Meat and meat products processing -Level-II

Based on May 2019, Version 2 Occupational standards

Module Title: - Apply Hygiene and Sanitation Practices

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LG# 16	LO1- Clean own work area equipment during operations

Instruction sheet

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

- Cleaning worksite hygienically during operations
- Cleaning equipment's and surfaces hygienically
- Monitoring cleanliness of work area

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:

- Clean worksite hygienically during operations
- Clean equipment's and surfaces hygienically
- Monitor cleanliness of work area

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". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the "Self-checks" which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to "Operation sheets
7. Perform "the Learning activity performance test" which is placed following "Operation sheets" ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to "Operation sheets".

Information Sheet 1 Cleaning own work area and equipment during operations

Introduction

1.1 Cleaning worksite hygienically during operations

General hygiene rules for facilities, equipment and personnel in the meat industries

It is essential that all meat-processing operations, whether slaughtering, cutting or further processing, be carried out in a clean area and, as much as possible, that the products be protected from contamination from all sources.

When meat-processing operations are carried out within a facility specifically built and maintained for meat processing, sources of contamination can be much more easily and adequately controlled. The following requirements are considered essential to good sanitary preparation of meat and meat products.

FACILITIES

Floors. Brick, tile, smooth concrete or other impervious, waterproof materials are suitable for floors. In some areas wooden floors will suffice if they are tight, smooth, in good repair and properly maintained. Wooden floors are not suitable in areas where slaughtering or curing takes place and meat juices and moisture collect.

Drains. To carry away waste liquids, there should be sufficient drains of the proper size that are correctly located, trapped and vented. All floors should be sloped toward the drains. Generally for adequate waste disposal, one drain is needed for each 18 m_2 of floor space in slaughtering areas, and one drain for each 46m_2 in processing and other areas.

Walls.

Glazed tile, smooth cement plaster, rustproof metal panels and smooth plastic panels that are properly caulked are all acceptable for walls in processing and refrigerated areas because they can all be effectively cleaned and sanitized. Other materials are also acceptable if they can be satisfactorily cleaned. In no instance should walls be made of materials that absorb moisture or other liquids. Ceilings must be tight, smooth and free from any scaling that may fall into the meat products, and should also be of moisture-resistant materials. All light bulbs should be covered with unbreakable material to prevent broken pieces from falling into the product.

Doors and doorways.

All doorways, through which the product must pass, whether suspended on rails or lying on hand trucks, should be wide enough to ensure that the meats never touch the doorways risking contamination. Wooden doors and doorways should be covered with metal with tightly soldered seams.

Water supply.

Whether from individually owned and controlled sources such as wells or streams or from a municipal system, the water supply must be potable and abundant cold and hot water must be distributed to all parts of the operation.

Lighting.

In all areas where products are critically examined during sanitary control or for cleanliness, 50-foot candles of light should be provided. For adequate visibility 20-foot candles of light should be provided wherever any processing occurs. In all other areas, such as dry storage, there should be sufficient light to keep the area orderly and sanitary.

Refrigeration.

The main purpose of refrigeration is to cool the meat down after slaughter and to maintain it in a chilled state for shorter or longer storage periods and for cutting and further processing. If frozen storage is provided and utilized, it should be maintained at the lowest possible temperature for maximum shelf-life. Minus 18° to -12°C is satisfactory freezer storage; however, large quantities of product must either be quick frozen prior to storage or thinly spread out to facilitate freezing. It is also recommended that all rooms where meat is processed, except in the slaughter and cooler storage areas, should be maintained at a temperature of about 12°C.

In facilities where no refrigeration or cooling is furnished in processing areas, the handling of meat products is possible if all equipment contacting the products is thoroughly cleaned and sanitized from time to time (recommended every four hours). Frequent cleaning is necessary because in warmer temperatures bacteria multiply rapidly and the risk of product contamination increases.

1.1.1 Understanding Occupational Health and Safety (OHS)

Personal Protective Equipment (PPE) in the Meat Industry

THE MAIN LEGISLATIVE REQUIREMENTS

The Health and Safety at Work Act (HSW) - requires employers and the self- employed to take reasonable precautions to protect the health and safety of themselves, their employees and others who might be affected by their work activities.

The Management of Health and Safety at Work Regulations 1999 - require employers and the self-employed to assess risks to health and safety in order to identify the means of reducing risks to an acceptable level.

Personal Protective Equipment (PPE) at work regulations requires that suitable PPE is supplied and used at work wherever there are risks to health and safety that cannot be adequately controlled in other ways.

These Regulations also require that PPE is:

- properly assessed before use to ensure it is suitable
- fitted properly on the wearer
- maintained in working order
- stored in suitable accommodation
- used by employees in accordance with instructions
- compatible with other items of PPE worn
- effective without increasing overall risk

Types of PPE used in the meat industry

Eye and Face Protection

The main types of eye and face protection are safety spectacles, goggles and face shields.

Safety spectacles can be fitted with prescription lenses if required, but only offer protection to the eyes against certain types of hazard. When liquids or dust are the hazard, goggles (of which there are several categories), or a face shield will usually be required. Goggles give the eyes protection from all angles as the complete rim is in contact with the face. Face shields protect the face and most types can be worn over prescription glasses. Hazards that require eye and face protection include liquid or chemical splash including biological agents and contaminants, working with cleaning chemicals and vapour or liquid mist and particles from high pressure cleaning tools or some types of powered cutting equipment eg hand-held circular saws.

Hand Protection

Gloves of various designs can provide protection against a wide range of hazards including cuts, abrasions and stabs, extremes of temperature, skin irritation and dermatitis, contact with chemicals and other hazardous substances including biological hazards.

There are four types of hand and arm protection including gloves (for the hand only), gloves with a cuff (for hand and wrist), gauntlet (for hand, wrist and part of forearm) and sleeping or arm protection. Care should be taken in the donning, use and removal of gloves to prevent contamination of the hands.

Gloves come in a range of sizes and care should be taken to select the right size for the individual.

Protection against Cuts and Stabs

Knife accidents are very common in the meat industry, usually involving cuts or stabs to the non-knife hand, forearm or body. The best protection will normally be achieved by the use of chain mail. Cut-resistant material used for PPE such as gloves is not a substitute for chain mail but it may be used in circumstances where chain mail is not reasonably practicable and can be justified by risk assessment.

For example, in the slaughter hall, operatives may use chain mail to protect the non-knife hand and use cut-resistant material on the knife hand.

Hearing Protection

The Noise Regulations specify that employers have to provide their employees with hearing protection if they ask for it, and their noise exposure is between the lower and upper exposure action values specified in the regulations (eg. between 80 and 85 decibels for daily exposure). Remember you should not use hearing protection as an alternative to controlling noise by other methods. Select equipment that is suitable for the working environment. .

Protective Footwear

The safety boot or shoe is the most common type of safety footwear. They normally have steel toe caps, but may also have other safety features including slip resistant “anti-slip” soles that can reduce the likelihood of slipping on certain floors, steel midsoles and insulation. Wellington boots, usually made of rubber protect against water and wet conditions and are suitable for washing and disinfection to maintain hygienic

conditions. The main hazards which may need consideration in the working environment are objects falling on and crushing the feet or toes, treading on slippery surfaces eg floors, working in cold conditions, working with hazardous chemicals and in environments that are wet or contaminated.

Protective Aprons

Butchers and slaughterhouse workers should wear plate link or preferably chain mail aprons.

Aprons should be sufficiently long enough to provide adequate protection depending on the nature of the work eg usually covering the body area from mid breast bone to mid-thigh.

Head Protection

There are several types of head protection available including industrial safety helmets or “hard hats” which protect against falling objects or impact with fixed objects, and bump caps which protect against bumping the head (eg walking into a fixed object). Bump caps do not offer adequate protection where there is a risk of falling objects or moving or suspended loads.

Respiratory Protection

RPE (reptitive is designed to protect the wearer against inhalation of hazardous substances in the workplace air. Respirators (filtering devices) use filters to remove contaminants in the air and are available with a range of different face pieces. Masks and other tight fitting face pieces (e.g. disposable masks, half and full face masks)

Thermal Protection

Many workers in the meat industry work in temperature controlled areas. Regulation requires temperature in fresh meat preparation rooms to be kept below 12 degrees Celsius. In practice to maintain product quality temperatures of 5 degrees Celsius or lower are common. In addition some staff will spend long periods inside chillers or

freezers where temperatures may be kept well below zero. Protective clothing and gloves play an important part in protecting the health, safety and welfare of workers at such temperatures.

Prevention

Compiling data on accidents and diseases that occur in the workplace is the first step in understanding the types of safety and health problem in these sectors. Once data are analyzed regarding common types and causes of injuries and diseases, safety and health risks can be assessed at enterprise and sectoral levels. This should then lead to measures to eliminate or minimize those risks, which should result in reduced accidents and diseases.

Information, instruction and training for employees

PPE is only effective if it is used correctly and properly maintained. The law requires employers to provide suitable and sufficient information, instruction, training and supervision to help employees meet these requirements.

Employees should be provided with sufficient information, instruction and training to enable them to know:

- the risks which the PPE will avoid or limit;
- how the PPE is to be used;
- action to be taken to ensure it remains effective;
- how to report loss or defects.

Figure 1-1 Examples of signs indicating that appropriate PPE must be worn

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 (1pt)

1. Employees should be provided with sufficient information, instruction and training to enable them to know:

A. The risks which the PPE will avoid or limit;
B. How the PPE is to be used;
C. Action to be taken to ensure it remains effective;
D. How to report loss or defects.
E. All

Test II: Short Answer Questions

1. Define all facilities of essential to good sanitary.(1pt)
2. Define the purpose of refrigeration in meat production.(2pt)
3. What is the amount of candles of light in slaughtering room?(2pt)
4. What is the benefit of water supply?(2pt)
5. What are personal protective equipment? List them as you can(2pt)

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

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information Sheet 2 Cleaning equipment's and surfaces hygienically

Introduction

Equipment

The equipment needed for converting livestock into meat products need not be elaborate and expensive. The amount of equipment will depend on the slaughtering and processing procedures employed. If possible,

All equipment should be made of and constructed of

- Stainless steel or plastic,
- Be rust resistant and
- Easily cleaned and sanitized.
- Stainless steel,
- Galvanized steel,
- Aluminum or
- Approved plastic.

- ✓ **Wooden tables** are not acceptable because wood absorbs meat juices and fats and cannot be thoroughly cleaned. **Hardwood cutting-boards** maintained smooth and free from checks and cracks may be used. Cutting tables covered with other than hard plastic are not acceptable for contact with meat.

All other equipment should be of the type that can be taken apart and thoroughly cleaned. Any stationary equipment must be located far enough from walls to permit proper cleaning around and under it.

In all areas there should be conveniently located foot-pedal or knee operated wash-basins with hot and cold water, soap and disposable towels.

In slaughtering areas

- **Lavatories** should be convenient to the dressing operations.
- **Hot-water containers**, either electric or steam-heated to 82°C, should be available for sanitizing tools contaminated with diseased material or other filth during dressing.
- **Rails** must be located high enough to prevent meat from touching the floor. For beef carcasses, the minimum height for rails should be 3.4 metres, while 2.4 metres is sufficiently high for small livestock such as goats, hogs and sheep. Rails should also be far enough away from fixed objects and walls to avoid contact.

1. Sinks for workers' use should be stainless steel with soap dispensers and paper towels at hand. This is an example of a stainless-steel sink with knee operated taps. Foot-operated types are also acceptable, but not hand operated types

Figure 1-2 stainless steel sink

2. A knife sterilizer mounted on a stainless steel sink should contain water at 82°C

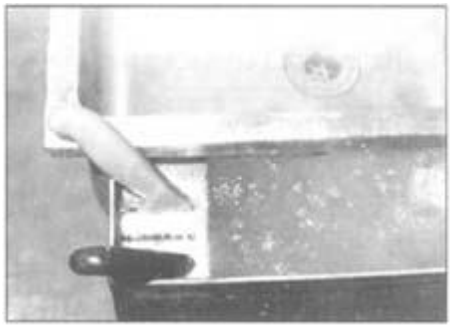


Figure 1-3 Knife sterilisers

Personnel Hygiene

Probably as important as anything in the production of clean, wholesome, unspoiled products is the attitude of the workers toward cleanliness. Personnel with clean hands, clothing and good hygienic practices are absolutely essential to the production of high-quality foods.

All clothing should be

- Clean,
- In good repair and
- Made of washable material.

Street clothing should be covered with coats or gowns while handling exposed product.

White or light-closured clothing is most desirable and garments that become soiled or contaminated should be changed when necessary.

All persons working with exposed meat products should have their hair under control, either completely covered with a clean **cap or hat** or confined by a **hairnet** to prevent hair from falling into products.

Safety devices such as **aprons**, **wrist guards** and **mesh gloves** must be made of impervious material, clean and in good repair. At no time should leather aprons, wrist guards or other devices be worn unless clean, washable coverings are used over them.

Light-coloured rubber or plastic gloves may be worn by product handlers only if clean and in good repair.

No person working with meats should wear any kind of **jewellery**, badges or buttons that may come loose and be accidently included in the product.

Shoes and boots should be worn at all times and should be appropriate for the operations being conducted. They should also be made of impervious materials (Fig. 4). Any aprons, knives and footwear that become contaminated during operations should be routinely cleaned in areas or facilities provided for that purpose.

No cloth twine, belts or other similar materials should be used to cover implement handles or used in other places where they may harbour filth and serve as a ready source of product contamination.

3. Workers must wear clean and protective clothing. Note the hairnet to prevent contamination from loose hairs and the chain-mail apron and glove to protect from knife cuts

Figure 1-4 Water proof full PPE

4. Footwear should be waterproof so that it can be washed frequently and always when moving to another part of the factory

Figure 1-5 Water proof foot wear

5. Hands should be frequently washed under running hot water and always after visiting the toilet, smoking, coughing or sneezing, handling money, garbage, soiled or infected material

Fig. 1-7 hand washing

6. Particular attention should Be paid to cleaning under the fingernails with a brush

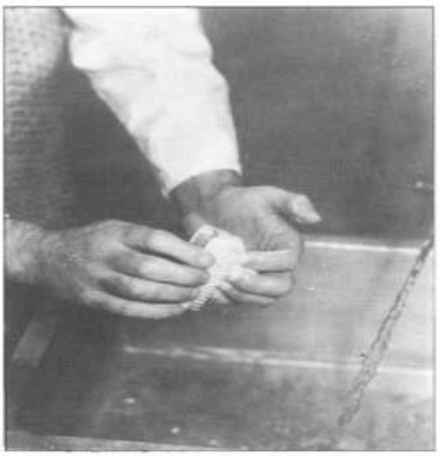


Fig. 1-8 finger washing

Hands should be washed frequently to remove all visible soiling.

Stainless-steel sinks without plugs should be conveniently accessible to all workers.

Water should be supplied at approximately 43°C to a simple tap which is foot- or knee-operated.

Liquid disinfectant soap and paper towels should be available Particular attention should be paid to cleaning under the fingernails. Hands should also be thoroughly washed after using the toilet, smoking, coughing or sneezing, handling money, garbage or soiled or infected material.

7.The cleaning operation begins with clearing all debris from the floor

Fig1-9cleanig

8. All surfaces must be thoroughly washed down at the end of each day

Fig. 1-10 surface washing

All precautions should be taken to prevent product contamination by visitors or other persons who are simply passing through the work area.

Repetitive Cleaning of rooms and Equipment

The floors should be kept clear of all debris, such as hooves and horns, in slaughter halls or other inedible parts or fat and meat particles in cutting, processing and by-product handling areas, and must be frequently washed down. At the end of each day a thorough cleaning programme should be followed.

All matter should be removed from floors, platforms, gullies, etc., followed by a thorough hosing down of walls, floors and all surfaces to loosen dirt. Finally a strong cleaning solution should be applied and left for a while before being rinsed off. A thorough inspection should be made afterwards and any areas remaining soiled should be cleaned again.

In order to maintain the cleanest possible products a standard cleaning routine of the equipment should be established. Initially all large pieces of refuse material should be scraped or swept together and disposed of.

Follow-up should include scrubbing of the equipment using brushes and a soap or detergent and a complete sanitizing with hot water at 82°C and an approved chlorine or iodine rinse. Finally, a coating of light mineral oil can be applied to metal equipment particularly that not fabricated of stainless steel, to prevent rust.

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers. **(1 points each)**

1. All equipment of slaughtering and processing procedures should be made of
   A. Stainless steel ,plastic
   B. Be rust resistant
   C. Easily cleaned and sanitized
   D. All
2. What are safety device include?
   a. Aprons
   b. Wrist guards
   c. Slaughtering machine
   d. a& b are the answer

Test I: Short Answer Questions (3 points each)

1. Why we need equipment in slaughtering and processing procedures?
2. Why we don't use wooden table in slaughtering and processing procedure?
3. What are the requirement that should b present in slaughtering area?

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

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information Sheet 3 Monitoring cleanliness of work area

Introduction

Hygiene

A well-planned, well-executed and controlled cleaning and sanitation programme for rooms, machines and equipment is very important to achieve a hygienic standard. Cleaning and sanitation alone, however, will not assure a hygienic standard in production where process hygiene as well as personal hygiene are important factors.

Well-planned working routines may assure a better cleaning standard during processing. For example, cleaning during processing, removal of solid waste and sufficient space in processing rooms are factors which facilitate cleaning.

Adequate personal hygiene assures the overall cleaning process. Deterioration of the cleaning standard may occur if microorganisms are transmitted to well-cleaned surfaces from unwashed hands before processing starts.

Neither process hygiene, personal hygiene nor cleaning and sanitation alone can assure a sufficient hygienic standard but together, if carried out in an optimal manner, they will guarantee a complete hygienic standard.

Process Hygiene

It is impossible to give an adequate definition of process hygiene because the critical points will vary, depending on:

- processing
- processing buildings (site, size, buildings)
- equipment available
- permanent or non-permanent personnel (working routines, training)
- climatic conditions

Sanitary facilities

- water and energy supplies
- liquid and solid waste disposal

Water points, hoses, sterilizers for hand tools etc. and cleaning equipment must be provided in sufficient numbers. Where possible sterilizers should be supplied with hot water instead of chemical disinfectants.

Sanitary facilities must also include a sufficient number of toilets/latrines and arrangements for hand-washing or even possibilities for bathing (showering). These facilities must be kept clean and well maintained.

To avoid back-flow from toilets in case of flooding the toilet outlets must be separated from common waste water outlets.

Areas/rooms for resting and eating may be required assuring that food for the personnel and the carcasses/meat cannot be mixed.

Water and energy supplies

If sufficient water of drinking quality is available, it will be possible to plan processing and cleaning procedures in a way which assures hygienic products. The water supply may be from the premises own well or from the community supply. Working routines should be planned to economize the consumption of water because of waste water disposal.

Energy supplies will be necessary if the slaughterhouse is more or less automatic. Energy supplies will also be necessary for automatic cleaning and could be provided through windmills, biogas production, fuel and electricity and water could also be heated by solar energy.

If water and energy supplies are sufficient it will be the responsibility of the management of the slaughterhouse to see that these supplies are used efficiently and that sufficient water and energy are used for hygienic purposes.

Process

The elements of hygiene will differ depending on the type of processing. There will be significant differences between the hygiene standard required in a plant manufacturing meat products, which are sold as sliced, prepackaged meat products, and the hygienic standard required in a place where the animals are slaughtered.

The main hygiene principle in processing is that clean and unclean operations are efficiently separated. This requires a well-planned plant layout, where the purpose of any structure should be to protect the products against unintended contamination.

Processing principles are shown in the following flow-diagram (Fig.).

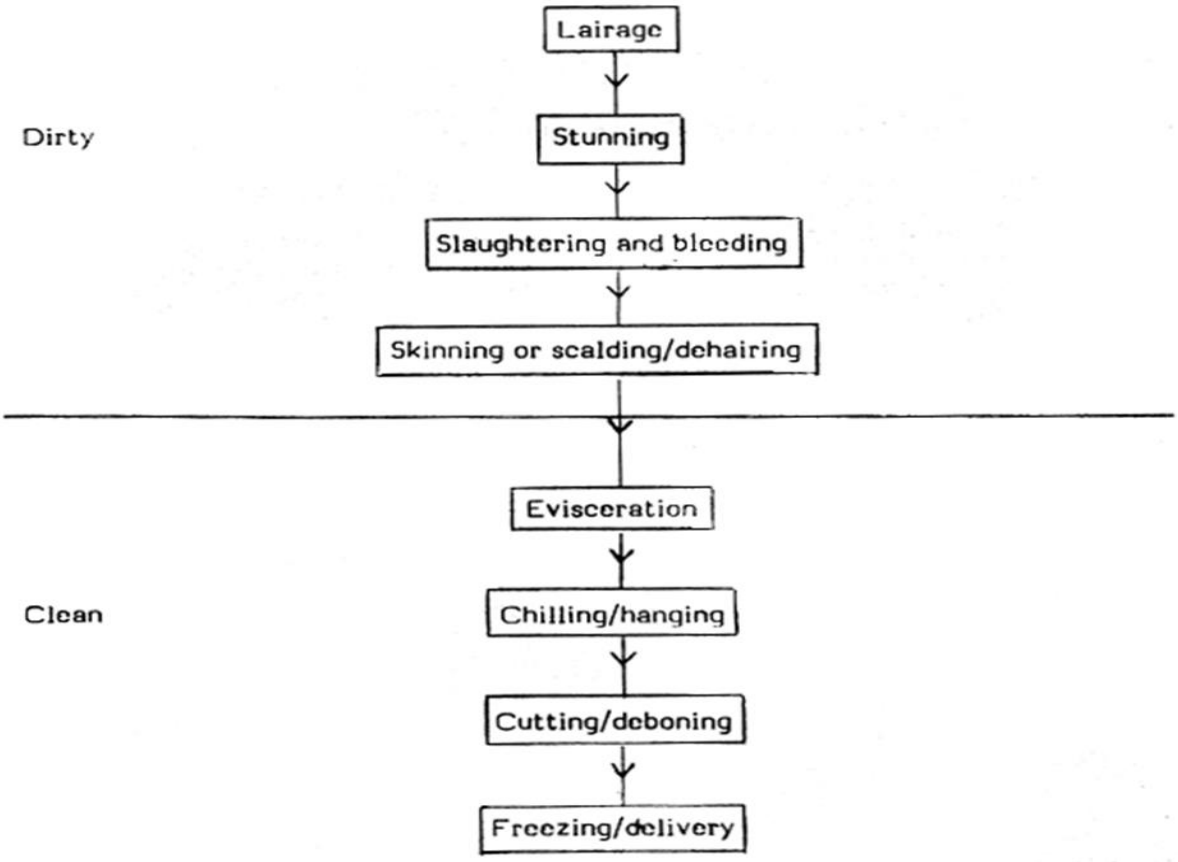


Fig 1.11 Flow-diagram showing the principles in a slaughtering process.

The sub processes are divided in “dirty” and “clean” operations.

- **Lairage.** There should be sufficient space and a sufficient supply of potable water for drinking purposes. A spraying system where the animals can be cleaned before entering the slaughterhouse is recommended, if sufficient water is available. The floor should be constructed of concrete and sloping towards drains in order to facilitate cleaning.

Regulations concerning feeding and watering of the animals before slaughter should be considered.

Stunning, slaughtering and bleeding

These processes must, if possible, be separated from the operations which follow. If the blood is not intended for use it should be drained away into a separate pit and should not be allowed to drain into the waste water. The animals should be hoisted to facilitate bleeding and decrease the risk of contamination of the carcasses.

This area should be constructed with a slope towards drains .

Scalding, skinning, dehairing or plucking

The process varies according to animal (poultry, pigs and cattle).

Skinning or dehairing may be carried out in a separate room/area or in the slaughtering place. However, it should be carried out separately from the evisceration process. The same principle applies to plucking of poultry.

The un skinned/ undehaired carcass must never enter the clean area, but as soon as possible after skinning, dehairing, or plucking, it must be hygienically transferred to the clean area (evisceration room/or area). It is important to handle the carcass carefully to minimize contamination.

To secure and improve cleanliness and efficiency hoists and overhead rails are required for the skinning/dehairing process. If hoists and overhead rails are not available, the carcasses should be kept above floor level by means of cradles. Procedures assuring cleaning of hoists, overhead rails and cradles should be established.

Special rooms/areas should be available for treatment of hides.

Evisceration

During the evisceration process care should be taken to minimize contamination. Special care must be taken to avoid damaging the intestines. Edible organs must be handled in a hygienic way (stored/ removed in separate containers etc.). Waste must be removed rapidly from the floor in the evisceration room/area.

A sufficient number of sterilizers for hand tools, knives, etc. must also be available in the evisceration area.

Chilling/hanging

Carcasses may be chilled or divided in halves or quarters and then distributed for sale as soon as possible. When chilling is carried out, there must be sufficient chilling capacity and space to assure sufficient chilling.

Carcasses can even be chilled when they are just hanging up and are air-dried, chilling being caused by evaporation.

Cutting /deboning

If cutting and/or deboning is carried out care must be taken to minimize contamination of the meat. The carcasses must be cut, preferably hanging or on surfaces (tables, cutting planks, chopping blocks), which are regularly cleaned. A sufficient amount of sterilizers must be available for cleaning of hand tools, knives, etc. The meat must be removed and/or stored in clean containers, which solely are used for meat. Disposable containers will assure hygienic transport and storage, but will be costly.

Packaging

The meat may be packaged ready for the retail trade. If this is done, the p ackaging must be done in a way to prevent contamination of the meat. The packaging material must be clean and approved for food.

Freezing/delivery

If the meat is frozen the freezing capacity must be sufficient to assure correct freezing.

Condemned products

A separate lockable room or area for keeping condemned material until the end of the working day should be provided. An incinerator or a deep pit should be available for disposal of condemned material.

Liquid and solid waste disposal

The easiest disposal method is to divert effluents into existing pools, rivers or lakes. However, this method cannot be recommended in view of the consequent contamination of water sources for humans, and domestic and wild animals.

For the safe disposal of liquid and solid waste, the following action should be taken:

1. Separation of blood
2. Screening of solids
3. Trapping of grease

1. The blood from slaughtered animals will coagulate into a solid mass, which may block up both open and closed drains. It is therefore recommended that the blood is collected and used for human consumption, stock feed production or fertilizers, if the religious and cultural traditions allow the use of blood.
2. Solids (meat or skin trimmings, hair, pieces of bones, hooves, etc.) must be screened. This may be done by providing the drains with vertical sieves.
3. Effluents from slaughterhouses always contain small amounts of fat (melted fat or small pieces of fatty tissues). Grease traps should be installed in the drains. The fat solidifies, rises to the surface and can be removed regularly.

The final effluent disposal will depend on local conditions and legislation. Disposal of the effluents into a lake or permanent river should not be allowed because it will contaminate the stream.

Environmental hygiene

Environmental hygiene and its implementation will depend on the area where the slaughterhouse/meat plant is situated. The precautions to be taken will be different if the site is in a town or in the country.

The main principles of environmental hygiene will consist of:

- Proper fencing (public, dogs, etc.)
- Pest control (rodents, insects, birds)
- Liquid and solid waste disposal

Insect control

Principles in insect control may be:

1. Biological control through emphasis on the natural enemies of pests.
2. Cultural control through alteration of the environment to make it unfavourable to pests. Sanitation programmes and water management are examples.

3. Physical and mechanical control. Burning and sticky adhesives are examples.
4. Autocidal control, disrupting the breeding cycle of a pest (release of sterilized male insects or genetically altered insects).
5. Behavioral control, which involves the identification, production, and application of chemical attractants which draw the insects to a trap or interrupt and confuse breeding patterns.
6. Chemical control, which is the most obvious control method, but also the most controversial of all control methods. This method includes chemical insecticides but non-chemical methods should be employed if possible.

These principles can also be used for the control of rodents a nd birds but the slower generation time of these animals reduces some of the above-mentioned alternatives.

Rodent control

The most effective way to control rats is to separate them from food supplies forcing the rats to migrate in search of food thus depressing the reproduction rate. This can only be done through careful management of hygiene standards in food production.

Other principles in rodent control are:

- chemical control
- physical control
- biological control

Chemical control

In probaiting a non-poisoned bait is introduced for a rat population over a period and then the non-poisoned bait is replaced with the identical poisonous variety of bait.

The rodenticides used as baits can be divided into two main types, multiple dose of chronic chemicals, and single-dose (acute) rodenticides. According to the situation, each type can be recommended.

The type of bait station used will depend on its location. It is important to prevent spread of rodenticides in the production areas and the bait stations must be inspected regularly.

May include the use of rodenticides as tracking powder. These materials kill rats when the animal grooms itself after having been in touch with the powder. Tracking powders (like other baits) should not be used in production areas.

Physical control

The best known method of physical control is traps. Trapping is of special importance in an environment where food is produced, handled or stored because poisonous baits cannot be used for safety reasons.

Biological control

Rodents (rats) have natural enemies such as cats and dogs, but these animals should not be permitted to control (kill) rodents in food production areas.

Bird control

The best control is to prevent the birds from having access to buildings. It is important to understand the relationship between birds and their environment. Bird attractants may be food supplies, water, special vegetation around buildings, etc. and these attractants must be removed or modified. Toxicants, shooting and trapping may be used to control birds.

Liquid and solid waste disposal

Handling of liquid and solid waste influences both hygiene in processing and of the environment the latter depending on the precautions taken to avoid contamination with liquid and solid waste.

Personal hygiene

Personal hygiene will usually be the main element in the term “hygiene”; the reason being obvious. Bacteria causing diseases or spoilage may be carried and transmitted to surfaces and food by workers handling the food products.

Hand-washing

Careful and frequent hand-washing will do much to reduce contamination. Therefore hand-washing facilities must be sufficient if the water supply is adequate.

Basically there should be two sites where the staff can wash their hands - the rest room and the working area where sufficient hand washing facilities must be placed close to the working places. If the hand-washing facilities are situated in particular areas away from working places, there is a great risk that they will not be used.

It must be impressed on the staff that hand-washing must be done:

- before work starts
- after using the toilets
- after touching dirty objects and materials
- after smoking and eating

It must be impressed on the staff that hands will be contaminated if used for scratching the skin or the hair, correcting clothes and picking the nose. Bacteria may be transmitted to the hands by these acts and thereafter transmitted to meat (food) which is handled by hand.

Special guidelines concerning hand-washing must be followed. The management of slaughterhouse/slaughter facilities or the authorities may require the use of a special bacteriostatic soap or dipping of the hands after washing in a germicidal rinse etc. Use of a nail brush is recommended because bacteria often hide along and under the nails.

Working clothes

The clothing of slaughterhouse workers must be clean. The purpose is not to protect the worker against contamination but to protect the meat/food against contamination. Working clothes must be used exclusively in the working area and nowhere else. If possible, it is advisable to avoid admittance from the unclean area to the clean area without changing clothes. Working routines should be planned in a way that the staff works either in the clean area or in the unclean area.

Hair covering

Human hair and beards are normally heavily contaminated with bacteria and to prevent contamination of food a hair or beard covering in the process area is a necessary part of the working clothes.

Many different types of hair coverings are seen in the food industry. It is important that the hair is completely covered and that the covering is clean. Disposable or washable hair and beard coverings are recommended.

Gloves

If the use of gloves is indicated they must be kept in the same good hygienic conditions as hands, otherwise it is better to avoid their use. Gloves may be of rubber or plastic and they are used to protect the meat against contamination. They may also be used to protect the hands against knife cuts and will then be made of steel. Great care should be taken to keep a certain hygienic standard of these gloves.

The staff may eventually be allowed to go from clean to unclean work but never in the opposite direction, except when they have changed working clothes and washed hands.

Working clothes should be comfortable and easy to wash. Their design should encourage good hygiene habits. Light colored working clothes show the need for cleaning earlier than dark colored working clothes.

In tropical climates a loincloth is recommended dispensing with working clothes.

In areas where more clothes than loincloths are necessary, aprons made of washable or even waterproof materials, such as rubber, are recommended.

Working clothes should be free of loose adornments (buttons, sequins etc.). During work jeweler, wrist-watches etc. are prohibited as these objects may be sources for contamination and make hand-washing difficult.

Working clothes should ideally be supplied by the slaughterhouse and a laundry service is recommended to assure a certain level of hygiene.

Arrangements for storage of aprons and tools should be available outside toilets and rest rooms.

Health

Good health is important for workers in the meat industry. Ill persons will often be carriers of more microorganisms (pathogenic microorganisms) than is usually the case. These microorganisms may then be transmitted to the meat/food with the risk of causing disease to the consumers. Illness must always be reported to the manager and/or the meat inspector of the slaughterhouse who will decide if the worker can stay or has to leave.

Cleaning/disinfection standard

The cleaning programme must be performed regularly, dependent on the demand for cleaning in the specific areas. The requirements for cleaning have to be defined before establishing cleaning programmes.

The disinfection programme should follow the cleaning programme and must be planned in relation to the previous cleaning programme and specific requirements.

Sanitation includes more than disinfection, and procedures concerning sanitation (pest control, waste disposal, maintenance of buildings, proper fencing, etc.) should be planned and carried out accordingly.

Hygiene standard

It must be impressed on everybody employed in the meat/food industry, that hygiene concerns both:

- process hygiene
- environmental hygiene
- personal hygiene
- cleaning, disinfection/sanitation and that regulations in this regard must be observed.

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. The floor should be constructed of concrete and sloping towards drains in order to facilitate cleaning.

A. Chilling/hanging
B. Evisceration
C. Lairage
D. All

Test I: Short Answer Questions

1. Define hygiene briefly (2pt)
2. Why we cannot give an adequate definition for process hygiene? explain it as you can(2pt)
3. Draw the flow- diagram of Processing principles (2pt)
4. Write the working closes (2pt).

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

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

LG# 17	LO2 Identify sources of contamination and spoilage

Instruction sheet

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

- Identifying source and cross contamination risk and taking steps to reduce the risk
- Taking preventive and corrective action on contamination

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 source and cross contamination risk and taking steps to reduce the risk
- Take preventive and corrective action on contamination

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”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1: Identifying source and cross contamination risk and taking steps to reduce the risk

2.1 Identifying source and cross contamination risk and taking steps to reduce the risk

Microbiological cross-contamination

Pathogens can be transferred from one food to another, either by direct contact or by food handlers, contact surfaces or the air. Raw, unprocessed food should be effectively separated, either physically or by time, from ready-to-eat foods, with effective intermediate cleaning and, where appropriate, disinfection.

Access to processing areas may need to be restricted or controlled. Where risks are particularly high, access to processing areas should be only via a changing facility. Personnel may need to be required to put on clean protective clothing, including footwear, and wash their hands before entering.

Surfaces, utensils, equipment, fixtures and fittings should be thoroughly cleaned and, where necessary, disinfected after raw food, particularly meat and poultry, has been handled or processed.

Physical and chemical contamination

Systems should be in place to prevent contamination of foods by foreign bodies such as glass or metal shards from machinery, dust, harmful fumes and unwanted chemicals. In manufacturing and processing, suitable detection or screening devices should be used.

The impact of microbial contamination on meat and meat products

Meat hygiene serves to minimize the impact of undesirable microorganisms and chemical residues on meat. While residue control is primarily the task of the competent

authorities, control of microbial contamination is the responsibility of meat plants in the first place. Meat plant management and staff should therefore possess sufficient knowledge about impact of microorganisms on food and of basic rules on how to prevent or minimize microbial contamination

Microorganisms of relevance with regard to meat hygiene include parasites, moulds, bacteria and viruses. Within these groups bacteria play the most important role. Therefore, the focus of meat plant internal hygiene measures is mainly on bacteria, while moulds and viruses play a minor role but disinfection measures must also target them.

The incidence of parasites should normally pose no major problems in meat which has passed meat inspection, or if efficient internal pest control programs or measure are in place.

How does bacterial contamination of meat occur?

In live animals, the muscle meat is virtually sterile. However other parts of the animal such as skins, hooves and intestines contain enormous numbers of bacteria. Depending on the slaughter hygiene, these bacteria find their way to the carcass or “contaminate” the meat during slaughterhouse operations.

Skinning, scalding, evisceration, dressing and carcass transport are common contamination points. Most bacteria reach the carcass via butchers’ hands, tools, contact with equipment or through water, air, etc.

The bacterial contamination of meat is not stopped after slaughtering. It is ongoing during the operations following the slaughter process, such as meat cutting and meat processing

It is quite normal and unavoidable to find bacterial counts of “total plate count” of the order of several thousands per cm2 on meat surfaces in commercial slaughtering and

meat handling. However, the principle must be to keep bacterial counts as low as possible through adequate hygienic measures. Total plate count numbers exceeding 100,000 per gram (105 per cm2) on fresh meat are not acceptable and alarm signals and meat hygiene along the slaughter and meat handling chain must be urgently improved (Table 1).

Table 19: Recommended microbiological criteria for fresh meat

	Good microbiological standard	Critical microbiological condition	Not acceptable
Total plate count1 per cm2	Less than 10000 <104	Between 10000 and 100000 >104 - <105	More than 100000 >105
Enterobacteriaceae2 per cm2	<100	>100 - <1000	>1000

Meat spoilage through micro-organisms

Meat spoilage bacteria will grow if temperatures are not kept in the cooling **(-1°C to +4°C) or freezing (below -1°C**) range. Not all bacteria which contaminate meat will behave in the same way. Some may multiply already at temperatures at around **10°C,** others at higher temperatures, for example 30°C.

Most bacteria can optimally grow in the range between 30°C and 37°C. Some may attack the protein portion of the meat resulting in the production of very unpleasant putrefactive odours, others may break down carbohydrate components in particular in processed meats causing intensive sour taste or acidity.

Others may attack the fats, producing rancidity .These various bacterial impacts result in meat spoilage or decomposition. Spoilage of meat and meat products causes serious financial losses for the meat industries as such products, due to their sensory changes exposed through unpleasant smell and taste are unfit for human consumption. But spoiled meat, if accidentally ingested, is usually not the cause for illness in consumers.

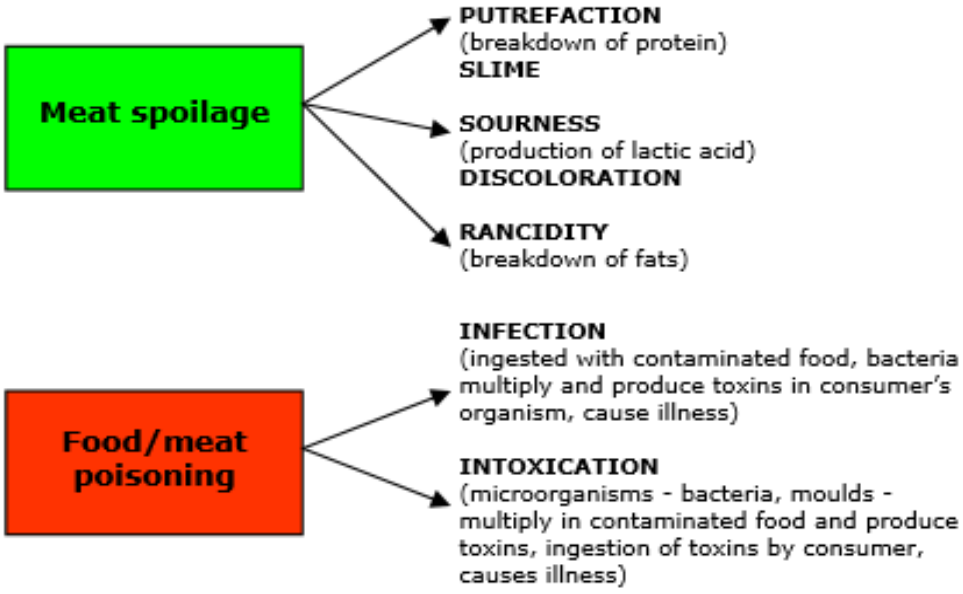


Fig.1 Impact of Bacteria on Meat

Table 2: Microorganisms causing microbiological spoilage of meat

Putrefaction	Pseudomonas ("Cold room flora"), Proteus, Clostridium(fig1)
Souring	Lactobacillus, Enterococcus, Pediococcus ("Lactic acid bacteria")
Fermentation1	Yeasts (Saccharomyces), Enterobacteriaceae, Lactic acid bacteria
Turbidity (cloudy brine in meat juice)	Lactic acid bacteria, Enterobacteriaceae (e.g. vacuum packed meat, sausage slices)
Greenish discoloration	Lactic acid bacteria (fig3)
Slime formation	Pseudomonas, Streptococcus, Enterobacteriaceae (on open meat), Lactic acid bacteria (on vacuum packed meat and meat products), Yeasts (on raw fermented products such as raw hams)(fig2)
Rancidity of fats	Mainly due to presence of oxygen, but certain microorganisms are also capable of causing fat deterioration.
Mould growth	Penicillium, Aspergillus, Mucor(fig4)

Fig2 Putrefaction of lower part of beef quarter

Fig3 Slime formation on sausage surface and attached to packing film

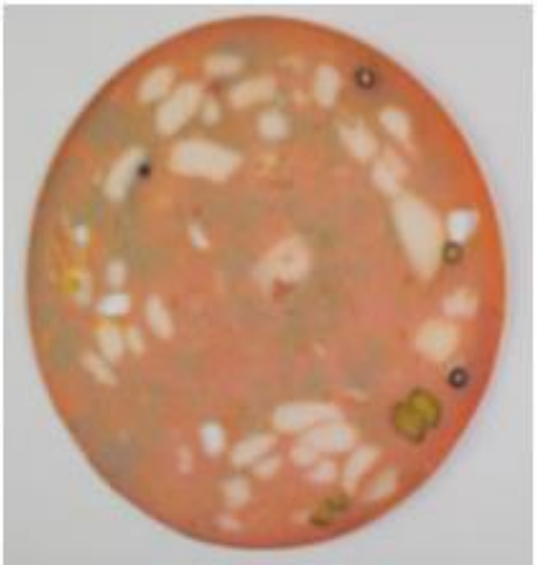


Fig.3: Greenish discoloration (sliced mortadella)

Fig. 4: Mould growth

Meat poisoning through micro-organisms

Harmful microbes may have little adverse effect on carcasses or meat in terms of visible alterations and spoilage (smell and taste), but can have severe negative effects on consumers called food or meat poisoning. After consumption of meat contaminated with food poisoning bacteria, food poisoning results in severe illness with consumers needing intensive and costly medical treatment.

- The impact of food poisoning bacteria, depending on the species of microorganisms, is either as a
    - food borne infection or
    - food borne intoxication.

- Bacteria that cause food borne infections must first multiply to high infectious numbers in rich protein foods such as meat and have to be ingested by consumers. They cause sickness through microbial metabolic substances i.e. toxic substances released by the living microorganisms inside the human digestive tract.

The best known examples of food borne infections are those caused by Salmonella bacteria. In some instances relatively high numbers of bacteria are needed to make people severely sick. For example, it is estimated that 105/g of Salmonella bacteria are needed in ingested food to cause Salmonellosis.

In other cases, for example in the case of a recently emerged very pathogenic form of the normally harmless E.coli bacteria (entero-pathogenic form, mostly type O157 H7 residing in faecal material, on skin of animals), only a few hundred bacteria per gram food can cause severe illness with gastro-intestinal symptoms and fever and even death.

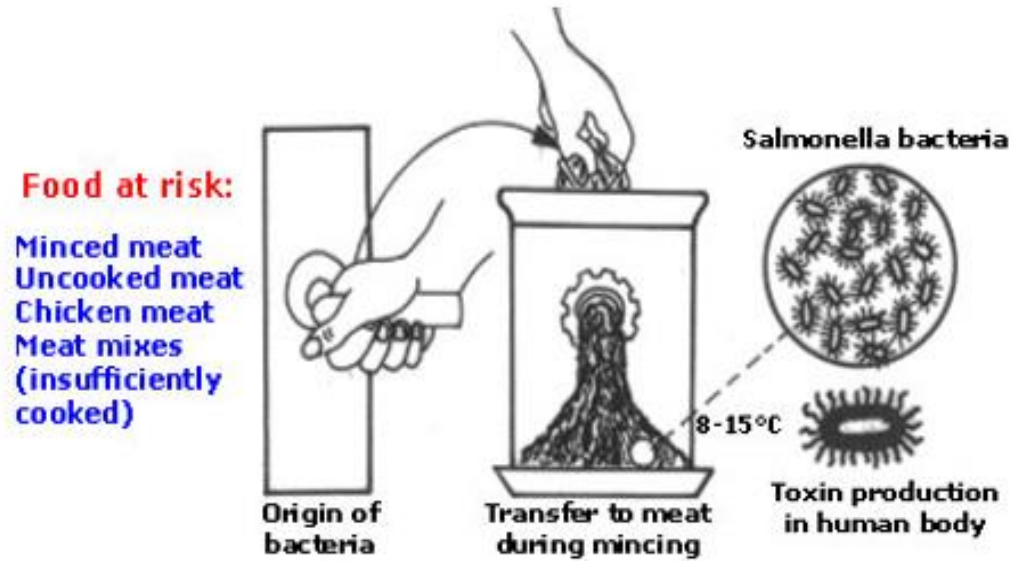
- Principles of meat processing hygiene and regulatory practices (incl. GHP and HACCP)

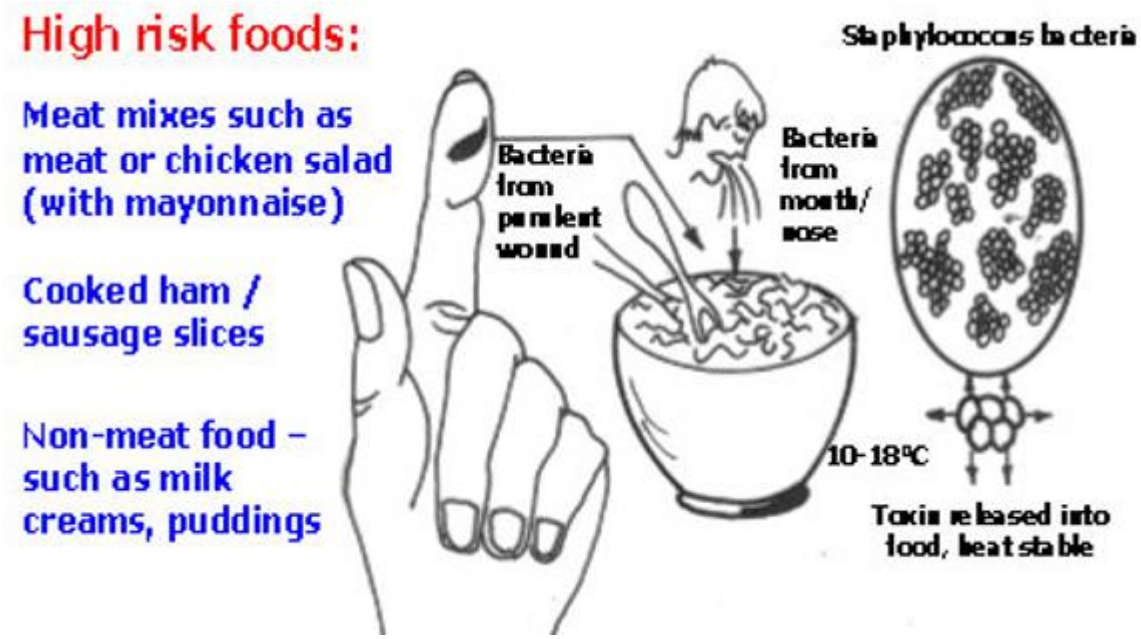
Microorganisms causing food borne intoxications produce and release the poison during their multiplication in the food. Upon ingestion by consumers of such food, which was heavily intoxicated outside the human body, severe gastro-intestinal food poisoning symptoms (vomiting, diarrhea, abdominal pain, fever) occur.

- Food borne intoxications are frequently caused by **Staphylococcus aureus**. These bacteria are present in purulent wounds an frequently in the respiratory system of healthy people. When they get into meat, which is not sufficiently refrigerated, they multiply rapidly and produce toxins, which cause severe gastro-intestinal symptoms only a few hours after ingestion by consumers.

- Another bacteria, **Cl. botulinum**, in the absence of oxygen e.g. in canned food or deep layers of raw fermented hams, is capable of producing one of the strongest toxins known. Intoxication, if not treated immediately, can be fatal to consumers.

- Bacteria are the most common food poisoning microorganisms. Apart from bacteria, moulds can also play a role in the incidence of food poisoning.

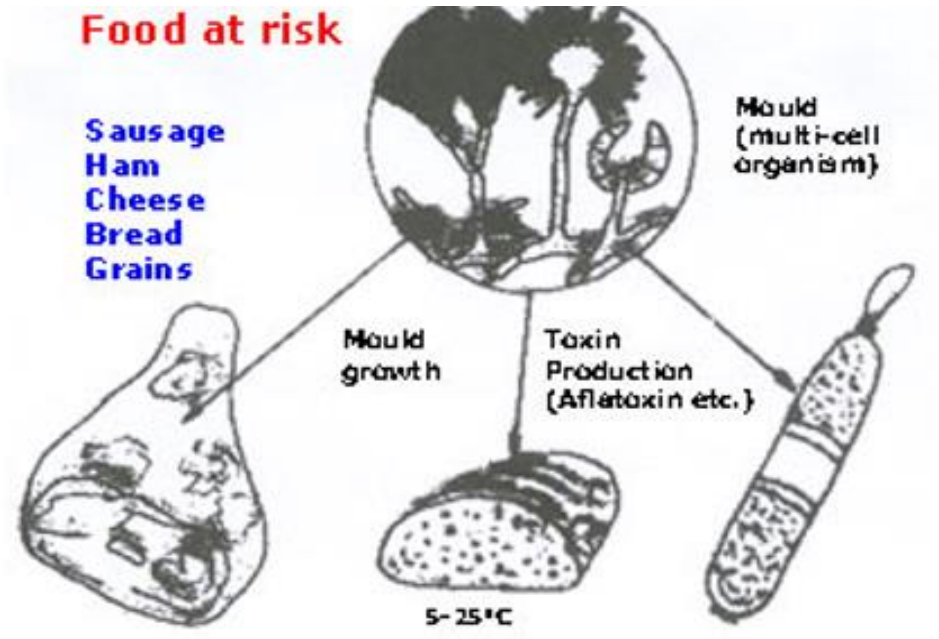




- **Moulds** are sometimes found on the surface of meat products after prolonged storage. Growth of moulds on meat can have two undesirable effects.

Firstly, strong growth of moulds can spoil the affected meat parts. Secondly, and this is a more serious issue, certain types of moulds produce toxins which are released into the food. If consumed in food or feed they can, in the long term, have carcinogenic effects.

Aflatoxins are strongly carcinogenic, in particular hepatotoxic, i.e. cause liver cancer through long term impact (Aflatoxin = toxin of Aspergillus flavus). Ochratoxin is strongly nephrotoxic, i.e. it causes kidney disease, in particular kidney enlargement and kidney failure (Ochratoxin = toxin of Penicillium vividicatum).



- **Viruses** were always suspected to cause food infections. In the last years it has been shown that in particular the Norovirus group can be responsible for food infections with similar, mainly gastro-intestinal symptoms, as bacterial food infection agents.

Meat processing hygiene is part of Quality Management (QM) of meat plants and refers to the hygienic measures to be taken during the various processing steps in the manufacture of meat products.

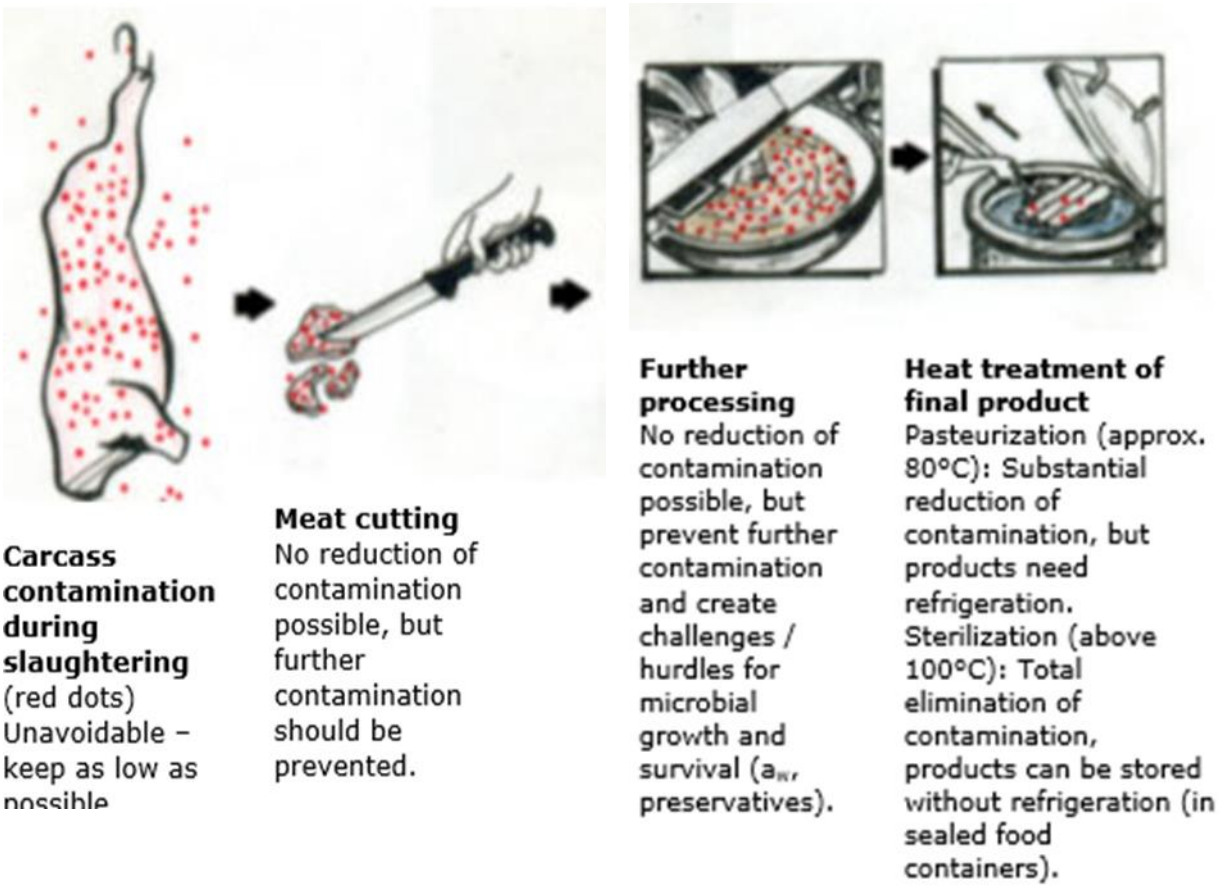
Regulatory authorities usually provide the compulsory national framework for food/meat hygiene programmes through laws and regulations and monitor the implementation of such laws. At the meat industry level, it is the primary responsibility of individual enterprises to develop and apply efficient meat hygiene programmes specifically adapted to their relevant range of production.

Operations in meat processing plants comprise the manufacture of value-added meat products from primary products of meat origin and non-meat origin.

There are three principles of meat hygiene, which are crucial for meat processing operations.

- **Prevent microbial contamination** of raw materials, intermediate (semi-manufactured) goods and final products during meat product manufacture through absolute cleanliness of tools, working tables, machines as well as hands and outfits of personnel.
- **Minimize microbial growth** in raw materials, semimanufactured1 goods and final products2 by storing them at a low temperature.
- **Reduce or eliminate3 microbial contamination** by applying heat treatment at the final processing stage for extension of shelf life of products (except dried and fermented final products, which are shelf-stable through low aw and pH)4

Fig. 3: Microbiological contamination in the meat processing chain



The above three principles guide meat hygiene programs in the further processing of meat (see Fig. 3). However, meat processing hygiene is more complex. In particular, the hygienic treatment of meat before reaching the processing stage is the most importance for the processing quality of the meat.

Failures in slaughter hygiene, meat cutting and meat handling/transportation and in the hygiene of by-products and additives will all contribute to quality losses and deterioration of the final processed meat products.

Highly contaminated raw meat is unsuitable for further processing. Final products made from hygienically deficient raw meat materials are unattractive in colour, tasteless or untypical in taste with reduced shelf life due to heavy microbial loads. Moreover, there is also the risk of presence of food poisoning microorganisms, which can pose a considerable public health hazard.

In the light of growing consumer consciousness as well as regionalization and globalization in trade, quality conscious meat plants need internal quality control/quality management schemes not only for the final products but also for the raw materials and the various processing steps.

Carcass contamination during slaughtering (red dots) Unavoidable – keep as low as possible.
Meat cutting No reduction of contamination possible, but further contamination should be prevented.

Further processing No reduction of contamination possible, but prevent further contamination and create challenges / hurdles for microbial growth and survival (aw, preservatives).

- Heat treatment of final product Pasteurization (approx. 80°C): Substantial reduction of contamination, but products need refrigeration. Sterilization (above 100°C): Total elimination of contamination, products can be stored without refrigeration (in sealed food containers).

Quality Management Schemes (QM) has technical and hygienic components. Technical aspects encompass product composition, processing technologies, packaging, storage and distribution.

Details on the manufacturing practice for each individual group of meat products are included in the chapters on processing technology For the sanitary quality and safety related to meat processing, two useful schemes1 can be applied known as

- Good Hygienic Practices (GHP) and
- Hazard Analysis and Critical Control Point (HACCP) Scheme.

Both schemes are not verbally laid down in codes ready to be used for the various purposes in the meat sector although some generic examples can be accessed in handbooks or via internet. Factory and production specific versions need to be established and compiled by taking into account official laws and regulations as well as recommended codes of practice.

Good Hygienic Practices (GHP)

Good Hygienic Practices/GHP follows general hygienic rules and applies recognized hygienic principles2 as well as laws and regulations issued by the competent authorities, referring to meat and meat products, equipment, premises and personnel. GHP schemes are not factory specific, they apply to all types of meat plants. They are intended to establish and maintain acceptable hygienic standards in relevant meat operations.

There is more emphasis on slaughter hygiene in GHP schemes for slaughterhouses and more emphasis on meat processing hygiene in GHP schemes for meat products

manufacturing enterprises. However in principle, GHP schemes remain interchangeable for similar types of meat plants.

GHP for meat processing plants refers principally to:

- Appropriate functional plant layout and sanitary design of equipment
- Raw materials that meet hygiene quality standards
- Processing methods that allow safe handling of food
- Appropriate waste and pest control measures
- Appropriate sanitation procedures (cleaning and disinfection)
- Compliance with potable water criteria
- Functional cold chain
- Regular examination of health and personal hygiene of staff
- Regular training of staff on hygiene requirements.

Table 4: Major meat poisoning organisms

Salmonella	Food borne infection
E.coli (enteropathotgenic type	Food borne infection
Listeria monocytogenes	Food borne infection
Campylobacteria jejuni	Food borne infection
Yersina enterolytica	Food borne infection
Staphylococcus aureus	Food borne intoxication
Clostridium botulinum	Food borne intoxication
Mycotoxin producing moulds	Food borne intoxication
Norovirus	Food borne infection

Good Hygienic Practices in meat processing

Microbial meat spoilage or food poisoning through meat can be prevented if the microbial load/bacterial contamination, which occurs during slaughtering and meat handling, is kept as low as possible. The key for achieving this is strict meat hygiene including an uninterrupted cold chain throughout the entire meat production and handling chain.

Meat hygiene is a complex field, based on regulations by competent authorities and meat plant internal hygiene programs, to be supervised by the plant management. Those programs will only be successful if meat plant staff are familiar with and active in observing basic hygiene requirements. In order to facilitate the application of hygiene requirements, it has proven useful to differentiate between:

- Personal hygiene
- Slaughter and meat processing hygiene
- Hygiene of slaughter and meat processing premises
- Hygiene of slaughter and meat processing equipmen

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 II choose the best answer

1. ……..were always suspected to cause food infections
   A. Virus
   B. Bacteria
   C. Fungus
   D. All

2. **…….** are sometimes found on the surface of meat products after prolonged storage
   A. Mold
   B. Bacteria
   C. Fungus
   D. All

Test I: Short Answer Questions

1. What is microbiological cross-contamination?
2. What is the impact of microbial contamination on meat and meat products?
3. What are Physical and chemical contamination?
4. How does bacterial contamination of meat occur?
5. What is the impact of bacteria on meat?

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

Information Sheet 2 Taking preventive and corrective action on contamination

2.2 Taking preventive and corrective action on contamination

Introduction

FOOD SAFETY PRACTICES

Food hygiene includes all practices, precautions and procedures involved in:

A. **Protecting food** from the risk of **biological**, **chemical** or **Physical contamination.**

B. **Preventing any organisms** multiplying to an extent that would expose consumers to risk or result in premature decomposition of food.

C. **Destroying any harmful bacteria** in food by thorough cooking or processing.

Benefits from high standards of food(meat) hygiene include

a. Reduced risk of food poisoning, foreign body contamination and spoilage.
b. Economic advantages, including increased shelf life and reduction of waste.
c. Consumer satisfaction and enhanced reputation.
d. Increased morale of personnel

Hazard analysis critical control point

A. **Identifying any hazards** that must be prevented, eliminated or reduced to acceptable levels.
B. **Identifying the critical control points** at the step or steps at which control is essential to prevent or to reduce it to acceptable levels.
C. **Establishing critical limits** at critical control points which separate acceptability from unacceptability for the prevention, elimination or reduction of identified hazards.

D. **Establishing and implementing** effective monitoring procedures at critical points.

E. **Establishing corrective actions** when monitoring indicates that a critical control point is not under control.

F. **Establishing procedures**, which shall be carried out regularly, to verify that the measures outlined in subparagraphs (a) and (e) are working effectively.

G. **Establishing documents** and records commensurate with the nature and size of the food business to demonstrate the effective application of the measures outlined in subparagraphs (a) and (f).

When preparing individual HACCP (Hazard Analysis) units are advised to consider the following definitions in order to determine the type of risk that applies at each stage of food preparation:

a. **Control point** – specific stages in those operations where food hazards i.e. contamination may occur.
b. **Critical point** – control points which are considered critical points where the hazard must be controlled to ensure that it is eliminated or reduced to a safe level.
c. **Critical control point** – is a critical point in the process where a specific hazard must be controlled on the basis that no further process will adequately eradicate that hazard.

Supply of food and water

The **Regulation states** that no raw materials or any other material used in processing products, if they are known to be, or might reasonably be expected to be, so contaminated with **parasites, pathogenic micro-organisms**, or **toxic**, **decomposed** or **foreign substances**, to such an extent that, even hygienically applying normal sorting and/or preparatory or processing procedures the final product would still be unfit for human consumption..

Food storage

The Regulation requires food products and ingredients to be stored in food premises in appropriate conditions, designed and maintained to prevent harmful deterioration and to protect food from contamination.

- **Dry Foods Storage** these storerooms are to be kept clean and orderly to minimize the potential hazards from **"foreign bodies"** and to prevent pests. Where practicable these stores are to be proofed against pest entrance. Part used packs are to be resealed adequately to prevent contamination. High ambient temperatures (above **13ºC**) and high humidity are to be avoided. Dry goods (canned foods) should be stored on suitable racking high off the ground.

- **Chilled Storage (<8ºC)** Cold rooms and refrigerators are to be kept clean and tidy. It is the responsibility of the Catering Manager to raise the appropriate request if refrigerated space is considered inadequate. Best Practice guidance indicates that the ideal operating temperature of a refrigerator is 5ºC.

- **Frozen Storage (-18 to -21oC).** The operating temperature of a freezer is between –18oC to –21oC; this temperature range is to be strictly adhered to. To ensure the maximum operating efficiency of a freezer it is to be regularly defrosted as well as being kept clean and tidy at all times.

It is essential that frozen meat and poultry are thoroughly thawed on raised perforated trays or racks, or if unavailable in a designated defrosting area, or ideally in a defrosting cabinet. Raw meat and poultry are not to be washed due to the increased risks of cross contamination.

- Raw materials accepted for production should be free, as far as possible, from microbiological hazards, such as E. Coli O157 and Salmonella, from chemical

hazards such as grease and dirt, and from physical hazards such as metal and other foreign bodies.

- Temperature controls are important as bacteria can multiply quickly if meat is kept at a temperature that promotes bacterial growth. Poor hygiene will increase the potential for contamination of food, including transfer from meat to ready-to-eat products, and increase the possibility of food poisoning.

Some **further processing techniques** will result in a final product that the consumer will not need to cook further, and these products pose a considerably higher risk. Procedures are needed to minimize the risk of these hazards causing illness in consumers.

1. Ready-to-eat products

Ready-to-eat products, such as **cooked meats**, **dried** or **cured sausage**, are made to be eaten without the need for further cooking (though they may need to be defrosted), and consumers may choose to cook them for a better taste or appearance.

These products can present a higher risk to consumers if there is no further heat treatment to eliminate or reduce levels of food poisoning bacteria, which can be due to contact with, for example, contaminated equipment, packaging, preparation surfaces, food handlers or other foods.

Cross contamination

Cross contamination is the process whereby pathogenic bacteria present in raw food, such as meat, poultry, and vegetables, come into contact with ready to eat food. This contamination can be either **direct** i.e. through contact with surfaces, equipment,

splashes, drips, utensils, hands and cloths, or **indirect** via pests, food handlers, visitors or air supply (flowing from high to low risk areas).

To prevent cross contamination

Raw and ready to eat foods are to be kept apart. Good management planning of workflow through the kitchen can assist in this. The flow of waste is also to be considered, along with raw products and prepared food.

Additionally, it is to be ensured that:

A. Where possible, there are separate designated preparation areas for raw and RTE foods(**cooked meats**, **dried** or **cured sausage)**.
B. If raw and cooked food is to be stored in the same refrigerator, raw foods are always to be stored (and adequately covered) below cooked or salad foodstuffs.
C. Food handlers always wash their hands between handling raw and RTE foods and change their protective clothing.
D. Separate colour coded cutting boards (red for raw meat, blue for raw fish, and colour-coded knives are used.
E. Separate machines for raw and cooked food are used, or slicing and mincing machines are thoroughly cleaned and disinfected between raw and cooked food.
F. All food is kept in covered, dated and labelled containers during storage and before service.

Temperature control and monitoring

The Food Safety and Hygiene regulations impose two holding temperatures of below 8ºC or above 63ºC. The purpose of the regulations is to inhibit or prevent harmful micro-organisms from multiplying by keeping food outside of the recognised best practice ‘danger zone' 8°C to 63°C. These Regulations allow limited periods outside

temperature control during preparation, display, service, storage or transport, but it is an offence to keep food out of temperature control for so long that it could become unsafe.

Monitoring – check on a daily basis that staff are following the company's procedures for processing, for example:

- Cleanliness of food handling areas, storage and transport
- Meat handling procedures, including adequate tool cleaning and disinfection
- Meat temperatures in workrooms, storerooms, vehicles
- Effectiveness of heat treatment, if used
- Adequacy of personal hygiene practices
- Microbiological testing, if carried out

Records:- keep an accurate, dated account (for example, in a diary/daybook) of observations, of issues requiring special attention, and of any corrective action taken.

Corrective action:-take action when evidence of failures of procedures are identified. Such action may include:

- Change suppliers
- Dealing with any incoming raw materials or product that may be contaminated
- Establishing the underlying cause and what needs to be done to prevent similar incidents in the future
- Informing and, if necessary, changing suppliers; and
- Improving staff instructions and training

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

1. ……is the process whereby pathogenic bacteria present in raw food.(1pt)

A. Cross contamination
B. Contamination
C. Hygiene
D. all

2. Benefits from high standards of food(meat) hygiene include(1pt)

a. Reduced risk of food poisoning, foreign body contamination and spoilage.

b. Economic advantages, including increased shelf life and reduction of waste.

c. Consumer satisfaction and enhanced reputation.

d. Increased morale of personnel

e. All

Test II: Short Answer Questions

1. What are the Benefits from high standards of food hygiene include(1pt)
2. What are the hazard analysis critical control point, list them?(1pt)
3. Define the regulation states about meat products.(2pt).
4. What the temp. of dry foods storage?(2pt)
5. What the temp. Chilled Storage?(2pt)

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

LG# 18	LO3 follow work place hygiene and sanitation requirements

Instruction sheet

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

- Following personal hygiene practice
- Handling products in work place hygienically
- Conducting individual's work hygienically
- Processing products with regulatory requirements

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:

- Follow personal hygiene practice
- Handle products in work place hygienically
- Conduct individual's work hygienically
- Process products with regulatory requirements

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". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

4. Accomplish the "Self-checks" which are placed following all information sheets.

5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Following personal hygiene practice

Following personal hygiene practice

Personal Hygiene

- A personal hygiene policy and procedure shall be developed, documented and implemented.
- As a minimum, the following elements shall be included:
- Staff illness
- Eating, drinking and smoking restrictions
- Hand-washing requirements
- Sneezing, coughing and blowing of noses
- Cuts, wounds and bandage requirements
- Clothing requirements
- Jewelry restrictions (including watches
- Control of personal items including medication and mobile phones
- False nails (including acrylics) and false eyelashes
- Staff Movement restrictions
- Control of visitors and contractors
- Procedures shall be in place to ensure the storage of protective clothing such that there is no cross contamination risk from low risk to high risk clothing e.g. storage of gum boots and personal protective clothing
- Returning to work after breaks
- Use of signs (Signs displayed are maintained and understandable, placed in prominent and sensible locations, and made of suitable material to prevent the risk of product contamination)

Personnel hygiene facilities and toilets

Personnel hygiene facilities should be available to ensure that an appropriate degree of personal hygiene can be maintained and to avoid contaminating food. Where appropriate, facilities should include:

- adequate means of hygienically washing and drying hands, including wash t basins and a supply of hot and cold (or suitably temperature controlled) water;
- lavatories of appropriate hygienic design; and
- adequate changing facilities for personnel.

Such facilities should be suitably located and designated.

ESTABLISHMENT: PERSONAL HYGIENE

1. **Health status**

People known, or suspected, to be suffering from, or to be a carrier of, a disease or illness likely to be transmitted through food should not be allowed to enter any food handling area if there is a likelihood of their contaminating food.

Any person so affected should immediately report illness or symptoms of illness to the management.

Medical examination of a food handler should be carried out if clinically or epidemiologically indicated.

1. **Illness and injuries**

Conditions that should be reported to management so that any need for medical examination and/or possible exclusion from food handling can be considered include:

- Jaundice;
- Diarrhea;
- Vomiting;

- Fever;
- Sore throat with fever;
- Visibly infected skin lesions (boils, cuts, etc.);
- Discharges from the ear, eye or nose

2. Personal cleanliness

Food handlers should maintain a high degree of personal cleanliness and, where appropriate, wear suitable protective clothing, head covering and footwear. Cuts and wounds, where personnel are permitted to continue working, should be covered by suitable waterproof dressings.

Personnel should always wash their hands when personal cleanliness may affect food safety, for example:

- At the start of food handling activities;
- Immediately after using the toilet; and
- After handling raw food or any contaminated material where this could result in contamination of other food items; they should avoid handling ready-to-eat food, where appropriate

3. Personal behavior

People engaged in food (meat) handling activities should refrain from behavior that could result in contamination of food, for example:

- smoking;
- spitting;
- chewing or eating;
- sneezing or coughing over unprotected food.

Personal effects such as jewellery, watches, pins or other items should not be worn or brought into food handling areas if they pose a threat to the safety and suitability of food.

4. **Visitors** Visitors to food manufacturing, processing or handling areas should, where appropriate, wear protective clothing and adhere to the other personal hygiene provisions in this section.

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

1. Personal behavior that could contaminate the meat processing area are (1pt)

A. smoking;

B. spitting;

C. chewing or eating

D. all

Test II: Short Answer Questions

1. Write elements of personal hygiene(2pt)
2. Define personal hygiene facilities briefly(2pt)
3. Explain health status depending on (based on) personal hygiene(2pt)
4. Define personal cleanliness(2pt)
5. What are the pillars to establishment of personal hygiene? (2pt)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information Sheet 2- Handling products in work place hygienically

Basic hygiene of meat processing

- Ideally meat cutting/deboning should be carried out in climatized rooms (approx. + 10°C) with low air humidity. Meat should be brought in progressively and not accumulate on work tables.
- If visual contamination of manufacturing meat occurred, do not try to wash it off but remove it with knives by cutting off superficial meat parts in the case of minor contamination. Discard the meat in case of heavy contamination.
- Do not hose down floor and wall areas or equipment next to meat processing operations or final products with a power hose. (Risk of contamination by aerosol/droplets

- Never take meat pieces, which accidentally had contact with the floor or other contaminated surfaces, back onto working tables or into meat processing machines
- Containers for meat, fat, or semi–or fully processed meat products must not be placed directly on the floor but on hygienic stands, pallets etc

Fig. Meat which falls accidentally on to the floor, must not be taken, goes to waste.

fig. Meat containers must not be placed directly on the floor

- Adequate rooms for personnel must be available including sections for changing clothes and for personal hygiene. ¾ Wall windows must be positioned at a sufficient height from the floors in order to allow profound washing and disinfection of floors and walls.

Hygiene of meat processing equipment
(Hygienic requirements for design and construction of machinery, working tables and tools)

In production lines in the meat industries equipment and hand-tools should be used, which enable workers to perform all operations according to Good Hygienic Practices. It is the responsibility of the meat plant management to provide adequate equipment for all working places. For equipment manufacturers, directives have been issued as to proper design and construction of meat processing equipment. Designs must allow easy and profound cleaning and avoid any accumulation of difficult to remove organic matters

Fig, Corroded meat grinder (Hygienically obsolete)

fig Old fashioned meat processing equipment

As a principle in modern meat industries it is commonly accepted that tools and surfaces in contact with meat should be made of food grade stainless steel or synthetic materials.

Stainless steel must be used for working tables, meat hooks (at least their parts contact in meat), blades of knives, saws, cleavers and axes.

All parts of machinery in contact with meat, fat, sausage mixes and meat ingredients must be of stainless steel such as frozen meat cutter, grinder, meat mixer and tumbler, meat emulsifier, sausage stuffer, brine injector etc.

The bowls of bowl cutters are nowadays also mostly made of stainless steel. All the stainless steel parts must be smooth, easily accessible for cleaning and without hidden spaces, where particles of meat materials may accumulate.

Fig. Minced meat and vegetable in same chiller - risk of cross contamination

Fig. stainless steel meat hook

Galvanized steel or food-grade aluminum is useful materials in the meat industries as they are non-corrosive. Those materials should however not be in direct contact with meat, as they are not sufficiently smooth or may release unwanted substances. But they

are very suitable materials for overhead rails and supporting structures, working platforms and frames for tables and machinery

Food grade synthetic materials are used for many types of meat containers and for handles of knives and other hand tools, for cutting boards and some internal parts of meat processing equipment such as washers, parts of valves.

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

1. Containers for meat, fat, or semi–or fully processed meat products must not be placed directly on the floor but on hygienic stands, pallets.

   A. True
   B. False

2. **Galvanized steel or food**-grade aluminum are useful materials in the meat industries as they are non-corrosive.

   A. True
   B. False

Test II: Short Answer Questions

1. What is personal hygiene practice(2pt)
2. What are the elements of personal hygiene?(2pt)
3. Explain about personnel hygiene facilities.(2pt)
4. Explain personal cleanliness?(2pt)
5. Define health status in personal hygiene.(2pt)

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

Information Sheet 3 Conducting individual's work hygienically

Basic elements of HACCP in meat processing plants

- Every single meat product with product specific technology requires a specifically designed individual HACCP scheme.
- As a precondition for implementing HACCP concepts, hazard analysis and risk assessment referring to meat plant specific processing methods or products, have to be carried out.
- Critical control points (CCPs) have to be identified, critical limits be established and monitoring systems properly implemented.

Preparation of meat

(1) A food handler shall prepare meat in food premises in accordance with the following requirements:-

(a) The area used for the preparation of meat is cleaned and disinfected before and after the preparation on each working day and maintained at all times in a clean condition;

(b) The area or equipment for cutting, deboning or further preparing fresh meat is reserved for those purposes only and such area is maintained at a temperature below 15^{o}c and appropriate humidity during such preparation; and

(c) A frozen meat is stored in a room or container at a temperature below minus 18^{o}C and as required under sub regulation 38(3).

(2) All appliances used in the course of meat processing shall be constructed of smooth and easily cleaned material that can resist corrosion and cleaned before and after its use.

(3) Any food handler who fails to comply with sub regulation (1) or (2) commits an offence and shall, on conviction, be liable to a fine not exceeding ten thousand ringgit or to imprisonment for a term not exceeding two years.

Carriage of meat

(1) A person who carries fresh meat shall ensure that the carcasses or any portion of the carcasses is carried as a hanging load or on racks to prevent or protect it from any contamination.

(2) Any person who fails to comply with sub regulation (1) commits an offence and shall, on conviction, be li able to a fine not exceeding ten thousand ringgit or to imprisonment for a term not exceeding two years.

Sale of meat

(1) A person who sells meat shall ensure that:-

(a) All chilled meat is stored at a temperature between minus 8-10^{o}c

(b) All meat on display or exposed for retail sale is kept in a refrigeration unit or an effectively insulated facility maintained at or below a temperature of 10^{o}C.

(2) Any person who fails to comply with sub regulation (1) commits an offence and shall, on conviction, be liable to a fine not exceeding ten thousand ringgit or to imprisonment for a term not exceeding two years.

The guidelines must at least cover the following points:

- Cleaning and disinfection of hands
- Eating, drinking, smoking and chewing gum
- Steps to be taken in the event of any injuries
- Fingernails, jewellery, piercings and watches

- Hair and beards
- Rules of veterinary inspection

Each member of staff must be provided with adequate protective clothing as well as headgear (eventually beard protection). There must be sufficient options to ensure hand hygiene and instruction signs on use of the disinfectant.
Hand hygiene facilities in the production facilities must at least fulfill the following requirements:

- Running hot and cold water from hands-free fixtures (sensor/knee switches)
- Liquid soap and disinfectant from dispensers
- Disposable towels or alternative methods (e. g. hand dryers)

If coat hooks are present, they must be mounted in a suitable and appropriate location.
A process must be in place for the regular monitoring of systematic implementation of staff hygiene in the company.

The findings must be evaluated and optimization measures taken where necessary. All persons whose activities directly affect product safety must have the necessary experience/training.

Production of meat that is safe and suitable for human consumption requires that detailed attention be paid to the design, implementation, monitoring and review of process control.

a. The establishment operator has the primary responsibility for
b. Implementing systems for process control. Where such systems are applied,
c. The competent authority should verify that they achieve all meat
d. Hygiene requirements.
e. Process control should limit microbiological contamination to the
f. Lowest level practicable, according to a risk-based approach.

Principles of meat hygiene applying to process control

i. HACCP should be applied wherever practicable as the system of choice for process control, and should be supported by prerequisite GHP that includes sanitation standard operating procedures (SSOPs).
ii. Process control should reflect an integrated strategy for control of hazards throughout the food chain, with information available from primary production and pre-slaughter being taken into account wherever possible and practicable.
iii. All bodies of animals should be subjected to post-mortem inspection that is science- and risk-based, and is tailored to the hazards and/or defects that are reasonably likely to be present in the bodies of animals presented for inspection

iv. The competent authority should determine the procedures and tests to be used in postmortem inspection, how that inspection is to be implemented, and the necessary training, knowledge, skills and ability required of personnel involved (including the role of veterinarians, and personnel employed by the establishment operator

v. Post-mortem inspection should take into account all relevant information from primary production, ante-mortem inspection, and from official hazard control programmes.

vi. Post-mortem judgements should be based on: food-borne risks to human health, other human health risks, e.g. from occupational exposure or handling of meat in the home, food-borne risks to animal health as specified in relevant national legislation, and suitability characteristics.

vii. Performance objectives or performance criteria for the outcome of process control and post- mortem inspection activities should be established by the

competent authority wherever practicable, and should be subject to verification by the competent authority.

viii. Where appropriate, microbiological testing, for verification purposes, should be included in meat preparation and manufactured meat HACCP plans. Such testing should be relevant to the type of product and the likely risks to consumers, including vulnerable sub-populations.

ix. Handling of ready-to-eat (RTE) products up until the point of sale to the consumer should ensure that there is no contact with non- ready-to-eat (RTE) products, and any other exposure to potential sources of microbiological contamination.

x. **Quality assurance (QA**) systems implemented by the establishment operator where they enhance meat hygiene activities, and they may be taken into account in the verification of regulatory requirements by the competent authority.

➢ 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 answer (2pt)

1 ……..have to be identified, critical limits be established and monitoring systems properly implemented.

A. HACCP C. hygiene
B. Critical control points (CCPs) D. None

2 All meat on display or exposed for retail sale is kept in a refrigeration unit or an effectively insulated facility maintained at or below a temperature of 10^{o}C.

A.True B. false

Test II: say true or false (8pt)

1. If visual contamination of manufacturing meat occurred, do not try to wash it off but remove it with knives by cutting off superficial meat parts in the case of minor contamination.
2. Ideally meat cutting/deboning should be carried out in acclimatized rooms (approx. + 10°C) with low air humidity.
3. Never take meat pieces, which accidentally had contact with the floor or other contaminated surfaces, back onto working tables or into meat processing machines.
4. Containers for meat, fat, or semi–or fully processed meat products must not be placed directly on the floor but on hygienic stands, pallets.

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

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

Information Sheet 4 Processing products with regulatory requirements

GENERAL REQUIREMENTS FOR ALL MEAT PROCESSING FACILITIES

1. General responsibilities of licensees and operators

a) The licensee of a meat processing facility must comply with the duties imposed by these regulations on a licensee for the premises for which he or she is the licensee.

b) The operator of a meat processing facility must comply with the duties imposed by these regulations on an operator for the premises for which he or she is nominated as an operator.

2. Cleanliness of premises, vehicles and appliances

a) The licensee or operator of a meat processing facility must ensure that the premises, vehicles and all appliances are maintained in a clean and sanitary condition.

3. Removal or destruction of refuse

The licensee or operator of a meat processing facility must ensure that—

a) All refuse at the premises is regularly removed and disposed of daily in a sanitary manner to the satisfaction of an inspector; and

b) No nuisance is caused by the destruction, removal or disposal of the refuse.

4. Prescribed records for abattoirs

a) For the purposes of section of the Act, the prescribed information to be recorded in a record book for an abattoir for each day's operation information relating to:-

II. Number of animals supplied;

III. Number of animals examined;

IV. Number of animals slaughtered including details of (animal species with their weight)

V. Number of animals removed;

VI. Number of carcasses and part-carcasses of various descriptions distributed;

VII. Weight of each category of meat distributed;

VIII. Animal species of carcasses, part-carcasses and meat distributed;

IX. Name, address and licence number of the person or company to whom carcasses, part-carcasses or meat is distributed.

(2)For the purposes of section of the Act, the prescribed information to recorded in a record book for an abattoir of all inedible meat removed from the abattoir must include—

I. The quantity and weight of meat removed each day and the total number of containers; and

II. The names of the consignees and the quantity of meat sent to each consignee; and

III. information in the form of

5. Prescribed records for general meat processing facilities other than abattoirs

I. For the purposes of the Act, the prescribed information to be recorded in a record book for a general meat processing facility other than an abattoir is information in respect of each day's operation relating to—

(a) Meat received including:-

I.Number of carcasses and part-carcasses of various descriptions received;

II.Weight of each category of meat received;

III. Animal species of carcasses, part-carcasses and meat received;

IV. Name, address and licence number of the person or company from whom the carcasses, part-carcasses or meat was received;

(b) Meat distributed including—

I. Number of carcasses and part-carcasses of each category distributed;

II. Weight of each category of meat distributed;

III. Animal species of carcasses, part-carcasses and meat distributed;

IV. Name, address and licence number of the person or company to whom carcasses, part-carcasses or meat is distributed.

6. Prescribed records for meat inspection depots

In addition to the records required to be kept under, for the purposes of the Act, the prescribed information to be recorded in a record book for a meat inspection depot (including premises where imported meat is received) is a record of all carcasses and meat received at the depot including—

A. The name and date of the owner or consignor; and

B. The date on which the carcasses or meat were received; and

C. The number and description of carcasses; and

D. The quantity and description of meat; and

E. The number and description of the carcasses and the quantity of meat condemned, and the reasons for condemnation; and

F. The method of disposal of condemned carcasses and meat; and

G. The name and address of each person to whom carcasses were delivered.

7. Prescribed records for knackeries

For the purposes of the Act, the prescribed information to be recorded in a record book for a knackery must be recorded daily in the form of

8. Prescribed records for pet food processing facilities other than knackeries

For the purposes of the Act, the prescribed information to be recorded in a record book for a pet food processing facility other than a knackery must:-

A. Include the amount of pet meat received each day;

B. Identify the premises from which the pet meat was obtained each day and the distribution of the pet food from the facility in the form of and

C. In the case of a retail pet meat shop include the purchases by that shop of pet meat each day in the form of

9. Records to be retained

All records required to be kept by the licensee under these regulations must be retained on the premises for 3 years and be available to an inspector on demand.

10. Refrigeration facilities

The licensee or operator of a meat processing facility must ensure that sufficient refrigeration facilities are provided at the premises.

1. Inspector to order temporary closure of premises

If an inspector considers that there is a potential danger to public health owing to uncleanliness or to the presence of infection on or about the premises where the processing is carried on, he or she may require the operator of the meat processing facility to:-

A. Take action to correct the method of production; or

B. Temporarily cease production; or

C. Temporarily cease production in any section of the premises and require the cleaning, disinfection or decontamination of the premises.

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

Short answer

1. What are the 2 General responsibilities of licensees and operators in for all Meat Processing Facilities? (2pt)
2. List 5 general requirements for all meat processing facilities.(3pt)
3. Define Prescribed records for abattoirs (2pt)
4. Explain about Prescribed records for meat inspection depots (3pt)

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

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

- **Reference Materials**

Book:

Guideline Processing meat and meat products
Meat Industry Guide
Workplace Health & Safety (Queensland)
WorkCover Corporation (South Australia)
WorkSafe Western Australia Workplace Standards Authority

Anil, A.M. and McKinstry, J.L. 1992. Th e eff ectiveness of high frequency electrical stunning in pigs. Meat Sci., 31:481-491. Anil, M.H. and McKinstry, J.L. 1998. Variations in electrical stunning tong placements and rela-tive consequences in slaughter pigs. Vet. J., 155:85-90. Becerril-Herrera, M., Alonso-Spilsbury, M., Lemus-Flores, C., Guerrero-Legarreta, I., Hernandez, A., Ramirez-Necoechea, R., and Mota-Rojas, D. 2009. CO2 Stunning may compromise swine welfare compared to electrical stunning, Meat Science, 81:233-237. Bellodi, L., Giampaolo, P., Caldriola, D., Arancro, C., Bertani, A., and DiBelle, D. 1998. CO2 induced panic attacks: A twin study, Amer. J. Psychiatry 155:1184-1188. Benjamin, M.E., Gonyou, H.W., Ivers, D.L., Richardson, L.F., Jones, D.J., Wagner, J.R., Seneriz, R. and Anderson, D.B. 2001. Eff ect of animal handling method on the incidence of stress re¬sponse in market swine in a model system. J. of An. Sci. 79:279 (Supl. 1) (Abstract). Berghaus, A. and Troeger, K. 1998. Electrical stunning of pig's minimum current fl ow time required to induce epilepsy at various frequencies. International Congress of Meat Science and Technology 44:10701073. Blackmore, D.K. 1988. Quality control of stunning. Proc. Of the Intl Congress of Meat Sci and Tech, CSIRO, Brisbane, Australia. Blackmore, D.K. and Peterson G.V. 1981a. Stunning and slaughter of sheep and calves in New Zealand. New Zealand Vet J. 29;99-102. Blackmore, D.K. and Newhook, J.C. 1981b. Insensibility during slaughter of pigs in comparison to other domestic stock. New Zealand Vet. J. 29:219-222.

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http://www.wsa.tas.gov.au/oh&s
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