MEAT AND MEAT PRODUCTS PROCESSING

Level-III

Based on October 2019, version 2 OS and March 202, V1 curriculum

Module Title: - Implement Food Safety Program in Meat Processing Plant

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LG #17 LO #1-Identify microbiological hazards for meat and meat safety

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying types of micro-organisms.
- Identifying and assessing major microbiological threats.
- Identifying types of bacteria causing food poisoning and meat spoilage.
- Identifying effects of bacterial contamination
- Identifying sources of bacterial contamination.
- Identifying growth characteristics and requirements of bacteria.
- Identifying critical control points (CCP) and control points.
- Implementing control methods of microbiological hazards.
- Identifying Customer and regulatory requirements
- Identifying relevant microbiological tests and assessing test result.

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify types of micro-organisms.
- Identify and assessing major microbiological threats.
- Identify types of bacteria causing food poisoning and meat spoilage.
- I Identify effects of bacterial contamination
- Identify sources of bacterial contamination.
- Identify growth characteristics and requirements of bacteria.
- Identify critical control points (CCP) and control points.

- Identify control methods of microbiological hazards.
- Identify Customer and regulatory requirements
- Identify relevant microbiological tests and assessing test result.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

Information Sheet-1 Identifying types of micro-organisms.

1.1 Introduction

Bacteria, yeast, mold, virus and parasite are the most common Microorganisms. However they are too small to be seen with the unaided eye and have the ability to reproduce rapidly. Many MO can produce toxins and can cause infections. For all of these reasons, the microbiological quality of the food is scrutinized closely.

Microorganisms are tiny, mostly one-celled organisms that can be seen only with the help of microscope which are capable of rapid reproduction under proper growth conditions include the bacteria, viruses, yeasts, molds, and protozoan. Microorganisms are bacteria, yeasts, molds and viruses and include, but are not limited to, species having public health significance (i.e. capable of causing illness or disease). Microorganisms can occur in food in the form of.

1.2 Bacteria

Bacteria are single-celled micro-organisms found in nearly all natural environments.

Bacterial cells have definite characteristic structures such as the cell wall, cytoplasm, and nuclear structures. Bacteria are very resilient microorganisms that are found everywhere. Some examples of where they can live and multiply are:-

- in air, soil, and water
- in intestines of animals and humans
- on skins of fruit and vegetables
- on raw meat, poultry, and seafood
- on shells of nuts
- on insects and rodents
- On hands, skin, hair, and clothing of people.

1.3 Yeast

Yeast is a living microscopic organism which converts sugar or starch into alcohol and carbon dioxide, which is why beer brewers, wine makers and bread bakers like it.

Baker's yeast is what we use most often for leavening when cooking. Yeast can grow under conditions of high salt or sugar content, they can cause the spoilage of certain foods in which bacteria would not grow.

Figure 1- Meat affected by yeast

1.4 Mold

Molds can also cause problems in foods. Certain kinds can produce poisons called mycotoxins. Mold spores are quite abundant in the air. So, any food allowed to stand in open becomes contaminated with mold if adequate moisture is present. Many yeasts and molds grow in acidic environments below pH 4 up to pH 3 and spoil acidic foods.

Figure 2- Mold on meat

1.5 Virus

Virus doesn't grow in the food but the food serves as a carrier of the viral particle. The onset of food viral disease is usually several weeks until the viral particle invade the host cell and replicate. Viruses are extremely small parasites. They require living cells of plants, animals, or bacteria for growth.

Figure 3- Virus attacked meat

Self –check-1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

1. _____ Bacteria, yeast, mold, virus and parasite are the most common Microorganisms? (2 point)
2. _____ Yeast is a living microscopic organism which converts sugar or starch into alcohol and carbon dioxide? (2 point)

Test 2: Choose the best answer for the following questions.

1. _____can grow under conditions of high salt or sugar content, they can cause the spoilage of certain foods in which bacteria would not grow?(3points)

a) Yeast B) mold C) bacteria D virus

Test 3: Give short answer for the following questions.

1. Which Microorganisms can occur in food? (2 points)
2. What is main reason cause infection and toxin on food? (2 points)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Answer Sheet

Score = _____

Rating: _____

Short Answer Questions

1. _____
   _____
2. _____
   _____
   _____

Information Sheet -2 Identifying and assessing major microbiological threats.

2.1 Identifying and assessing major microbiological threats.

Meat can be, or become, unacceptable for human consumption either because the living animal has a disease or condition, or because the meat becomes spoiled. Spoilage occurs post mortem either by chemical breakdown, for instance the oxidation of fats to produce rancidity, or by the growth of microorganisms. An example of a condition that may make meat unacceptable is the occurrence of extreme boar taint. Disease can make the meat aesthetically unacceptable or, more importantly, can lead to transmission of infection to humans.

2.2 Microbial spoilage

Microbial spoilage is the major cause of food spoilage it occurs as a result of contamination of food by microorganisms. The food provides a suitable environment for their growth, and then microorganisms degrade the foodstuffs.

2.3 control microbial buildup

- **To control microbial buildup, you must control the following:**
  - ✓ **The source of microorganisms** - people, raw materials, equipment, air currents, dust & pests.
  - ✓ **Food residues**, which are required
  - ✓ **Moisture,** which is required for growth;
  - ✓ **Relative humidity (RH)** should be also monitored**.**
  - ✓ **Time,** a given set of conditions to which food product is exposed that promote bacterial growth.
  - ✓ **Temperature,** it determines the generation time of microorganisms

2.4 Microbiological control

Microbiological control prevention measures such as sanitation, hand washing, food and water safety, and with ascertaining levels of contamination by those microorganisms that cause spoilage.

Normal microorganism counts in foodstuffs vary according to composition and processing methods. Raw cured meat products may have counts of harmless organisms ranging into the millions**.**

Self –check-2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

1. _____ Microbial spoilage is the major cause of food spoilage it occurs as a result of contamination of food by microorganisms? (3 point)
2. _____Disease can make the meat aesthetically unacceptable or, more importantly, can lead to transmission of infection to humans? (3 point)

Test 3: Give short answer for the following questions.

3. Write four control microbial buildup (2 points)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

3. _____

_____

Information Sheet-3 Identifying types of bacteria causing food poisoning and meat spoilage.

3.1 What is Food Spoilage?

Food spoilage is defined as any change in the organoleptic qualities of the food that makes the food unacceptable to the consumer, such as:

- Flavor,
- Appearance,
- Odor or
- Texture

3.1.1 Spoilage

Spoilage is a natural phenomenon; it occurs at varying rates depending on:

- The storage temperature,
- Kind of food involved,
- Kind of microorganisms present,
- Packaging materials used,
- Food additives used and method of preservation**.**

3.2 A spoilage of meat

Spoilage of meat occurs, if the meat is untreated, in a matter of hours or day and results in the meat becoming unappetizing, poisonous, or infectious. Spoilage is caused by the practically unavoidable infection and subsequent decomposition of meat by bacteria and fungi, which are borne by the animal itself, by the people handling the meat, and by their implement. Meat can be kept edible for a much longer time though not indefinitely if proper hygiene is observed during production and processing and if appropriate food safety, food preservation and food storage procedures are applied.

3.3 Types of food spoilage

Types of food spoilage fall into two major categories, according to the cause of the spoilage:

A) **Microbial spoilage:-** It is caused by microorganisms and their products;

B) **Non-microbial spoilage:-** This can be caused by foreign material in the meat or by enzymes that occur in the foodstuff

3.4 Food Poisoning

Food poisoning is a food borne disease. Ingestion of food that contains a toxin, chemicals or infectious agent like a bacterium, virus and parasite may cause adverse symptoms in the body. Those symptoms may be related only to the abdominal tract causing vomiting or diarrhea or they may involve other organs such as kidney, brain or muscle.

Self –check-3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Choose the best answer for the following questions.

1. Spoilage is a natural phenomenon; it occurs at varying rates depending on: ?(3points)
   a. The storage temperature,
   b. Kind of food involved,
   c. Kind of microorganisms present
   d. all
2. Spoilage of meat occurs when?
   a. if the meat is untreated
   b. in a matter of hours or day and results in the meat becoming unappetizing
   c. poisonous
   d. none above
   e. all

Test 3: Give short answer for the following questions.

4. What is meat spoilage (2 points)
5. What is non-microbial spoilage (2 points)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

_____

_____

_____

_____

Information Sheet-4 identifying effects of bacterial contamination

4.1 Introduction

Food of animal origin should be monitored to ensure that people can be obtained consumable meat. Beef meat may include biological, physical and chemical hazard that may occur at any point during the supply process from slaughtering to table. Pathogenic microorganisms are normally found in the digestive tract of the healthy cattle.

4.2 Bacterial contaminant

Various bacterial species, increasing during storage and varying considerably between samples. Growth Spoilage bacteria lead to defect in the product of meat and can be responsible for:-

- Unwanted taste
- Color
- Odor
- Texture

4.3 Microbial contamination in meat

Microbial contamination in meat can start from the first skin incision made to remove the blood, especially if the tools and equipment used by the operator are not sterile. Subsequent contamination can occur on the surface of the meat during

- Preparation
- Carcass or meat cutting
- Manufacturing of processed meat product
- Packaging
- Storage
- Distribution

4.4 Effects of bacteria

Bacteria cause disease in humans according to the following three classifications:

- **Food born Infection**:
  - ✓ The sickness resulting from eating food contaminated with bacteria in the food.
  - ✓ The infection bacteria are those invading the intestinal tract.
  - ✓ damage the epithelial cell lining,
  - ✓ disrupt the uptake of solution in to the body,

- ✓ imbalance the osmotic pressure,

- **Food born Intoxication**
  - ✓ The sickness resulting from eating food contaminated with toxins produced by certain bacteria.
  - ✓ The causative bacteria are those toxins producing on the food during their growth.
  - ✓ If the food contaminated with the bacteria stored in the way which favor their growth, the toxin will be produced on the food
  - ✓ The toxin produced ingested with food and results for food born Intoxication

- **Intoxification:**
  - ✓ The sickness resulting from eating food contaminated by certain bacteria which are toxins producing in small intestine SI.
  - ✓ The causative bacteria are those inter into small intestine (SI) and produce toxins.

Self-Check -4	Written Test

Name…… ID……. Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: **Test 1: Choose the best answer for the following questions.**

1----------. Are normally found in the digestive tract of the healthy cattle

a. Pathogenic microorganisms b. unwanted taste c. Color d. all

Test 1: matching A columns with B columns. (6 points)

A	B
1. Food born Infection	a. imbalance the osmotic pressure
2. Food born Intoxication	b. The sickness resulting from eating food contaminated with toxins produced by certain bacteria
3. Intoxification	c. the sickness resulting from eating food contaminated by certain bacteria which are toxins producing in small intestine SI.

Note: Satisfactory rating – ≥3 points **Unsatisfactory - below 3 points**

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Score = _____

Rating: _____

Information Sheet-5 Identifying sources of bacterial contamination

5.1 Introduction

Cleaning and sanitation are among the most important activities in the meat products plants, as these measures provide the necessary environment for proper meat handling and processing. There are direct links between inadequate sanitation and the contamination of meat and meat products with pathogenic bacteria.

5.2 Proper cleaning and sanitation

Proper cleaning and sanitation is becoming increasingly important in modern meat processing as more perishable and hygienically sensitive meat products come on the market, particularly convenience foods such as prepackaged portioned chilled meat, vacuum or modified atmosphere packaged sliced meat products, both cooked and uncooked (ham, sausage, etc.). These products are examples of “ready - to - eat” products or RTE, as they are usually taken right from the package and consumed as they are, with little or no heat treatment. Sanitation is critical for ensuring that RTE products do not become cross -contaminated.

Figure 4- machine cleaning

5.3 Cross - contamination

Cross - contamination is the transfer of bacteria and possible pathogens to the exposed read-to-eat RTE product before packaging. These bacteria may come from the environment, from the employees, or from the equipment. This is the reason why factors like housekeeping, personal hygiene, training and education of the personnel, plant

layout, design of equipment and machines, characteristics of material selected, and the maintenance and general condition of the plant should be addressed when deciding on cleaning and disinfection procedures.

5.4 Sources of Contamination

- Primary sources and routes of microorganism to fresh meats:
  - ✓ the stick knife
  - ✓ Animal hide.
  - ✓ Gastrointestinal tract.
  - ✓ Hands of handlers.
  - ✓ Containers
  - ✓ Handling and storage environment
  - ✓ Lymph nodes.

Contamination subsequently occurs with the introduction of microorganisms on the food contact surfaces in operations performed during

- Slaughtering,
- Cutting,
- Processing,
- Storage
- Distribution of meat

5.5 Contamination of machine

Contamination of machine occurs during production; even with hygienic design features, equipment may collect microorganisms and other debris from the air, as well as from employees and materials during production.

- **Employees**

Plant personnel are among the most significant reservoirs and vectors of microorganisms, chemical residues, and foreign material in a food facility. The skin, hands, hair, nose, and mouth harbor microorganisms that can be transmitted through direct routes to food contact surfaces during processing, packaging, and preparation. The transfer of contaminants can also occur indirectly via personal equipment, such as clothing, foot-wear, and tools used in daily tasks.

- Raw meat characteristic pathogens are
  - ✓ Salmonella,
  - ✓ Listeria monocytogenes,
  - ✓ Staphylococcus aurous,
  - ✓ Campylobacter (in poultry),
  - ✓ Escherichia coli

Self-Check -5	Written Test

Name…… ID……. Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in

Test 1: Choose the best answer for the following questions.

1. **----------** is the transfer of bacteria and possible pathogens to the exposed read-to-eat RTE product before packaging

a. Cross contamination b. Contamination of machine c. raw meat contamination

d. all

2. what is Sources of Contamination

   a. Spoilage microorganisms can come either from outside the animal
   b. from the gut, or by being introduced at slaughter on the bolt of the
   c. Captive bolt stunning pistol or on the blade of the sticking knife
   d. The raw meat also source of contamination
   e. all

Test 2: Give short answer for the following questions.

1. Contamination of meat comes from? (5 points)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

I. _____

_____

_____

_____

____

Information Sheet-6 Identifying growth characteristics and requirements of bacteria.

6.1 Introduction

Microbes that cause spoilage can be bacteria, yeasts or other fungi molds). The bacteria can be those that thrive only in the presence ofoxygen or those that grow under conditions

where oxygen is absent.Offensive putrefaction is generally associated with the growth ofbacter ia growing in the absence of oxygen and producing indole, ethylamine and hydrogen sulphide from decomposition of proteins and amino acids. Sour odours are produced by the decomposition of sugars. An excellent account of the bacteria found on meat and of the effects of different storage procedures on their growth.

6.2 The growth of bacteria

Four phases are recognized in the growth of bacterial colonies. As the number of bacteria increases, the amount of enzymes produced increases. Higher temperature can cause increased enzymatic activity with large numbers of bacteria and high temperatures, a meat will spoil very rapidly. In the Initial lag phase the bacteria adjust to the environment. There follows an exponential phase where the numbers of bacteria multiply rapidly. Then comes a stationary phase when the rates of growth and multiplication are balanced by the number of bacterial cells dying. Finally, in the reduction phase there is a progressively greater death of cells because the substrate is depleted. As we have already seen for Clostridium, under un favorable conditions some bacteria can produce spores. These are often very resistant to, for example, high temperatures or dry conditions. Bacteria grow by each cell dividing into two daughter cells. In exponential growth, the number of cells doubles at progressive equal time intervals. Off odor's often start to develop at approximately 107–108 organisms.
There is four steps bacterial growth.

I. Lag phase

When bacteria are placed in a medium that provides all of the nutrients that are necessary for their growth, the population exhibits four phases of growth that are representative of a

typical bacterial growth curve. Upon inoculation into the new medium, bacteria do not immediately reproduce, and the population size remains constant. During this period, called the lag phase, the cells are metabolically active and increase only in cell size.

II. Log phase

They are also synthesizing the enzymes and factors needed for cell division and population growth under their new environmental conditions. The population then enters the log phase, in which cell numbers increase in a logarithmic fashion, and each cell generation occurs in the same time interval as the preceding ones, resulting in a balanced increase in the constituents of each cell.

III. Stationary phase

Stationary phase is steady-state equilibrium where the rate of cell growth (division) is exactly balanced by the rate of cell death. It occurs because of a loss of limiting nutrients or a build-up of toxins.

IV. Death phase

The stationary phase is followed by the death phase, in which the death of cells in the population exceeds the formation of new cells. The length of time before the onset of the death phase depends on the species and the medium. Bacteria do not necessarily die even when starved of nutrients, and they can remain viable for long periods of time.

6.3 Growth Requirements for Microorganisms

A characteristic of microorganisms is their ability to grow and form a population of organisms. One of the results of microbial metabolism is an increase in the size of the cell. The many requirements for successful growth include those both chemical and physical.

A. Chemical requirements. In order to grow successfully, microorganisms must have a supply of water as well as numerous other substances including mineral elements, growth factors, and gas, such as oxygen. Virtually all chemical substances in microorganisms contain **carbon** in some form, whether they be proteins, fats, carbohydrates, or lipids.

B. Physical requirements. Certain physical conditions affect the type and amount of microbial growth. For example, enzyme activity depends on the **temperature** of the environment, and microorganisms are classified in three groups according to their temperature.

6.4 Factors affecting bacterial growth

An overview of the growth requirements of microbes in relation to their growth on food, and the preservation of food. Important factors are temperature, oxygen availability, pH, redox potential, competition with other bacteria and moisture availability of the substrate. The availability of water is more correctly described in terms of water activity (aw).

6.4.1 Temperature

Temperature is the most important with growth rate generally being higher at higher temperatures. However, different types of bacteria will grow best in different temperature ranges and microbiologists group them accordingly slowly at refrigeration temperatures and will continue to grow up to 30°C, but not above 35°C.

6.4.2 PH

Bacteria will grow better at neutral pH values (around pH 7) than at lower or higher values. The nature of a solution based on its acidity or alkalinity is described as PH. The pH scale ranges from 0, strongly acidic, to 14, strongly basic. Neutral solutions are pH 7, the pH of pure water. The acidity or alkalinity of an environment has a profound effect on the activity & stability of macro-molecules such as enzymes. Most microbes grow best at pH values around 7.0 (6.6-7.5), Meats, fish, poultry, and most dairy products are near pH 7, which is ideal for bacterial growth.

Self-Check -6	Written Test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Choose the best answer for the following questions.

1. Which of the following includes steps bacterial growth? (3 points)
   b. lag
   c. log
   d. stationary
   e. death
   f. All
2. The _____is followed by the death phase, in which the death of cells in the population exceeds the formation of new cells.

a. Lag b. log c. stationary d. death

Test 2: Give short answer for the following questions.

1. Write factors affecting bacterial growth (5 points)

Note: Satisfactory rating – ≥4 points **Unsatisfactory - below 4 points**

. Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____

Information Sheet-7 Identifying critical control points (CCP) and control points.

7.1 Critical control points (CCP)

Critical control points (CCPs) are the steps in the of manufacturing or preparing food in which the right procedure can minimize or remove a potential health hazard such as a food borne illness process that are necessary to prevent or eliminate food safety hazards. A critical control point (CCP) is a step in the food production process where preventative measures can be applied to prevent, reduce or eliminate a food safety hazard, such as bacterial growth or chemical contamination. Critical control points exist at every stage of the process, from purchasing ingredients to the moment the product is consumed. This step involves establishing criteria that must be met to prevent, eliminate or the reduce the identified hazard at the CCP so that the food is safe to eat.

7.2 How to identify critical control points

To identify the critical control points in meat processing industry, we must first identify all of the food safety hazards that could reasonably occur. Food safety hazards are classified as biological, chemical or physical, but a particular agent often poses multiple hazards. For example, a hair in your soup is both a physical hazard and a biological hazard, because the hair will be teeming with bacteria and other microorganisms.

To help identify hazards and critical control points, it helps to imagine how food and ingredients move through business.

Typically, that goes something like this:

- purchasing
- receiving
- storing
- serving
- preparation
- cooking
- plating

In between each of these steps, you or your Food Handlers perform critically important tasks that are absolutely essential to ensuring the safety of the food. Using the example above (a grilled chicken sandwich), some of those critically important tasks would include:

- storing raw chicken in your refrigerator at a temperature of 5°C or below to slow down the growth of bacteria

- cooking chicken to a minimum internal temperature of 75°C to kill bacteria

In short, a critical control point (CCP) is a task that must be done to prevent, reduce or eliminate a food safety hazard. Other tasks related to the preparation of a dish may not be critically important for safety (e.g. garnishing or visual presentation of food), and therefore are not critical control points. If skipping the step won't hurt anybody or make them sick, you can be reasonably sure it's not a CCP.

7.3 Control point

Determine whether the hazard could be controlled at some later stage in the process. For example one hazard in beef production is that fragment of metal from the grinder can contaminate the beef. By using a metal detector at the end of the production process, the manufacturing facility can control the hazard.

Self-Check -7	Written Test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

1. _____ Critical control points (CCPs) are the steps in the of manufacturing or preparing food in which the right procedure can minimize or remove a potential health. (3 point)

Test 2: Choose the best answer for the following questions.

2. . Food safety hazards are classified as? (2 points)
   a. Biological hazard
   b. chemical
   c. physical
   d. all
   e. none

Test 3: Give short answer for the following questions.

3. Write how to identify the critical control points in meat processing industry? (5 points)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Score = _____

Rating:

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____

Information Sheet-8 Implementing control methods of microbiological hazards.

8.1 Food-borne illness?

".when a person becomes ill after ingesting a contaminated food..."

- It is any illness resulting from ingestion of food.
- Those sources associated with food and resulting for food-borne illness are termed as hazards.

Those sources associated with food and resulting for food-borne illness are termed as hazards.

- **Food Safety Hazards**

In food safety management systems, hazards refer to conditions or contaminants in foods that can cause illness or injury. It is important to understand that hazards do not refer to undesirable conditions or contaminants such as

- ✓ presence of insects
- ✓ spoilage
- ✓ hair or dirt
- ✓ Violations of regulatory food standards not directly related to safety.

8.2 The type of microbiological hazards in food

- **Types of microbiological hazard are categorized in three groups:**
  - ✓ Biological hazards
  - ✓ Chemicals hazards
  - ✓ Physical hazards

- **Biological Hazards**

There are a number of different types of biological hazards that can be present within food. These are typically microorganisms and include

- ✓ bacteria
- ✓ viruses
- ✓ Parasites.

- **Chemical hazard**

Chemicals hazard include chemicals substances that occurs naturally in the food such as plant toxin , chemicals and those that are added to the foods such as antibiotics

- **Physical hazards**

Physical hazards include bone, metals, plastics and any others foreign mater that harms consumers if ingested.

8.3 General Control Points for microbiological Hazards

8.3.1. Product Specification

It is important to be aware of the presence and number of microorganisms in food. Many raw materials, therefore, have microbiological standards. It is common in the food industry to have specifications for the absence of microbiological contaminants.

8.3.2. Control Mechanisms

Physical and chemical control mechanisms significantly affect the survival and multiplication of microorganisms; for example, a reduction in pH in fruit juice by the addition of ascorbic acid can prevent microorganisms from multiplying. Time and temperature are important control points since cooking or freezing rapidly can prevent the growth of biological contaminants. Freezing usually stops the multiplication of microorganisms; however it does not kill them. Thermal processing will kill most biological hazards.

8.3.3. Cross-Contamination

- Cross-contamination is the transportation of harmful substances to food from food, and from human to food.
- Control systems should be in place and your staff made aware of their responsibility to prevent contamination. Your staff must also be aware of correct product handling and personal hygiene.

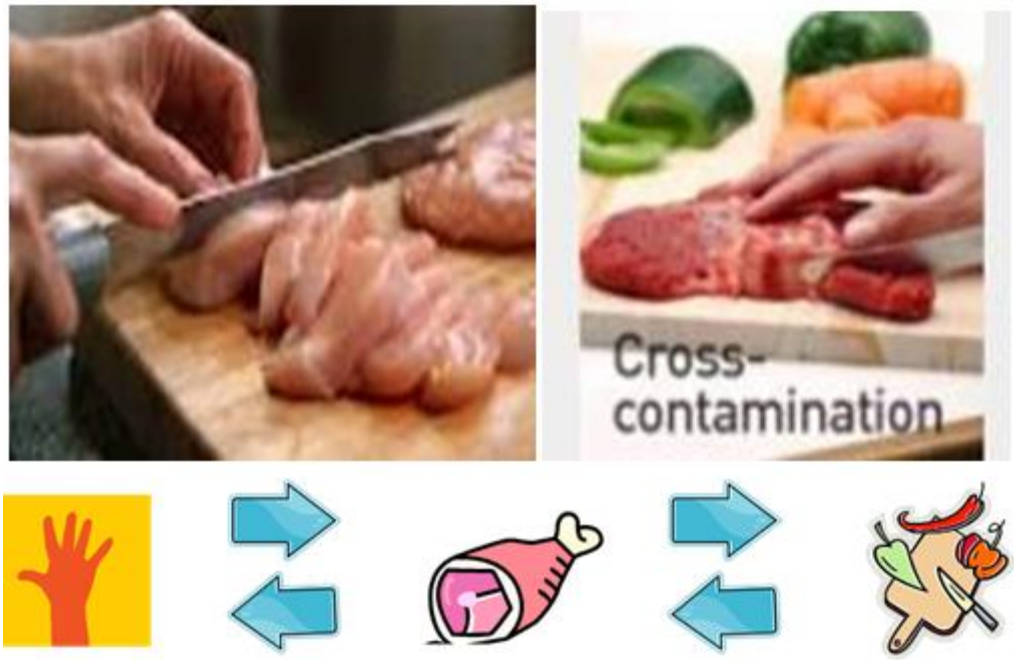


Figure 5- Cross contamination

8.3.4. Cleaning and Disinfection

The equipment used for producing, processing, and storing products should be sanitized on a regular basis. It is good practice to have a cleaning schedule in place. The packing, storage, and distribution must be controlled so that no biological hazard can contaminate or survive on food products. This process will entail suitable packaging for the product and temperature control in storage and distribution.

8.3.5. Conditions for Use

The directions you provide to the consumer are very important. Providing information on how to correctly store and cook the product can reduce the risks of biological hazards.

Self-Check -8	Written Test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

1. _____those sources associated with food and resulting for food-borne illness are termed as hazards. (3 point)
2. _____ Time and temperature are not important control points since cooking or freezing rapidly can prevent the growth of biological contaminants.(3 point)

Test 2: matching A columns with B columns. (6 points)

A	B
4. Biological hazard	a. bacteria
5. Chemical hazard	b. metal
6. Physical hazard	c. toxin

Test 3: Give short answer for the following questions.

4. Write Control Points for microbiological Hazards? (5 points)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

2. _____

_____

Information Sheet -9 Identifying Customer and regulatory requirements.

9.1 Introduction

Meat defined as all animal tissues suitable as food for human consumption. Ethiopia has one of the largest livestock populations in Africa and the tenth in the world. The country had 59.5 million heads of cattle, 30.70 million heads of sheep, 30.20 million heads of goats, 56.53 millions of poultry and 1.21 million heads of a camel. Cattle in Ethiopia provide draught power, income for farming communities, means of savings and investment. It is central to the Ethiopian economy contributing about 45% to the agricultural GDP, supporting the livelihoods of 70 % of the population, 18.7% to the national GDP and 16–19% to the total foreign exchange earning of the country Meat is the most valuable livestock product and for many people serves as their first-choice source of animal protein which provides all the essential amino acids and various micronutrients in proper proportion to the human beings. This includes all processed or manufactured products prepared from animal tissues

9.2 Meat production and consumption

Meat production and consumption is an important in the Ethiopian economy. The annual contribution of ruminants to meat production in Ethiopia is estimated at over 3.2 million tones, representing over 72% of the total meat production. Cattle meat accounts for over 70% of the total red meat production and over 50% of the total meat output in Sub-Saharan Africa

9.3 Meat Proclamations, regulations and guidelines in Ethiopia

9.3.1 Proclamations:

Animal disease control No 267/2002. Refers to prevention and control of diseases outbreak notification authority, provisions, declarations and measures and power. Establishment of quarantine stations; entrance and exit ports for export of LLP international animal health sanitary certification, animal movement permit. Meat inspection No 274/1970. Gives power to MoA to control and regulate lawfully establishment of foreign and domestic markets to ensure wholesomeness of foreign and domestic markets dealing with LLP handling and

processing. Meat inspection amendment No 81/1976. Gives power to MoA to issue regulations and establish criteria useful to determine LLP as fit for human consumption, classification and inspection of LLP, processing plants and database management.

9.3.2 Regulations

Meat inspection No 428/1972. Sets regulations for abattoirs and commercial establishments dealing with slaughtering, preparation and processing of LLP for export from or import into Ethiopia. (Draft) Animal diseases prevention and control regulation. Aims at enhancing the disease reporting, investigation and surveillance mechanisms at federal and regional levels. It also sets modus operandi for intervention and control of disease outbreaks. (Draft) Regulation to control movement of animal and transportation of animal products & byproducts. Sets mechanisms to prevent spread of infectious diseases out of the foci of occurrence and increase confidence of recipient/importing countries. (Draft) Regulations to provide for the registration and licensing of animal health professionals. Issues regulations governing the registration of animal health professionals, delivery of services and other miscellaneous provisions.

9.3.3 Guidelines:

Meat inspection, hygiene and construction of export abattoir, 2000. Adopt standards for good practice to ensure bio–safety measures and reinforcement mechanisms. Operational procedures of export abattoir. Routine procedures pertaining to details of examination of animals destined for slaughter, decisions on ill–health findings, sanitary precautions and measures in abattoir environments, etc.

Table.1. D/t species and its standard

Species	Species Code (data field 1)
Bovine (Beef)	**10**
Bovine (Veal)	**11**
Porcine (Pork)	**30**
Ovine (Sheep)	**40**
Caprine (Goat)	**50**
Llama 60	**60**
Alpaca	**61**
Alpaca	**70**
Alpaca	**71**

9.4 Minimum requirements

All meat must originate from animals slaughtered in establishments regularly operated under the applicable regulations pertaining to food safety and inspection.

- pork/cuts must be:
  - ✓ Intact, taking into account the presentation
  - ✓ Free from visible blood clots, or bone dust

Figure 6- Pork meat cut

- Caprine Meat (goat) Cut
  - ✓ Free from any visible foreign matter (e.g. dirt, wood, metal particles)
  - ✓ Free of offensive odors
  - ✓ Free of obtrusive bloodstains
  - ✓ Free of unspecified protruding or broken bones
  - ✓ Free of contusions having a material impact on the product
  - ✓ Free from freezer-burn2
  - ✓ Free of spinal cord (except for whole un split carcass)

Figure 7- Goat meat packaging

9.5 Purchaser specified requirements

The following subsections define the requirements that can be specified by the purchaser together with the codes to be used in the UNECE goat Code.

9.5.1 Additional requirements

Additional purchaser specified requirements, which are either not accounted for in the code (e.g. if code 9 “other” is used) or that provide additional clarification to the product or packing description shall be agreed between buyer and seller and be documented appropriately.

9.5.2 Refrigeration

Meat may be presented chilled, frozen or deep-frozen. Depending on the refrigeration method used, tolerances for product weight to be agreed between buyer and seller. Ambient temperatures should be such throughout the supply chain to ensure uniform internal product temperatures as follows:

Table 2 Practical storage life of meat and meat products

Products	Practical storage life in months		
	-18 °C	-25 °C	-30 °C
Beef carcass	12	18	24
Roasts, steaks, packaged	12	18	24
Ground meat, packaged, (unsalted)	10	>12	>12
Veal carcass	9	12	24
Roasts, chops	9	10–12	12
Lamb carcass	9	12	24
Roasts, chops	10	12	24
Pork carcass	6	12	15
Roasts, chops	6	12	15
Ground sausage	6	10	
Bacon (green, unsmoked)	2–4	6	12
Lard	9	12	12
Poultry, chicken and turkeys, eviscerated, well packaged	12	24	24
Fried chicken	6	9	12
Offal, edible	4		

9.5.3 Production History

a. Traceability

The requirements concerning production history that may be specified by the purchaser require traceability systems to be in place. Traceability requires a verifiable method of identification of goat animals, pork, cartons and cuts at all stages of production.

Figure 8-A Pork meat in refrigerator

Figure 8-B beef dry meat

b. Mandatory Information

The following table contains information that must be listed on product labels:

Table 3 Information's of labels product

Labeling information	Carcass and cuts	Packaged or packed mea
Health stamp	X	X
Slaughter number or batch number	X	X
Packaging date	X	X
Name of the product		X
Use-by information as required by each country		X
Storage conditions: e.g. refrigeration		X
Appropriate identification of packer, processor or retailer		X

9.5.4 Meat product transportation

Fresh meat products are transported with trucks from the slaughterhouse to the retailers and the super market. If a product is processed, the meat is transported from the slaughterhouse to the meat processing manufacturer and then to retailers and super markets. Ethiopia has Meat Control (Transport of Meat) Regulations.

- **In these Regulations, except where the context otherwise requires:-**
  - **a. "carrier"** means any vehicle, aircraft, cart, bicycle, train or any motorized or hand driven transport system in or on which meat may be carried by or on behalf of the holder of a permit to any place for the purposes of selling;
  - **b. "container"** means any box, detachable compartment, receptacle or any other arrangement in which meat may be carried by or on behalf of the holder of a permit, to any place for the purposes of selling;
  - **c. "Inspecting officer"** means any veterinary officer, health inspector or any tether person duly authorized in writing by the Director of Veterinary Services to be an inspecting officer for the purposes of these Regulations;
  - **d. "Permit"** means a valid permit issued under regulation.

Figure 9- Vehicles for meat transportation

Self-Check -9	Written Test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

1. _____ Meat defined as all animal tissues suitable as food for human consumption. (3 point.
2. _____ Ethiopia has one of the largest livestock populations in Africa and the tenth in the world..(3 point)

Test 2: Give short answer for the following questions.

1. Write at least four minimum requirements of pork and goat meat (5 points)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1. ._____

_____

_____

Information Sheet- 10 Identifying relevant microbiological tests and assessing test result.

10.1 Microbiological testing

- Microbiological testing of food is the examination of their microscopic organisms in food.
- This organisms could be single cell, multiple cell or without cell.
- Microbiology includes various sub- disciplines like virology, mycology, parasitology and bacteriology.
- Living organisms can grow in extreme condition where no other living organisms can survive.
- They can grow in temperature like at boiling points at similarly can grow and survive in extreme freezing point like -20 degree & -30 degree.
- Microorganisms can be found in meat and beverage and they can be harmful if they inter in to a human body.

10.2 Reasons for microbiological test

The typical reasons for microbiological testing are to:

- Meat desired specification for raw material, intermediate, and finished product
- Identify risk factors,
- Process verification, and
- Conform that regulatory guidelines are followed

Figure 10- Microbiological testing for meat

10.3 Common testing methods

Although a wide range of technologies is used for the identification and verification of microorganisms, among these technologies, three types of methods are commercially popular. These are:

I. Culture media

A special medium that is used in microbiological laboratories to identify and detect different types of MO by culturing or growing. Usually, a culture medium is composed of different nutrients to enhance microbial growth.

Figure 10- Culture media testing method

II. Immunoassay

Immunoassay can be illustrated as a microbiological test that is used to measure the concentration of a macromolecule in a solution via using an antibody or immunoglobulin.

III. Polymerase chain reaction

Polymerase chain reaction (PCR) test can recognize pieces of a DNA or PC, which are expected to be unique to the target MO. PCR is based on using the ability of DNA polymerase and can generate billions of copies of a specific DNA sequence

Self-Check -10	Written Test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

Test 1: matching A columns with B columns. (6 points)

A	B
1. Culture media	a. used to identify and detect different types of MO by culturing or growing
2. Immunoassay	b. used to measure the concentration of a macromolecule in a solution
3. Polymerase chain reaction	c. used to the ability of DNA

Test 2: Give short answer for the following questions.

3. Write three Common testing methods (5 points)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

._____

_____

_____

LG #18	LO #2- Identify chemical hazards for meat and meat safety

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying Chemical hazards
- Identifying and assessing Common sources of chemical hazards
- Determining and implementing Control methods
- Explaining Effects of chemical residues
- Identifying Chemical residue testing programs

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify Chemical hazards
- Identify and assessing Common sources of chemical hazards
- Determine and implementing Control methods
- Explain Effects of chemical residues
- Identify Chemical residue testing programs

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

Information Sheet - 1 identifying chemical hazard.

1.1 Chemical Hazards

- **There are different types of chemical hazards associated with food:**
  - ✓ naturally-occurring chemicals
  - ✓ intentionally-added chemicals
  - ✓ Unintentional or incidental chemical additives.

Control points for chemical hazards must be identified during the process and storage of food products. Such can be done by using hazard analysis technique.

a. Naturally Occurring Chemical Hazards

There is a perception that if something is naturally grown or raised it will not have any chemical hazards present. This belief is not true; naturally occurring chemical hazards are present in many foods. For example, there are toxins found in many varieties of mushrooms and some seafood. In many countries there is legislation relating to the presence or level of toxins, so you should be aware If you are using foods which may contain these toxins. It would be good practice to refer to legislation and analysis samples of the product before use.

- **Examples of naturally occurring chemical hazards are**
  - ✓ toxins produced by Clostridium botulinum, Staphylococcus aureus, Bacillus cereus
  - ✓ Scombrotoxin (histamine) – fish
  - ✓ Saxitoxin – paralytic shellfish toxin
  - ✓ Ciguatoxin – finfish
  - ✓ Mycotoxins – produced by molds (fungi).

b. Intentionally Added Chemicals – Food Additives

There are two types of intentionally added chemicals, Direct and indirect food additives.

Direct additives are compounds such as preservatives; these include nitrites, sodium benzoate, and sulfiting agents. You must be aware of the regulations relating to the use of these compounds since legislation does differ from country to country. Additives such as

colors and nutritional additives (such as vitamins) are also direct. All direct additives must be included on all labels. You can see from the table the risks of using direct food additives improperly.

- **Indirect food additives** include
  - ✓ adhesives
  - ✓ paper and paperboard components
  - ✓ polymers
  - ✓ Adjuvants, protection aids, and sanitizers.

In most cases these indirect food additives are undesirable and migrate into the food from inappropriate packaging.

- **Unintentionally Added Chemicals**

There are a number of unintentionally introduced chemicals added to foods by agricultural processes including

- pesticides
- fungicides
- herbicides
- fertilizers
- antibiotics
- Growth hormones.

These substances are prohibited in certain countries. To ensure your company is complying with legislation where the food is sold, you should carefully review the appropriate legislation. There are private standards and business-to-business requirements that can be stricter than legislative requirements and the customer will closely scrutinize the product for the presence and level of substances that violate these standards.

Table 4.Sources of chemicals

Source	Why a Hazard?
Agricultural Chemicals (e.g. pesticides, herbicides)	If improperly applied, some can be acutely toxic or may cause long-term health effects
Cleaning Chemicals (e.g. acids, caustics)	Can cause chemical burns if present in the food at high levels
Equipment Components (e.g. copper pipe fittings)	Acidic foods can cause leaching of heavy metals from pipes and joints (e.g. copper and lead)
Maintenance Chemicals (e.g. lubricants)	Some chemicals that are not approved for food use may be toxic
Packaging Materials (e.g. tin)	High nitrite levels in food can cause excessive detinning of uncoated cans resulting in excessive levels of tin in the food

- **Controls of Chemical Hazards**

Having a management system in place that identifies sampling points and sampling levels is good practice to reduce the risk of chemical hazards. The table shows suggested areas of inspection.

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer (2 point)

1, Control points for chemical hazards must be identified during the process and storage of food products

a. true b. false

2. Test 2: Give short answer for the following questions.

1. Write types of chemical hazards associated with food:
2. Write types of intentionally added chemicals
3. Write control methods of chemical methods

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1_____

2_____

3_____

Information Sheet-2 Identifying and assessing Common sources of chemical hazards.

2.1. Recognition of chemical hazards

Working with chemicals always involves the risk of exposure. It is important to review and understand any information about hazards and special precautions regarding the handling and use of a chemical.

2.2. Evaluation of chemical hazards

Safety Material Data Sheets (SDS's). An SDS outlines a substance's physical and chemical hazards that include but are not limited to

- Identity Information
- Hazardous Ingredients
- Physical/Chemical Characteristics
- Fire and Explosion Hazard data
- Reactivity Data
- Health Hazard Data
- Precautions for Safe Handling & Use
- Control Measures

2.3. Sources of chemical hazard

Chemicals can enter the environment from many different sources such as landfills, incinerators, tanks, drums, or factories. Human exposure to hazardous chemicals can occur at the source or the chemical could move to a place where people can come into contact with it. Chemicals can move through air, soil, and water.

2.4. Health Effects of Chemicals

Working with chemicals always involves the risk of chemical exposure. The health risk is dependent upon the toxicity of the chemical, the types of effects and the various routes of entry.

Figure 12 - Effects of chemical hazard

I. Toxicity vs. Hazard

Toxicity: - ability of a chemical to act as a poison or cause injury to tissues.

Hazard: - likelihood that a chemical will cause injury in a given environment or situation; degree of hazard depends on how toxic the substance is, how it is absorbed, etc.

II. Acute vs. Chronic Exposures

Acute Exposures: - exposure of short duration, usually to relatively high concentrations or amounts of material.

Chronic Exposures:- continuous or intermittent exposure is extending over a long period, usually to relatively low material amounts or concentrations.

III. Local vs. Systemic Effects

Local Effects: - chemical may be localized on a specific area of the body such as nose or throat.

Systemic Effects: - entire body system and organs are all affected by exposure to the chemical.

Self-check 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer (2 point)

1, Control points for chemical hazards must be identified during the process and storage of food products

a. true b. false

Test 2: Give short answer for the following questions.

1. Write at least four sources of chemical hazards (3points)
2. Write Health Effects of Chemicals (3points)

Note: Satisfactory rating – ≥3points **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

2. _____

Information Sheet-3 Determining and implementing Control methods

3.1. Control methods for chemical hazards.

A. Designated Area: - This is an area assigned for the usage of either a particularly hazardous substance or purpose. Designated area" should be assigned, and warning label should be posted.

B. Engineering Controls: - this is the most effective and desirable method for minimizing risk of exposure either to toxic chemicals or to mechanical equipment. Examples of engineering controls: guards, remote controls, or interlock systems. Ventilation systems are the best approaches to help reduce personal exposure to acceptable levels.

C. Work Practice Controls

In most cases, a well-designed set of work practices is the best risk management tool.

- **Chemical Transportation**

Assure that an unbreakable secondary container is being used, and that transport carts are designed for this purpose.

- **Eating, Drinking and Smoking**

There should be no eating**,** drinking, smoking, chewing of gum or tobacco, application of cosmetics, storage of utensils, food, or food containers in the laboratories

- **Pipetting**

Mechanical pipetting aids should always be used for all pipetting procedures. Oral pipetting is prohibited. Two mechanisms are commonly employed and pipettes are therefore classed as being either air displacement, or positive displacement.

Figure 13 (A): Air displacement automatic pipette, (B) Positive displacement automatic pipette.

- **Personal Hygiene**

All personnel should wash their hands immediately after the completion of any procedure in which chemicals have been used and when they leave the laboratory. If hazardous chemical exposures occur to skin, immediately shower or wash affected areas.

- **Housekeeping Keeping**

The working area clean and orderly reduces the frequency and severity of accidents. Here are some common sense tips:

- ✓ Keep aisles, exits, stairs and hallways free of obstructions.
- ✓ Avoid slip hazards by keeping the floor clean of ice, stoppers, glass beads or rods, other small items and spilled liquids.
- ✓ Keep drawers and cabinet doors closed.
- ✓ Never store chemicals on the floor.
- ✓ Workspaces and storage areas should be kept clear of broken glassware, leftover chemicals and scraps of paper.

Figure 14 Housekeeping

D. Standard Operating Procedures (SOP)

An SOP, or Standard Operating Procedure, is a documentation of how a process works. SOPs work best as a step-by-step list of procedures that anyone can follow with a bit of training. Companies develop SOPs for a variety of reasons. One of these reasons is that SOPs help reduce the training time for new team members. Hand them a well-built SOP, and they'll have a considerable head start on completing the task at hand.

E. Personal Protective Equipment (PPE)

PPE comprises of clothing or equipment that is used to isolate a worker from direct exposure to workplace hazards.

- Examples of PPE include the following:
  - ✓ Protective clothing
  - ✓ Gloves
  - ✓ Eye Protection
  - ✓ Respirators
  - ✓ Face Shields PPE is used in conjunction with engineering and administrative controls for worker protection.

It should provide adequate protection if it is properly worn and appropriately used. Prior to usage, consult EH&S (752-1493) to ensure proper PPE selection.

Figure 15-.personel protective equipment

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: choose the best answer (3pt)

1. Which one is example of PPE?

   a. Protective clothing

   b. Gloves

   c. Eye Protection

   d. Respirators

   e. all

Test II: Short Answer Questions

1. What is engineering control (3pt)
2. What is Work Practice Controls? (3pt)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1_____

2_____

3_____

Information Sheet-4 Explaining Effects of chemical residues

4.1. Chemical residues

- Chemical residues are the traces of a chemical or its breakdown products that remain in or on treated produce.
- The main concern is when chemical residues are detected at unacceptable levels, above the maximum residue limit (MRL), which indicates that chemicals may not have been used in accordance with good agricultural practice (GAP).
- A residue is what remains of a chemical or heavy metal (for example, lead, arsenic, cadmium) inside a plant at a point in time. The residue may be the original substance or a derivative (metabolite) of the original substance.
- All chemicals and heavy metals cause residues but the time taken for a residue to break down varies depending on the substance and the type of crop.

4.2. Chemicals used in processing meat

- Processed meat products are usually high in sodium chloride, also known as table salt.
- For thousands of years, salt has been added to food products as a preservative.
- However, it is most often used to improve taste
- **How do harmful residues occur?**
  - ✓ Meat and meat products are important for nutrition and the human diet, but are also one of the major routes of human intake of contaminants.
  - ✓ Contaminating substances may enter the food chain at many different stages.
  - ✓ Through various constituents like fertilizer ingredients and contaminants, irrigation water, contaminants and pesticides can enter food crops through plant roots.
  - ✓ Contaminants in forages and other feeds can be transmitted to animal products.

4.3. Avoid harmful chemical residues

Keep food free of harmful residues by:

- ✓ Following all veterinary chemical label directions or veterinary directions
- ✓ Keep records of pesticide applications
- ✓ Ensure spray applicators are trained

- ✓ Observe the WHP, both grazing and harvest
- ✓ Check chemical application records before harvesting crops
- ✓ Prior to harvest, decontaminate treated grain storage, transport equipment or grain handling equipment and equipment that has been in contact with treated seed (pickled seed).

Self-check 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Say true or false for the following questions.

1._____All chemicals and heavy metals cause residues but the time taken for a residue to break down varies depending on the substance and the type of crop. (3 point)

2. _____Not all residues are harmful (3 point)

Test II: Short Answer Questions

3. How you avoid chemical residues .(3pt)
4. What is harmful residues (3pt)
5. List at least four chemical residues? (3pt)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1_____2

_____

3_____

Information Sheet-5 Identifying Chemical residue testing programs.

5.1 Identifying Chemical residue testing programs.

The term 'residue' is generally used to describe the small amounts of agricultural and veterinary chemicals, or their breakdown products, that remain in or on an agricultural product. In the broader context of food safety, a substance can be defined as a 'contaminant' if it is 'an impurity which gives consumers health, safety or cleanliness concerns.

- **Chemical Contaminants include:**
  - ✓ residues arising from the use of pesticides and veterinary medicines
  - ✓ heavy metals (e.g. mercury, cadmium, lead)
  - ✓ naturally occurring chemicals such as mycotoxins (toxins produced by certain fungi)
  - ✓ Microorganisms.
  - ✓ All of these may be present in food, either through natural circumstances or as a consequence of industrial or agricultural activities. Table 5. Common chemical residues found in the food

Sulfites	Sulfites are most often used as antimicrobial and antioxidant agents in food and beverages, particularly in wine-making during the fermentation process. Due to potential adverse reactions of intolerant individuals and other food safety concerns, total sulfite content is commonly regulated by government agencies.
Methanol	Methanol is a highly flammable and poisonous liquid. It is a naturally occurring substance present during the distillation process, which should be separated and removed thereafter. Methanol should only be found in small dose in spirits, beers, and wines. Otherwise, it becomes highly toxic if consumed; possibly causing central nervous system depression, blindness, and death to name a few.
Alkaline Phosphatase	An essential process in the production of safe and pathogen-free milk is pasteurization. Alkaline phosphatase is an enzyme naturally present in all raw milk, but is destroyed at a temperature near to the ideal pasteurization temperature. The Alkaline Phosphatase test is used by dairy farms and processors and food producers to determine whether milk has been sufficiently pasteurized, or whether it has been contaminated with raw milk after the process of pasteurization.

✓

Pesticide	Most crops are treated with pesticides. Pesticides enable farmers to increase crop yields, preserve product quality, and extend shelf life. At the same time, pesticides can pose harmful effects upon exposure and ingestion.
GMO	Genetically Modified Organisms (GMO) undergo a lot of biochemical processes. GMO production is increasing around the globe, thus brought out the necessity to establish regulatory standards in order to facilitate trade and safety of GMO products for human consumption.
Ruminant (MBM)	Meat and bone meal is a valuable protein source in feed production. However, it was determined as a cause of the spread of Bovine Spongiform Encephalopathy (BSE) or mad cow disease. In order to prevent the spread of BSE, most countries have imposed restrictions, and even outright bans, on the use of ruminant by-products and proteins in feed for ruminants.
Melamine	Melamine is a chemical used in a variety of industrial processes and can be found in food contact surfaces in processing plants, can coatings, dishware, and other kitchenware. Furthermore, it is also used illegally to increase the apparent protein content in food samples such as milk.

- **Maximum levels**

MLs were established as an effective risk management function for foods which provide a significant contribution to the dietary exposure of a particular contaminant. MLs are set at levels that are consistent with the protection of public health and safety, and are reasonably achievable through sound production and natural resource management practices.

- **Testing programs**

Residue testing programs involve random and targeted monitoring of animal and plant products. Laboratory performance evaluation and proficiency testing ensure the reliability of the analytical results upon which the residue testing program depends.

Figure 16-Residue testing for meat

- **Random monitoring**

Programme is designed to estimate the occurrence of a residue(s) by using randomized sampling processes. NRS random residue monitoring data facilitates and underpins the demonstration of:

- ✓ compliance with requirements for domestic consumption
- ✓ The certification of commodities for export (where required)
- ✓ The setting or review of Food Standards.

This underpinning helps participating industries to maintain access to important export markets and a competitive advantage in those markets. Testing program also play an important role in the negotiation of access to new and potential markets.

- **Targeted monitoring**

Targeted monitoring program run in conjunction with random sampling arrangements and are designed to obtain more focused information concerning known or potential residue problems. These programs use specific sampling processes tailored to the particular area or participants of concern.

- **Trace back**

Laboratories test samples against an agreed chemical screen which meets market requirement... If a laboratory finds a sample that contains a residue above the countries Standard, a trace back investigation is undertaken to establish the cause. The responsible state or territory agency then provides advice to the producer to prevent recurrence. In more serious circumstances, regulatory action may also be taken.

All trace back activities and findings are reported to the NRS. This feedback is important in highlighting potential problems, such as inappropriate chemical use and improving farm practices. Where appropriate, trace back information is also forwarded to industry and government authorities for consideration. Trace back information may also be forwarded to the APVMA for consideration during its chemical review processes.

Self-check 5	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. What is Testing program? (3pts)

Test II: Write true if the statement is correct and false if the statement is incorrect

1. Residue' is generally used to describe the small amounts of agricultural and veterinary chemicals, or their breakdown products, that remain in or on an agricultural product.
2. Residue testing programs involve random and targeted monitoring of animal and plant products. (2pts)

Note: **Satisfactory rating - 6 points** **Unsatisfactory – 6 below points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

1._____

_____

2. _____

LG #19	LO #3- Identify physical hazards on meat and meat products.

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Explaining Physical hazards.
- Identifying and assessing Common sources of physical hazards
- determining and implementing Control methods
- Explaining Effects of physical hazards

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Explain Physical hazards.
- Identify and assessing Common sources of physical hazards
- determine and implementing Control methods
- Explain Effects of physical hazards

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the information Sheets
3. Accomplish the Self-checks

Information Sheet-1 Explaining Physical hazards.

1.1. Physical Hazards in Food

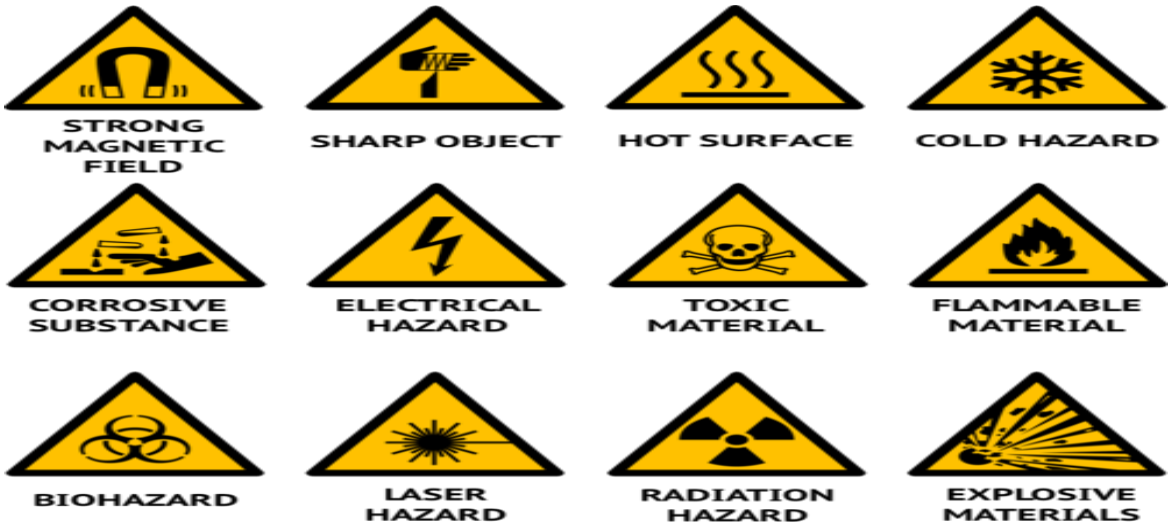
Physical hazards are either foreign materials unintentionally introduced to food products (ex: metal fragments in ground meat) or naturally occurring objects (ex: bones in fish) that are hazardous to the consumer. A physical hazard contaminates a food product at any stage of production. Food processors should take adequate measures to avoid physical hazards in food. A physical hazard is any potential harmful extraneous matter not normally found in food. They are different to biological or chemical hazards. Generally cause problems for relatively few consumers per incident.

1.2. Common Physical Hazards

- Common sources of physical hazards in food include:
  - ✓ **Glass:** light bulbs, glass containers and glass food containers
  - ✓ **Metal:** fragments from equipment such as splinters, blades, needles, utensils, staples, etc.
  - ✓ **Plastics**: material used for packaging, fragments of utensils used for cleaning equipment.
  - ✓ **Stones:** incorporated in field crops, such as peas and beans, during harvesting.
  - ✓ **Wood**: splinters from wood structures and wooden pallets used to store or transport ingredients or food products.
  - ✓ **Natural components of food: hard or sharp parts of a food** (ex: shells in nut products) if consumers do not expect them.

Figure 17- Physical affected meat

Sign of physical hazard in working area



Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. What is Common Physical Hazards found in food? (3pts)

Test II: Write true if the statement is correct and false if the statement is incorrect

1. A physical hazard is any potential harmful extraneous matter not normally found in food.(3pnts)

Stone is incorporated in field crops, such as peas and beans, during

Test III: matching A columns with B columns. (6 points)

A		B
1.	glass	a. splinters, blades
2.	metal	b. glass food containers
3.	Plastic	c. material used for packaging

Note: **Satisfactory rating - 6 points** **Unsatisfactory – 6 below points**

.

Score = _____

Rating: _____

1._____

_____

2. _____

Information Sheet-2 Identifying and assessing Common sources of physical hazards

1.1. Hazard classification

- Physical Hazards – (slips, trips and falls, entanglement, noise, vibration, harmful energy sources)
- Mechanical Hazards – (moving parts, friction, abrasion, cutting, severing, shearing, stabbing, puncturing, impact, crushing, noise, vibration, etc.)
- Chemical Hazards – (inhalation, contact with or ingestion of chemicals)
- Biological Hazards – (contact with allergens or pathogens such as bacteria or viruses, etc.)
- Ergonomic Hazards – (Improperly adjusted workstations, Poor posture, Vibration. manual handling, repetitive movement, etc.)
- Psycho-social Hazards **–** (threat of physical violence, bullying or intimidation)

1.2. A physical hazard

- Physical hazard is an agent, factor or circumstance that can cause harm with contact.
- They can be classified as type of occupational hazard or environmental hazard. Physical hazards include ergonomic hazards, radiation, heat and cold stress, vibration hazards, and noise hazards.
- Engineering controls are often used to mitigate physical hazards.

1.3. Common sources of physical hazard

Physical hazards are a common source of injuries in many industries.

- They are perhaps unavoidable in certain industries, such as construction and mining, but over time people have developed safety methods and procedures to manage the risks of physical danger in the workplace.
- Employment of children may pose special problems
- **The main factors and conditions associated with physical hazards include:**
  - ✓ body stressing
  - ✓ confined spaces
  - ✓ electricity
  - ✓ heat
  - ✓ heights
  - ✓ noise

- **Source of physical hazard**

Table 5. Sources of physical hazard.

Noise	Noisy machines
Hand / Arm Vibration	Operation of vibrating hand held equipment
Whole- Body Vibration	Working on a vibrating platform, driving farm tractors or other heavy vehicles, especially on rough terrain
Hot Environments	Working near furnaces. Summer outdoor work
Cold Environments	Working outdoors in cold weather. Working in cold storage.
Hyperbaric (High Pressure) Environments	Diving
Hypobaric (Low Pressure) Environments	High altitude work
Ionizing Radiation	Working near x-ray machines. Handling radioactive materials. Uranium mining. Working in nuclear energy power plants. Working in nuclear research laboratories.
Non-Ionizing Radiation	Exposure to electromagnetic waves, lights and lasers. See the chart below.
Ultraviolet	Sunlight, Arc welding, Black light lamps, Germicidal lamps
Light, Lasers	Lasers, Welding
Microwave and	Microwave ovens, radio and TV

Radio-frequency	transmission, radar, antenna, cell phones
Power Frequency Electromagnetic Field (ELF)	Working near electric power transmission or distribution lines.
Slips, Trips and Falls	Slippery and cluttered floors and working surfaces.
Fires	Chemical reactions, heat, ignition, electrical short circuit, static electricity, friction.

Self-check 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Write and discuss classification of hazard? (5pts)
2. Write difference b/n physical chemical hazard

Test II: Write true if the statement is correct and false if the statement is incorrect

1. Working on a vibrating platform, driving farm tractors or other heavy vehicles, especially on rough terrain is source of physical hazard (3pnts)
2. Sunlight, Arc welding, Black light lamps, Germicidal lamps are not source of physical hazard. (3pnts)

Note: **Satisfactory rating - 6 points** **Unsatisfactory – 6 below points**

.

Score = _____

Rating: _____

1._____

_____

2. _____

Information Sheet-3 Determining and implementing Control methods.

3.1. Control methods of physical hazard

- There are many ways food processors can prevent physical hazards in food products.
- Assess every step of operation for potential sources of contamination.
- Physical hazards are either foreign materials unintentionally introduced to food products (ex: metal fragments in ground meat) or naturally occurring objects (ex: bones in fish) that are hazardous to the consumer.
- A physical hazard contaminates a food product at any stage of production.

- **Food processors should take adequate measures to avoid physical hazards in food are:-**
  - ✓ Inspect raw materials and food ingredients for field contaminants, such as stones in cereals that were not found during receiving
  - ✓ Handle food according to Good Manufacturing Practices (GMPs). (Ex: avoid inclusion of physical hazards such as jewelry or false fingernails in food products by using proper personnel practices.)
  - ✓ Eliminate potential sources of physical hazards in processing and storage areas. (Ex: use protective acrylic bulbs or lamp covers to prevent contamination by breakable glass.)
  - ✓ Install an effective detection and elimination system for physical hazards. (Ex: metal detectors or magnets will detect metal fragments in the production line while filters or screens will remove foreign objects at the receiving point.)
  - ✓ Establish an effective maintenance program for the equipment in your facility to avoid sources of physical hazards such as foreign materials that can come from worn out equipment.

3.2. Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) is used as temporary (until more effective hazard control techniques can be used) or last line of protection for workers against hazards. The PPE you use will depend on the work environment, the work conditions, and the process being performed. Each piece of PPE has a specific use and may be made of specialized materials appropriate for one use, but not appropriate for another.

Which are the PPE used by food industry workers?

The PPE that are to be worn by workers in the food industry are not very different from those used in the pharmaceutical industry. Both medicines and food additives, in fact, are composed by a very high percentage of reagents and chemical substances. Prolonged exposure to dust during the different stages of dispensing, weighing and mixing of food additives, is one of the main causes that lead to contracting serious and annoying respiratory diseases such as, for example, occupational asthma. Respirators and face masks equipped with blower units are among the essential PPE that food production technicians should always be provided with. For example, thick natural rubber gloves will protect the wearer from strong solutions of sodium hypochlorite (bleach) for an 8 hour working day, but it will not protect them from ammonia hydroxide as effectively.

Figure 18 -PPE in food industry

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Write Food processors should have taken measures to avoid physical hazards in food are (2pts)
2. Write **PPE used by food industry workers**(2pts)

Test II: Write true if the statement is correct and false if the statement is incorrect

3. Respirators and face masks equipped with blower units are among the essential PPE that food production technicians should always be provided.(3pnts)
4. Each piece of PPE has a specific use and may be made of specialized materials appropriate for one use, but not appropriate for another. (3pnts)

Note: **Satisfactory rating 5 points** **Unsatisfactory – 5 below points**

.

Score = _____

Rating: _____

1._____

_____

2. _____

Information Sheet-4 Explaining Effects of physical hazards

4.1 Explaining Effects of physical hazards Physical contaminants are additional matter or alien objects normally not existing in food that could cause injury, disease.

4.2 Effects of Physical Hazards

Table.6. summarizes the sources of physical hazard exposure and their health effects

Types	Possible Sources	Health Effects
Noise	Noisy machines	Hearing loss, Stress, Annoyance
Hand / Arm Vibration	Operation of vibrating hand held equipment	White finger, Hand-Arm Vibration Syndrome (HAVS)
Whole- Body Vibration	Working on a vibrating platform, driving farm tractors or other heavy vehicles, especially on rough terrain	Back disorders, Wide range of health conditions.
Hot Environments	Working near furnaces. Summer outdoor work	Heat stroke, Heat Syncope (fainting)
Cold Environments	Working outdoors in cold weather. Working in cold storage.	Hypothermia, Frostbite, Trench foot
Hyperbaric (High Pressure) Environments	Diving	"Bends" or decompression sickness, joint pain, breathing or ear disorders.

Hypobaric (Low Pressure) Environments	High altitude work	Disorders of the lungs, Mountain sickness (headaches, nausea, vomiting)
Ionizing Radiation	Working near x-ray machines. Handling radioactive materials. Uranium mining. Working in nuclear energy power plants. Working in nuclear research laboratories.	Radiation sickness within hours or days after exposure to very high radiation levels. Cancer after several years of low-level exposure.
Non-Ionizing Radiation	Exposure to electromagnetic waves, lights and lasers. See the chart below.	Does not produce ions in the body chemicals. Reach by causing heat and other effects
Ultraviolet	Sunlight, Arc welding, Black light lamps, Germicidal lamps	Skin Cancer, Eye damage, Retinal damage
Light, Lasers	Lasers, Welding	Retinal damage
Microwave and Radio-frequency	Microwave ovens, radio and TV transmission, radar, antenna, cell phones	Heating of the body, Central Nervous System (CNS) effects
Power Frequency Electromagnetic Field (ELF)	Working near electric power transmission or distribution lines.	Indications of leukemia in children.
Slips, Trips and Falls	Slippery and cluttered floors and working surfaces.	Bodily injury, broken bones, permanent

		disability
Fires	Chemical reactions, heat, ignition, electrical short circuit, static electricity, friction.	Burns, inhalation of toxic fumes

Figure 19 A. Effects of poor lightening

Figure B. Effects of vibration

Self-check 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Say true or false for the following questions.

1._____ Hearing loss, Stress, Annoyance are effects of noise (3 point)

2. _____ Heat stroke, Heat Syncope (fainting) is effects of cold environment (3 point)

Test II: Short Answer Questions

1. Write and discuss at least five physical hazard with its effects (3pt)
2. What are sources of Whole- Body Vibration? (3pt)

Note: Satisfactory rating – ≥6 points **Unsatisfactory - below 6 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1_____2_

_____

3_____

LG #20	LO #4- Calibrate thermometers

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying and explaining appropriate calibre able Thermometers.
- calibrating Thermometers

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify and explain appropriate calibre able Thermometers.
- calibrate Thermometers

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

Information Sheet-1 Identifying and explaining appropriate calibre able Thermometers

1.1. Identify the food thermometer

- Thermometer is an instrument for measuring and indicating temperature.
- It is the act of ensuring that a method or instrument used in measurement will produce accurate results.

1.2. Types of thermometer

There are eight types of thermometer and, each designed to serve different purposes. Let's take a look at the types of food thermometers available, and what makes them different from each other.

I. Thermocouples

Thermocouples read temperatures very fast – in as little as 2-5 seconds. These restaurant supplies are very versatile and can measure both thick and thin foods. They can be calibrated for easy reading. Unfortunately, they are highly inaccurate during cooking and are best used when the food is nearly cooked, for accurate results. Being rather sensitive restaurant supplies, thermocouples are not safe for oven usage.

Figure 20 -Thermocouples Thermometer

II. Thermistors or Digital Instant Read)

Thermistors are great restaurant supplies that provide fast and accurate readings. A thermistor can be used to measure temperature in both thick and thin foods. However, not all models can be calibrated, and they cannot be used food while cooking.

III.

Figure 21- Thermistors (Digital Instant Read)

III. Oven Probe Cord Thermometers

Oven probe cord thermometers are versatile restaurant supplies that can be used in the temperature measurement of most foods. They are specifically designed for use inside an oven or covered pot while cooking, but can also be used outside the oven. The main downside is that they are not calibrated.

Figure 22- Oven Probe Cord Thermometers

IV. Thermometer-Fork Combination

a typical thermometer-fork combination reads temperatures in 2 – 10 seconds. These are versatile restaurant supplies that can be used in most foods. Thanks to their fork-like nature, they are highly convenient for use when grilling. Thermometer-forks cannot be used until your food is almost done cooking.

Figure 23- Thermometer-Fork Combination

V. Dial Oven-Safe Bimetallic Thermometers

Dial bimetallic thermometers read temperatures in 1 – 2 minutes. This is much slower than most thermometers on this list. However, unlike many on the list, these restaurant supplies can be used in foods while cooking – although they have to be placed at least 2

inches deep for accuracy. These restaurant supplies are a good fit for roasts, soups and casseroles, but are not advisable for use when preparing thin foods. Due to the metallic nature of these thermometers, they are able to easily conduct heat and do not always provide accurate readings.

Figure 24- Bimetallic Thermometers

VI. Digital Instant-Read Bimetallic Thermometers

Digital bimetallic thermometers are handy restaurant supplies provide fast and accurate readings. However, like many others on this list, they cannot be used while food is still cooking, but they can be used in both thick and thin foods. For those conscious of calibration, be sure to check if the model you're considering is calibrated.

Figure 25- Instant-Read meat thermometer

VII. Disposable Temperature Indicators

Disposable temperature indicators are, as their name implies, single-use restaurant supplies. They provide accurate temperature readings in 5 – 10 seconds. Great for liquid foods, these thermometers are designed to measure food temperature while cooking. They are programmed to detect a specific temperature, changing colors when that temperature is attained.

Figure 26- Disposable thermometer

VIII. Pop-up timers

another type of single-use thermometer, these restaurant supplies “pop up” when food reaches a certain temperature. They are most often used when roasting turkeys and chickens. Combining pop-up timers with other conventional food thermometers will provide you with the best results.

Figure 27- Pop-up meat thermometer

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer (6 point)

1. Which thermometer read temperatures in 1 – 2 (3pnts)

A. Thermocouples

B. Thermistors (Digital Instant Read

C. Oven Probe Cord Thermometers

D. Thermometer-Fork Combination

2. Which thermometers are designed to measure food temperature while cooking.(3pnts)

a. Oven Probe Cord Thermometers b. Thermocouples c. Thermometer-Fork

Test I: Short Answer Questions

1. Define thermometer .2pt)
2. Define Pop-up timers (2pt)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Information Sheet-2 calibrating Thermometers

2.1. Calibrate thermometer

- Instrument calibration is one of the primary processes used to maintain instrument accuracy.
- Calibration is the process of configuring an instrument to provide a result for a sample within an acceptable range.
- Eliminating or minimizing factors that cause inaccurate measurements is a fundamental aspect of instrumentation design.
- Calibration is the act of ensuring that a method or instrument used in measurement will produce accurate results.

Figure 28- Meat thermometer

2.2. Methods of calibration

There are two types of thermometer calibration methods

I. Method 1: ice water

- Fill a glass with ice cubes, and then top off with cold water.
- Stir the water and let sit for 3 minutes.
- Stir again, and then insert your thermometer into the glass, making sure not to touch the sides.
- The temperature should read 32°F (0°C). Record the difference and offset your thermometer as appropriate.

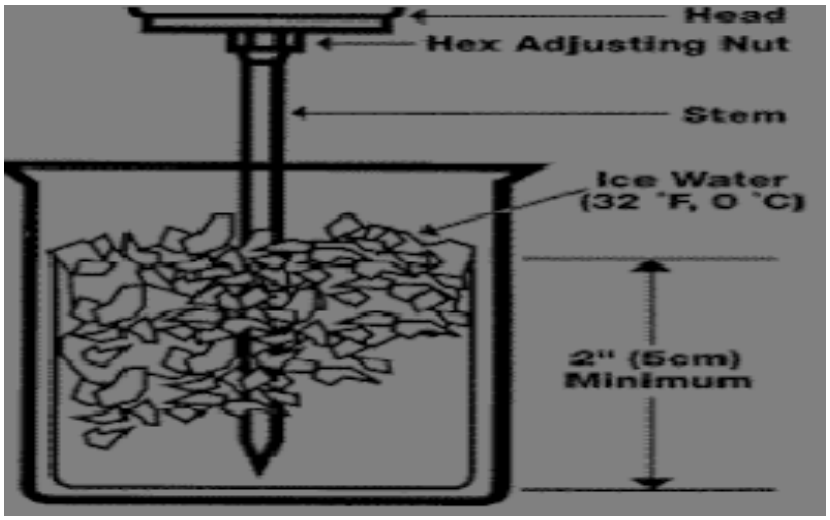


Figure 29 Ice water

II. Method 2: boiling water

- Boil a pot of distilled water.
- Once the water has reached a rolling boil, insert your thermometer, making sure not to touch the sides or bottom of the pot.
- The temperature should read 212°F (100°C). Record the difference and offset your thermometer as appropriate.

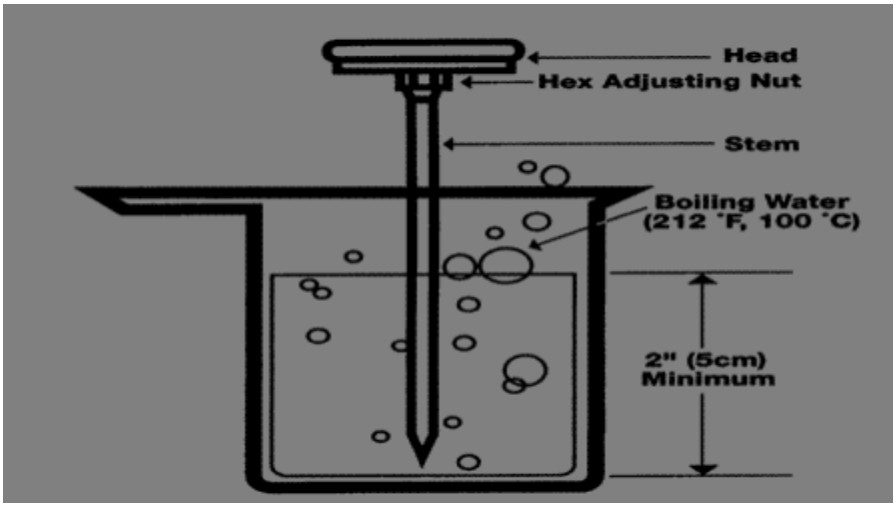


Figure 30 boiling water methods

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

1. _____Instrument calibration is one of the primary processes used to maintain instrument accuracy? (3 point)
2. _____ Calibration is the act of ensuring that a method or instrument used in measurement will produce accurate results (3 point)

Test 2: Give short answer for the following questions.

1. Write types of calibration method of thermometers (4points)

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1._____

_____

Operation sheet-1	Using and calibrating a digital oral thermometer

Steps / Procedures to determine total solids in wastewater

Step 1 Wash your hands with soap and warm water.

Step 2 Use a clean thermometer, one that has been washed in cold water, cleaned with rubbing alcohol, and then rinsed to remove the alcohol.

Step 3 Do not eat or drink anything for at least five minutes before you take your temperature because the temperature of the food or beverage could make the reading inaccurate. You should keep your mouth closed during this time.

Step 4 Place the thermometer tip under the tongue.

Step 5 Hold the thermometer in the same spot for about 40 seconds.

Step 6 Readings will continue to increase and the F (or C) symbol will flash during measurement.

Step 7 usually, the thermometer will make a beeping noise when the final reading is done (usually about 30 seconds). If you are keeping track, record the temperature and the time.

Step 8 Rinse thermometers in cold water, clean it with alcohol and rinse again.

LAP Test	Performance Test

Name……ID…… Date……

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 4 hours. The project is expected from each student to do it.

Task-1: Perform calibrating thermometer by Ice-Point Method

Task-2: Perform calibrating thermometer Boiling-Point Method

LG #21	LO #5- Identify the components of a Hazard Analysis Critical Control Point (HACCP)-based QA program for meat processing plants

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying and explaining Regulatory basis.
- Identifying and explaining Steps in the development of a HACCP program.
- Identifying Nature and importance of work instruction.
- Identifying elements of a HACCP program.
- Identifying nature and importance of Good Manufacturing Practices (GMP).
- Identifying and explaining mechanisms for validation, monitoring and verification.

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify and explain Regulatory basis.
- Identify and explain Steps in the development of a HACCP program.
- Identify Nature and importance of work instruction.
- Identify elements of a HACCP program.
- Identify nature and importance of Good Manufacturing Practices (GMP).
- Identifying and explaining mechanisms for validation, monitoring and verification.

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the information Sheets
3. Accomplish the Self-checks

Information Sheet-1	Identifying and explaining Regulatory basis

1.1. Identifying and explaining Regulatory basis

Environmental impact assessment (EIA for short) is a recent phenomenon in Ethiopia. It became a legally required procedure toward the end of year 2002, though emerged de facto before 2002 when a few land developers, including state-owned agencies, approached the Environmental Protection Authority (EPA) to have their environmental impact studies reviewed. Since the Environmental Impact Assessment Proclamation № 299 of 2002 was adopted by the House of Peoples' Representatives, some efforts have been made to implement the law by the EPA and the relevant regional environmental organs, which were themselves established by Proclamation № 295 of 2002. In spite of these efforts, EIA in Ethiopia has until now remained weak

The Environmental Policy of Ethiopia provides a number of guiding principles that require adherence to principles of sustainable development; in particular, the need to ensure that EIA's:

- Consider impacts on human and natural environments
- Provide for early consideration of environmental impacts in projects and projects Design;
- Recognize public consultation;
- Include mitigation and contingency plans;
- Provide for auditing and monitoring; and
- Is a legally binding requirement.

Governmental goals for the livestock sector focus on improving productivity, which will indirectly improve the per-animal environmental impacts by providing a more productive base (the same amount of erosion per cow, but less erosion per kilo of meat or per other animal's product per kilo or liter.

The quality policy & quality strategy is the main driver of quality performance of a firm because they identify long and short term food quality goals, objectives and how to achieve them by the quality system. Management concerns for food quality range from long term to short term: strategic, innovation, and operations management.

1.2. Quality assurance

Quality assurance is a way of preventing mistakes and defects in manufactured products and avoiding problems when delivering products or services to customers; which ISO 9000 defines as "part of quality management focused on providing confidence that quality requirements will be fulfilled".

- **Quality**
  - ✓ **Q** stands **for QUALITATIVE ORIENTATION**
  - ✓ **U** stands **for UNIQUE INNOVATIVE PROGRESS**
  - ✓ **A** stands **for ACHIEVING EXCELLENCE/ASSURANCE**
  - ✓ **L** stands **for LEARNING ABOUT BEST PROPERTIES**
  - ✓ **I** stand **for INTELLIGENT APPLICATION OF MIND TO OVERCOME WEAK**

- **AREAS**
  - ✓ **T** stands **for TALENT TO MARCH TOWARDS EXCELLENCE**
  - ✓ **Y** stands **for YEARNING FOR KNOWLEDGE**

1.3. Work instruction

- Workers must maintain good personal cleanliness.
- Wash hands every time after using toilets and before handling produce.
- Not handle food if suffering from infectious disease.
- Smoking, eating, chewing gum should not be allowed in production or processing areas.
- Spitting, sneezing and coughing on the produce should be prohibited.
- Personal affects like Jewellery, watches should not be allowed into the food producing area.

Self-check 1	Written test

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Give the best answer (3points each)

1. Define quality assurance
2. List major problems of livestock's in relation to environmental issues.

You can ask you teacher for the copy of the correct answers.

Information Sheet-2 Identifying and explaining Steps in the development of a HACCP program.

2.1. Introduction

Hazard Analysis and Critical Control Point (HACCP) is an acronym used to describe the Hazard Analysis and Critical Control Point system. The HACCP concept is a systematic approach to food safety management based on recognized principles which aim to identify the hazards that are likely to occur at any stage in the food supply chain and put into place controls that will prevent them from happening. HACCP is very logical and covers all stages of food production from the growing stage to the consumer, including all the intermediate processing and distribution activities.

2.2. Uses of HACCP

HACCP is a proven food safety management system that is based on prevention. By identifying where in the process the hazards are likely to occur it is possible to put into place the control measures required. This ensures that food safety is managed effectively and reduces reliance on the traditional methods of inspection and testing.

2.3. Regulatory position of HACCP

Governments and enforcement authorities are increasingly recognizing HACCP as the most effective means of managing food safety. The European Community Directive 93/43 EC (1993) on the hygiene of foodstuffs states that `food business operators shall identify any step in their activities critical to ensuring food safety and ensure that adequate safety procedures are identified, implemented, maintained and reviewed'. This is effectively a recommendation to adopt the HACCP approach towards food safety for all food businesses.

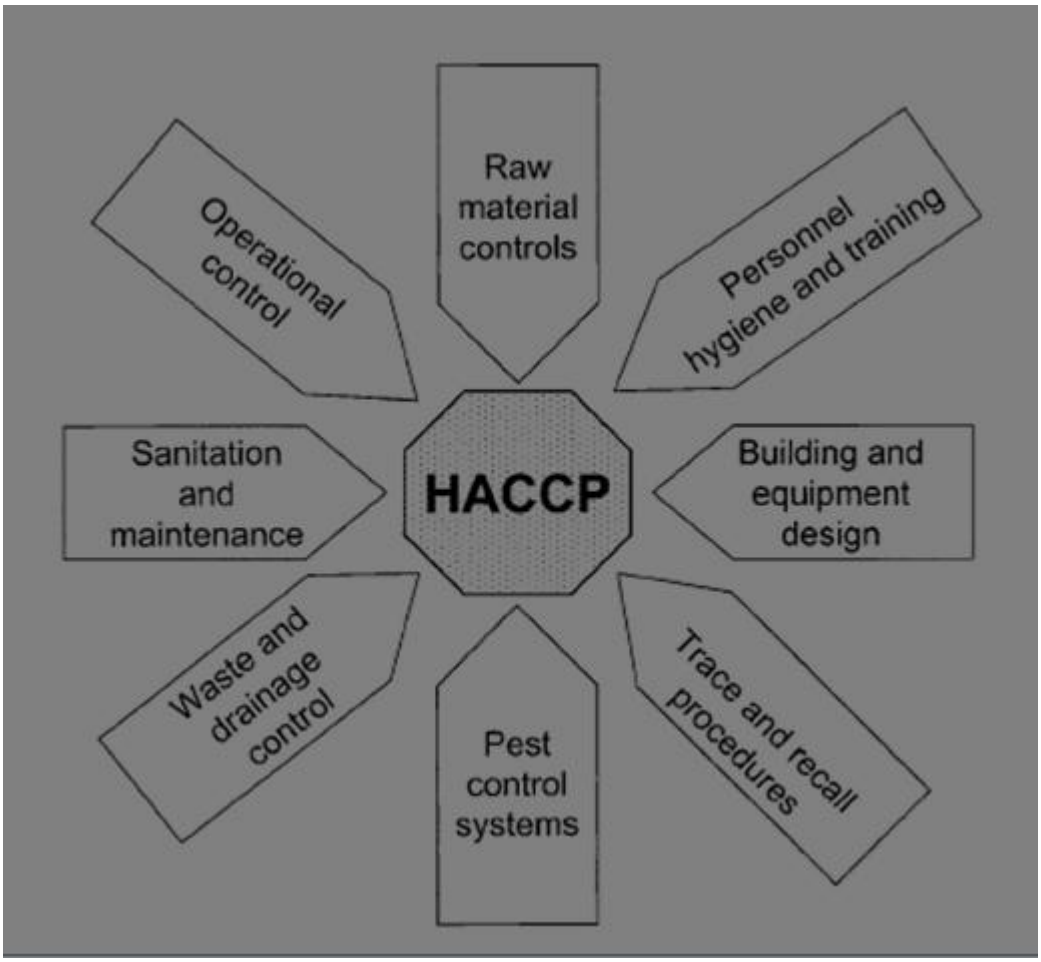


Figure-31 Effective HACCP system

2.4. Principles of the haccp system

I. The HACCP system consists of the following seven principles:

- **Conduct a hazard analysis:-**A food safety hazard is any biological, chemical or physical property that may cause a food to be unsafe for human consumption. We analyze hazards to identify any hazardous biological, chemical, or physical property in raw materials and processing steps, and to assess their likeliness of occurrence and potential to render food unsafe for consumption.

- **Determine the Critical Control Points (CCPs):-** A critical control point is a point, a step or a procedure in a food manufacture process at which control can be applied and, as a result, a food safety hazard can be prevented, eliminated, or reduced to an acceptable level.

- **Establish critical limit(s):-** Limit for critical control point is a criterion which separates acceptability from unacceptability. It is the maximum or minimum value to which a physical, biological, or chemical hazard must be controlled at a critical control point to prevent, eliminate, or reduce to an acceptable level the occurrence of the identified food safety hazard.

- **Examples of limits for critical control point are**
  - ✓ Time
  - ✓ Temperature
  - ✓ Humidity
  - ✓ Water activity
  - ✓ pH value

- **Establish a system to monitor control of the CCP:** - Monitoring is a planned sequence of observations or measurements to assess whether a critical control point is under control and to produce an accurate record for future use in verification. Monitoring is very important for a HACCP system. Monitoring can warn the plant if there is a trend towards loss of control so that it can take action to bring the process back into control before the limit is exceeded. The employee responsible for the monitoring procedure should be clearly identified and adequately trained.

- **Establish corrective actions: -** Corrective action is an action taken when the results of monitoring at the critical control point indicate that the limit is exceeded, i.e. a loss of control. Since HACCP is a preventive system to correct problems before they affect food safety, plant management has to plan in advance to correct potential deviations from established critical limits. Whenever a limit for critical control point is exceeded, the plant will need to take corrective actions immediately.

- **Establish procedures for verification to confirm that the HACCP system is working effectively**

Verification is the application of methods, procedures, tests and other evaluations, in addition to monitoring, to determine compliance with the HACCP plan.

Some examples of verification are the calibration of process monitoring instruments at specified intervals, direct observation of monitoring activities, and corrective actions. Besides, sampling of product, monitoring records review and inspections can serve to verify the HACCP system.

- **Establish a record system: -** Maintaining proper HACCP records is an essential part of the HACCP system.
- A**ccurate and complete HACCP records can be very helpful for:**
  - ✓ documentation of the establishment's compliance with its HACCP plan;
  - ✓ tracing the history of an ingredient, in-process operations, or a finished product, when problem arise;
  - ✓ identifying trends in a particular operation that could result in a deviation if not corrected;
  - ✓ Identifying and narrowing a product recall.

Figure-32 Principles of HACCP

2.5. Development of a HACCP program

There are 14 steps to develop development of a HACCP program.

Step 1: Obtaining company commitment and management Involvement

Step 2: Assembling the HACCP team

Step 3: Establishing the scope of the HACCP plan

Step 4: Describing the product and its intended use

Step 5: Setting food safety objectives

Step 6: Constructing and confirming the process flow diagram

Step 7: Writing and confirming job descriptions1

Step 8: Identifying food safety hazards

Step 9: Determining Critical Control Points

Step 10: Establishing critical limits

Step 11: Establishing a monitoring system

Step 12: Establishing corrective action requirements

Step 13: Establishing verification procedures

Step 14: Establishing documentation and recordkeeping procedures

Self-check 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: **Give a short answer for the following questions.(3pnts)each.**

1. What is uses of HACCP
2. Write principles of HACCP system

Test 2: matching A columns with B columns. (6 points)

A		B
1.	HACCP 2	a. Establish critical limit(s).
2.	HACCP 4	b. Determine the Critical Control Points (CCPs). contaminated with toxins produced by certain bacteria
3.	IHAPP 3	c. Establish a system to monitor control of the CCP

.

Information Sheet - 3 Identifying Nature and importance of work instruction.

3.1. Work instructions

Work instructions are key to reducing variation, allowing manufacturers to improve quality and meet demand. Even better, written work instructions are a great training tool for new employees. Work instructions are documents that clearly and precisely describe the correct way to perform certain tasks that may cause inconvenience or damage if not done in the established manner. That is, describe, dictate or stipulate the steps that must be followed to correctly perform any specific activity or work. Standard work instructions enforce consistency when performing tasks. They allow engineers to measure quality and task time.

- **Eight basic steps of writing Work Instructions**
  - ✓ Know exactly how to do the task.
  - ✓ Plan how to write steps in order.
  - ✓ Write instructions beginning with a verb.
  - ✓ Write each step as a small piece.
  - ✓ Include warnings as pre-steps.
  - ✓ Write the steps in logical order.
  - ✓ Review and edit instructions carefully.
  - ✓ Express steps in the positive.

3.2. Standard work

- Standardization is the process of developing, agreeing upon and implementing technical or program specifications, methods, processes and practices throughout an organization.
- The goal of standardization is to do more with fewer resources, less time, and less effort.
- It shows how to capture those best practices, document them, and roll them out across your workforce.

Figure 33 Standardization for meat

3.3. The importance of work instructions

Work instructions answer a fundamental question in a customer satisfaction process. In this, they highlight an equally important challenge for the company: document and analyze each task to make the entire structure productive and profitable while producing at a high level of quality. Work instructions are an integral part of knowledge management. The aim here is to document in a synoptic (diagrams) or textual way (step-by-step instructions) the skills and knowledge of each operator in order to best accomplishes each task.

- **Work instructions then become continuous improvement tools that allow each operator:**
  - ✓ To accomplish its task effectively;
  - ✓ To identify the relevance of each step defined in the work instructions;
  - ✓ To propose improvements;

Figure 34 -Work instruction

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Say true or false for the following questions.

1. _____ Work instructions are key to reducing variation, allowing manufacturers to improve quality and meet demand (3 point)
2. _____Standardization is the process of developing, agreeing upon and implementing technical or program specifications, methods, processes and practices throughout an organization. (3 point)

Test II: Short Answer Questions

1. Write functions of work instruction (3pt)

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1_____

2_____

3_____

Information Sheet -4 Identifying elements of a HACCP program

4.1 Identifying elements of a HACCP program.

Hazard Analysis and Critical Control Points (HACCP) is a management system that addresses food safety through the analysis and control of biological, chemical, and physical hazards. HACCP involves raw material production, procurement and handling, manufacturing, distribution and consumption of the finished product.

4.2 Elements of the HACCP principles

- **Four key elements of the HACCP principles are:**
  - ✓ Flow of Food
  - ✓ Hazard Analysis
  - ✓ Critical Limits
  - ✓ Variances

4.2.1. Flow of Food

The flow of food in a retail or food service establishment is the path that food follows from receiving through service or sale to the consumer. A flow diagram that delineates these steps forms the foundation for applying the seven HACCP principles. Most food items produced in retail or food service establishment can be categorized into one of three preparation processes based on the number of times the food passes through the temperature danger zone between 41°F to 135°F.

4.2.2. Hazard Analysis

Food safety management systems require food establishments to identify food safety hazards that exist in the flow of food. Once food safety hazards have been identified, it is possible to determine and implement control measures text annotation indicator in order to achieve active managerial control.

4.2.3. Variances

Certain food processes have resulted in higher rates of foodborne illness and can present a significant health risk if not conducted under strict operational procedures. These types of operations require additional oversight to ensure that the proposed method of operation is carried out safely. Depending on the process, the Food Code may requires a variance, a HACCP plan, or both.

Self-check 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: **Give a short answer for the following questions.(3pnts)each.**

1. List Elements of the HACCP principles
2. What is flow of food?

Test I: Say true or false for the following questions.

3. _____ Work instructions are key to reducing variation, allowing manufacturers to improve quality and meet demand (3 point)
4. _____ HACCP involves raw material production, procurement and handling, manufacturing, distribution and consumption of the finished product.

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Information Sheet -5 Identifying nature and importance of Good Manufacturing Practices (GMP).

5.1 Good Manufacturing Practices (GMP)

Good Manufacturing Practices (GMP) is a system that ensures that the goods produced by various manufacturing facilities are consistently produced and controlled according to specified quality standards. There are GMP systems for everything from harvesting to finished products food. https://slideplayer.com/slide/5785466/

5.2. Importance of Good Manufacturing Practices (GMP)

Good Manufacturing Practice (GMP) guidelines aid manufacturers in improving their production of goods. GMP ensures that companies execute consistent procedures within safe environments. Hence, it prevents contamination, recalls, and loss of profit.

5.3. Principles of Good Manufacturing Practices (GMP)

There are ten principles of good manufacturing practice (GMP)

I. Written Procedures

The first principle of GMP is to develop detailed step-by-step procedures, in writing, that provide a "road map" for consistency in performance. Written procedures allow for workplace standards to be clearly established, ensuring that a job or procedure is performed in the same way each time, with each step followed as set out in the written instructions.

II. Following Procedures

The written procedures will only be effective if they are followed to the letter, so it is important that no short cuts or modifications be permitted. Any deviation from the written instructions may adversely affect consistency in product quality.

III. Documentation

The third GMP principle calls for prompt and accurate documentation of work, thus allowing for compliance with regulations and the ability to trace any problems. Accurate records provide a way to evaluate what happened if there is ever a problem or complaint regarding a product. This record keeping also chronicles the precise steps taken relating to GMP regulations.

IV. Validating Work

This GMP principle notes the importance of validating that all systems and processes are working as they are meant to. This is achieved through documentation and properly following the written procedures, thus ensuring that quality and consistency are carried out according to plan.

V. Facilities and Equipment

The fifth GMP principle outlines the importance of integrating productivity, product quality and employee safety into the design and construction of the company's facilities and equipment. This reinforces the goals of quality and consistency at all stages of the process.

VI. Maintenance

Equipment and facilities must be properly maintained, with documented written records to back up any work done. This minimizes any safety concerns and avoids any potential issues relating to contamination and quality control.

VII. Job Competence

Job competency must be clearly demonstrated by each employee relating to his job. GMP requires an employee to be completely competent in his role. However, the definition of competence may vary for different people, so it's important that clearly defined and developed job competencies are in place relating to each job.

VIII. Avoiding Contamination

The eighth GMP principle is to ensure a product is protected from contamination. The first step in achieving this is to make cleanliness in the workplace a daily habit. Since the

degree of cleanliness needed depends on the type of product being manufactured, standards must be put in place to ensure the appropriate cleanliness guidelines are followed.

IX. Quality Control

This principle involves building quality directly into products via the systematic control of components and processes relating to each product. Quality control includes such areas as manufacturing, packaging, labeling, distribution and marketing. By placing clearly defined controls over all these areas and keeping accurate, timely records, quality is built into all stages of production.

X. Audits

Finally, the only way to determine how well GMP is being implemented is to conduct planned periodic audits to assess the success of compliance with GMP regulations.

Self-check 5	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: **Give a short answer for the following questions.(3pnts)each.**

1. List principles of the GMP.
2. What is importance of good manufacturing practice?

Test I: Say true or false for the following questions.

3. _____ Job Competence principle involves building quality directly into products via the systematic control of components and processes relating to each product. (3 point)
4. _____ any deviation from the written instructions may adversely affect consistency in product quality.

Note: Satisfactory rating – ≥5 points **Unsatisfactory - below 5 points**

.

Score = _____

Rating: _____

Information Sheet -6 Identifying and explaining mechanisms for validation, monitoring and verification.

6.1. Verification

Verification is the process of checking that software achieves its goal without any bugs. It is the process to ensure whether the product that is developed is right or not. It verifies whether the developed product fulfills the requirements that we have.

6.1.1 Mechanisms to Perform Verification

- Following are the ways to perform verification of simulation model
- By using programming skills to write and debug the program in sub-programs.
- By using “Structured Walk-through” policy in which more than one person is to read the program.
- By tracing the intermediate results and comparing them with observed outcomes.
- By checking the simulation model output using various input combinations.
- By comparing final simulation result with analytic results

6.2. Validation is the process of comparing two results. In this process, we need to compare the representation of a conceptual model to the real system. If the comparison is true, then it is valid, else invalid.

6.2.1. Mechanisms to Perform Validation

This can be achieved using the following steps −

Step 1 − Design a model with high validity.

- The model must be discussed with the system experts while designing.
- The model must interact with the client throughout the process.
- The output must supervised by system experts.

Step 2 − Test the model at assumptions data. This can be achieved by applying the assumption data into the model and testing it quantitatively. Sensitive analysis can also be

performed to observe the effect of change in the result when significant changes are made in the input data.

Step 3 − Determine the representative output of the Simulation model. This can be achieved using the following steps −

- Determine how close the simulation output with the real system output .
- Comparison can be performed using the Turing Test. It presents the data in the system format, which can be explained by experts only.

6.3. Monitoring

The following list of condition monitoring techniques, grouped by several category types, shows the extent technology has moved monitoring ahead.

Oil Analysis/Tribology

This technique involves collecting and testing machine oils, equipment lubricants or other fluid samples to ascertain the condition of either/both the fluids and the Techniques include: Presence of water , Viscosity/kinematic viscosity test, ICP or atomic emissions spectroscopy to identify presence of contaminants Dielectric strength test, Microbial analysis, Particle quantification index (iron content Fourier transform)infrared spectroscopy, Ultraviolet spectroscopy Potentiometric titration/total acid number and total base number Sediment test machines.

6.3.1. Vibration Analysis/Dynamic Monitoring

Equipment and parts respond to vibrations in a variety of ways that can be used to identify defects due to misalignments, imbalances or design flaws, Wear on machine parts, bearings, rotors and shafts, causes these parts to vibrate with specific patterns that can be recorded and analyzed. Techniques include: Shock pulse analysis, Fast transforms, Broadband vibration analysis, Ultrasonic analysis, Power spectral density (PSD) Time waveform analysis Spectrogram/spectrum analysis.

6.3.2. Motor Circuit Analysis

Motor circuit analysis (MCA) is a battery of computerized tests on an electric motor to ascertain the motor's overall condition and possible sources of potential failures. Electrical imbalances and degradation of insulation are the chief causes of motor failure and are the focus of MCA testing. Inspection points include: Power circuit/current signature, Online and offline testing (not tests but testing regimes), Rotor Stator Insulation and Power quality Air gap

6.3.3. Performance Monitoring

This method of monitoring equipment is a valuable technique where advanced technological testing methods are not available. Much of the interpretation of results depends on careful record keeping and interpretation and application of hands-on experience. Techniques include: Visual inspection, Audio inspection, Flow rates, Touch inspection, Temperatures, Pressures Output, or performance trends and Downtime analysis system output.

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Say true or false for the following questions.

1 _____Validation is the process of comparing two results. In this process, we need to compare the representation of a conceptual model to the real system (3 point)

2. _____ Verification is the process of checking that software achieves its goal without any bugs. It is the process to ensure whether the product that is developed is right or not. (3 point)

Test II: Short Answer Questions

3. List monitoring techniques (3pt)
4. List techniques of validation(3pnts)

Note: Satisfactory rating – ≥6 points **Unsatisfactory - below 6 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

_____

_____

_____

LG #22	LO #6- Conduct pre-operational hygiene check

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Identifying Pre-operational checklists
- Identifying and explaining Corrective action procedures.
- conducting Pre-operational hygiene check

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Identify Pre-operational checklists
- Identify and explaining Corrective action procedures.

conduct Pre-operational hygiene check

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets

Information Sheet -1 Identifying Pre-operational checklists

1.1. Identifying Pre-operational checklists

Pre-operational check is important for the workers safety. It involves a daily check of the machines health. Currently the pre-ops check is often skipped or not conducted in the right way. Any forklift or warehouse machine that needs repairs, maintenance or is observed to be unsafe to operate has to be taken out until such repair or maintenance has been done. How can you then tell if the forklift has to go to maintenance? The operator is responsible to perform the pre-operational check before operating the machine. The purpose of a GMP pre-op check is to make sure that no hazards exist before you start your production for the day.

1.1. Some of the key areas that need to be checked include:

- That all equipment is clean, maintained and functioning correctly.
- Staff is complying with personal hygiene procedures.
- Waste bins are clean and accessible.
- The correct packaging is on hand.
- Monitoring forms are available as required.
- There is no evidence of pests or other contaminates.

1.2. Quality control

It is related to certain predetermined characteristics such as shape, dimensions, composition, finish, color, weight, etc. In simple words, quality is the performance of the product as per the commitment made by the producer to the consumer.

- **Some of the important advantages to quality control are as follows:**
  - ✓ The brand products build up goodwill or image which ultimately increases sales.
  - ✓ It helps the manufacturers/ entrepreneurs in fixing responsibility of workers in the production process.
  - ✓ Quality control also helps in minimizing the costs by increasing efficiency, standardization, working conditions, etc.

- ✓ It also enables the entrepreneur to know the cost of his / her product quite in advance which helps him in determining competitive prices of his product.

1.3. Elements of Quality Control

- The quality control policies and procedures applicable to a firm's accounting and auditing practice should encompass the following elements:
  - ✓ Independence, Integrity, and Objectivity.
  - ✓ Personnel Management.
  - ✓ Acceptance and Continuance of Clients and Engagements.
  - ✓ Engagement Performance.
  - ✓ Monitoring.

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Say true or false for the following questions.

1 _____It is related to certain predetermined characteristics such as shape, dimensions, composition, finish, color, weight, etc. (3 point)

2. _____ Pre-operational check is important for the workers safety. It involves a daily check of the machines health (3 point)

Test II: Short Answer Questions

1. List advantages to quality control (3pt)
2. What is key areas that need to be checked include (3pnts)

Note: Satisfactory rating – ≥6 points **Unsatisfactory - below 6 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

_____

_____

_____

_____

Information Sheet -2 Identifying and explaining corrective action procedures.

2.1. Identifying and explaining Corrective action procedures.

Corrective action: - is a process of communicating with the employee to improve attendance, unacceptable behavior, or performance. Under a properly implemented HACCP System, whenever a deviation from a critical limit (CL) for a critical control point (CCP) occurs, there shall be a corrective action. A deviation is a failure to meet a CL. It indicates that a possible food safety hazard may have occurred and that unsafe product may have been produced. Thus, corrective actions must be immediate and must trigger an automatic review of the HACCP plan. The HACCP team should routinely pay close attention to operational trends. This should include tracking the frequency of the process adjustments that are required when operating limits are exceeded. A pattern of exceeding operating limits on a regular basis could serve as a warning that a deviation may be imminent.

2.2. Properties of Corrective Actions

- **Specific**: Corrective actions are required for each affected CCP, and for each and every deviation at each CCP.
- **Immediate and comprehensive**: The time for corrective action is dependent upon the monitoring frequency. All food products affected and produced within the monitoring time period must be brought under control. Holding and storage provisions for pending product must be included.
- **Documented**: Every corrective action for every deviation must be recorded on an appropriate form.

2.3. Corrective Action Plan

A corrective action plan is a set of actions to correct an issue, problem, non-compliance or underperformance. It is essentially a plan to improve performance and/or reduce risk. The following are illustrative examples. A written Corrective Action Plan is required, and each corrective action must be documented. Corrective actions are specific for each hazard and for each CCP.

The plan must provide for immediate corrective actions. However, time factors will vary with monitoring procedures. It is important to note that, when a deviation occurs, a corrective action must be taken on all affected food products produced since the last monitoring observation or measurement. Thus, provisions in a corrective action plan should include procedures for holding suspected product as appropriate.

- **The goals of a Corrective Action Plan are to:**
  - ✓ Establish a system that allows and promotes rapid response to deviations from a critical limit;
  - ✓ Correct and eliminate the cause of the deviation and restore process control;
  - ✓ Maintain accurate documentation and records; and
  - ✓ Identify affected product and determine appropriate disposition.

2.4. Effective Corrective Action System

- Key Steps to Plan and Implement an Effective Corrective Action System

  Step 1: Understand System Requirements (Plan)

  Step 2: Plan the Process (Plan)

  Step 3: Develop and Document (Do)

  Step 4: Conduct Training (Do)

  Step 5: Implement (Do)

  Step 6: Test the System (Check)

  Step 7: Adjust and Improve (Act)

Figure 35 - Food safety and corrective action on meat

Self-check 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Say true or false for the following questions.

1 _____ A corrective action plan is a set of actions to incorrect an issue, problem, non-compliance or underperformance. (3 point)

2. _____ every corrective action for every deviation must be recorded on an appropriate form. (3 point)

Test II: Short Answer Questions

3. What is goal of corrective action plan (3pt)
4. List a properties of corrective action (3pnts)

Note: Satisfactory rating – ≥6 points **Unsatisfactory - below 6 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

_____

_____

_____

_____

Information Sheet-3 conducting Pre-operational hygiene check

1.1. conducting Pre-operational hygiene check

It involves a daily check of the machines health. Currently the pre-ops check is often skipped or not conducted in the right way. Any forklift or warehouse machine that needs repairs, maintenance or is observed to be unsafe to operate has to be taken out until such repair or maintenance has been done.

- **Reason for conducting pre operational hygiene checks**
  - ✓ The reason for conducting pre-operational and regular checks is to reduce the Potential for time out of the paddock due to maintenance issues.
  - ✓ To ensure the Spray system is working correctly and efficiently.

Good maintenance and regular checks can help to resolve minor problems before they lead to the need for major repairs. Unexpected downtime at critical periods in the Season can be especially frustrating when conditions are good for spraying. There are many things the operator should check on a regular basis. Some of these will be quick checks while spraying, others may be at the end of the tank or the end of a day's spraying. The most important of all checks the operator can do is when the sprayer is first delivered. Never assume that a new sprayer is ready to spray when it arrives on farm. This module refers specifically to checks of the spraying system itself. Spray Operators should always perform checks on other mechanical components of the Sprayer, as and when recommended by the manufacturer.

1.2. Uses of tools and equipment inspection necessary before using

- Safety Inspections ensure that all equipment is safe before use.
- A record of regular, properly conducted inspections provides liability protection and due diligence.
- Failure to conduct equipment inspections as required by law can result in fines and extreme liability exposure.

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test II: Short Answer Questions

1. Reason for conducting pre operational hygiene checks (3pt)
2. What is Uses of tools and equipment inspection necessary before using (3pnts)

Note: Satisfactory rating – ≥3 points **Unsatisfactory - below 3 points**

.

Score = _____

Rating: _____

Answer Sheet

1._____

_____

_____

LG #23	LO #7 conduct microbiological test swabbing

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Identifying appropriate microbiological testing regimes
- Performing Swabbing for microbiological testing
- Assessing and taking Microbiological test results

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Identify appropriate microbiological testing regimes
- Perform Swabbing for microbiological testing
- Assesse and taking Microbiological test results

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets

Information Sheet-1 Identifying appropriate microbiological testing regimes

1.1 Identifying appropriate microbiological testing regimes

Microbiological analysis covers the use of biological, biochemical or chemical methods for the detection, identification or enumeration of microorganisms. It is often applied to disease causing and spoilage microorganisms.

Any testing program should be science-based and objective driven. Prior to implementation one should know why the testing is being performed, the basic assumptions underlying the test, the relative certainty of detecting an issue, and potential results. This will allow one to identify the type of samples to be collected, the sampling plan to be used, the specific test to be performed, and actions to be taken prior to and after the test results are obtained.

1.2 Methods of testing

- Sensory evaluation
- Physical testing
- Chemical testing
- Microbiological testing

1.2.1. Sensory evaluation

Sensory evaluation is a common and very useful tool in quality assessment of processed meat products. It makes use of the senses to evaluate the general acceptability and quality attributes of the products.

- Sense of sight is used to evaluate the general appearance of the product such as color, size, shape etc. Sense of smell for the odor
- Sense of taste for the flavor which includes the four basic tastes sour, sweet, bitter and salty
- Sense of touch for the texture either by mouth feel or finger feel.

1.2.2. Physical Test Methods

With physical test methods important parameters such as temperature, acidity (pH), water activity (aw) and water binding capacity can be determined. Other physical parameters are light intensity and mechanical testing for texture. All routine physical testing can be carried out with portable instruments.

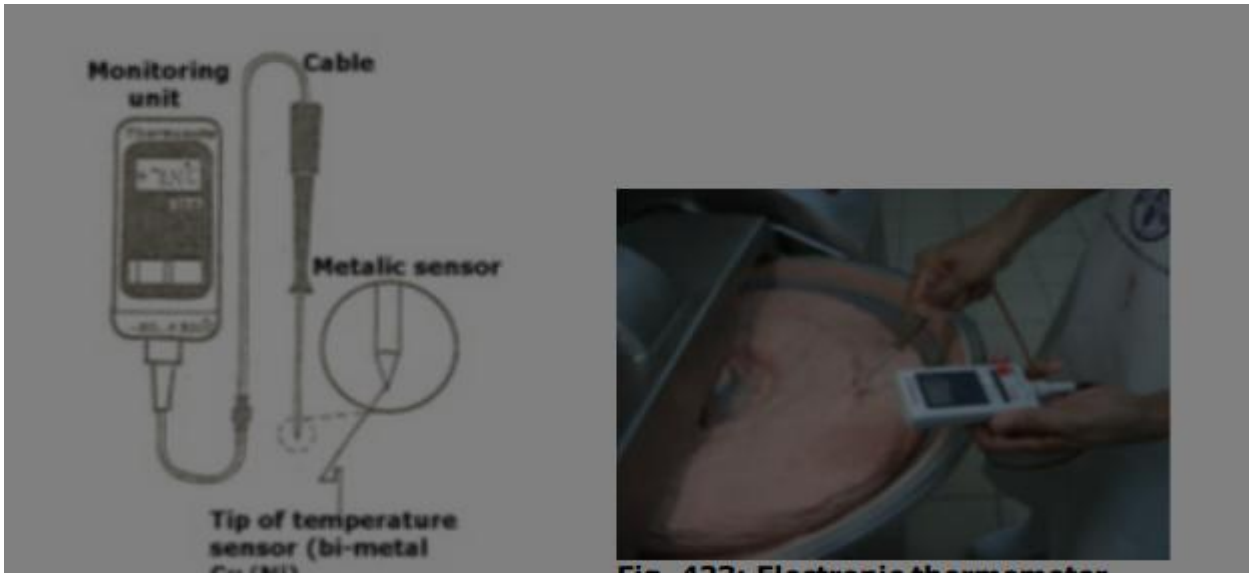


Figure 36- Measurement of temperature of meat batter during comminuting

1.2.3. Chemical testing methods (Protein, fat, water, ashes)

Chemicals analysis to determine the content of protein, fat, water and minerals (ashes) of processed meat products are carried out to establish the nutritive and economic value of the products. Weighed and ground sample is prepared for respective analysis.

1.2.4. Microbiological Sampling and Testing

The purpose of microbiological testing is to determine the degree of bacterial contamination on surfaces of equipment, tools, and premises as well as in meat and meat products. This testing can be done qualitatively as microbiological screening, for example by contact such as using an impression plate or quantitatively by determining the exact number of microorganism per sample unit (in cm2 or grams) by using the swab or the destructive method. Quantitative testing can be either determination of the entire contaminating flora, also called “total plate count” or determination of a specific group of microorganisms out of the entire flora, also called “selective plate count”.

Self-Check -1	Written Test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

1. _____ testing of meat is used to improve the quality of product(3 point)

2. _____ Sensory evaluation is a common and very useful tool in quality assessment of processed meat products.(3pnts)

Test 2: Choose the best answer for the following questions.

1. All of physical testing methods except? (3 points)

a. Temperature
b. PH
c. Fat
d. Light intensity
e. all
f. none

Test 3: Give short answer for the follo4wing questions.

1. List and discuss methods of testing (3 points)

Note: Satisfactory rating – ≥6 points **Unsatisfactory - below 6 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1._____

_____

Information Sheet-2 Performing Swabbing for microbiological testing

2.1. Performing Swabbing for microbiological testing

All food handling companies and establishments should employ an environmental Sampling program to monitor for food spoilage microorganisms and food poisoning Pathogen. Such a program, if well designed will enable the detection of unacceptable Microbial contamination in a timely manner. Over the last decade environmental monitoring has changed from essentially random sampling, employing imaginary grids over a production area and testing points within each grid, to current methods that are focused on risk assessment to determine the most appropriate methods for monitoring.

2.2. Uses of microbiological testing meat

- To improve the quality of product
- Market shift from Quantity Oriented to Quality Oriented
- Consumer consciousness about health
- Safety of meat
- competitiveness of food production more dependent on the reliability of the safety and the quality of the food
- Acceptability of the production procedures than on quantity and price.

2.3. Swabbing: - MO collected from a surface with sterile cotton or calcium alginate swabs (alginate swabs) are the best since the alginate can be readily dissolved in (hexametaphosphate), transferred to broth where they are dislodged, then diluted and used with further tests to determine total numbers. Sponges can be used to swab larger areas then placed in a buffer filled bag.

Figure 37- Swab meat for microbial test

Self-Check -1	Written Test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

1. _____ competitiveness of food production more dependent on the reliability of the safety and the quality of the food (3 point)

Test 2: Give short answer for the follo4wing questions.

2. What is swabbing (3 points)

Note: Satisfactory rating – ≥6 points **Unsatisfactory - below 6 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1._____

_____

_____

_____

2.1. Assessing and taking Microbiological test results

Food testing and analysis is an essential part of the food safety ecosystem to assure that the food is safe to consume. Methods of Sampling and Analysis are involved in revision of the existing testing methodologies and new parameters for analysis of various food articles.

2.2. Purpose of microbiological testing

To identify and restrict harmful microorganisms, which can spoil foods, and ensure safety from food borne diseases.

2.3. Microbiological Analysis

- **Total Plate Count (using nutrient agar)**
  - ✓ For determination of the number of viable or living microorganisms in a sample.
    - **a.** Meat sample (10 grams meat + 90 ml sterile distilled water or 0.1% peptone water). Homogenize in stomacher. First dilution.
    - **b.** Transfer 1 ml from first dilution (101) to second test tube (Test tube contains 9 ml. of sterile distilled water) (2nd dilution or 102) then from second test tube transfer 1ml to the third tube (3rd dilution or 103) and so on up to the 4th or 6th dilution.

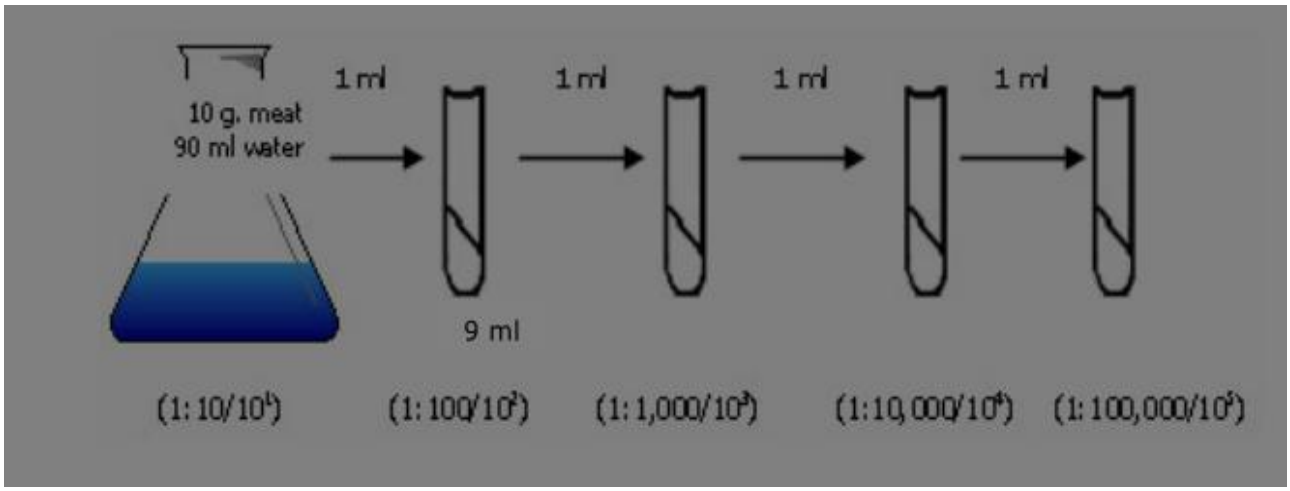


Figure 37- Testing methods

c. Inoculate sample. Pipette 1 ml from 3rd dilution and transfer to the sterile petridish, also from the 4th dilution to another sterile petridish depends upon how many dilutions are desired.

d. Incubate for 12 to 24 hours at 35 to 37°C, alternatively 24-48 hours at 30°C.

e. Results Count all colony forming units (CFU), including those of pinpoint size. Select spreader-free plate.

✓ normal plates 25-250 counts

✓ Plates with more than 250 colonies for all dilution - too numerous to count.

✓ Plates with no CFU. Report as less than 1 times the corresponding dilution used.

✓

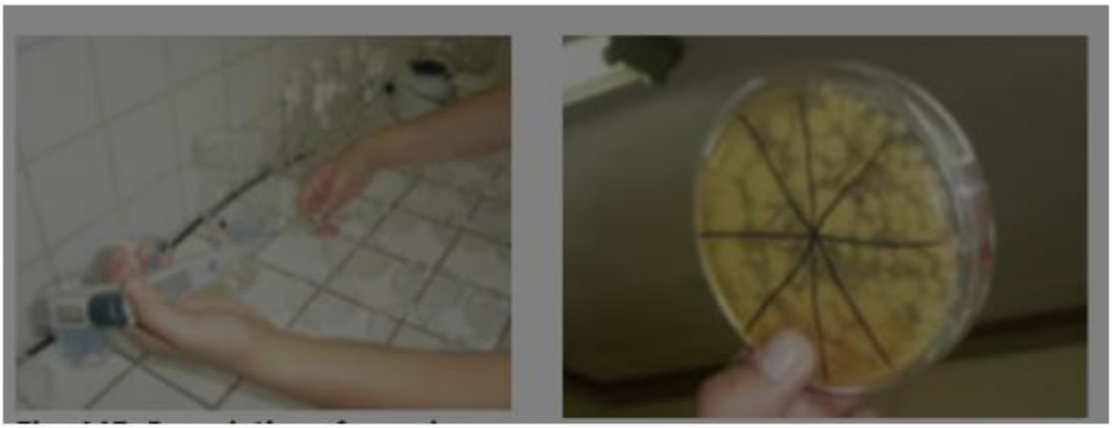


Figure 38 A- Inoculation of sample

Figure 38 B-Reading of results from Petri dish

Self-Check -1	Written Test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Test 1: Say true or false for the following questions.

1. _____ Food testing and analysis is an essential part of the food safety ecosystem to assure that the food is safe to consume. (3 point)

2. _____Methods of Sampling and Analysis are involved in revision of the existing testing methodologies and new parameters for analysis of various food articles.(3 points)

Note: Satisfactory rating – ≥3 points **Unsatisfactory - below 3 points**

.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1._____

_____

_____

_____

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Support to nepad–caadp implementation tcp/eth/2908 (i) (nepad ref. 05/08 e)

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LO1 Self-check 1 1. True 2.True 3. A	Self-check 10 1. A 2. B 3. C 1.Culture media 4. Immunoassay 5. Polymerase chain reaction	Self-check 2 1. True 2. true Ice and boil water **LO 5** Self-check 1. a way of preventing mistakes and defects in manufactured products and avoiding problems
Self-check 2 1. True 2. True 3. PH,RH,MOISTURE,	**LO2** Self-check 1 1. True 1. naturally-occurring chemicals 2. intentionally-added chemicals	Self-check 2 1. is a systematic approach to food safety management based on recognized principles which aim to identify the hazards 2. b. a
Self-check 3 1. D 2. d	Self-check 2 1. True 2. landfills, incinerators, tanks, drums,	Self-check 3 1. True 2. True
Self-check 4 1. true 2. a 1. b	Self-check 3 2. e 3. This is the most effective and desirable method	Self-check 4 1. True 2. True

	for minimizing risk of exposure either to toxic chemicals or to mechanical equipment.	
	Self-check 4	Self-check 5
Self-check 5	1. true	1. true 2. 2. True 1. Written Procedures 2. Following Procedures 3. Documentation 4. Validating Work
1. true 2. all 3. all	4. true	Self-check 6
	1. Keep records of pesticide applications	1. True 2. True
	Self-check 5	**LO 6**
Self-check 6	1. true	Self-check 1
2. f 3. c 4. PH, moisture temp, RH	1. true	1. True 2. true 3.The brand products build up goodwill or image which ultimately increases sales
	LO3	
Self-check 7 1. True 2. all	Self-check 1 1. Glass. Metal, plastic 1. B 2. A. 3. C. 1.	

	Self-check 2 2. True	Self-check 2 1.true 2. true 3.Maintain accurate documentation and records
		Self-check 3
		1. To ensure the Spray system is working correctly and efficiently.
Self-check 8	3. True	**LO7**
1. true .true 2. a 3. c 4. b	Self-check 3 1. true 2. true	Self-check 1 1. true 2. true 3. e
	Self-check 4	
Self-check 9	1. true	
2. true 3. true	1. true 1. Hot Environment, Cold Environments and Hand / Arm Vibration 2. Working on a vibrating platform	
Free from freezer-burn2 Free of offensive odors Free of obtrusive bloodstains Free of unspecified	**LO4**	
	Self-check 1 1. C 2. b 3. is an	

protruding or broken bones	instrument for measuring and indicating temperature	