/seafood product away from the area of WIP (Work in Progress), processed, cooked and packaged products.
    - Monitoring of temperature and humidity
    - FIFO First received (In) materials must move out first
    - Non –toxic containers for food storage
    - Stored on racks or pallets well above the floor and away from the wall

Fig. 4.16: Storage of raw materials and food

Review Of Product Label /Packaging Usage And Control

Labels should be reviewed prior to their receipt for their accuracy. Line Personnel should be trained to ensure labelling is changing when a changeover takes place.

Food Processing / Preparation, Packaging and Distribution / Service

- **Storing at appropriate temperature:** The Food Business shall develop and maintain the systems to ensure that time and temperatures are controlled effectively where it is critical to the safety and suitability of food. Such control shall include time and temperature of receiving, processing, cooking, cooling, storage, packaging, distribution and food service till it reaches the consumer, as applicable.
- **Food Packaging:** Packaging materials shall provide protection for all food products to prevent contamination, damage and shall accommodate required labelling as laid down under the FSS Act & the Regulations there under.
- **Transportation:** All critical links in the supply chain need to be identified and provided to minimize food spoilage during transportation. Processed / packaged and / or ready-to-eat food shall be protected as per the required storage conditions during transportation and / or service.
- **Management and Supervision**
  - Provision of resources to implement & maintain Food Safety
  - Developing SOPs for processing, packing, dispatch & storage of food
  - Competent Technical Managers & Supervisors:
    - having skills on food hygiene principles & practice
    - taking appropriate preventive & corrective action
    - ensure effective monitoring and supervision.
- **Maintaining Process related records (e.g. production records)**
- **Sanitation And Maintenance of Establishment Premises**
  - Facilities should permit effective cleaning.
- **Cleaning Program**
  - areas to be cleaned,
  - cleaning frequency,
  - procedure,
  - equipment,
  - cleaning material and method

Visualizing for HK material


Kamishibai Board for maintaining HK


Hanging of Flexible pipes for ease of cleaning

Fig. 4.17: Cleaning Program

- **Maintenance**
  - Preventive and Corrective Maintenance
  - Lubricants and heat transfer fluids shall be food compatible Procedure for releasing maintained equipment back to production
  - Maintenance personnel shall be trained in the product hazards associated with their activities

Fig. 4.18: Maintenance

- **Pest Control Systems**
  - Report pest infestations immediately.
  - Do not use pesticides/insecticides in food processing area.

Fig. 4.19: Fly Catcher and Rodent Traps

- **Personal Hygiene**
  - Health Status
    - Personnel suffering from disease or illness shall not be allowed to enter in food handling area
    - System to report illness or symptoms of illness to management
    - Medical examination of food handlers/ employees once in a year
    - Records of medical examination
    - Factory shall be compulsorily inoculated against the entire group of diseases and recorded
    - In case of epidemic, all workers to be vaccinated irrespective of the yearly vaccination.
  - **Personal Cleanliness**
    - High degree of personal cleanliness by food handlers
    - Food business shall provide to all food handlers;
    - Protective clothing
    - Head covering
    - Face mask
    - Gloves
    - Foot wear

Fig. 4.20: Personal Cleanliness

- **Visitors Generally**
  - Generally visitors should be discouraged to go inside the food handling areas
  - The food business shall ensure visitors to its food manufacturing/ handling areas shall;
  - Wear protective clothing
  - Footwear
  - Adhere to personal hygiene provisions envisaged in the respective section
- **Product Information And Consumer Awareness**
  - Batch Identification
    - Identifies producer
    - Product recall
    - Effective stock rotation - FIFO
  - Product Information
    - Adequate information & enables other person in food chain to handle, display, store, prepare & use the product safely & correctly
  - Labeling
    - Should confirm to Legal Requirements
- **Consumer Education**
- **Training**
  - Awareness & responsibilities
  - Training Programmes
    - Nature of food
    - Control Spoilage
    - Handling of food
    - Storage
  - Training Records
  - Instruction & supervision
    - Periodic assessment of training & effectiveness
  - Refresher training
- **Good Manufacturing Practices For Whole Premise**

  Good Manufacturing Practices* (GMPs) are the basic operational and environmental conditions required to produce safe foods. They ensure that ingredients, products and packaging materials are handled safely and that food products are processed in a suitable environment.

  GMPs address the hazards associated with personnel and environment during food production. They provide a foundation for any food safety system. Once GMPs are in place, processors can implement a Hazard Analysis Critical Control Point (HACCP) system to control hazards that may affect the ingredients and packaging material during food processing.

GMPs Address:

Fig. 4.21: GMPs Address

- **Environmental control (premises):** Location, design and construction of the building and its interior, equipment, water supply.
- **Personnel practices:** Personal hygiene, hand washing, clothing/footwear/headwear, injuries and wounds, evidence of illness, access and traffic patterns, chemical use.
- **Shipping, receiving, handling, storage:** Inspection procedures for transport vehicles; loading, unloading and storage practices; inspection procedures for incoming products; shipping conditions; returned and defective products; allergen control; chemical storage; waste management.
- **Pest control:** Monitoring procedures for the exterior and interior of the building (ex: surveillance, fumigation) and the use of pesticides.
- **Sanitation:** Cleaning and sanitizing procedures and pre-operational assessment.
- **Equipment maintenance:** Procedures describing preventive maintenance and calibration of all the equipment and instruments that can affect food safety (ex: thermometers, thermocouples, metal detectors, scales, pH meters)
- **Recall and traceability:** Procedures that ensure final products are coded and labeled properly; incoming materials; in-process and outgoing materials are traceable; recall system is in place and tested for effectiveness (ex: procedures for mock recalls).
- **Water safety:** Water safety monitoring procedures for water, ice and steam, and water treatment procedures that ensure it is potable for use in food processing

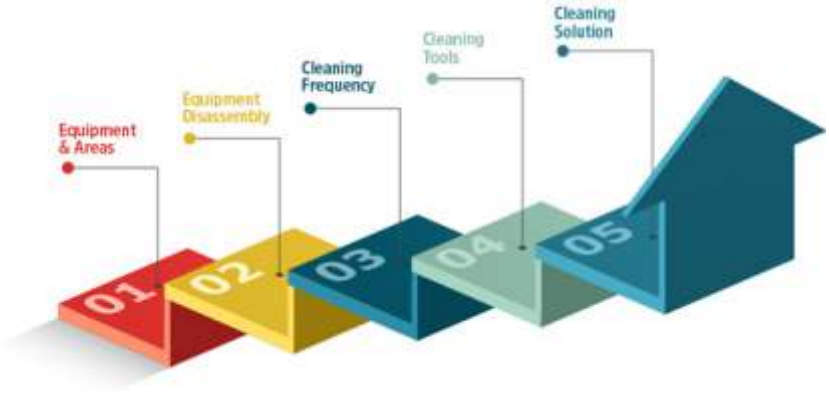

Fig. 4.22: Storage of sanitizing materials

Where and How to Store Your Cleaning Supplies

- **Clean, Cool, Dry:** Store your cleaning supplies in an area that is clean and free of debris. Make sure that there aren't any temperature extremes in the area where your cleaning supplies are stored. Another thing to make sure of is that the area is dry.
- **Original Containers:** Keep cleaning supplies in their original containers. If you mix your own cleaners, make sure you use new clean bottles and label them to avoid a mixup.
- **Safe Storage:** Be sure to keep your cleaning supplies stored in places where your children and/or pets will not be able to get to them. Consider higher storage or locked storage options to protect small children and pets.

Cleaning and Sanitization Process, Need and Importance

Workplace Sanitation: Maintaining a clean work environment is critical in preventing foodborne illness. Bacteria can grow on unsanitary surfaces and then contaminate food. Just because a work surface looks clean does not mean that it is sanitary. Always ensure that you clean and sanitize a work area before starting to prepare food.

Cleaning Procedures and Schedules: Cleaning with soap and other detergents is just one step of the cleaning procedure. It is also necessary to sanitize. Cleaning will remove any dirt or grease, but will not necessarily kill any bacteria or other pathogens. Only a sanitizer will kill bacteria and ensure the area is safe for food preparation. Leading sanitizers used in the food service industry are chlorine solutions (bleach), quaternary solutions (quarts), and iodine. Use these materials according to the manufacturer's instructions that accompany the product and that are found on the material safety data sheet (MSDS) using the appropriate personal protective equipment.

A sanitation plan is important in any food service preparation area. It ensures that all surfaces are cleaned on a regular basis and reduces the risks of transferring bacteria or other pathogens from an unclean surface to clean equipment such as cutting boards or tools. A sanitation plan has two components:

- A list of cleaning and sanitizing agents or supplies with instructions on their safe use and storage
- A cleaning schedule, outlining how each item needs to be cleaned, who is responsible, and how frequently it happens

Routine Equipment Maintenance

Refer to the manufacturer's instructions and training provided by your employer or instructor on how to do this safely. Some equipment is intended to be cleaned in place. This should be identified in your sanitation plan and cleaning schedule.

All equipment must be routinely cleaned and inspected. Older equipment may have nooks and crannies where dirt and bacteria can hide, which can be difficult to clean effectively. Proper cleaning procedures must be established and followed at all times with regular review to ensure that procedures are working. If equipment is replaced or cleaning materials change, the process may have to be adjusted. If you notice any safety concerns with the equipment while cleaning it, such as a frayed cord, missing guard or loose parts, let your supervisor know immediately.

- **Good Food Hygiene Practices**
  - Cleaning
    - Food areas and equipment between different tasks, especially after handling raw food shall be cleaned.
    - The surface shall be thoroughly cleaned in case if somebody spills food / water / drink.
  - Raw materials
    - Raw materials shall be purchased from reliable and known dealers and checked for visible deterioration & off-odour, physical hazards and foreign body contamination.

Fig. 4.23: 8 Principles based on eight quality management principles

- Cooking
  - The preparation/ processing/ cooking should be adequate to eliminate and reduce hazards to an acceptable level which might have been introduced at the raw food level.
  - The preparation/ processing/ cooking methods should ensure that the foods are not re-contaminated.
  - The preparation/ processing/ cooking of veg. & non-veg. products should be segregated.
  - Whenever cooking or reheating of food is done, it should be hot all the way through, it is especially important to make sure that food is cooked thoroughly.
  - Re-use of cooking oil should be avoided.
  - In case of reheating of oil use maximum three times to avoid the formation of Trans fat. It is ideal to use once if possible.
- Chilling
  - Semi cooked or cooked dishes and other ready-to-eat foods such as prepared salads and desserts having short shelf life should not be left standing at room temperature.
  - Chilled food intended for consumption should be cold enough.
  - Food items that need to be chilled should be put straight away into the fridge.
  - Cooked food should be cooled as quickly as possible and then put it in the fridge.
  - Chilled food should be processed in the shortest time possible.
  - Fridge and display units should be cold enough and as per requirement. In practice, fridge should be set at 5°C to make sure that food is kept in chilled condition. Also, fridge and display units should be maintained in good working condition to avoid food spoilage and contamination.
- Cross-contamination

  Following should be done to avoid cross-contamination.
  - Separation of each crop/species and also processed and unprocessed foods.
  - Hands should be thoroughly washed after touching.
  - Work surfaces, chopping boards and equipment should be thoroughly cleaned before the preparing of food starts and after it has been used.

- **Personal Hygiene**
  - High standards of personal hygiene should be maintained.
  - All employees handling food should wash their hands properly
    - before preparing food
    - after touching raw food or materials, specially meat/poultry or eggs
    - after breaks
    - after using the toilet after cleaning the raw materials or utensils / equipments
  - Street shoes inside the food preparation area should not be worn while handling & preparing food.
  - Food handlers should ensure careful food handling & protect food from environmental exposure.
- **Transportation and Handling Of Food**
  - Food shall be adequately covered during transportation to assure food safety.
  - Transportation vehicles
    - Vehicle inspection
    - Shall not contaminate foods & packaging
    - Should be easy to clean and maintain

- Provide effective protection from dust & dirt
- If required maintain temperature, humidity, atmosphere
- If required allow monitoring of temperature, humidity, etc.
- Should be used only for carrying food.
- Regular maintenance of vehicles is required.
- Appropriate supply chain to minimize food spoilage
- Non-toxic, clean, well maintained food containers during transportation
- Temperature and humidity control during transportation
- Dedicated vehicles for food transportation
- Effective cleaning and sanitation of vehicles between loads carrying high risk foods as fish, meat poultry to avoid cross contamination

Fig. 4.24: Transportation and handling of food

- **Storage**
  - It is very important to store food properly for the purpose of food safety. Following things must be ensured:
    - Raw meat/poultry should be stored separately from other foods
    - Storage temperature of frozen food should be -18°C or below.
    - Storage instructions over food packaging should be followed.
    - Dried foods (such as grains and pulses) should be stored off the floor, ideally in sealable containers, to allow proper cleaning and protection from pests.
    - Store commercial ice cream at temperatures below 0°F.
    - Store biscuit, brownie, and muffin mixes at room temperature.

Stock rotation

The rule for stock rotation is FIFO (first in, first out) to make sure that older food is used first. This will help to prevent wastage. Older product will have nearer shelf life expiry, so older product should be moved out first, but new products will have time to move out since expiry is so far. That's why a rule of FEFO does also exist which means First Expiry First Out. It is called Good Distribution Practice.

UNIT 4.3: Personal Hygiene

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify types of health and safety policies and procedures

4.3.1 Personal Hygiene

The expression "food hygiene" is often associated to personal hygiene. The concept of food hygiene really refers to the general cleanliness state of the food handlers' body and clothes. Microorganisms can easily pass to food and reach the consumer if the handler comes into contact with any pathogenic microorganism by their clothes, hands, hair, nails, rings and then sets out to prepare food. As so, the personal hygiene of whoever contacts with food, as well as behaviors they assume during its processing, constitute an important preoccupation in the food business. The set of rules, conditions and practices that assure adequate personal hygiene make up the good practices for personal hygiene.

4.3.2 Importance of Personal Hygiene

It is imperative for safe food-handling outcomes for all workers to be familiar with standard sanitation and hygiene practices. Fig. 1.3.1 shows the cycles of transmission of micro-organisms. One of the basic principles is to break the cycle by avoiding cross-contamination, which can be achieved by ensuring personal hygiene practices are followed.

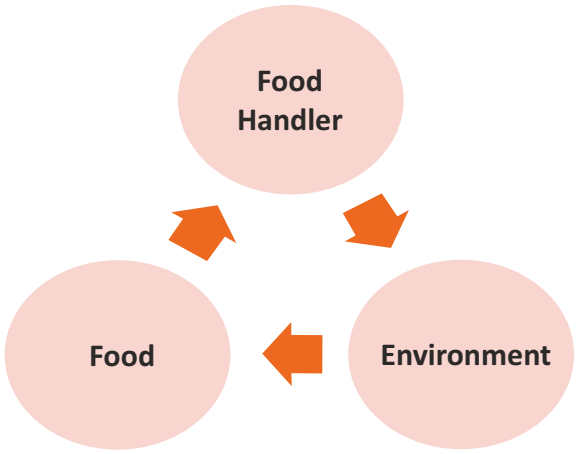

Fig. 4.25: Importance of Personal Hygiene

Proper personal hygiene is critical in any food service premise. Personal hygiene includes:

- Showering and bathing regularly
- Keeping hair clean hair and covered or tied back
- Keeping clean clothing and footwear that is used only at work
- Hand washing regularly

Fig. 4.26: Personal hygiene

4.3.3 Hand Washing

Proper and regular hand washing is a critical part of any food safety system.

Fig. 4.27: Methods of washing hand

How to Use Sanitizer?

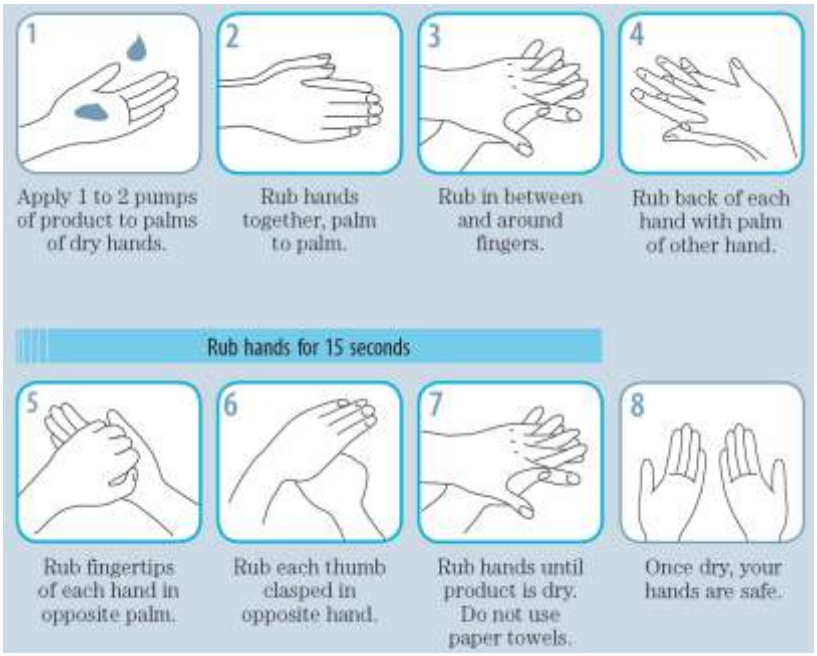

Fig. 4.28: Usage of Sanitizer

When to Wash and Sanitize Hand?

Fig. 4.29: Times to wash and sanitize hand

We need to stop the spread of COVID-19 in food industry by washing hands regularly with soap and water for 20 seconds – especially after going to the bathroom, before eating, and after coughing, sneezing, or blowing our nose.

4.3.4 Good personal hygiene can prevent food poisoning.

Bacteria that cause food poisoning can be on everyone – even healthy people. You can spread bacteria from yourself to the food if you touch your nose, mouth, hair or your clothes, and then food.

Good personal hygiene also makes good business sense. Customers like to see food-handling staff who take hygiene seriously and practice safe food handling.

- Personal hygiene is important to prevent food poisoning.
- When handling food, wash your hands thoroughly and often.
- If you are sick, do not go to work, because you can contaminate food more easily.
- Food handlers should be properly trained in safe food handling.

Food handling businesses ensure the following factors are considered to ensure personal hygiene:

- **Hand Washing —** ensure effective hand washing techniques are followed at appropriate times
- **Minimise hand contact with food —** try to minimise direct hand contact with raw food by using appropriate utensils and safe use of disposable gloves
- **Personal cleanliness —** cover hair; do not sneeze or cough over food; cover cuts and sores; and do not wear jewellery
- **Wear protective clothing —** wear suitable clean protective clothing and handle appropriately to prevent cross contamination
- **Exclude ill staff —** staff must report illnesses; exclude staff with vomiting or diarrhoea

UNIT 4.4: Health Safety

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Illustrate the concept of health safety
2. Understand the hazards of health safety
3. Explain the health and safety policies and procedures
4. Describe the personal protective equipment
5. Discuss the types of personal protective equipment

4.4.1 Health Safety

The term Health and Safety is generally used to describe Occupational Health and Safety, and relates to the prevention of accidents and ill health to employees and those who may be affected by their work.

4.4.2 Health Safety Hazards

Safety hazards exist in every workplace, but how do you know which ones have the most potential to harm workers? By identifying hazards at your workplace, you will be better prepared to control or eliminate them and prevent accidents, injuries, property damage, and downtime.

First of all, a key step in any safety protocol is to conduct a thorough safety hazard assessment of all work environments and equipment

In a safety hazard assessment, it is important to be as thorough as possible because after all, you can't protect your workers against hazards you are unaware of and unprepared for. Avoid blind spots in your workplace safety procedures by taking into consideration these 3 types of workplace hazards:

- **Safety hazards**

  Safety hazards are number one on the list of 3 types of workplace hazards. These hazards play an effect on employees who work directly with machinery or in construction sites. Safety hazards are unsafe working conditions that that can cause injury, illness, or death.

  

  Fig. 4.30: Safety hazards

  Safety hazards are the most common workplace risks. They include:

  - Anything that can cause spills or trips such as cords running across the floor or ice
  - Anything that can cause falls such as working from heights, including ladders, scaffolds, roofs, or any elevated work area.
  - Unguarded and moving machinery parts that a worker can accidentally touch.
  - Electrical hazards like frayed cords, missing ground pins and improper wiring
  - Confined spaces

- **Ergonomic hazards**

  Ergonomic safety hazards occur when the type of work, body positions, and working conditions put a strain on your body.

  Ergonomic Hazards include:

  - Improperly adjusted workstations and chairs
  - Frequent lifting
  - Poor posture
  - Awkward movements, especially if they are repetitive
  - Having to use too much force, especially if you have to do it frequently
  - Excessive vibration

Fig. 4.31: Ergonomic Hazards

- **Work organization hazards**

Safety hazards or stressors that cause stress (short-term effects) and strain (long-term effects). These are hazards associated with workplace issues such as workload, lack of control and/or respect, etc.

Examples include:

- Workload demands
- Workplace violence
- High intensity and/or pace
- Respect (or lack thereof)
- Flexibility
- Control or say about things
- Social support or relations
- Sexual harassment

4.4.3 Health and Safety Policies and Procedures

Overview

The law says that every business must have a policy for managing health and safety.

A health and safety policy sets out your general approach to health and safety. It explains how you, as an employer, will manage health and safety in your business. It should clearly say who does what, when and how.

4.4.4 What is Personal Protective Equipment?

Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits.

Employers are also required to train each worker required to use personal protective equipment to know:

- When it is necessary
- What kind is necessary
- How to properly put it on, adjust, wear and take it off
- The limitations of the equipment
- Proper care, maintenance, useful life, and disposal of the equipment

If PPE is to be used, a PPE program should be implemented. This program should address the hazards present; the selection, maintenance, and use of PPE; the training of employees; and monitoring of the program to ensure its ongoing effectiveness.

4.4.5 Types of PPE

Head protection

Examples of head protection equipment:

- Helmets
- Hard hats
- Hair nets

Hand protection

Examples of hand protection equipment

- Work gloves and gauntlets
- Wrist cuff arm nets

Eye and face protection

- Safety glasses and goggles
- Eye and face shields

Fig. 4.32: Eye and face protection

Respiratory Protection

This type of PPE must be present when being in contact with large amounts of gases, powders, dust and vapors.

Fig. 4.33: Types of Respirators

Hearing protection

Examples of hearing protection equipment:

- Earplugs and defenders
- Noise meters
- Communications sets
- Acoustic foam

Foot protection

As examples of foot protection equipment can be pointed out the following ones:

- Safety boots and shoes
- Anti-static and conductive footwear

Height and access protection

As examples of height and access protection equipment can be mentioned in the following ones:

- Fall-arrest systems
- Body harnesses
- Lowering harnesses
- Rescue lifting
- Energy absorbers and others

Fig. 4.34: FSSAI dos and don'ts for food handlers

First aid kit

The kit should be kept in an accessible location and /or close to areas where there is a higher risk of injury or illness. The first aid kit should provide basic equipment for administering first aid.

Pictograms

Not only is preparing your workshop for accidents a smart thing to do, it is even smarter to organize your workshop in such a way that no serious accidents can take place. A simple way to make your workshop safer is to use pictograms: indicating flammable materials, the necessary use of hearing protection, indicating emergency exits.

Health and Safety Policy

FBO is committed to the goal of providing and maintaining a healthy and safe working environment, with a view to continuous improvement. This goal is only achievable by adherence to established objectives striving to exceed all obligations under applicable legislation, and by fostering an enthusiastic commitment to health, safety and the environment.

In particular:

Management, working in cooperation with the Joint Health and Safety Committee, will strive to take all reasonable steps to reduce workplace hazards to as low as reasonably achievable.

Supervisors and managers are held accountable for the health and safety of all employees under their supervision. This includes responsibility for applicable training and instruction, appropriate followup on reported health and safety concerns, and implementation of recommended corrective action.

FBO is committed to providing all necessary training and instruction to ensure that appropriate work practices are followed on the job, and to promote their use off the job.

Health, safety, the environment and loss control in the workplace are everyone's responsibility. Company expects that everyone will join in our efforts to provide a healthy and safe working environment on a continuous day to day basis.

Importance of Preventive Health Checkups

No matter what age group you are a part of, regular preventive health tests are essential for each one of us.

Whether one is feeling fit from within or is still in his early years of life, a preventive health checkup is an important practice that one must inculcate in his or her daily life.

- It can detect developing disease and prevent them
- Increase better chances for treatment and cure
- Can identify health issues early and prevent them
- It helps to improve lifestyle and increase productivity at work

FSSAI Format for health check up

PERFORMA FOR MEDICAL FITNESS CERTIFICATE FOR FOOD HANDLERS

(FOR THE YEAR .....)

(See Para No. 10.1.2, Part- II, Schedule - 4 of FSS Regulation, 2011)

It is certified that Shri/Smt./Miss..... employed with M/s....., coming in direct contact with food items has been carefully examined* by me on date ..... Based on the medical examination conducted, he/she is found free from any infectious or communicable diseases and the person is fit to work in the above mentioned food establishment.

Name and Signature with Seal
of Registered Medical Practitioner /
Civil Surgeon

***Medical Examination to be conducted:**

1. Physical Examination
2. Eye Test
3. Skin Examination
4. Compliance with schedule of Vaccine to be inoculated against enteric group of diseases
5. Any test required to confirm any communicable or infectious disease which the person suspected to be suffering from on clinical examination.

Fig. 4.35: Format for health check up

Medical examination to be concluded –

1. Physical examination
2. Eye Test
3. Skin examination
4. *Compliance with schedule of vaccine to be inoculated against enteric group of diseases
5. Any test required to confirm any communicable or infectious disease which the person suspected to be suffering from on clinical examination

* Vaccine to be inoculated against enteric group of diseases shall be decided by the medical practitioners in accord to remove the ping to the list as declared by the municipal corporation of that area.

Summary

- Food safety refers to routines in the preparation, handling and storage of food meant to prevent food borne illness and making food safe for human consumption. Safe food handling practices and procedures are thus implemented at every stage of the food production life cycle in order to curb these risks and prevent harm to consumers.
- It is important to be aware of food allergens in food industry as this is the risk associated with the unintended presence of allergen due to cross contamination and should take this a matter of serious concern. Food allergies can cause serious and even deadly reactions.
- The presence of unwanted materials such as dust and particles during the manufacturing and transportation time is called contamination. The term contaminants include any unwanted matter that is found in the product. These contaminants affect the quality of the product or the process.
- Refrigerated transportation is a shipping cargo with advanced temperature adjustment features. It is built and designed mainly for climate-sensitive goods such as vegetables, fruits, meat, all-prep meals, bread, etc. in which the freight is loaded with ice and salt to maintain the food's quality at a particular temperature.
- The retail food industry plays a significant role in assuring a safe food supply for its consumers. At the retail level, activities to control food safety risks can be divided into four key areas: the supplier and source of foods and food ingredients; in-store practices and procedures; education and training of employees and food handlers; and consumer engagement.
- Good Manufacturing Practices (GMPs) are the basic operational and environmental conditions required to produce safe foods. They ensure that ingredients, products and packaging materials are handled safely and that food products are processed in a suitable environment.
- Maintaining a clean work environment is critical in preventing foodborne illness. Bacteria can grow on unsanitary surfaces and then contaminate food. Just because a work surface looks clean does not mean that it is sanitary. Always ensure that you clean and sanitize a work area before starting to prepare food.
- The rule for stock rotation is FIFO (first in, first out) to make sure that older food is used first. This will help to prevent wastage. Older product will have nearer shelf life expiry, so older product should be moved out first, but new products will have time to move out since expiry is so far. That's why a rule of FEFO does also exist which means First Expiry First Out. It is called Good Distribution Practice.
- The expression "food hygiene" is often associated to personal hygiene, being many times limited to the care of washing hands. The concept of food hygiene really refers to the general cleanliness state of the food handlers' body and clothes.
- Health and Safety is a term that generally covers the legal requirements that fall under the Health and Safety at Work Act etc. 1974. The term Health and Safety is generally used to describe Occupational Health and Safety, and relates to the prevention of accidents and ill health to employees and those who may be affected by their work.

Exercise

A. Answer the following questions by choosing the correct option:

1. _____ refers to routines in the preparation, handling and storage of food meant to prevent food borne illness and making food safe for human consumption.
   a. Food Safety
   b. Fire Safety
2. _____ is a factor or agent which may lead to undesirable effects like illness or injury in the absence of its control, whereas, risk refers to the probability that the effect will occur.
   a. Threat
   b. Hazard
3. The presence of _____ materials such as dust and particles during the manufacturing and transportation time is called contamination.
   a. wanted
   b. unwanted
4. _____ is one of the most important factors in the preservation of food because microorganisms have been found to grow in almost all temperature.
   a. Storage temperature
   b. Hazard temperature
5. Selling fresh and _____ produce is essential in groceries and retail food businesses.
   a. low-quality
   b. high- quality

B. Answer the following questions briefly.

1. What are the most common types of contaminant?
2. Outline the layout and design of food establishment premises.
3. Explain VACCP
4. What are the facilities provided by water supply?
5. What are the two components of the sanitation plan?

Notes

5. Managing Accidents and Emergencies

Unit 5.1 - Hazard, Risk and Accidents
Unit 5.2 - Standard Practices and Precautions
Unit 5.3 - Uses of Electrical Equipment
Unit 5.4 - Usage of Personal Protective Equipment
Unit 5.5 - Organisational Protocols
Unit 5.6 - Dealing with Toxics
Unit 5.7 - Fire Prevention and Fire Extinguishers
Unit 5.8 - Artificial Respiration and CPR
Unit 5.9 - Rescue and Evacuation In Case Of Fire
Unit 5.10 - First Aid
Unit 5.11 - Potential Injuries and Ill Health
Unit 5.12 - Precautions in Mobility
Unit 5.13 - Significance of various types of hazard and safety signs

Key Learning Outcomes

At the end of this unit, the trainee will be able to:

1. Recognize the types of hazards, risks as well as accidents
2. Categorize the standard precautions and practices
3. Examine the utilization of the electrical equipment
4. Explore the usage of personal protective equipment
5. Recognize the organizational protocols
6. Monitor the ways to handle the toxics
7. Identify fire prevention and fire extinguisher
8. Evaluate CPR as well as the artificial respiration
9. Discuss the evacuation and rescue
10. Catalogue the first aids
11. Understand the ill health as well as potential injuries
12. Demonstrate the precautions in mobility
13. Discuss the significance of various types of hazard and safety signs

UNIT 5.1: Hazard, Risk and Accidents

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify the types of hazards, risks as well as accidents

5.1.1 Types of hazards, risks and accidents

Hazard is considered a sort of incident or source that can fundamentally harm something, whether in a living or non-living state. It states to be significant to identify the hazard and the amount of risk or impact it would create on its surroundings. Thus, an individual must be prepared from the initial stages to manage such occurrences.

It is important to control workplace hazards by eliminating and identifying the capable risks. This is required as it is capable of causing accidents or hazards, along with finding the access based on the ways to isolate the risk which can lead to the hazard.

To ensure the safety of an individual and the workplace surrounding, an individual requires to regularly participate in the safety drill, which is conducted at their specific times.

Types of Hazards:

- **Safety Hazard:** A safety hazard is among the most common dangers found in every workplace. A safety hazard is capable of causing specific serious injuries or damage to the industrial workers. The safety hazards perform a practical part on the employees who have regularly contacted the heavy equipment or machinery throughout their working hours.

  Some of the safety hazards which lead to accidents in the workplace tend to include:

  - Anything capable of causing a fall, such as floor holes or opening walls, slippery surfaces, unprotected edges, and ladders which is unsafely situated.
  - Heavy-duty mechanisms, which is seen to be usually present in every industry, such as construction, manufacturing, mining and so on, can sometimes be the cause behind the accident. It is due to loose machinery parts, sharp edges, hot surfaces causing severe cuts, burns and wounds.
- **Chemical Hazards:** Chemical substances are seen to include but are also not restricted to acidic substances, petroleum products, reagents, acids, flammable liquids and many more.
  - Acidic substances are firmly alkaline in their state as they tend to possess properties to damage the accidental arrival in contact with the other substances by forming a chemical reaction.
  - The petroleum products generate gasoline such as Butane, Propane, Kerosene, and LPG as they are incredibly flammable hazards and can damage on a larger scale.
  - Acids occur to be more hazardous, relying on their corrosive materials. The common acid includes Hydrochloric Acid, Sulphuric Acid, and Nitric Acid.
- **Biological Hazards:** Biological hazard is also known as the biohazard and is connected to the biological substances that lead to sickness and illness in humans during its occurrence in direct contact.

  Sources through which the biological hazard might include are:

  - Bacteria, viruses, insects, plants and humans are capable of being the hazard carrier that adversely impacts their health, causing skin irritation and can also lead to serious infections, like Tuberculosis, AIDS, and carcinogenic infection.

- Toxins from biological sources stand to be extensively poisonous in their state as they are manufactured by harmful animals and plants, such as snake venom toxins and botulinum toxins.
- The most recent example of the biological hazard is the outbreak of Covid-19.

- **Physical Hazard:** A physical hazard is the least common hazard at the workplace and is not limited only to physical presence. Extreme weather conditions or unfavourable working environments are the major causes of physical hazards.

  Physical hazard has a prolonging effect on the health of the workers. These types of hazards are generally unrecognizable, like:

  - The temperature can also be a cause of danger for the workers who attempt to work indoor as well as outdoors, having the factors such as overexposure to heat and cold leading to some serious illness like heat stroke, sweaty palm increasing the risk of accident, frostbit hypothermia which can eventually lead to death also.
  - Harmful radiation like micro-waves, radio-waves, electro-magnetic waves, and so on.

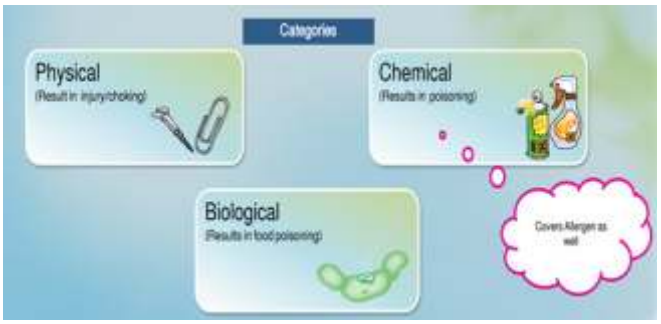

Fig. 5.1: Examples of physical, Chemical, Biological hazards

- **Ergonomic Hazard:** An ergonomic hazard is a type of hazard that adversely affects the worker's physical health, having continuous work leading to lower back pain, joint pains, muscles ache, and ligaments pain.

  Ergonomic hazards may include:

  - Poor sitting or standing postures.
  - Improperly adjusted chairs and workstation height.
  - Too much vibration or loud noise in the workplace.
  - Frequent lifting of heavyweights.
  - Prolong working conditions demanding physical force

- **Work Organization Hazard:** Work organization hazard usually defines the issues related to the workplace such as;
  - Excessive workload
  - Inappropriate behaviour of peers
  - Bullying
  - Lack of mental support
  - Work-related stress

Fig. 5.2: Sources of different types of hazards

5.1.2 Hazard Identification and Risk assessment

Risk Assessment (RA) and environment review (ER) were done for hazard and environmental impact. It is done from different stages, from evaluating a new operation, modification to the existing facilities, maintenance work and others.

RA identify all safety and health hazards – Including Operational, mechanical, electrical, chemical, biological and ergonomic for ER indicate the environmental aspects and impacts taken into consideration.

Review and update of R.A and ER to be done under following circumstances: -

- Amendments/addition in legal, corporate and other voluntary requirements.
- Change in process or product handled or new developments/ modifications in activities/ products/ services.
- Occurrence of the accident, emergency
- While initiating any corrective and preventive actions
- While purchasing and erecting any new equipment/ machinery/ building

UNIT 5.2: Standard Practices and Precautions

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Categorize the standard precautions and practices

5.2.1 Standard Practices and Precautions

- Hand hygiene- Physical, Chemical or Biological hazard
- Usage of personal protective equipment- Safety hazard
- Respiratory hygiene/ Cough Etiquette- Biological hazard
- Sharp Safety- Safety hazard
- Safe injection practices- Biological or Physical hazard
- Sterile instruments and Devices- Biological or Physical hazard
- Avoiding ergonomic hazard

- **Hand hygiene:** Washing hands regularly is a significant step towards cleanliness, protecting us from various diseases and infections. Washing hands can keep us healthy well as it protects us from viruses capable of travelling from one person to another person. Germs and bacteria are the only host which comes from touching the nose, eyes with dirty hands, or eating/cooking food with smeary hands.
- **Usage of Personal Protective Equipment**
  - Personal protective equipment, or PPE, protects its user against any physical harm or hazards that the workplace environment may present. It is important because it exists as a preventative measure for industries that are known to be more hazardous, like manufacturing and mining. Some of the personal protective equipment are: gloves, masks and eyewear.
- **Respiratory Hygiene / Cough Etiquette:** One should follow the below guidelines to maintain respiratory hygiene.
  - Covering the mouth and nose with a cloth or elbow while coughing or sneezing.
  - Throw the used tissues in a separate bin.
  - Washing of the hands or sanitizing before touching the nose or mouth
- **Sharp Safety:** Sharp objects such as needles, lancets, and surgical knives must be handled with utmost care to prevent injury or spread of infection.
- **Avoiding ergonomic hazard:** Headsets, monitor stands, and adjustable chairs are just some devices that can be easily integrated into a workspace to diminish the risk of injury from repetitive motions. Awkward locating refers to positions in the body when a person deviates significantly from a neutral position while performing tasks.

UNIT 5.3: Uses of Electrical Equipment

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Examine the utilization of the electrical equipment

5.3.1 The Utilization of the Electrical Equipment

Electrical equipment is generally that equipment that requires electrical supplies for their operations. It generally consists of several small components in an enclosed form and is controlled by a power switch. It tends to include:

- Electric switchboard
- Distribution board
- Circuit breakers and disconnects
- Electricity meter
- Transformer

Fig. 5.3: Different type of electrical equipment's

Hazards Related to Electrical Equipment's

The five hazards described here are very common and easily preventable.

- Working on live circuits
- Skipping Lockout/Tagout. It is also known as LOTO, which disconnects electricity and avoids electrical hazards.
- Forgetting PPE.
- Improper grounding.
- Damaged extension cords.

Fig. 5.4: Electrical hazard symbols

UNIT 5.4: Usage of Personal Protective Equipment

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Explore the usage of personal protective equipment

5.4.1 The Usage of Personal Protective Equipment

Personal protective equipment is majorly used to protect oneself from serious accidents or illnesses originating from the workplace's physical, biological, chemical, and mechanical hazards.

Personal protective equipment includes:

Fig. 5.5: The usage of personal protective equipment

Importance of PPE in Food Industry

Protective Clothing Reduces Injury and Contamination Risks. In the food manufacturing units, workers are at a surprising risk of exposure to harsh and toxic chemicals, which can cause further contamination of the food product. Also, PPE importance can be identified during working at height to avoid slip, trip and fall.

UNIT 5.5: Organisational Protocols

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Recognizing the organizational protocols

5.5.1 The Organizational Protocols

Accidents are unplanned experiences resulting in injuries, illness, death, and loss of property and/or production. While there is no way to avoid accidents, some actions, plans, and preparations are capable of being taken to diminish them.

Knowledge of the Hazards

- Be aware of the environment. Look around and recognize workplace risks that are capable of causing harm.
- Look for manners to diminish or eliminate hazards and implement them.
- Report unsafe areas or practices.
- Dress for the weather.
- Use the EHS (Environmental Health & Safety) Job Hazard Analysis devices to recognize hazards linked with job sorts.

Originate a Safe Work Sector

- Keep an orderly job place. Poor housekeeping is capable of causing safety hazards and serious health. The workplace's layout requires to have accurate egress routes as well as be debris free.
- Take breaks as well as mobilize around regularly all through the day. Short breaks (moving around and standing up) can make a big distinction in combating the threats of residing in a static position all day long.
- Pay attention to workstation ergonomics.

Use Safe Lifting Techniques

- Follow the following safe lifting practices:
    - Lift from a position of power
    - Keep the load close
    - Use a staggered stance
    - Cable/Rope/Slings in good repair
    - Hoist chain/Rope free of kinks and twist
    - Hooks not deformed or damaged and safety latches intact
    - Display of testing date, capacity and safe working load
    - Do not attempt to twist while lifting
- Training in body mechanics can reduce strain injuries and keep employees safe during moving and lifting.
- Regular Interaction
    - Notify supervisors regarding the safety hazards
    - Speaking up as well as being included in safety strategizing.
    - Constantly cultivate a safety level
- Training as well as Education
    - Make sure for everyone who possesses the appropriate safety training linking to the job's

threats.

- Take benefit of Environmental Safety and Health online training events.
- Each employee's responsibility is to take an active role in maintaining safety.

Emergency Preparedness Plan

Nowadays, many organizations, including the food industry, also implement their emergency preparedness plan, which includes hazards identified during their past years of operation; possible weather or climatic condition; spillages during operational activities, etc. Hazards can be classified as low, moderate and significant impact on the organization based on the geolocation of the unit.

Incident Reporting and Investigation

Incident

It is an event that causes damage to equipment material or other property. It may or may not be accompanied by human injury. It can be categorized as: -

- **No Injury Incident / Dangerous Occurrences**

  Fire– An incident in which a fire broke out which has the potential of causing burn injury to humans or damage to property.

  Near Miss– An incident that has the potential for causing an injury to humans or damage to property but narrowly escapes
- **Industrial / Injury incident:** An incident is a sudden and unforeseen event, attributable to any cause, which happens to the person, arising out of or in this course of his or her work and resulting in an employment injury to that person.
- **Major Incident** An incident results in a human fatality, permanent disability or extensive loss of equipment or materials.
- **Lost Time Incident**- Human injury incident prevents the person from doing his work for more than 48 Hrs.
- **Minor Incident–** An incident that causes minor injury to a human which may prevent him from undertaking his work up to 48 Hrs.
- **First Aid Case–** An injury incident that requires a person to go to a dispensary for a one-time treatment and/or any follow-up visit for observation of minor scratches, cuts, burn, splinters or other minor industrial injuries which do not ordinarily require medical care.
- **Unsafe Act:** The violation of a commonly accepted safe procedure or practice which resulted in the incident or was against the safety guidelines. Examples are operating without authority, operating at an unsafe speed, making safety devices inoperative, posture or unsafe position, failure to use personal protective equipment etc.
- **Unsafe condition:** The condition which has the potential to cause injury/harm & damage to property material/ environment or process, improper guarding, defective tools/ equipment, hazardous arrangement or process, Improper ventilation, high temperature/dust Noise.

Incident Investigation

- Persons investigating any incident should collect all information, evidence regarding the situation under which the incident; this shall also include the condition of the persons, physical and mental conditions.
- The investigation should be based on fact-finding, and immediate causes of incidents are listed in two groups (Unsafe Condition and Unsafe Act). The investigating team shall find out and note down. The investigation team shall attempt to list all unsafe conditions and all unsafe behaviours on personnel.

UNIT 5.6: Dealing with Toxics

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Monitor the ways to handle the toxics

5.6.1 The Ways to Handle the Toxics

Toxics are chemical substances that can cause serious harm to the person if he/she comes directly in its contact. One should be extra careful while handling such substances and an organisation must have clear labelling, separate storage rooms and proper guidelines for its usage.

- **Exposure hazards:**
  - **Contact or Absorption:** It can cause when a person comes in direct contact with toxic substances. It can result in drying or defatting of skin, skin irritation, or redness.
  - **Inhalation** occurs when a person inhales the fumes or vapour of toxic substances. It can cause shortness of breath, sore throat, coughing, an effect on the nervous system, and irritation during the breath.
  - **Ingestion:** It occurs when people accidentally consume toxic material. It can result in diarrhoea, vomiting, indigestion, effect on the functioning of the liver and kidney.

- **Storage requirement:**
  - Toxic substances must be stored in designated storage compartments only.
  - It should be stored under the optimum condition as prescribed. Always take the material in desired quantity and never put the used or remaining material in the original container.
  - One should always look for an alternative before using the toxic agent.
  - Only authorised
  - Personnel should be given access to the storage compartment.

- **Labelling requirement:**
  - Toxic substances or materials should be labelled in clear and readable format and proper usage instructions.
  - Work areas should be labelled properly where toxic substances are used regularly or excessively.
  - Always label the emergency contact number near the storage and the work area.

- **Spill and accident procedures:**
  - In case of a spill or accident, immediately alert the people in that area and inform the supervisors.
  - Evacuate the area and seize the entry.
  - Inform the relevant authority in case of leakage or spillage in larger quantities.
  - The trained professional of designated staff should only perform cleaning of toxic spillage.
  - Usage of absorbent while cleaning the corrosive or other harmful liquid.
  - Usage of neutralizing agent while cleaning the acidic, toxic substances.
  - Never touch the toxic substance with naked hands.

- **Waste management:**
  - Toxic waste must be segregated separately in accordance with its nature.
  - It should be managed separately from other wastes.
  - Flammable chemicals, acids should be disposed of carefully and separately in order to prevent any type of accident or injury.
  - Never dispose of the toxic substance in an open area.
  - It should always be disposed of in a leak-proof and airtight container.

Fig. 5.6: Waste disposal process for a different type of waste

UNIT 5.7: Fire Prevention and Fire Extinguishers

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify fire prevention and fire extinguisher

5.7.1 Fire Prevention and Fire Extinguisher

Prevention from fire is necessary to avoid excessive damage. Their major goal remains to educate the workers on the ways to prevent the environment from fire.

To prevent the workplace from fire, we must enforce the following measures:

- Workers should be highly trained for the mock drill.
- No smoking signs around the highly flammable liquid and gases.

Causes of fire

- **Flammable and combustible liquids:** This requires proper storage and handling in order to prevent the occurrence of fire which must be stored under a well labelled and closed container to avoid any accident.
- **Liquified Petroleum Gases:** LPG gas has a low density and is heavier than air. It usually accumulates in low lying areas so that the workers are warned if they tend to find any leakage or hole in the cylinders. Moreover, they must not use fire; instead of that, they are capable of utilizing soapy water and finding out the bubbles.

Prevention of the Casualties from Fire

- **Fire Alarm Devices:** These are the devices used to warn people during fire and smoke or any other types of fire emergencies. These alarms are automatically activated once smoke and heat are detected. It should be installed on the telephone desk and the employer's entrance in order to evacuate promptly.
- **Fire Extinguisher:** It is a lifesaver device that is used to control small fires as well as in emergency situations. It should not be used in indented fire issues if it is reached to the walls, ceiling or where there is no route for escape.

  Placement of fire extinguishers at workplace or organization must include.

  - The fire extinguisher should always be placed or mounted on a wall and should be properly marked.
  - Employees should be well trained with PASS methods or firefighting.
  - The fire extinguisher should always be kept at the ease of location to all employees.
  - Vehicles should also carry out one ABC rated extinguisher in case of emergency.
  - All extinguishers should be well marked and labelled and should be clearly visible.
  - All extinguishers should be inspected on a monthly basis, and their place it has not tampered with.
  - For the point of safety, all extinguishers should be examined yearly or required to be refilled in order to ensure operability.
  - A tag should also be attached to ensure its maintenance or refilling date and the signature of the authorized person.

- **Fire Extinguisher Classes:** There are four types/classes of fire extinguishers, which are most common, i.e., A, B, C and D, where every class is capable of putting out a varied sort of fire.
  - Class A extinguishers would be capable of putting out fires in ordinary combustibles such as wood and paper.
  - Class B extinguishers are utilized for flammable liquids like grease, gasoline and oil.
  - Class C extinguishers are used only for electrically energized fires.
  - Class D extinguishers are used on flammable metals.

Fig. 5.7: Types of fire extinguishers

Uses of Fire Extinguishers

Once it is installed in the workplace or industry, it is important for every employee to get familiar with the usage and the direction of fire extinguishers so as to be well prepared for the sudden occurrence of any hazardous incidents and accidents. Fire extinguishers are relatively easy to use in case of small fires by using some simple technique called PASS.

Fig. 5.8: Pass technique for Fire Extinguisher use

Fire Hydrant/ Fire Hydrant Pump

Fire hydrant consists of a system of pipework connected directly to the water supply mainly to water to every hydrant outlet as well as is attempted to present water for the firemen in order to fight a fire. The water is seen to be discharged into the fire engine, from which it is then pumped and sprayed over the fire. Where the water supply is not inadequate or reliable, hydrant pumps requires to be presented to pressurize the mains of the fire.

UNIT 5.8: Artificial Respiration and CPR

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Evaluate CPR as well as the artificial respiration

5.8.1 CPR As Well As the Artificial Respiration

Artificial respiration and CPR is an act (or) technique used for stimulating respiration when there is a sudden stoppage of breathing or lung functioning.

Techniques used to provide artificial respiration are:

- Mouth-to-mouth breathing
- Prone-pressure method
- Cardiopulmonary resuscitation (CPR) or external chest compression

There are two types of ways to provide Artificial respiration. They are:

- Manual and,
- Mechanical

Manual ways consist of:

- Mouth-to-mouth breathing
- Prone Pressure Method
- Back Pressure Arm-Lift

Mouth-To-Mouth Breathing

The steps to perform in this specific process are:

		
Position your hand	Interlock fingers	Give chest compressions

Open the airway

Give rescue breaths

Watch chest fall

Repeat chest compressions and rescue breaths

Fig 5.9: CPR steps

Prone Pressure Method

This method, additionally known as the Schafer method, stands to be a type of artificial respiration which is used for a patient in case of drowning. In this, the patient is placed in a prone or placed in a face-down position allowing rhythmically pressure with the help of hand on the thorax by means of which the water present would get expelled from the lungs allowing air to enter by clearing the passage in order to breath.

Back Pressure Arm-Lift

This particular method is used as an alternative when other methods are not possible or are not working out.

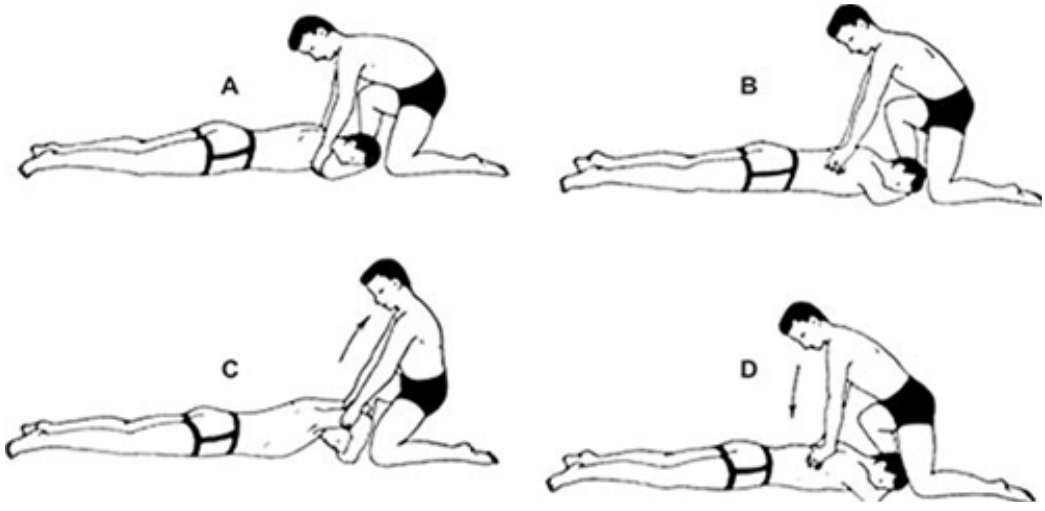

Fig. 5.10: Back Pressure Arm-Lift

A Mechanical Method of Artificial Respiration

These types of artificial respiration methods are generally performed by highly trained professionals such as a doctor, nurses, and paramedic forces. The mechanical method often uses machine-like ventilators. Another device that is used in the mechanical method is a bag valve mask. It has the self-inflate and deflates mechanism as well as has an air supply that is controlled by the valve.

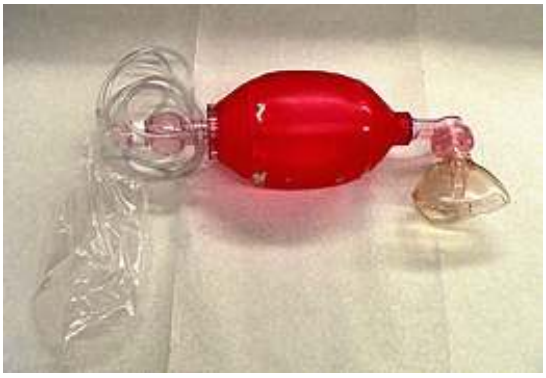

Fig. 5.11: Big Valve mask

Fig. 5.12: Ventilator

UNIT 5.9: Rescue and Evacuation In Case Of Fire

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Discuss the evacuation and rescue during a fire incident

5.9.1 The Evacuation and Rescue during a Fire Incident

A "Fire Emergency Evacuation Plan (FEEP)" stands a scripted document that involves the activity to be adapted by all staff in the event of a fire and the sequences for calling the fire brigade.

Staff Fire Notice High fire threats or extensive premises that would be required a more illustrated emergency evacuation strategy which takes account of the findings of the assessment of fire risk, e.g. the staff importantly at threat and their spots. In addition, notices providing transparent and concise routine's instructions to be followed in the instance of fire that requires to be appropriately showcased.

In some instances, the inidviduals requires to be nominated inidviduals in order to conduct the fire action plan as well as provide them enough training in firefighting as well as procedures for evacuation. The following items require to be taken into consideration where appropriate:

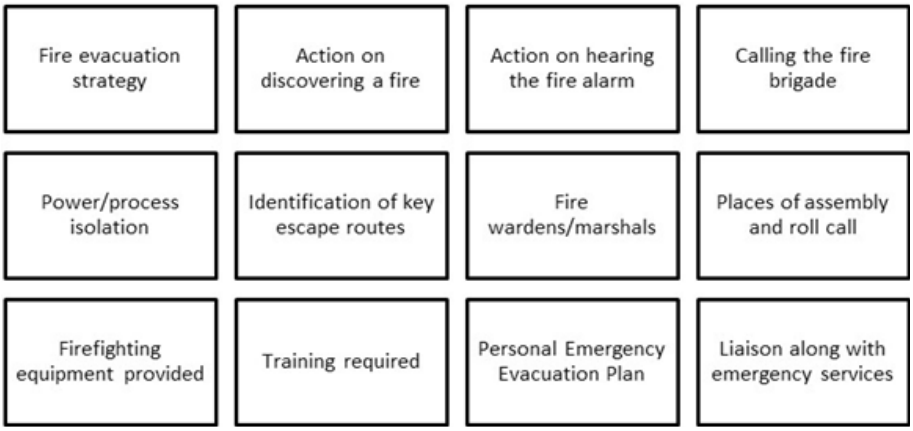

Fig. 5.13: Staff Fire Notice

Fire Evacuation Plan

You require taking into consideration of how you would tend to arrange the premises evacuation in the light of your risk evaluation as well as the other fire precautions that the individuals possesses or intended to put in spot.

Simultaneous Evacuation

In most premises, the evacuation in the instance of fire would easily be by means of each one responsing to the warning signal given when a fire is discovered, then making their way, by regards of escape, to a spot of safety away from the boundaries. This is referred as a simultaneous evacuation and would generally be initiated by the sounding of the normal alarm over the system of fire warning.

Vertical Phased Evacuation

In certain larger complex premises, the emergency arrangements are designed to allow people who are not at immediate risk from fire to delay initiating their evacuation. It might be accurate to start the evacuation by initially performing the evacuation by only the sector closest to the fire as well as warning other individuals to stand by. This is generally done by suddenly evacuating the floor where the fire is spotted as well as the floor located above. The other floors are then evacuated among the individuals to neglect congestion on the escape paths. The rest of the indivdiuals are then evacuated if it is important to do so. The fire warning system requires to be capable of providing two distinctly different signals (warning and evacuation) or giving accurate voice messages. Horizontal phased evacuation in hospitals as well as care homes: the floor may be divided into a number of fires resisting compartments, and the occupants are moved from the compartment involved in the fire to the adjacent compartment as well as, if required, moved again. Depending on the fire situation, it might eventually be significant to take into consideration vertical evacuation.

Other Fire Precautions

- systems of voice alarm
- fire control points
- compartmentation of the premises using fire-resisting construction
- sprinklers in buildings where the top floor is 30 meters or more above ground standards

Staff Alarm Evacuation (Silent Alarm)

In certain instances, it might not be accurate for a normal alarm to start immediate evacuation (Cinemas and Theatres). This could be as of the number of members of the public provided and the requirement for the staff in order to put pre-arranged strategies for the safe evacuation of the premises into action. In the mentioned situations, a staff alarm is capable of being provided (by fire records, personal pagers, discreet sounders, or a coded phrase on a public address system etc.). Following the staff alarm, a more normal alarm signal is capable of being provided, as well as a phased or simultaneous evacuation initiated. The general alarm might be activated automatically if manual initiation has not taken place within a pre-determined time.

Defend in Place

This strategy might be taken into consideration in blocks of flats where each flat is a minimum 60-minute fire-resisting compartment. It might additionally be considered in hospitals or nursing homes where patients are connected to life-supporting equipment as well as is not capable of being moved. The concept authorises the occupants to stay put as well as authorise the fire facility to extinguish the fire. If the fire spreads as well as it is not capable of being controlled, then they would tend to initiate an entire evacuation. In the instance of patients connected to life-supporting equipment, a decision has to be made which choice stands to be the best, stay or move; in either manner, the patient would be at grave threat.

You should only strategise in order to utilise defend-in-place, phased evacuation schemes or a alarm system for the staff if the individuals have sought the suggestion of a competent individual as well as the fire and rescue service.

Action on Hearing the Fire Alarm

On discovering a fire, it is the duty of every person to sound the nearest fire alarm immediately. The plan should include the method of raising the alarm in the case of fire.

People, on hearing the alarm, should proceed to pre-determined positions to assist members of the public and staff in leaving the building by the nearest safe route.

Lifts and escalators should not be used due to possible electrical failure unless they are part of a Personal Emergency Evacuation Plan.

Calling the fire brigade

The Fire Service should also be informed to combat from fire.

Power/Process Isolation

Close Down Procedure – Adopt your own 'Close Down' procedure as appropriate.

Fig. 5.14: Fire evacuation process

UNIT 5.10: First Aid

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Cataloguing the first aids

5.10.1 First Aids

First aid, as the name suggests, stands to be the first and immediate care or assistance provided to the person in case of either minor, serious injury or illness. First-aid provided on time can save the life in case of life and death kind of situation as well as additionally assists to control the condition from worsening further.

First aid is often controlled by the 3 P's principle:

- Prevent further injury
- Preserve life
- Promote recovery

It is necessary that each floor or manager should have the first aid box handy with them and can be easily accessed by the employees in case of emergency or need.

Fig. 5.15: First Aid Kit

UNIT 5.11: Potential Injuries and Ill Health

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Understanding the ill health as well as potential injuries

5.11.1 The Ill Health As Well As Potential Injuries

The major role of work is based on enhancing self-esteem, wellbeing and social mobility. However, work-related accidents or illnesses can impact the employee's health in longer or shorter terms and may result in economic as well as social repercussions for the employer.

It is mandatory for an employer to have precautionary measures in place to avoid such incidents. A few common work-related injuries and illnesses are:

- **Slips, trips and falls:** One of the most common causes of injury are slippery surface, fall from ladder or height. It can be avoided through a safety grill or safety bars.
- **Muscle strains:** Muscle strain occurs at the workplace due to lifting heavy items regularly and long-standing or sitting hours. This can be prevented easily through exercise, training and guidance.
- **Being hit by falling objects:** Employees working in warehouses often encounter injuries caused by fall-ing objects. It can be controlled by providing adequate storage and encouraging staff to store the item safely.
- **Cuts and lacerations:** It generally occurs by inappropriately handling sharp objects and is capable of being controlled by delivering the proper training to the staff, wearing proper protection and providing safety equipment to the workers.
- **Inhaling toxic fumes:** Workers who are dealing with chemicals are more likely to become a victim of an injury caused by toxic materials like inhaling dangerous gases or fumes. It is mandatory for the em-ployer to provide adequate safety gear to its worker who regularly meets such kinds of substances.
- **Crashes and collisions:** It can happen in warehouses and construction sites due to vehicle movement, and prevention can be done through necessary safety measures such as PPE, sufficient light, safety alert etc.
- **Exposure to loud noise:** Industrial deafness can occur to employees working in loud noise areas, and it can be avoided by wearing earplugs or earmuffs.
- **Fights at work:** Disagreement or tension may lead to fighting at work. It is a must to have an employee grievance department in order to deal with such cases.

UNIT 5.12: Precautions in Mobility

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Demonstration of the precautions in mobility

5.12.1 The Precautions in Mobility

For the safety of the workers or employees at the workplace or any industry, one should always take the necessary precautions.

All manufacturing owners need to comply with the legal requirements to order to ensure that their industry and workplace is safe to work for everyone, from the customers to employees, suppliers, visitors, contractors and others.

In order to provide better productivity for a workplace, the management of the organization:

- Should minimize illness and injury of employees.
- Should reduce the risk of accidents.
- Should maximize productivity.
- Should reduce the cost of injuries and workers compensation.
- Should meet their legal requirements and responsibilities.
- Should retain their staff for better performance.

Precautions at the workplace may include.

- Keep every corner organised, clean and clutter-free
- Usage of mats on slippery floors
- Properly stored combustible material
- Ensure proper training while handling equipment and machinery

It is very important to have medical facilities and proper first aid for the employees working with heavy equipment and machinery.

1. **Clothes for each different appropriate task:** The people who are working with tools or with machinery must have proper clothing while operating the machinery. They must wear the right size of gloves according to the type of work and must wear safety shoes as well as all protective equipment while handling the tools, machinery and chemicals.

   Different industries have different types of personal protective equipment based on their mode of work. Those are:

   - **The food processing industry:** In this particular industry, they do not require special types of uniforms unless they require antibacterial head caps, clothing or aprons in order to prevent bacterial contamination.
2. **Implementation of emergency procedures:** This procedure usually contains emergencies that do not announce themselves, and there can be the expectation of fire and accidents. For this, there is a need to be prepared beforehand for such emergencies in order to ensure the safety of the employees, workers, visitors as well for business.

3. **Reduce workplace stress:** The common cause of stress during work is working for long hours, insecurity of job and conflicts between employees, which can sometimes lead to depression, difficulties during work and affects the concentration of the employees. Employers must avoid excessive workload on their employees as it may lead to employee's frustration which will provide a direct impact on employee productivity.

In order to promote a healthy and stress-free environment at the workplace, it is the employer's duty to take care of both the physical and emotional well-being of its employees by conducting regular training on time management, outdoor activities, small group discussion and many more.

UNIT 5.13: Significance of Various Types of Hazard and Safety Signs

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Understanding the impact of various types of hazard and safety signs

5.13.1 The Impact of Various Types of Hazard and Safety Signs

Safety Hazard Significance

A hazard is a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. Hazards may be natural, anthropogenic or socio-natural in origin.

Safety hazards are number one on the list of 6 types of workplace hazards. These hazards play an effect on employees who work directly with machinery or on construction sites. Safety hazards are the most common workplace risks. They include:

- Anything that can cause spills or trips such as cords running across the floor or ice
- Anything that can cause falls, such as working from heights, including ladders, scaffolds, roofs, or any elevated work area.
- Unguarded and moving machinery parts that a worker can accidentally touch.
- Electrical hazards like frayed cords, missing ground pins, and improper wiring
- Confined spaces.

Safety Hazards Symbol

Safety symbols, hazard symbols or safety labels are meaningful and recognizable graphical symbols that warn of or identify hazards associated with the location or item.

Fig. 5.16: Role of hazard in Risk assessment

Chemical Hazard Significance

A chemical hazard is a (non-biological) substance that has the potential to cause harm to life or health. Chemicals are widely used in the home and in many other places. Exposure to chemicals can cause acute or long-term detrimental health effects. In the workplace, exposure to chemical hazards is a type of occupational hazard. The use of personal protective equipment (PPE) may substantially reduce the risk of damage from contact with hazardous materials.

Chemical Hazards Symbol

Hazard pictographs are a type of labelling system that alerts people at a glance that there are hazardous chemicals present. The symbols help identify whether the chemicals that are going to be in use may potentially cause physical harm or harm to the environment.

These pictographs are also subdivided into classes and categories for each classification. The assignment for each chemical depends on its type and severity.

Fig. 5.17: Chemical hazard safety signs

Biological Hazard Significance

Biological health hazards include bacteria, viruses, parasites and moulds or fungi. They can pose a threat to human health when they are inhaled, eaten or come in contact with skin.

Fig. 5.18: Biological hazard safety signs

Biological Hazards Symbol

The biohazard symbol is used or displayed only to signify the actual or potential presence of a biological hazard. Appropriate wording may be used in association with the symbol to indicate the nature or identity of the hazard, the name of the individual responsible for its control, precautionary information, etc., but never should this information be superimposed on the symbol.

Ergonomic Hazard Significance

Poor ergonomics contributes to muscle strain, muscle imbalances, and fatigue. Many muscle strains result from performing the same motion over and over again. These become repetitive stress injuries, which are some of the most common workplace injuries.

Ergonomics alone won't eliminate this type of injury. However, proper ergonomics will significantly reduce fatigue and strain.

Ergonomic Hazard Symptoms

Signs and symptoms of ergonomic injuries include pain which may be dull and aching, sharp and stabbing or a burning sensation—tingling or numbness; swelling, inflammation, stiffness. Muscle weakness or discomfort; extremities are turning white or cold.

Work Organization Hazard Significance

A few examples of work organization hazards and it is effective they are defined below.

- Falls and Falling Objects- It can result in serious injury or fatality
- Fire Hazards- It can result in loss, serious injury or fatality
- Electrical Hazards- It can result in loss, serious injury or fatality

Work Organization Hazard Symbol

There are multiple signs or symbols used in an organization to alert the people in their workstations.

Fig. 5.19: Work organization related hazard safety signs

Summary

- Hazard can be identified as an extended-term as it is capable of causing severe disruption to the environment or surroundings.
- Risk Assessment (RA) and environment review (ER) were done for hazard and environmental impact. It is done from different stages, from evaluating a new operation, modification to the existing facilities, maintenance work and others.
- Electrical equipment is generally that equipment that requires electrical supplies for their operations.
- Personal protective equipment is majorly used to protect oneself from serious accidents or illnesses originating from the workplace's physical, biological, chemical, and mechanical hazards.
- Accidents are unplanned experiences resulting in injuries, illness, death, and loss of property and/or production. While there is no way to avoid accidents, some actions, plans, and preparations are capable of being taken to diminish them.
- The "Occupational Safety and Health Administration (OSHA)" needs to implement the organization with a fire prevention event in order to prevent injuries and accidents from the occurrence of fire in the workplace. Prevention from fire is necessary to avoid excessive damage.
- Fire hydrant consists of a system of pipework connected directly to the water supply mainly to water to every hydrant outlet as well as is attempted to present water for the firemen in order to fight a fire. The water is seen to be discharged into the fire engine, from which it is then pumped and sprayed over the fire.
- Artificial respiration and CPR is an act (or) technique used for stimulating respiration when there is a sudden stoppage of breathing or lung functioning. It requires metabolic processes to exchange the gases which tend to be present in the body by external or pulmonary ventilation.
- Fire drills can be initiated with a defined frequency in a surprising manner to ensure employees are well aware of the fire evacuation process. Attendance can be taken in assembly points, and briefing also can be arranged to further train the staff.
- First aid, as the name suggests, stands to be the first and immediate care or assistance provided to the person in case of either minor, serious injury or illness. First-aid provided on time can save the life in case of life and death kind of situation as well as additionally assists to control the condition from worsening further.
- The major role of work is based on enhancing self-esteem, wellbeing and social mobility. However, work-related accidents or illnesses can impact the employees' health in longer or shorter terms and may result in economic as well as social repercussions for the employer.
- A hazard is a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. Hazards may be natural, anthropogenic or socio-natural in origin.
- Poor ergonomics contributes to muscle strain, muscle imbalances, and fatigue. Many muscle strains result from performing the same motion over and over again. These become repetitive stress injuries, which are some of the most common workplace injuries.

Exercise

A. Answer the following questions by choosing the correct option:

1. Is Covid -19 a biological hazard?
   A True B False
2. Which of the following is included in Personal Protective equipment?
   A Spectacles or clear goggles B Earmuffs
   C Hard hat D All of them.
3. Can toxic substances spillage be wiped off with a normal cloth and with bare hands?
   A True B No
4. A simple technique for using fire extinguisher_____.
   A. PASS method B Installation on telephonic desk
5. Which is not a part of potential injury at the workplace?
   A Muscle strain B Cuts
   C Slip or fall D Drowning

B. Answer the following questions briefly.

1. Explain the golden rule of "First Aid".
2. Why is Organisational Protocol necessary for an organisation?
3. Describe any two types of electrical equipment?
4. Explain why hand hygiene is necessary for oneself.
5. Describe the various types of hazards involved while handling or dealing with toxic?

Notes

6. Working Effectively in an Organization

Unit 6.1 - Organizational Policies
Unit 6.2 - Legislations, standard, policies, and procedures
Unit 6.3 - Reporting Structure
Unit 6.4 - Inter-Dependent Functions
Unit 6.5 - Harassment and Discrimination
Unit 6.6 - Prioritising Tasks
Unit 6.7 - Communication Skills
Unit 6.8 - Teamwork
Unit 6.9 - Ethics and Discipline
Unit 6.10 - Grievances Solution
Unit 6.11 - Interpersonal Conflicts
Unit 6.12 - Disabilities and Challenges
Unit 6.13 - Gender Sensitivity and Discrimination
Unit 6.14 - Applicable Legislation, Grievance Redressal Mechanisms
Unit 6.15 - Transacting With Others without Personal Bias

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Key Learning Outcomes

At the end of this unit, the trainee will be able to:

1. Categorize the organizational policies
2. Catalogue the Legislations, standards, policies, and procedures
3. Analyse the reporting structure
4. List the inter-dependent functions
5. Discuss the impact of harassment and discrimination
6. Monitor the ways of prioritising the task
7. Record the types of communication skills
8. Evaluate the ways of carrying out teamwork
9. Highlight the ethics and discipline
10. Illustration of the grievance's solution
11. Recognize the interpersonal conflicts
12. Identify the disabilities and challenges
13. Outline the gender sensitivity and discrimination
14. Discuss the applicable legislations, grievance redressal mechanisms
15. Analyse the process of transacting with others without personal bias

UNIT 6.1: Organizational Policies

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Categorize the organizational policies

6.1.1 The Organizational Policies

Organizational policy or work place policy is a type of statement which provides the outlining of any organization that practices out the procedures. This eventually leads to its business which covers and everything, starting from the operations to concerns and compliances along with the employee's legislation. It also protects the organization from risks and hazards. It consists of a group of statements that could showcase the purpose for one or more guidelines and actions that are required to be taken against it in order to achieve the goals. The statements are required to be written in simple formats for providing efficiency, depending on the type of issues in which the length of policy is stated.

Benefits of Organizational Policies:

- It stands to be in line with organizational values
- It tends to have the list of complaints with the employment and associated legal requirement
- It provides proper clarity on the roles and responsibilities
- It ensures that an organization operates efficiently and in the specified business manner
- It helps in strengthening the staff position during or in the legal situation
- It enforces consistency and uniformity in the operational procedure and in the processes of decision making
- It saves time for the employees while the problems can be resolved rapidly and effectively through the existing policy

Types of organizational or workplace policies:

- Workplace health and safety policy
- Non-discrimination and anti-harassment policies
- Equal opportunity policy
- Employee code of conduct policy
- Leave policy
- Employee time-stamping policy
- Employee disciplinary and termination policy
- Employee grievance policy
- Social media policy
- E-mail policy
- Mobile phone policy
- Temporary policy

1. **Workplace health and safety policy:** It is very essential for a recruiter to provide safe and healthy work environments to their employees since the hazards might arrive without alarming anybody about the risks.
2. **Non-discrimination and Anti-harassment policy:** The principle behind this policy highlights its providing of guarantees in which human rights are exercised without any discrimination. These discriminations stand to be against individuals on the basis of their race, colour, gender, age, language, national origin, religion, gender identity, sexual orientation, property, marital status, family status, and citizenship. The proposal of this policy is mainly to inhibit any kind of harassment, whether it could be verbal or nonverbal and any kind of physical conduct which is designed to threaten the co-workers and to intimidate the employees or any person working on behalf.
3. **Equal opportunity policy:** This policy ensures that the employees are hired irrespective of their gender, religion, colour, age, caste, marital status, or physical ability.
4. **Employee code of conduct policy:** The policy sets the guidelines for all the employees and various stakeholders in which they are expected to follow in their professional and personal behaviour at the workplace.
5. **Leave policy:** This policy recognises that employees require time off from their works in order to maintain the work-life balance. It also understands the various other needs, like personal commitment, medical exigencies, relaxes time and so on of the employees.
6. **Employee time-stamping policy:** This policy describes the rules and regulations related to the working hours of an employee. It additionally assists the guidelines related to their reporting time, work duration/hours and breaks time.
7. **Employee disciplinary and termination policy:** The major objective of the mentioned policy is to define the procedures and protocols in case of any breach of the company's policy, employee misconduct or any in-disciplinary behaviour.
8. **Employee grievance policy:** The aim of this policy is to make sure that every employee has a formal way to raise their concern or complaint to their senior management. It has a clear structure and point of contact details in a case in which the employee wants to raise a concern.
9. **Social media policy:** It is expected from every employee who is engaged or involved in social media sites, like Facebook, Instagram, and Twitter, LinkedIn and several other similar platforms, to understand and follow the guidelines of the company's social media policy. This mainly stands to be the concern for the company if their action or engagement involves the company name. Failing to do so can put their employment with the company at risk.
10. **E-mail policy:** This policy describes the guidelines and uses of corporate e-mails to meet business requirements. One should follow the corporate standards, including copyrights, logos and signatures, while sending the e-mail within or outside the organization.
11. **Mobile phone policy:** This policy implies restrictions or limitations on the usage of mobile phones at the workplace.
12. **Temporary Policies:** These policies are added to the main body of company's policy guides and could be changed or removed as needed example during the COVID-19 pandemic organization implemented policy to handle social distancing, masking, disinfecting and other safety procedures for keeping employee's and workplace safe for smooth running of organization or business.

UNIT 6.2: Legislations, Standard, Policies, and Procedures

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Catalogue the Legislations, standards, policies, and procedures

6.2.1 The Legislations, Standards, Policies, and Procedures

It is the legal requirement of an organisation to comply with the local laws as well as regulations and keep them updated time-to-time. The HR department is mainly responsible for continuously updating the regulations and making sure that it is communicated across the organisation. It also states that the laws and regulations of local authorities take over the organisational policy when required.

Standard practices at a workplace must have:

- Employers to define clear expectations from their employees.
- Provide a chance to utilise one's skills to perform a task.
- Support one's employees
- Motivate employees to collaborate and participate in decision making
- Welcoming nature for the feedback from the organization's employees.
- Investment in the employees learning and development process.
- Feedback received from employees and attempts to make a great workplace.

Policies and procedures at the workplace:

A policy is a general set of guidelines that are designed in line with the company's objective for dealing with an issue. Policies communicate the connection between the organization's vision and values.

A procedure sets out the specific task or action plan for implementing or carrying out a policy. Procedure tells employee's how to deal with a situation and when.

Importance of Policies and Procedure:

- It makes sure of the smooth functioning of the business and its day-to-day tasks.
- It clearly sets out the instruction for the employees which is expected from them.
- Having policy and procedure in place become handy at times while dealing with any kind of issue.
- It improves the overall image of an organisation in the market.
- It sends out a clear message to its external stakeholders and helps the organisation to build trust among its stakeholders.
- It enhances the goodwill of an organisation and, in turn, increases the market value.

The difference between policy and procedure is described below:

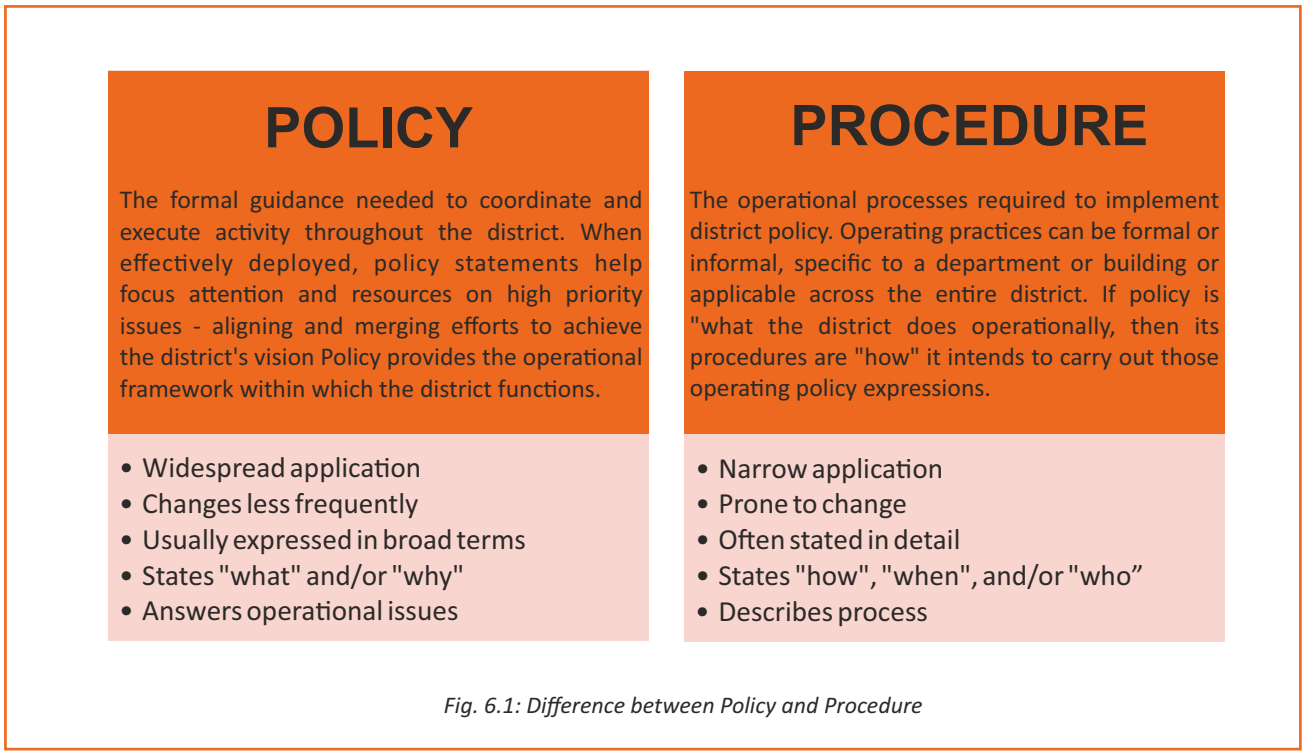

Fig. 6.1: Difference between Policy and Procedure

UNIT 6.3: Reporting Structure

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Analyse the reporting structure

6.3.1 The Reporting Structure

Reporting structure refers to the relationship between the employee's position in terms of authority –"who reports to whom". The reporting structure acts as a command it is hierarchal within every employee report to another employee who resides to be one level higher in their authority or position within the organisation including communication and decision channels.

Types of Reporting Structure

- **Vertical Structure:** The vertical organizational structure is a pyramid like top-down management structure. It creates a powerful hierarchical structure that emerges from top highest level of leadership CEO/owner followed by middle management then regular employees at bottom. Every employee has the authority to do their individual task or jobs. Every employee has to report to their supervisors in case of any issue. Here decision making often work from top to bottom, but work approval will work from bottom to top.
- **Horizontal Structure:** The flat structure or horizontal structure is an organizational structure having only a few layers of management into which the managers have a very wide span to control with one or more subordinates as it does not have many chains of command. The top layer of the structure is the owner of the business, whereas the second layer contains team leaders or managers who will report to the business owner. The third layer of team members is supervised by the team leaders or the managers of the second layer.

The company's reporting structure is generally prepared to keep the company's strategic goals and missions in mind. The authorities and work are delegated among the employees of the various departments according to various business functions.

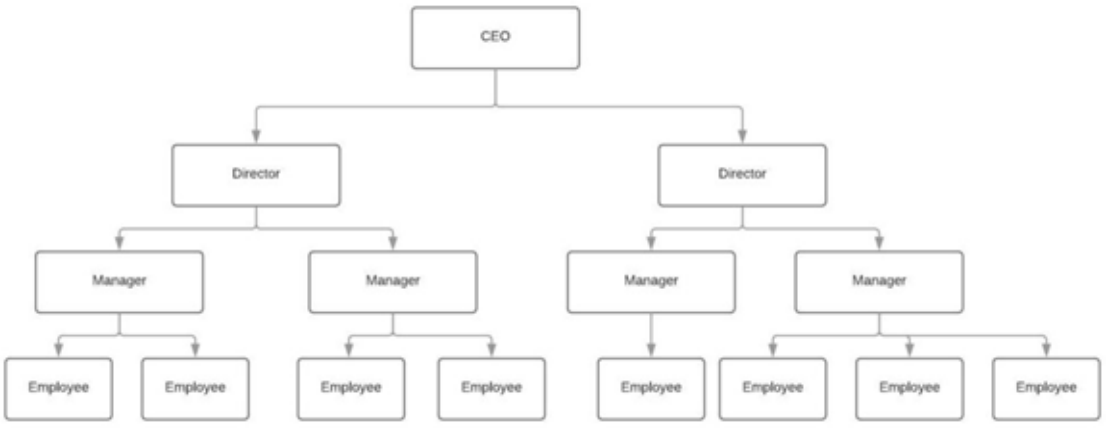

Fig. 6.2: Company's Reporting Structure

UNIT 6.4: Inter-Dependent Functions

Unit Objectives

At the end of this unit, the trainee will be able to:

1. List the inter-dependent functions

6.4.1 The Inter-Dependent Functions

Interdependence stands to be the key aspect of creating a healthy work environment and a sense of unity among the workers in order to achieve a common organizational goal. Teams of employees working together in hierarchy of organizational structure tend to demonstrate high chances of success rather than working individually. It also ensures the everyone is in line with the company's overall progress and are working towards the same objective.

The two main components of Inter-dependence are:

1. Collaboration
2. Delegation

Types of Inter-dependence:

- **Pooled inter-dependence:** In an organisation, each vertical or or horizontal department may not directly interact and do not directly depend on each other and perform completely separate functions having their own set of tasks, which stands to be different from each other, but they offer a contribution to the overall goal of an organisation as well. This type of inter-dependence is known as pooled inter-dependence. It means if any department fails to achieve its objective, the entire project or goal will collapse.
- **Sequential inter-dependence:** Sequential interdependence is a kind of inter-dependence when one department is witnessed to depend upon the functioning of the other department. As an instance, the procurement department must purchase the raw materials in order to ensure the proper functioning of the production department.
- **Reciprocal inter-dependence:** Similar to Sequential inter-dependence, Reciprocal inter-dependence also defines output of one department becomes input of other department in order to efficiently complete the task or project.

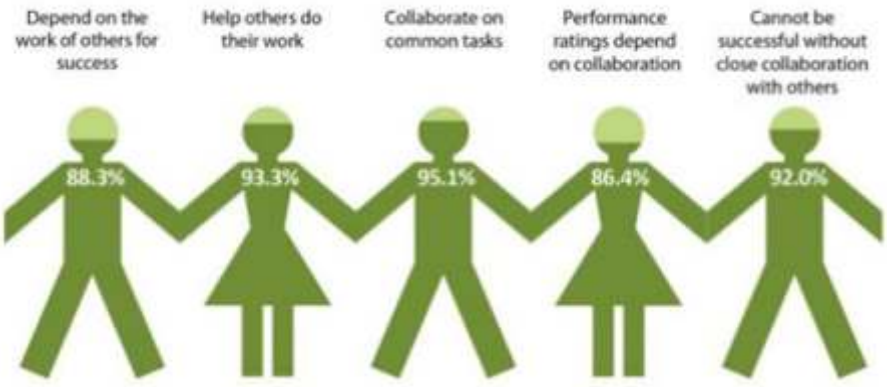

Fig. 6.3: Process of the concept of Inter-dependence

UNIT 6.5: Harassment and Discrimination

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Discuss the impact of harassment and discrimination

6.5.1 The Impact of Harassment and Discrimination

Any objectionable behaviour of someone towards an individual during professional or personal communication, whether on verbal or non-verbal terms, is referred to as harassment.

Harassment can include behaviours, such as:

- Telling abusive jokes about a particular group of members.
- Forwarding obvious or sexually suggestive emails or texts.
- Making disrespectful comments or taunts about a person's appearance and disability.
- Asking unwanted questions about someone's life.
- Displaying ethnic offensive screen savers.

Discrimination refers to a treatment when one person or a group of members are treated unfairly based on the factors such as race, colour, gender, sexual orientation, age, religion, and disability.

Discrimination that occurs in the workplace is of different types:

It occurs when an individual is discriminated against a number of factors. In addition to the reasons, job applicants and workers are also discriminated against because of their relationship with any other person.

The different types of workplace discrimination are.

- Gender Discrimination
- Age Discrimination
- Race Discrimination
- Skin colour Discrimination
- Mental and physical disability
- Genetic information
- Religion Discrimination

Pregnancy and parenthood: Harassment and Discrimination at workplace is illegal and unethical. It is not only treating your employee's equally the right thing to do but also avoiding any type of harassment and discrimination can also improve company's reputation and will also improve working environment in organization.

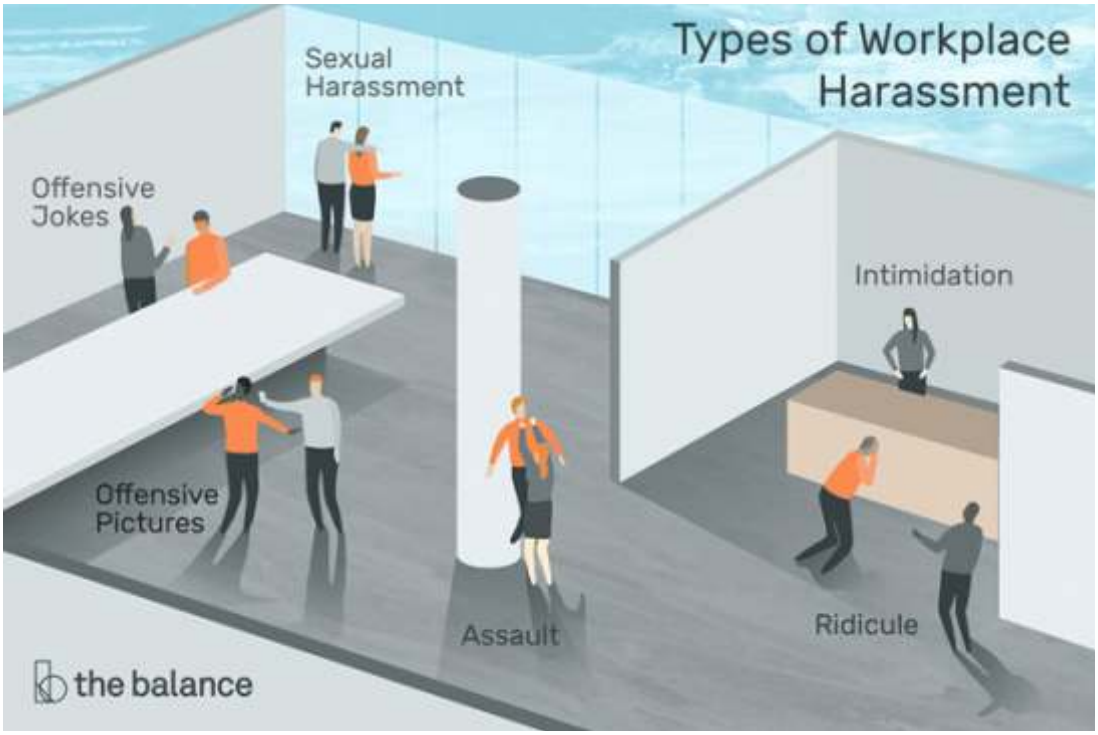

Fig. 6.4: Types of Workplace Harassment

UNIT 6.6: Prioritising Tasks

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Monitor the ways of prioritising the task

6.6.1 The Ways of Prioritising the Task

Prioritizing a task or work is a process of having an understanding of which task requires to be achieved first by determining the level of importance and urgency of task, thing or event. However, each task or work appears to be equally vital. Prioritization also helps the employees to attain more work or tasks in a less amount of time. It is very important for the employees and workers to prioritize their work in order to be productive rather than being reactive, which will indirectly decrease their efficiency of providing productive work.

How to Prioritize Task on Workplace When Everything's Important?

Seven strategies for prioritizing tasks at the workplace:

- Having a list that contains all tasks or works in one place
- Identify what's important
- Highlight what is necessary
- Prioritize based on importance
- Avoid competing with priorities
- Consideration of the efforts made in the tasks
- Constantly reviewing task and be realistic

UNIT 6.7: Communication Skills

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Record the types of communication skills

6.7.1 The Types of Communication Skills

Communication skill mainly addresses to the ability of the ways in order to communicate effectively with managers, colleagues and staff. It is an essential part for every industry. Communication is the act of transferring information from one place to another. It may be vocally (using voice), written (using printed or digital media such as books, magazines, websites or emails, visually (using logos, maps, chats or graphs), nonverbally (using body language, gestures, tone and pitch of voice). In practice it is often a combination of several of these. Productive communication skills in the workplace can reduce conflicts, lower the risk of projects indirectly and thus would make the work more agreeable.

In today's scenario having technical skills is not only enough to get the work done in the workplace. Completing the task must require the support of the whole team, and without proper communication, things will remain stringent in order to get better communication in the workplace. Communication skills are absolutely necessary for successful communication both in the workplace and in private life.

Fig. 6.5: Essential Communication Skills

Fig. 6.6: 7 Key Active Listening Skills

- **Body Language (non-verbal):** When there is a discussion about body language, it refers to the ways by an individual presents themselves while interacting with someone. It includes body posture, hand movements or gestures, the type of eye contact that is made, and the voice tone.
- **Listening:** Communication in the workplace is not entirely about speaking; it mainly represents atwo-way channel. Onehas to pay close attention while talking, as this allows the team members to ask and clarify their doubts as well asinquiries to ensure that they are on the same page or track.
- **Clarity and Conciseness:** One of the major ingredients for effective communication in the workplace is clarity, which mainly stands to be responsible to expresses the attempt of conveying an individual's message in the simple way possible. Before you start a conversation, type an email or being a discussion, have in mind what the purpose of the communication is and what information you hope to obtain as a result.
- **Friendliness:** In order to engage with the team members in an open or honest discussion, a person needs a friendly tone, a personal question, or simply a smile. It is important because the team members would not hesitate to contact the individual as they would be easily approachable for the conversation.

- **Empathy:** Showing compassion or empathy even when the individual disagrees with an employer, co-worker, or employee state to be very important as it helps in understanding their point of view and also respects their decision.
- **Confidence:** It is an important step to be confident when an individual tends to interact with others. As in all interactions, confidence (but not overconfidence) is crucial part. Conveying with confidence will give you peoples, faith in your abilities and will take you seriously.
- **Respect:** The employee must respect their co-workers' roles, skill set and ideas in order to meet the company's overall goal as a team.

  The team must communicate with each other in a respectful manner every time. Conveying them with respect through email by taking the time in order to edit their message is also required. If the individual would send them a sloppy written, confusing email, the recipient will think them to be disrespectful and also encourage them to think through the person's communication.

Summarizing the concept:

Effective and clear communication at the workplace ensures that the healthy work environment supports the overall team development, engagement of employees, innovative idea, which in turn help the overall company's growth, enhancing the goodwill and trust of its customers.

UNIT 6.8: Teamwork

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Evaluate the ways of carrying out a teamwork

6.8.1 The Ways of Carrying Out Teamwork

Teamwork is a cumulative effort done by a team or a group of members in order to acquire a common goal or to complete a given work or task in the most effective and powerful way. Good teamwork helps in building a strong relationship as well as provides morale in the workplace, which makes the workers more productive, leading to an increased profit.

Tips to improve teamwork in the organization:

- **Encourage informal social events:** In an informal environment, employees feel free to communicate with each other, and they also try to understand the personal behaviour of everyone.
- **Clarify Roles:** In order to work efficiently at the workplace, every employee should have a proper understanding of their roles and responsibilities according to their work demand.
- **Specify long-term as well as short-term goals:** Specifying goals help in streamlining the communication and makes the teamwork more purposeful.
- **Reward and recognition:** It is necessary for an employer to recognise the best performing employees as it will keep them motivated and also provide a sense of accomplishment.
- **Avoid micro-management:** One of the significant drawbacks of micromanagement is that the employee tends to focus on the small or less relevant thing which they think is required to please the immediate supervisor.
- **Establish Effective Communications:** It is not necessary that an employee needs to be friends with all the co-workers, but the thing which is necessary states the establishing and practising of effective/good communication.
- **Respect Individuality:** Every individual has their own personality, skill and preferential ways of working, which is a necessity of the employer in order to recognise these.
- **Seek feedback:** Seek feedback not only from the managerial staff but also from the ground level staff in order to gain the proper insights and scopes of improvement.

UNIT 6.9: Ethics and Discipline

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Highlight the ethics and discipline

6.9.1 The Ethics and Discipline

Work ethics refers to the ways by which the employees govern themselves and their attitude towards their work. It also refers to morality in the workplace.

A person having a good work ethic tends to create a healthy workplace environment for him/her as well as for their fellow co-workers.

It is mandatory for an employer to develop strong work ethics among the employees. It can be done in various ways.

- Setting clear goals and objectives
- Mentoring
- Set example
- Need of right work environment
- Encourage professionalism
- Discipline
- Listen to your employees
- Feedback
- Rewards and recognition
- Remove obstacles
- Discipline at Workplace

UNIT 6.10: Grievances Solution

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Illustration of the grievance's solution

6.10.1 The Grievance's Solution

Grievance's Solutions

A grievance can prove to be quite harmful if not dealt with in time. It may lead to frustration among the employees, and they can start losing their trust from the employers.

Work-related grievances and complaints from staff need to be tackledwith proper care and are also known to be a time taking procedure.

It is the liability of the HR department that employee grievances are addressed quickly and in an effective manner.

There are five ways in order to address the grievances effectively:

- **Prompt and timely Action:** The staff or department expert in handling the grievances must be highly trained in managing the employee grievances effectively and in a time-bound manner.
- **Grievance acceptance:** The supervisor or expert must accept the employee grievance and also should respect their genuine feelings.
- **Collect information:** Management should not wait for the grievances to be reported. Instead, it should take preventive steps in order to avoid it. In order to curb it, the management must discuss, collect information, communicate regarding various issues at the workplace.
- **Cross verify the grievance cause:** Once the information and cause of grievance are collected about the reported incident, the information must be cross-checked from various other sources.
- **Decision making:** On successful identification of the causes, the management must develop a series of steps in order to resolve it along with the next course of action.
- **Review and implement:** The management should not wait for a longer time once they have a rational and effective resolution. It is necessary to involve the concerning employee(s) in confidence before implementing the decision.

UNIT 6.11: Interpersonal Conflicts

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Recognize the interpersonal conflicts

6.11.1 The Interpersonal Conflicts

Interpersonal Conflicts

Interpersonal conflicts refer to any type of conflict among two or more people. The idea mainly refers to the situation when a person or group of employees try to interfere in some other employee's work.

Ways to Resolve Conflict at the Workplace

- Communicate
- Listen carefully
- Show empathy
- Never hold back any grudges
- Effective communication skill

UNIT 6.12: Disabilities and Challenges

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify the disabilities and challenges

6.12.1 The Disabilities and Challenges

People with disabilities are far more impacted by personal and environmental barriers than normal people. By the end of this module, you will be able to get clarity on the rights of disabled people in the workplace.

These challenges to employment can range from a variety of physical and social ones. These can include:

- Physical barriers
- Nature of co-workers and stereotyping
- Communication barriers
- Policy barriers

Physical Barriers

They can take the form of structural issues in an environment that retrogrades the basic functioning of disabled people. As an instance, the lack of a wheelchair ramp or an elevator can hamper basic tasks for disabled people or not allow them access to modern equipment that would authorizethem to perform tasks.

Nature of Co-Workers and Stereotyping

Judgements and assumptions against people with disabilities are pretty much the norms of our present-day society. They tend to prevent disabled people from getting hired or having a positive experience in the workplace. For example, a person might be denied useful resources because their employer believes that they don't tend to possess a learning ability. This is common for people suffering from autism, ADHD or several other 'invisible' disabilities.

Communication Barriers

Communication barriers can create an inefficacy to effectively write, speak, read or understand the necessary requirements for a job. Some examples would involve the inability to use a phone due to hearing disability, lack of braille prints for blind people, and usage of languages that are too technical for people with cognitive impairments.

Policy Barriers

Policy barriers can also be a defining factor for the challenged people to get a job in a cooperative workplace. These include giving people not enough time to complete their tasks.

UNIT 6.13: Gender Sensitivity and Discrimination

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify the disabilities and challenges

6.13.1 The Disabilities and Challenges

Gender sensitivity has also been an ongoing dialogue inside the workplace. The workplace has frequently been referred to as an "inhospitable place" for women due to the multiple decisions taken by the HRs (i.e., policies, decisions and their enactment, training, wage).

Ways to Build Gender Sensitivity and Eliminate Discrimination

- Recognizing the workplace's "Gender Equality Maker (GEM)."
- By being open and informative about it
- Altering existing policies to make room for gender diversity and equality
- Strict implementation of the policies

Recognize the Workplace's Gender Equality Maker

Being gender-sensitive is just one of the many necessary steps to be taken in order to have a gender-fluid workplace. Recognizing your company's current status in its diversity can be helpful and would point you in the right direction.

By Being Open and Informative About It

An open atmosphere in a workplace would help a company and its employees to excel in all directions. Understanding their needs and fulfilling them accordingly would help the employers and workers in a similar manner to achieve a gender-balanced environment.

For example, having group discussions with men, women, and LGBTQ+ would help people to understand their needs and concerns.

Altering Existing Policies to Make Room for Gender Diversity and Equality

The "Equal Remuneration Act of 1976" of India has prohibited differential pay to men and women employees for conducting the same work or work of the same nature.

Strict Implementation

Rules and regulations are only followed up with when implemented strictly. There are lots of rules and policies that can be put in place in order to check inequality and help a workplace to go from being gender-sensitive to gender transformative. One example which can be taken under consideration is the ensuring of nearly everyone to be confident and open to a leadership role if offered, while the otherscould portray equal pay amongst colleagues in the same position. Lastly, for sexual harassment, implementing strict rules against this kind of behaviour is paramount and shows that a corporation is heading in the right direction. Companies must realise that employees are working in a safe environment and do not need to be anxious about a harassment encounter.

UNIT 6.14: Applicable Legislation, Grievance Redressal Mechanisms

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Discuss the applicable legislations, grievance redressal mechanisms

6.14.1 The Applicable Legislations, Grievance Redressal Mechanisms

The Indian Constitution guarantees equality and prohibits discrimination on the grounds of religion, race, caste, sex, birthplace, and residence.

Discrimination against or profiling individuals can occur at two stages – pre-recruitment and post-recruitment. The former entails rejecting potential candidates on the basis of their gender, religion, caste, marital status, pregnancy etc. Post-recruitment discrimination manifests in lesser pay, fewer benefits and/or leave or even termination, based on the same grounds.

The Constitution guarantees equality of opportunity for every citizen in matters relating to employment or appointment to any office under the state.

“Equal Remuneration Act, 1976” needs the employers to pay equal remuneration to the employees for the same task or work of a similar nature without having any discrimination on the basis of sex.

Grievance Redressal Mechanism

A transparent, quick, robust and confidential grievance redressal system can effectively help in order to handle conflicts in the workplace and potentially go a long way in bringing harmony to the workplace. Some of the better places to work are identified to have an efficient worker-based grievance redressal mechanism.

In India, certain central and state-specific labour laws require the employer to adopt certain grievance redressal mechanisms at the workplace.

- **Internal Commite for Complaints:** According to the sexual harassment of women at workplace "(Prevention, Prohibition and Redressal) Act, 2013" of India (POSH Act), each workplace possessing at least ten employees is required to constitute an Internal Complaints Committee (IC). The IC is required to investigate complaints of sexual harassment of women at the workplace and also provide recommendations to the employers.
- **Grievance Redressal Committee:** According to section 9C of the Industrial Disputes Act, 1947 of India (IDA), each employer recruiting at least twenty workmen, is needed to structure a Grievance Redressal Committee (GRC) for resolution of the conflicts arising out of grievances of the people.
- **Works Committee:** The labour authorities might, under section 3 of the IDA, order an initiation possessing at least one hundred workmen to set up a Works Committee (WC).
- **Committee for Employee's Health and Safety:** Certain states in Indian like Maharashtra need employers to employ at least one hundred workers to structure a Health, Safety and Welfare Committee (HSW Committee). The responsibility of the HSW Committee includes surveying and identifying any accident-prone, hazardous objects or spots in the boundaries, rectifying such spots, conducting healthcare camps once a year.

UNIT 6.15: Transacting With Others Without Personal Bias

Unit Objectives

At the end of this unit, the trainee will be able to:

1. To administer with others without personal bias

6.15.1 Personal Bias

When it arrives at making choices at work, it's important to know they are not based on bias. It is essential for organizations to have concrete processes and procedures in place to curb unconscious bias. Nevertheless, there are many stages that can be adopted to check the biases and to create an inclusive environment for the team.

Recognizing an Individual's Own Biases

Recruitment is known to be an area where unconscious bias may come into play as it has been seen that people may unwittingly tend to favour applicants from their own familiar backgrounds.

Focusing on People

Many organizations are so focused on their processes that they lose sight of their own people. Of course, there is a requirement to find time, for example, to write reports, define job descriptions, and set up performance appraisals, but it's important that there is also the establishment of expectations communicate plans, and givingas well asreceiving feedback from everyone involved in the team.

Increasing Exposure to Biases

Many organizations assume that their policies on avoiding discrimination are robust and work well, so perhaps they fail to weed out some subtle biases. Declaration of the intentions about valuing a diverse workforce is extensively required. Saying words out loud, or writing them down, sends a clear message to everyone with whom an individual is working, as well as is involved inone's own subconsciousness.

Summary

- Organizational policy or work place policy is a type of statement which provides the outlining of any organization that practices out the procedures. This eventually leads to its business which covers and everything, starting from the operations to concerns and compliances along with the employee's legislation.
- It is the legal requirement of an organisation to comply with the local laws as well as regulations and keep them updated time-to-time. The HR department is mainly responsible for continuously updating the regulations and making sure that it is communicated across the organisation.
- Policies communicate the connection between the organization's vision and values.
- The reporting structure acts as a command it is hierarchal within every employee report to another employee who resides to be one level higher in their authority or position within the organisation including communication and decision channels.
- Teams of employees working together in hierarchy of organizational structure tend to demonstrate high chances of success rather than working individually.
- Prioritizing a task or work is a process of having an understanding of which task requires to be achieved first by determining the level of importance and urgency of task, thing or event.
- Effective and clear communication at the workplace ensures that the healthy work environment supports the overall team development, engagement of employees, innovative idea, which in turn help the overall company's growth, enhancing the goodwill and trust of its customers.
- Discipline at the workplace lays a strong foundation of trust between the employer and its employees. It includes reporting on time, maintaining decorum during working hours and at the workplace, appropriate dressing, proper communication, etc.
- A grievance can prove to be quite harmful if not dealt with in time. It may lead to frustration among the employees, and they can start losing their trust from the employers. In order to handle grievances properly, one should have an adequate set of procedures that lays out a clear step by step process in order to deal with the grievances.
- Women have been witnessed to have fought for their rights and for their place in this world for hundreds of years. However, it's not just women now, and the LGBTQ+ communities are also fighting for their rights and their voices in order to be heard.
- The Indian Constitution guarantees equality and prohibits discrimination on the grounds of religion, race, caste, sex, birthplace, and residence.
- A transparent, quick, robust and confidential grievance redressal system can effectively help in order to handle conflicts in the workplace and potentially go a long way in bringing harmony to the workplace.
- Recruitment is known to be an area where unconscious bias may come into play as it has been seen that people may unwittingly tend to favour applicants from their own familiar backgrounds. But a person can take practical steps in order to reduce this bias.

Exercise

A. Answer the following questions by choosing the correct option:

1. Which policy stands to be the workplace or organizational policy?
   A. Social Media Policy B. Environment Protection Policy
2. _____ at workplace lays a strong foundation of trust between the employer and its employees/
   A. Communication B. Discipline
3. _____ can prove to be quite harmful if not dealt in time.
   A. Actions B. Grievance
4. The employment barriers might include:

A. Communication barriers B. Disciplinary barriers

5. _____ requires employers to pay equal remuneration to the workers.

A. Equal Remuneration Act, 1976 B. Republic Act No. 9710

B. Answer the following questions briefly.

1. List down the importance of having the company policies in force.
2. State the differences between policies and procedures.
3. What do you understand by communication skills?
4. What are policy barriers?
5. What are some of the central and state-specific labour laws in India for focusing on the grievance redressal mechanism?

Notes

7. Material Conservation

Unit 7.1 - Material Handling

Unit 7.2 - Workstation Layout, Electrical and Thermal Equipment

Unit 7.3 - Organisational Procedures for Minimising Waste

Unit 7.4 - Practices of Efficient and Inefficient Management

Unit 7.5 - Material and Water Usage

Key Learning Outcomes

At the end of this unit, the trainee will be able to:

1. Identify the ways to handle materials
2. Categorize the workstation layouts, electrical and thermal equipment
3. List the organizational procedures for minimising waste
4. Analyse the practices of efficient and inefficient management
5. Discuss the material and water usage

UNIT 7.1: Material Handling

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify the ways to handle materials

7.1.1 The ways to handle materials

Material handling

Material handling is also known as the integrated system, which involves such activities of the movement, storage, protection and control of types of materials and products throughout the manufacturing, distribution, consumption and disposal. The major function involves the focus on methods, mechanical equipment, and related control systems to achieve the mentioned functions.

The fundamental objective of using material handling is to ensure that the material is in the right amount and is safely delivered to the desired place at the right time, along with minimum production cost. The cost of material handling has an estimated 20-25% of total manufacturing labour cost.

Principles of Material Handling

- **Planning:** The planning requires to be done in order to achieve the approach of the team with the input of consultants, suppliers and the end-users, from the management, engineering, operations, finance, sales and operations.
- **Standardization:** All the material handling equipment, methods, controls, and software requires to be standardized in such a way that it would be able to perform a wide range of tasks in a broad range of operations.
- **Work:** In material handling, the process requires to be clarified by reducing, shortening and eliminating in order to remove the unnecessary movement that would impact productivity.
- **Ergonomics:** Work and work-related conditions are being adapted to support the ability of a worker, which reduces the repetitive and difficult manual labour as well as safety.
- **Unit Load:** Due to the less use of effort and work required to move several individual items together as a single load (e.g., moving of many items one at a time), a unit load such as containers or pallets is required to be used.
- **Space Utilization:** In order to maximize the effective use of space within a facility, it is extensively crucial to keep the working stations organized and clutter-free to increase the density and availability of the storage area. 5S principle can be implemented for space utilization 5S stands for the 5 steps of this methodology: Sort, Set in Order, Shine, Standardize, Sustain.
- **System:** In material handling, the movement and the storage are required to be coordinated throughout the process in order to form or receive the inspection, storage, packaging, order selection, production, and shipping, return handling, as well as transportation.
- **Environment:** Energy, which is used in potential environmental impact, have been considered in designing the system with recycling and reusability processes implemented whenever possible, as well as for the establishment of practices for safe handling of hazardous materials.
- **Automation:** To develop operational efficiency and consistency, the automated material handling technologies need to be positioned whenever possible.

- **Life Cycle Cost:** For all the equipment used in material handling for a specified system, the analysis of a life cycle cost is required to be conducted. The areas of considerations require possessing the installations, programming, training, operation, maintenance and also repairing.

Material Handling Equipment

The simplest shelf to the most complex light out facilities, warehouse mechanization, is capable of being operated in the dark as it uses a lot of material handling equipment.

There are different kinds of material handling equipment, and they fall under four broad types. Material handling is the unloading and loading or movement of goods within a warehouse, especially with the help of mechanical devices. Thus, material handling equipment refers to the devices that are used in a warehouse's operation by storing and moving the goods.

Type 1: Storage and Handling Equipment

This stands to be usually the simplest type of material handling equipment which includes shelves and racks where an individual is capable of storing their material in the middle of shipping and receiving it. Drawers, bins, flow racks, cantilever racks and stacking frames are additionally included in this category.

Type 2: Bulk Material Handling Equipment

It is the process of storing, transportation and control of materials in loose bulk form. For instance, a silo, a large cylinder that is capable of holding stuff like grain. Other examples include:

- Reclaimers and Stackers:
- Hoppers
- Conveyor Belt
- Grain Elevators
- Dump Trucks
- Rotary Car Dumper
- Screw Conveyor
- Bucket Elevators
- Vacuum lifter

Type 3: Industrial Truck

These are the type of equipment or vehicles that is used to move materials. Sometimes it is run by workers, and sometimes they are automated. "Automated Guided Vehicles (AGVs)" fall under both industrial trucks and engineered systems. Other examples include:

- Forklifts
- Order Pickers
- Hand Trucks
- Pallet Trucks

Type 4: Engineered System

It is the type of material handling equipment that stands to be a more complicated system with multiple components, which are usually automatic. They include AGVs, conveyor belt or robotic delivery system that comes in different sizes and shapes or automated storage systems.

7.1.2 Hazards, Risks and Threats Associated with Handling Different Materials

There are multiple hazards, risks and threats can be identified during receiving, loading & unloading, storage, and transportation for handling different types of materials.

Receiving

Hazards, risks and threats can be identified during receiving of the material. Inspect incoming materials as soon as they are received to ensure established specifications such as product temperature, packaging conditions, etc. are met. A designated employee should verify and document:

- Incoming raw materials – Quality and other kinds of defects can occur during receiving of incoming materials. So, all kind of material should be from an approved supplier. Approved supplier can be verified through supplier visit, document verification and certification from legal bodies.
- Cleanliness of the truck – Foreign body, pest can be identified as a hazard. So, we must ensure that no foreign material, dirt, odours, rodents, insects or other pests are there in the vehicle.
- Temperature of the truck – Every different material requires different type of temperature requirements such as ambient (Normal temperature- 20-25°C), chilled (0-5°C), frozen (-16°C to -23°C) and dry items. Any deviation of temperature requirements can be considered as a hazard. Proper temperature needs to maintain for products according to specifications.
- Condition of door seals – Improper door closing, or door gaps of the vehicle can be one of the risk factors of material. So, it needs to ensure that close-fitting doors with no spaces at sides or bottom.
- General truck conditions or Material handling equipment's – Truck or material handling equipment's can be cause damage of product, infrastructure damage and injury of the person or even fatality.

Loading and Unloading

Loading and unloading process can be considered as hazard due to the potential risk involved to the product, property and person.

- Product damage and spillage can happen during loading and unloading process and it can be considered as a risk.
- Human error during loading or unloading process can cause damage to product, property or the employees. Employees responsible for loading and unloading materials should follow company standards for hygiene and sanitation practices.
- Proper product temperature must be maintained during loading and unloading as well. Movers should be aware of the product temperature requirements. Any kind of deviation regarding temperature can cause product damage. Document verification plays an important part for tracing shipments in case of a recall and should include: Time of receipt, type of product, ingredient and product packaging, labelling, lot number, pallet tag, quantity, size and weight.

Storage

Products should be stored adequately to maintain package/pallet integrity:

- Allow maximum air circulation and stock rotation. Air circulation is important to maintain the temperature, humidity inside the warehouse. Also, HEPA (High efficiency particulate air) filter can be installed to avoid biological hazard.
- Assign different storage areas for different products (ingredients, raw materials, finished products) to avoid cross contamination.

- Material should be used within the manufacturer's specified time period to maintain shelf-life requirements. Appropriate rotation of food and packing materials -- first in, first out (FIFO) -- helps minimize product contamination, damage and spoilage. Allergen control precautions need to establish for food industry regarding raw materials purchasing, transportation and storage Ensure suppliers have documented and implemented an allergen control plan. Check labels on incoming ingredients to ensure supplier has not sent the wrong product, a substitute product or used the wrong label. Ensure vehicles and shipping containers are cleaned before shipping. Clearly label raw materials to indicate they contain food allergens (ex: color-coded containers, tags).
- Pallet used to store materials can cause different hazards. For example- Damage pallets can result into product damage or fall down of the product; Protruded nails can product damage or injury.
- Loading strength and design should be based on Health and safety risk assessment. Major accidents can happen due to excessive product storage on each rack or improper design of racking system.

Transportation

Vehicles and containers that transport materials should be used only for the intended purpose and should have both sanitary design and pest control procedures in place. (Ex: truck's doors should be sealed to prevent entry of pests.) Refrigeration equipment in vehicles and temperature measuring devices should be calibrated and in good working order. Mechanical refrigeration should be provided for perishable food products such as meat, fish, poultry, milk and eggs.

Inspection of vehicles

Designated employees should evaluate and document the condition of trucks, containers and carriers of finished products before loading. The following should be verified before loading:

- Cleanliness of the truck should be maintained to avoid any physical, chemical or biological hazards.
- No odours or obvious dirt or debris.
- No evidence of chemical contamination such as fluids, powders, chemical residues
- Correct temperature in the truck.
- Temperature measuring devices will work properly during transportation. Documentation and maintain a log to verify inspection and cleaning tasks. Indicate type of loads, cleaning and sanitation procedures, inspections, etc.

UNIT 7.2: Workstation Layout, Electrical and Thermal Equipment

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Categorize the workstation layouts, electrical and thermal equipment

7.2.1 The Workstation Layouts, Electrical and Thermal Equipment

Workstation Layout

Workstation or workplace is also known as the floor space occupied by the workers, as well as by the machines or a group of machines. An ergonomic workplace is a scientific discipline that is concerned with improving the productivity, health, comfort and safety of people in order to promote effective interactions among people, the environment and technology.

During the design of the workstation layout, the following space requirements are taken into considerations:

- Requires having spaces for racks, bins and conveyor stations that either contain the under processed work or receive the work after it has been completed by the machine.
- There should be a rectangular space occupied by the length and width of the machine or group of machines. They need to include the space for the travel of moving parts as well as the projected parts of machines which include shafts, levers, pulleys, handles and wheels.
- There requires being a proper workspace for the workers in order to efficiently complete their tasks.
- Requires having clearance space for feeding the work on and off the machine.
- There needs to be a space for tool racks, workbenches, etc., required by the individual machine, if any.
- There needs to be proper floor space for the power source, or if in case of any electric motor, it has to be placed on the floor or within the working area.

Storage Space Requirement

In any plant layout, the space for workstations allocation requires to be made for the storage of material and space essentially required inside the plants. Every department and area need to be designed in such a way so that they are capable of providing waiting, processing and moving facilities.

The storage space requirement depends on various factors such as:

- Quantitative use of raw material per hour
- Movement of semi-built parts between two machines depending upon the weight and volume.
- Movement of parts between the departments, depending upon the weight and volume.
- The dependence upon the scrap weight and volume
- Vertical heights of the building plants.
- Production capacity of the assembly.

- Floor load-bearing capacity.
- Storage practices.

Once the space requirement for all machines has been estimated, the employer needs to have the provision for the basic amenities like canteen, drinking water, first aid, restrooms, sales department, changing room (for factory worker like machine operators), refreshment place, etc.

Workplace Layout Design:

Employee productivity stands to be directly in proportion to workplace conditions. A good and comfortable workplace always results in high productivity per employee.

Some important aspects which need to be considered while designing the workplace are:

- Cleanliness
- Proper lighting
- Noise
- Too ls and Material positioning
- Chairs and Workbench
- Machine design

Electrical and Thermal Equipment

In order to build an efficient workplace layout, one needs to consider the electrical and thermal requirements of the workers. Workstations that are well equipped with electrical supply takes care of the power source needs of employees in order to operate the required equipment and tools.

The following points require to be considered while designing an electrical workstation.

- Placement of electricity outlet or strips
- Power/voltage requirement of different equipment
- The number of power outlets required
- Alternative or emergency power source outlets

UNIT 7.3: Organisational Procedures for Minimising Waste

Unit Objectives

At the end of this unit, the trainee will be able to:

1. List the organizational procedures for minimising waste

7.3.1 The Organizational Procedures for Minimising Waste

Types of organisational waste and ways to minimise them:

- **Transportation:** Transportation waste refers to the movement of tools, equipment, inventory, raw material, people etc., more than the actual requirement or consumption. Unnecessary or excessive movement of resources leads to unnecessary work, increased wear and tear, increased damaged and defects.

  In order to curb this type of waste, the department which works closely needs to be designated next to each other. The materials required for production has to be placed in easy to reach locations as well as the multiple handling of material needs to be avoided.

- **Inventory:** Inventory is often considered as an asset to any organisation; however, storing inventory stands to be more than the required leads to unnecessary damage, defects and increased lead time during the production process. The main cause of this is over-purchasing of raw material, increased WIP (work in progress) and over-production in comparison to the actual customer needs.

  Measure to be taken in order to reduce such kind of waste involves the purchase of raw material as per the demand, avoid overproduction and reduce the work in progress.

- **Motion:** This includes unnecessary movement of tools or equipment, machinery or people. It also includes repetitive movement that doesn't add value to the work or customer, reaching for raw material, unnecessary walking to fetch tools or equipment and readjusting of installed machinery.

  Measures to be taken in order to reduce such kind of waste include a well-designed workplace, easy to reach location for tools or equipment, and efficient one-time installation of machinery.

- **Waiting:** It includes equipment or machinery which are kept idle and also the workers waiting for material or equipment. It is majorly caused by unevenness among the various production lines.

  This type of waste is capable of being curbed by streamlining the process for continuous workflow as well as training the workers on multiple skills set who are capable of easily adapting to the changing work demands and standardized workflow.

- **Overproduction:** Overproduction means manufacturing a product or material in excessive quantity than the actual demand.

  Measures to be taken in order to reduce such kind of waste include, even manufacturing rate between the station or production units and also manufacturing small batch size.

Fig. 7.1: Overproduction

- **Defects:** A defect usually refers to a specific product that is of no use. This results in either discarding the product or reworking on them and is capable of incurring the additional operational cost.

Tips

- For having an effective system of food processing implementation of automated statistical process control systems are extensively required
- Maintaining a high level of supply chain visibility is also considered to be important for efficient food processing

UNIT 7.4: Practices of Efficient and Inefficient Management

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Analyse the practices of efficient and inefficient management

7.4.1 The Practices of Efficient and Inefficient Management

Inefficient Management Practices

Inefficiency at the workplace often refers to low productive and poor confidence. Inefficiency directly impacts the cost incurred by any organisation.

Following are the key indicators of inefficient management:

- Uneven prioritization of work
- Non-essential work
- Lack of resource planning
- Improper justification of resources
- Inefficient productivity management
- Lack of fruitful collaboration

An efficient manager must answer the below questions in order to identify the inefficient management practices.

1. Who is working on what?
2. Are they working on the highest priority projects?
3. Do they have the resources they need?
4. Do they have the information they need?
5. How is work coming along?
6. Will work be done on time?

Efficient Management Practices

An efficient management practice refers to those practices which can perform the task with minimal wastage of resources. It also refers to the appropriate utilisation of resources leading to profit maximisation. The basic rules of effective management are:

- Consistency
- Goal setting
- Delegation
- Task prioritization
- Effective communication
- Rewards and Recognition
- Training and development
- Management Commitment

UNIT 7.5: Material and Water Usage

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Discuss the material and water usage.

7.5.1 The Material and Water Usage

Material Usage

Material refers to those components or raw goods which are used in producing hard goods like machines and equipment for another industry or end consumer as well as soft goods like food items, chemicals, medicines, apparel, etc.

Water Usage

In manufacturing units, water is used for various purposes like fabrication and processing of various materials, cleaning, diluting or as a coolant.

The need and demand for industrial water vary upon the product which is being manufactured. The other factors which need to be taken into consideration are water quality in the region, type of treatment required in order to make water usable.

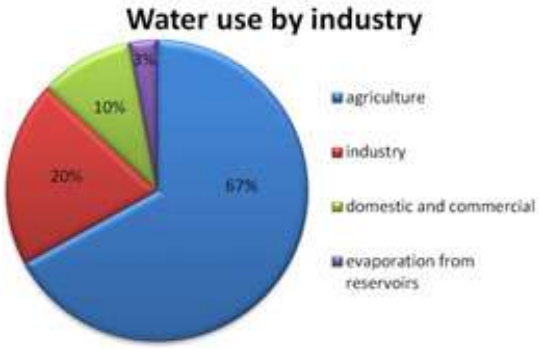

Fig. 7.2: Industry-wise water consumption

Industrial usage of water:

- Deionised or Ultra Pure water
- Water as coolent
- Usage of water in oil and gas
- Usage of water in pulps and paper mills

Fig. 7.3: Industrial wastage of water

Summary

- Material handling is also known as the integrated system, which involves such activities of the movement, storage, protection and control of types of materials and products throughout the manufacturing, distribution, consumption and disposal.
- Workstation or workplace is also known as the floor space occupied by the workers, as well as by the machines or a group of machines.
- Employee productivity stands to be directly in proportion to workplace conditions.
- An efficient management practice refers to those practices which can perform the task with minimal wastage of resources.

Exercise

A. Answer the following questions by choosing the correct option:

1. What is the manufacturing labour cost for material handling?

A. 20- 23% B. 20- 25% C. 20- 30% D. 20- 35%

2. What stands to be the full form of AGV?

A. Automated Guided Vehicle

B. Activated Guided Vehicle

C. Accurately Guided Vehicle

D. Action Guided Vehicle

3. _____ is the major component for manufacturing semiconductors and chips, which are widely used in mobile phones, computers and various other electronic goods.

A. Nitrogen B. Silicon C. Hydrogen D. Lithium

4. _____ directly affects the efficiency of the workers.

A. Proper lighting B. Noise C. Cleanliness D. Machine design

5. The appropriate temperature at the workplace usually requires being at _____ degrees Celsius.

A. 22

B. 30

C. 18

D. 16

8. Energy and Electricity Conservation

Unit 8.1 - Define Electricity

Unit 8.2 - Basics of electricity

Unit 8.3 - Energy efficient devices

Unit 8.4 - Standard Practices for Conserving Electricity

SGJ/N1702

Key Learning Outcomes

At the end of this unit, the trainee will be able to:

1. Define electricity
2. State the basics of electricity
3. Identify the energy-efficient devices
4. Explain the standard practices to be followed for conserving electricity
5. Illustrate electrical equipment and appliances

UNIT 8.1: Define Electricity

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Define electricity

8.1.1 Definition of Electricity

Electricity stands to be a general form of energy observable in a positive and negative form that takes place naturally (as in lightning) or is generated (as in a generator), as well as that is expressed in terms of movement and interaction of electrons.

The existence of an electric charge, which is capable of being either positive or negative, creates an electric field. The movement of electric charges leads to an electric current which further generates a magnetic field.

It is at the heart of many of our present era technologies, being utilized for:

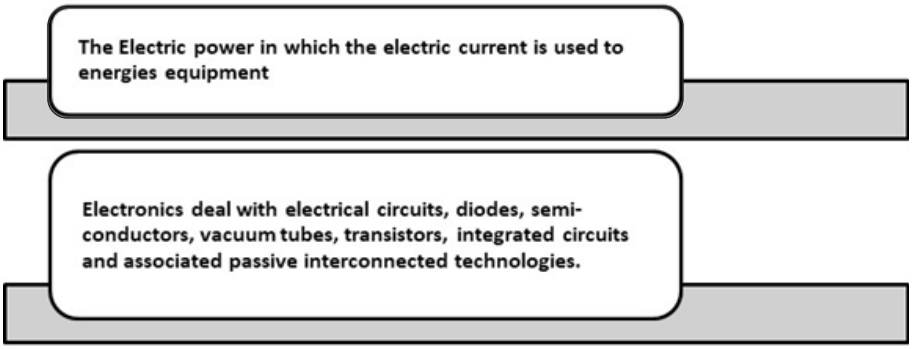

Fig. 8.1: Electricity utilization

UNIT 8.2: Basics of Electricity

Unit Objectives

At the end of this unit, the trainee will be able to:

1. State the basics of electricity

8.2.1 The Basics of Electricity

Electricity is easily put in the flow of electrons in a conductor. Electric current flows in the form of free electrons; thus, the greater the number of free electrons in a material, the better would stand to be its conductivity. On the basis of conductivity, these 'materials' can be classified into three categories:

- **Conductors –** Materials whose conductivity lies between 104 to 107-ohm m. For example, Iron, Copper, etc.
- **Semi-conductors –** Materials whose conductivity lies between 10-6 to 104-ohm m. For example, Graphite, Silicon, etc.
- **Insulators –** Materials whose conductivity lies between 10-20-to-10-10-ohm m. For example, Paper, Glass, etc.

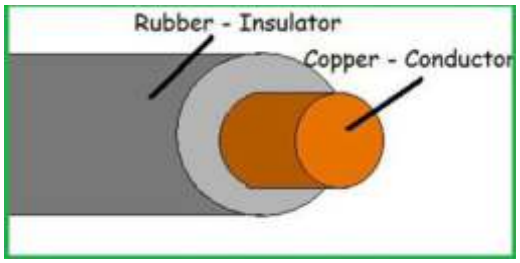

Fig. 8.2 : Conductor of Electricity

There are three primary electrical parameters:

- Volt
- Ampere
- Ohm

Volt: The amount of external force exerted on free electrons is known as "Electromotive Force (EMF)". Volt is the amount of EMF needed to push a current of one ampere through a conductor with the resistance of one ohm.

Ampere: Ampere defines the rate of flow of electric current. For example, when one coulomb of charge flows through a given point on a conductor in a second, it is defined as a current of one ampere.

Ohm: Ohm is the unit of resistivity of a conductor. Three factors determine the resistivity of a conductor:

- Size of conductor
- Composition of conductor
- Temperature of conductor

UNIT 8.3: Energy Efficient Devices

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify the energy-efficient devices

8.3.1 Energy-Efficient Devices

The use of energy– efficient devices has proved to be an effective strategy for the economics and planet as a whole, as it cuts down on unnecessary power consumption while also being cost-effective.

From the viewpoint of an energy consumer, the main motivation for saving energy is frequently and simply saving money by decreasing the cost of purchasing energy. From an energy policy viewpoint, there has been a long trend in wider recognition of efficient energy as "first fuel" (meaning the ability to avoid consumption of fossil fuels for energy production).

Fig. 8.3 : Energy-efficient devices

Energy-Efficient Devices

Devices like LED bulbs, fluorescent lighting or natural skylights reduce the amount of energy required to attain the same amount of illumination compared to using traditional incandescent light bulbs. Modern appliances such as freezers, dishwashers, ovens, stoves, dryers use significantly less energy than their previous generation models and line-ups. For example, modern energy-efficient refrigerators use 40% less energy than their conventional models did in 2001.

Energy Conservation

Energy conservation is broader in comparison to energy efficiency in including active efforts to decrease energy consumption. For example, through behavioural change it has an addition to using energy effectively. Energy conservation is a challenge requiring stringent policy programmers, technological development and behaviour change to go hand in hand. Many energies intermediary organizations, government, non-government, regional, local or at the national level, are working in order to meet this challenge.

8.3.2 Common Ways to Identify Electrical Problems

Electricity appears to be something most of us understand it for granted. When the individuals need it, you turn to the nearest switch or outlet, and there it is, ready to serve you 24/7.

Yet that electric energy faithfully facilitating us is additionally a potential destruction's source.

Several electrical fire dangers are hidden within the walls of your house or offices or other workplaces. Nevertheless, if the indivdiuals have the knowledge the ways to point the warning signs, the individuals are capable of making proactive — and less expensive — repairs that will also help protect your home in the long run. Here are certain manners to spot common issues and what to do about them.

- **Unknown odour:** When you detect an odd smell arriving from an electrical store, unplug anything linked to it, as well as don't utilise it again until a qualified electrician has tended to check it. In addition to this, if the individual's breaker panel or fuse box is emitting an odd odour, call an electrician immediately.
- **ARC faults:** Arc faults tend to take place when an electrical circuit veers off its intended path, frequently via a breach in the wiring. Arc faults stand to be preventable via the installation of a tool referred as an arc-fault circuit interrupter (AFCI).
- **Sparking or warm switches and outlets:** If the individual's light switches stand to be warm to the touch or an store is sparking, call a expertised the electrician immediately to see if your wiring needs repairs or the fixture should be replaced.
- **Buzzing sounds:** If you hear any buzzing, cracking or sizzling sounds when you flip a switch or plug into an outlet, turn off the power to that fixture immediately and consult a professional electrician.
- **Flickering lights:** Flickering lights usually indicate a power surge. These power surges don't necessarily have to come from a catastrophic event — more than likely, your appliances are making demands on the electrical system that it cannot handle.
- **Broken light switches and loose outlets:** If switches or outlets stop working or work only intermittently, it could be a sign of loose wiring — and another potential fire hazard. Loose outlets also create a potential for electrical shock.
- **Hot ceiling fixtures:** Occasionally check the area around your ceiling fixtures for warmth that could indicate a lack of sufficient insulation. Also, exceeding recommended bulb wattages can cause overheating. Either issue poses a potential fire hazard. Consider switching to compact fluorescent light (CFL) or light-emitting diode (LED) bulbs as these don’t produce as much heat as incandescent bulbs.
- **Circuit breaker problems:** Circuit breakers are designed to trip when a circuit is overloaded. Tripping prevents overheating and eliminates fire hazards. Occasional tripping probably indicates a simple overload, but if it occurs repeatedly, you need to call in an electrician and have them evaluate your entire electrical system.

UNIT 8.4: Standard Practices for Conserving Electricity

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Explain the standard practices for conserving electricity

8.4.1 Standard Practices for Conserving Electricity

Renewable energy sources have received plenty of attention in recent years, but the conservation of electricity is also important for sustainability. Nevertheless, the best results are acquired when clean power is combined with energy conservation, reducing the pressure to invest in newer infrastructure.

Environmental Reasons to Conserve Electricity

All systems of power generation have an environmental influence that must be taken into consideration before an investment decision. This is evident while dealing with fossil fuels since their combustion emits a constant stream of greenhouse gases in the atmosphere. The process of construction also has an environmental impact. Some waste materials are unavoidable, heavy machinery releases emissions and the ecosystem is seen to be disrupted.

Practices for Saving Electricity

For an average consumer, saving electricity can be good for the pocket and in turn, it reduces the increasing stress on the environment. Those savings can be diverted to alternative sources of energy like solar panel arrays, especially in a tropical country like India, where seasons are relatively moderate and 'timed'. Some practices and habits changes which would help in saving electricity are:

- Turning down the refrigerator
- Usage of energy-efficient LED bulbs
- Air drying the dishes and clothes
- Cooking under the right-sized burner
- Washing clothes with cold water
- Using window shades to alter sun rays entering the house
- Turning off electrical appliances, fans, lights when not in use
- Using low flow faucets and showerheads

Summary

- Electricity is a basic form of energy observable in a positive and negative form
- The main motivation for saving energy is frequently and simply saving money by decreasing the cost of purchasing energy.
- Energy conservation is broader in comparison to energy efficiency in including active efforts to decrease energy consumption.
- Renewable energy sources have received plenty of attention in recent years, but the conservation of electricity is also important for sustainability.
- All systems of power generation have an environmental influence that must be taken into consideration before an investment decision.
- Electrical equipment involves any machine powered by electricity.

Exercise

A. Answer the following questions by choosing the correct option:

1. On the basis of conductivity, conductors possess:

   A. Materials whose conductivity lies between 10-6 to 104-ohm m

   B. Materials whose conductivity lies between 104 to 107-ohm m

   C. Materials whose conductivity lies between 10-20-to-10-10-ohm m

   D. None of the above

2. What is the full form of EMF?

   A. Electromotive Force
   B. Electromagnetic Force
   C. Electro mobile Force
   D. Electro massive Force

3. _____ energy sources have received plenty of attention in recent years, but the conservation of electricity is also important for sustainability.

   A. Renewable
   B. Non- renewable
   C. Sustainable
   D. Non-sustainable

4. Energy _____ is broader in comparison to energy efficiency in including active efforts to decrease energy consumption.

A. Release
B. Emission
C. Conservation
D. Deletion

5. Modern energy efficiency refrigerators use _____ less energy than their conventional models did in 2001.

a. 50%
b. 40%
c. 60%
d. 90%

B. Answer the following questions briefly.

1. What are the classifications for the materials of electricity?

2. What are the three primary electrical parameters?

3. What are the components of electrical equipment?

4. What are the categories of appliances?

Notes

9. Waste Management and Recycling

Unit 9.1 - Types of waste

Unit 9.2 - Waste Management and Disposal Solutions

Unit 9.3 - Pollution and Remedies

SGJ/N1702

Key Learning Outcomes

At the end of this unit, the trainee will be able to:

1. List the types of wastes
2. Describe waste management and disposal solutions
3. Explain pollution and its remedies

UNIT 9.1: Types of Waste

Unit Objectives

At the end of this unit, the trainee will be able to:

1. List the different types of waste

9.1.1 The Different Types of Wastes

Unwanted, trash, rubbish, excess, superfluous, scrap, extra, rework, unused- there are so many synonyms for waste.

There are different types of waste which are recyclable or non-recyclable. Recycling of waste depends on the scientific progression as well knowledge about different kind of waste handling. Below are lists of different type of waste.

Recyclable waste	Non-recyclable waste
1. Concrete 2. Steel 3. Aluminium 4. Plastic (PET) 5. Newspapers 6. Corrugated Cardboard 7. Plastics (HDPE) 8. Glass 9. Mixed Papers 10. Used Motor Oil 11. Used oil from food industry	1. Garbage. Mixture of different of garbage makes it hard to recycle. 2. Food-tainted items (such as: used paper plates or boxes, paper towels, or paper napkins) 3. Ceramics and kitchenware. 4. Windows and mirrors. 5. Plastic wrap. 6. Packing peanuts and bubble wrap. 7. Wax boxes. 8. Photographs 9. Medical waste 10. Polystyrene or Styrofoam 11. Hazardous chemicals and chemical containers 12. Plastic toys or sporting goods equipment 13. Foam egg cartons 14. Wood 15. Light bulbs 16. Yard waste or garden tools

Table 9.1: Lists of different types of waste

'Waste' is any unwanted material. These are objects that have been discarded, either because they do not function as intended or are simply not required anymore. Waste can come in many forms: solid, liquid or even gaseous (although it's mostly solid). There are many types of waste, but the two general ones are:

- Municipal Waste
- Hazardous Waste

Municipal Waste

It consists of everyday items discarded by the population. It includes clothes, wires, glass, unwanted food and a multitude of other things. It is further sub-divided into household, commercial and demolition waste.

- Household Waste – Materials like unused food, unwanted paper, empty batteries come under this category.
- Commercial Waste – Waste collected from establishments like businesses, trading factories, schools, etc., comes under this category.
- Demolition Waste – Evident from its name, this type of waste comes from the destruction of buildings or any structure made of concrete, bricks, wood, etc.

Hazardous Waste

It refers to solid, liquid or gaseous waste that has the properties of corrosiveness, ignitability, reactivity and toxicity. Proper disposal and treatment of this waste are necessary as it is unsafe for the well-being and the environment at large. It is further sub-divided into industrial and biomedical waste.

Fig. 9.1: Hazardous wastes

- Industrial Waste – Waste produced by industries such as chemicals, pigments, ashes, metals, etc., come under this category.
- Also cafeteria garbage, dirt and gravel, masonry and concrete, scrap metals, trash, oil, solvents.
- Biomedical Waste – Waste coming from medical facilities such as hospitals, medical colleges, research centres etc., come under this category.

  PPE kits also consider as biochemical waste (specially now a days)

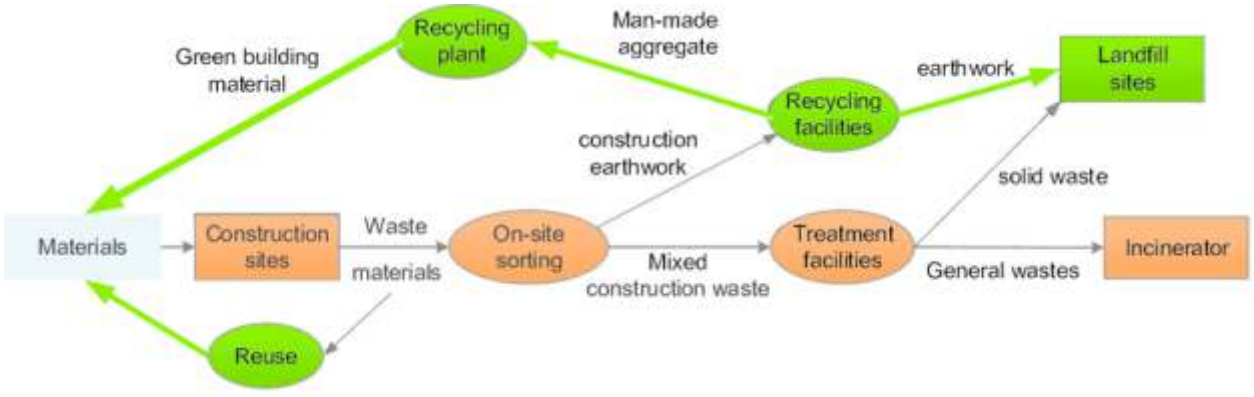

Fig. 9.2: Ways to process industrial and biomedical wastes

Significance of Different Coloured Dustbins

Colour coding of waste bin help us to understand which waste can be reuse or recycle and which waste need to dump. It also eliminates the amount waste through segregation process. Disposition process of waste can be defined based on different type of waste. Some waste can be dumped to land fill as it will not impact the soil quality such as food waste (onion, potato skin) as it act as fertilizer whereas industrial waste such as oil, batteries, chemical can't be dumped in land fill as it is hazardous to the soil property. It means if the wastes were separated in the 1st place then it will prevent or reduce any kind of negative impact to the environment due to waste disposition process.

Ideally every place where we discard waste should have three bins.

GREEN – for wet waste, which comes from the kitchen/cooking/food, goes to one bin.

BLUE – Dry recyclable waste such as newspapers, cardboard, packing plastics, bottles, cans, etc., should go to a different bin.

RED – Reject waste, which does not belong to the above two categories, including biowaste like diapers and bandages should go into a third bin.

All over the world, three-way segregation of waste is followed, and it is primarily instituted with some form of colour coding. It works just like the way traffic lights are coded in people's minds.

Govt authorised vendor details for different waste disposal solution-

There are many industries those are known for waste collection and disposal process approved by Indian govt. through registration process.

S No.	Registered PRO	Issued PRO Certificate
1	M/s. Attero Recycling Private Limited, H-59, Sector 63, Noida, UP-201301	11.10.2018
2	M/s. Auctus E Recycling Solutions Pvt. Ltd. A-58, Udyog Kendra-1, Ecotech-III, Village Habibpur, Noida-Dadri Road, Surajpur, Greater Noida (UP) 201306	12.11.2018
3	M/s Earth Sense Recycle Pvt. Ltd., Plot No:37, TSIIC Industrial Park, Mankhal, Maheshwaram Mandal, Rangareddy Dist., Telangana-501359	11.10.2018
4	M/s EPR Compliance Pvt. Ltd., 422, The Summit Business Bay, Andheri Kurla Road, Near WEH Metro Station, Andheri (East), Mumbai-93	12.11.2018
5	M/s Hulladek Recycling Pvt. Ltd., 4 D.L. Khan Road, Block B, Flat-401, 4th Floor, Kolkata-700025	12.11.2018
6	M/s Karo Sambhav Private Limited, 408-409, Fourth Floor, Suncity Business Tower, Sector-54, Golf Course Road, Gurugram-122002, Haryana	29.08.2018
7	M/s Mahalaxmi Metalloys India Private Limited, Plot No. 87, 91/92, Sikhera Road Industrial Area, Modinagar, Dist. Ghaziabad (U.P.)201204	23.10.2018
8	M/s Pegasus Support System Pvt. Ltd, F- 6, 1st Floor, 4648/1, 21, Ansari Road, Daryaganj, New Delhi 110002	14.09.2018
9	M/s Pro Connect, G-7, New Market, Near Khasa Kothi Circle, Jaipur-302016 Rajasthan	12.11.2018
10	M/s R2 PRO Pvt. Ltd., B03-Jain Height-Altura, Kalkondrahalli, Sarjapur Road, Banglore-560102	23.10.2018

Fig. 9.3 : Examples of waste collecting vendors

UNIT 9.2: Waste Management and Disposal Solutions

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Describe waste management and disposal solutions

9.2.1 Waste Management and Disposal Solutions

Waste management includes the activities as well as actions required to manage waste from its inception to its end disposal. This involves the disposal, collection, transport, and treatment of waste, together with regulation and monitoring of the waste management procedure and waste-related laws, technologies, as well as economic mechanisms.

Proper management of waste is significant for building sustainable and liveable cities, yet it remains a challenge for many developing countries and cities. A large portion of the practices of waste management deal with municipal solid waste, which stands to be the bulk of the waste that is produced by household, industrial, and commercial activity.

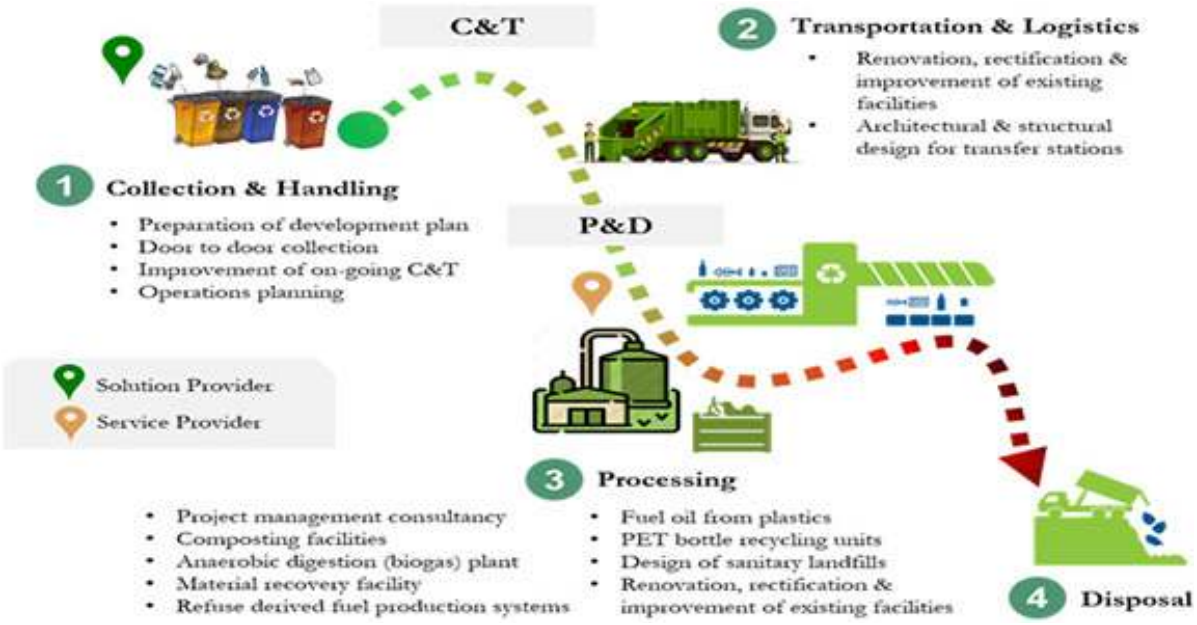

Fig. 9.4: Waste management and disposal solutions

Turn Away from Single-Use Plastics

A few instances of these include plastic straws, sanitary napkins, take-out containers etc. There are plenty of reusable alternatives to them, like glass and metal straws.

One good manner of doing this is by shopping at bulk stores and zero-waste stores that provide products without packaging. A good practice is to carry around a reusable bag, metal straw and a stainless steel bottle to cut the dependencies on polluting stuff.

Fig. 9.5: Waste Management Hierarchy

Conventional Technologies

It is apparent that certain technologies are no longer applicable to modern waste reduction as well as recycling, but some organizations continue to rely on them because they appear to be cheap. However, more technologies are evolving or being created to solve waste management problems. These technologies can be used to recycle or up cycle waste, creates alternatives from products that normally produce more waste, or find a way to address the ever-growing problem of waste management.

There is seen to be plenty of this technology, including plastic-free shampoo pods and toothpaste pills, machines that sustainably remove waste from bodies of water.

UNIT 9.3: Pollution and Remedies

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Explain pollution and its remedies

9.3.1 Pollution and Its Remedies

Today, the air is becoming foul, water is no longer clean, and forests are being cut down unscrupulously. Pollution in and of itself is difficult to define. The term is derived from the Latin word "polluere", which means 'to contaminate any feature of the environment. It may be broadly said to be 'adding to the environment a capably hazardous source or substance of energy faster than the environment can accommodate in it.

Methods to Counteract Pollution

Pollution prevention is considered as any action that reduces the number of contaminants released into the environment. Implementation of such processes reduces the severity and/or a number of hazards posed to both public health and the environment. If companies produce less waste, they do not have to worry about proper disposal. Some common methods for controlling pollution are:

- Reducing, Reusing, Recycling and Mitigating.
- Water pollution is capable of being controlled by using non-toxic soaps, detergents and cleaning products.
- Limiting the use of artificial fertilizers and pesticides helps in controlling soil and water pollution.
- Promoting and enforcing the use of biological methods for pest control.
- Chimneys should be longer in length so that polluting air is released high up in the atmosphere where it would not harm the surrounding environment.
- Automobiles should be installed with emission and pollution control systems.
- The timely servicing of automobiles also checks for air pollution.
- Carpooling and public transportation should be encouraged.
- Alternative sources of energy like wind, sun, water, geothermal should be harnessed and put to use.

Summary

- 'Waste' is any unwanted or un-useful material.
- Municipal wastes consist of everyday items discarded by the population.
- Hazardous waste refers to solid, liquid or gaseous waste that has the properties of corrosiveness, ignitability, reactivity and toxicity.
- Waste management includes the activities as well as actions required to manage waste from its in-ception to its end disposal.
- Proper management of waste is significant for building sustainable and liveable cities, yet it re-mains a challenge for many developing countries and cities.
- The biosphere and ecosystem are self-sustaining, and nature maintains a balance between the land, water, air and living organisms.
- The term "pollution" is derived from the Latin word "polluere", which means 'to contaminate any feature of the environment.
- Pollution prevention is considered as any action that reduces the number of contaminants re-leased into the environment.

Exercise

A. Answer the following questions by choosing the correct option:

1. Which one stands to be a general type of waste?
   - A. Commercial waste
   - B. Hazardous waste
   - C. Household waste
   - D. Demolition waste

2. Which one is the type of hydrocarbon-eating bacteria that feed on oil?
   - A. Alcanivorax borkumensis
   - B. Bacillus
   - C. Spirillum
   - D. Vibrio

3. _____, reusing, recycling and mitigating helps in pollution reduction.
   - A. Reducing
   - B. Reinstalling
   - C. Redeeming
   - D. Reinvolving

4. The Latin term for pollution is _____

   A. pollueme

   B. polluese

   C. polluere

   D. polluete

5. _____ waste comes from medical facilities.

   A. Municipal

   B. Biomedical

   C. Industrial

   D. Commercial

B. Answer the following questions briefly.

1. What are the differences between recyclable waste and non- recyclable waste?

   _____

   _____

   _____

2. What are two general types of wastes?

   _____

   _____

   _____

3. What stand to be the significance of the different colored dustbins?

   _____

   _____

   _____

4. Outline the responsible waste management hierarchy.

   _____

   _____

   _____

5. What are the methods for controlling pollution?

   _____

   _____

   _____

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11. Annexure

Annexure : QR Code

ANNEXURE - QR Codes

Chapter No.	Unit No.	Topic Name	Page No.	QR code(s)	URL
Chapter - 1 Introduction to Food Processing Sector and the Job of 'Pickle and Paste Making Technician	Unit 1.1 Introduction to Food Processing Industry	1.1.3 India's Food Processing Industry	5		https://youtu.be/wMu0EpUgCd4
	Unit 1.1 Introduction to Food Processing Industry	1.1.4 Overview of the Fruit and Vegetable Sector	6		https://youtu.be/iacTHJtrXIE
	Unit 1.2 Roles and Responsibilities of Pickle and Paste Making Technician	1.2.1 Roles and Responsibilities of 'Pickle and Paste Making Technician	11		https://youtu.be/GlvfUzTXAdg
	Unit 1.2 Roles and Responsibilities of Pickle and Paste Making Technician	1.2.5 Standard Practices for Handling Hazards and Cleaning Work Area	14		https://youtu.be/j9HIFj-g2x4
Chapter 3 Carry out Production of Various Types of Pickles and Pastes	Unit 3.2 Mechanism of Peeling And Slicing Fruits and Vegetables	Machinery in Pickle and Paste Making	77		https://youtu.be/C-6kF52qtOA
	Unit 3.3 Identify Spoilage in Fruits and Vegetables	Pickle making Process	77		https://youtu.be/AIWN5rTf9RI

Chapter No.	Unit No.	Topic Name	Page No.	QR code(s)	URL
	Unit 3.4 Prepare Pickle, Paste, And Murabba Using Essential Machines	Steps in Murrabba Making	77		https://youtu.be/FS5MMx4uI6Q
	Unit 3.5 Packaging And Post-Production Activities	Pickle Packaging and Storage	77		https://youtu.be/-Wrk4zAANpo
Chapter 10 Employability and Entreprenuership Skills	Employability and Entreprenuership Skills	Employability and Entreprenuership Skills	194		https://eskillindia.org/NewEmpl
		Understanding Entrepreneurship			https://www.youtube.com/watch?v=BzeoC3mSDgg
		Preparing to be an Entrepreneur			https://www.youtube.com/watch?v=3uEqWH9oWls

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