

Training book 1

INDUSTRIAL MEAT PROCESSOR

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Introduction:

Pakistan is an agrarian economy and livestock is vital part of this sector. Livestock sector not only ensures food security, increasing per capita income of small, landless and subsistence level of farmers, but also contributing to the GDP of the country. There is a huge potential in meat sector including meat production, processing and value addition. However there is a gap in skilled human resource in this sector. In an era of rapid change across global consumers, Pakistan's valuable meat production/processing/retail industries need skilled professionals who can apply knowledge and skills to meet the demands of consumers and solve complex industry problems.

The prevailing conditions at municipal slaughterhouses, animal mandi, meat markets and butchery shops are poor and do not meet requirements for animal slaughtering, carcass transportation, meat and carcass storage and butchery operations. The food safety compliance is not up to mark in Pakistan and need substantial involvement as well as commitment of the stakeholders particularly of the regulatory department of the government for improving the existing food safety compliance of cattle meat value chain.

Keeping in view the demand of the meat sector, this curriculum developed. The contents of this curriculum booklet will develop an in-depth understanding of various aspects of meat processing, which introduces the course participants/trainees to key features of meat science, processing and technology. This booklet encompasses all stages of meat processing including meat science, introduction of the slaughterhouse/abattoir, ante-mortem post-mortem examination, slaughtering and dressing procedures including de-hiding, de-Skinning, evisceration, chilling storage and grading.

Background

The Government of Japan, in partnership with the Japan International Cooperation Agency (JICA), has indicated its interest to work together with UNIDO on an agri-business capacity building initiative to be implemented in two provinces of Pakistan, namely Khyber Pakhtunkhwa (K.P.) and Baluchistan. As a result of preliminary assessments and stakeholder consultations with the involvement of the Government of Pakistan and its relevant provincial bodies, the Project for Agri-food and Agro-industry Development Assistance in Pakistan (SAP ID: 180109) was finalized, aiming to pilot the enhancement of productive and compliance capacities of relevant actors in the cattle meat value chain in selected districts of K.P. (Peshawar, Abbottabad, Kohistan, and D.I. Khan) and apple value chain in Baluchistan (Killa Saifullah, Killa Abdullah, Pishin and Quetta).

The project will simultaneously support the relevant governmental bodies to offer adequate services to the industry sustainably and ensure the possibility of upscale best practices. The project is implemented in close cooperation with Livestock and Agriculture Departments in Khyber Pakhtunkhwa and Baluchistan and under the Ministry of National Food Security and Research's overall supervision. In particular, UNIDO will provide technical support to value chain actors to improve competitiveness by improving the quality and safety, and value of their products. This, in turn, can contribute to better marketability, higher profit, productivity, and access to high-end markets.

In this regard, a service agreement was signed between the Department of Meat Science and Technology, UVAS, Lahore and UNIDO for undertaking various cattle meat value chain related technical assistance in selected districts of Khyber Pakhtunkhwa, such as technical assessment of slaughterhouses, advisory support for related policy-making platform, research and capacity building training as part of the "Project on Agri-Food and Agro-Industry Development Assistance in Pakistan."

How the curriculum developed

This curriculum was developed as part of the "Project on Agri-Food and Agro-Industry Development Assistance in Pakistan" (PAFAID). And technically lead by the United Nations Industrial Development Organization (UNIDO). The task was completed by the curriculum development team at the Department of Meat Science and Technology, University of Veterinary and Animal Sciences, Lahore, Pakistan after detailed discussions/consultations between project partners i.e. Animal Husbandry In-Service Training Institute (AHITI) and KP Livestock and Dairy Development Department (L&DD).

Module # 01

Meat Science

MEAT SCIENCE

Learning objectives:

Upon completion of this module, the operators will be able to deliver training in the following areas:

- Anatomy of meat animals, various parts of body and organs of food animals
- Structure of muscles and muscle fibres
- Post mortem changes in muscles and their conversion to meat

Anatomy

Skeleton:

The skeleton is composed of some 200 bones. It protects the body's soft tissues and supports locomotion and body movement. The skeleton of the meat animals is divided into two parts: one comprising the vertebral column or the spine, ribs, sternum, and skull, and the second representing the bones of the limbs. The foreleg contains the scapula, humerus, radius and ulna, carpus, metacarpus, and digits composed of phalanges. The hind leg comprises the pelvic girdle (ilium, pubis, and ischium), femur, tibia and fibula, tarsus, metatarsus, and digits.

Digestive System:

Ruminant's stomach is composed of four compartments: the rumen, reticulum, omasum, and abomasum. Rumen makes 80% of the compound stomach in the adult animal, and food is digested in the rumen through fermentation. The abomasum is the true stomach that secretes gastric juices to digest proteins and peptides. The small intestine comprises the duodenum, jejunum, and ileum. Pancreatic and bile ducts join in the duodenum. Although the small intestines secrete a nominal amount of enzymes, their primary function is to absorb released nutrients. The large intestine is mainly involved in water balance and the absorption of minerals and volatile fatty acids. The large intestine primarily secretes mucous to aid material movement and terminates at the rectum or anus, where the body voids the waste matter. Three segments of the large intestine are the caecum, colon, and rectum. The caecum also acts as a secondary fermentation vessel, bacterial activity providing further food breakdown.

Respiratory System:

The respiratory system comprises the nose, nasal cavity, pharynx, larynx, trachea, and lungs. Respiration allows an adequate oxygen intake and removes carbon dioxide by bringing blood in the lungs into proximity with the alveolar air. The left lung has three lobes named apical, cardiac, and diaphragmatic. The right lung has four or five lobes.

Cardiovascular system:

The blood circulation system comprises of heart, arteries, veins, and capillaries. The heart acts as a pump to transport items to tissue cells, including food, and remove the waste products of their existence. The circulation consists of two pumps, the left and right sides.

Lymphatic system:

Lymph nodes are found throughout the body. They act as filters for foreign materials which enter the lymph. The lymphatic system provides a favourable environment for the

interaction of different cell types. Lymph is a clear watery fluid that is very similar to blood plasma except that it contains large numbers of white blood cells, primarily lymphocytes. The lymphatic system helps transfer oxygen and nutritive matter from the blood to the body tissues, removing waste products.

Muscle Structure

There are some 300 muscles in the animal body of different sizes, shapes, and functions, but each possesses the same basic structure. Muscles are made up of numerous tiny spindle-shaped multinucleated muscle cells or fibres, each encased in a thin membrane called sarcolemma. Groups of muscle cells joined by a loose connective tissue (endomysium) form bundles sheathed in the connective tissue perimysium and fatty deposits. The connective tissue epimysium covers the complete muscle. The epimysium membrane extends past the muscle fibres' termination to form the tendons that attach the muscles to the bone via the periosteum.

Each fibre contains filaments of protein, which in the presence of ATP converts chemical energy into mechanical energy. Thick filaments are formed by the myosin, a protein that contains areas with an affinity for bonding with ATP and the protein forming the thinner filaments, actin.

Muscle to meat conversion/Post-mortem changes

Contraction:

On receiving the signal from the nerve, the myosin attracts the actin and binds with it. Body energy in the form of ATP then breaks this bond, and the actin rebinds at the next available myosin head further down the thick filament, and the process repeats. After the repeated process, the shortening of the sarcomere happens in a gear manner.

Rigor Mortis:

It is the change in the carcass due to the chemical modifications after slaughtering. In cattle, rigor mortis is completed in around 18-24 h while in chicken, it takes about 8 h after the death. At higher temperatures, these changes are enhanced. This also helps to calculate the length of an animal's death. This process depends on many factors like species, age, size, fat, etc. In case of improper practices during the rigor mortis, e.g., exposure to very cold temperatures, the meat quality can worsen.

Importance of acidification to the characteristics of meat

In rigor mortis, carbohydrates are converted into Lactic acid. In the presence of lactic acid, the pH of muscle falls from 7.0-5.8. This leads to a reduction in the capacity of the muscle to bind water and tend to lose the usually bound water and the ability of meat to retain its water during the application of external forces such as cutting, heating, grinding, or pressing. When the meat is cut, the fluid exudes onto the cut surface, which becomes moist. Eventually, this exudate may produce a drip, which can collect in the meat container or be lost, leading to weight loss. The change in the proteins increases the light scattering properties due to which meat looks dark or light-coloured.

The resolution of rigor

Keeping meat at refrigerated temperatures is expensive. There is the cost of the storage space, refrigeration, and the inevitable weight loss from the surface of the carcass by

evaporation of water or the loss of exudate from butchered joints, as meat presence outside the refrigerator microbial growth will spoil the meat rapidly. Therefore, a compromise has to be reached commercially to produce meat with acceptable tenderness in a reasonable period.

The ageing process continues irrespective of the size of the carcass or at what stage of the marketing chain the meat has reached. Ageing time can therefore include time spent in distribution and retailing. However, it does not proceed in the frozen state as enzymatic activities stop but will continue again on thawing.

Module # 02

Introduction of the slaughterhouse/Abattoir

Module:

Introduction of the slaughterhouse/abattoir

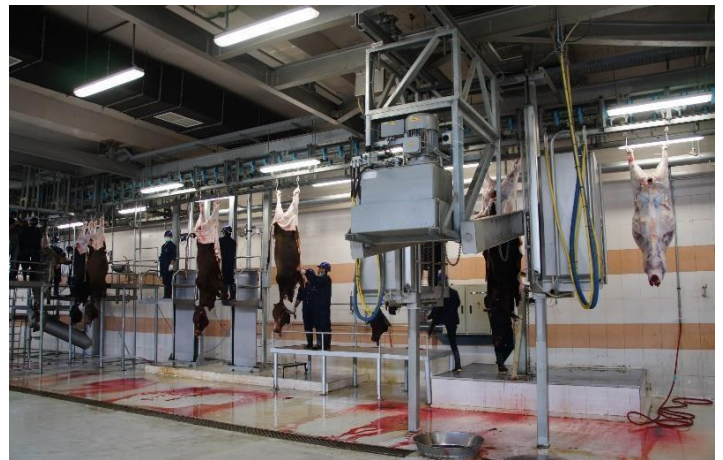
Learning objectives:

Upon completion of this module, the operators will be able to learn about:

- What are facilities required and responsibilities of abattoir staff regarding live animals
Receiving (Receiving, Holding, animal Wash) at the abattoir
- Basic requirements and design components regarding important structural elements of the slaughterhouse – (kill floor, boning room, retail cuts production, processed meat manufacturing)
- Various essential equipment in the modern slaughterhouses
- Layout and design of a compliant slaughterhouse to ensure food safety
- Cleaning, disinfection, and sanitation and their importance in food safety

Introduction

Slaughterhouse has the role of slaughtering and processing livestock (cattle, buffalo, horses, sheep, goats) shipped from the farmer and processing them into hygienic meat. Livestock carries many food poisoning bacteria in the intestines and body surface. They may also be infected with domestic animal infectious diseases, including zoonotic diseases. When slaughtering and processing performed unsanitary conditions and management, produced meat becomes a high-risk food.



Live cattle receiving

- (1) The roads, parking lots, and entrances and exits of buildings on the premises must be paved, so that vehicle operation is not hindered.
- (2) Proper platform should be available for animal unloading
- (2) A drainage for draining rainwater, etc., should be provided.

General items

- (1) Floors, inner walls, and ceilings.

The floor is made of impermeable and corrosion-resistant material. The floors have an appropriate slope for easy drainage. The structure should be easy to clean with no gaps.

The ceiling should be appropriate height, smooth, impervious, corrosion-resistant material. In addition, various pipes and lighting fixtures are not exposed in the room.

The windows shall be installed at the height of 0.9 m or more from the floor, and the window frame shall incline about 45 ° for hygiene.



The entrance and exit doors should be equipped with an automatically closed door (not the automatic door) made of corrosion-resistant material. The joint between the door and the wall should be sealed. To provide sufficient width because of prevention of contact between the carcass (product) and the door.



(2) Water supply and hot water supply equipment

Properly arrange the equipment that can supply the water (tap water or potable water) to be used sufficiently and hygienically. When using well water or private water supply, the water source should be provided at least 20 m away from places that may contaminate groundwater, such as toilets and waste collection points.

Equipment that can supply hot water above 83 ° C for cleaning and disinfection should be installed conveniently nearby.

The wash hose taps and hot taps should be placed in appropriate and convenient locations and have suitable shelves or frames for hanging the hoses.

3) Sewage and waste treatment

Drainpipes should be installed in the work area, and traps should be installed in the drain.

Drain pipes should be connected directly to the drain.

Drainage should not drain on the floor.

The facility requires a non-hole waste storage container with a lid. The container is made of an impermeable material, and it is easy to clean and does not leak odorous sewage. The container should be easily accessible to the waste collection site.



4) Instrument cleaning and disinfection room

A cleaning, disinfection room, or areas are provided conveniently for cleaning and disinfecting transport vehicles, containers, and equipment.

(5) Pest control

The following measures must be taken to prevent the invasion of mice and insects.

- Effective measures are required to prevent the invasion of rats and insects, such as installing wire mesh at windows and intake/exhaust ports open to the outside and installing iron bars at drainage ports.
- The entrance and exit doors should be equipped with an automatically closed door (not the automatic door) to prevent the invasion of mice and insects.



6) Hand washing equipment

The hand-washing equipment should be clean and in a convenient location.

Sufficient numbers and size for employee numbers are needed. The hand-washing facility is equipped with water supply facilities for washing hands and arms and a sufficiently large and appropriately high water tank made of durable materials such as stainless steel.

Place a container for liquid soap and paper towels and a container for disposing of them.

Do not use water that is stored in the water tank.

Drainage pipe of hand-washing equipment should be connected directly to drain.

Hand washing equipment at the workplace should be foot-operated or automatic.



(7) Changing rooms and toilets

Changing rooms and toilets should be clean and enough number and space of employee number. Changing rooms and toilets should be located conveniently.

The toilet is completely separated from other places by a bulkhead. The structure does not allow us to go to the toilet directly from the workplace, so it provides a walkway or space for installing a doorway between the toilets and the workplace.

Individual items

1) Slaughtering room

A dry landing zone should be an area of at least 2.2m x 2.5m. The space need equipment that prevents escaping cattle from the dry landing zone. In the Bleeding area, a phlebotomy rail with 4.9 m or more height must be installed to avoid contamination from floor to carcass. A device for cleaning and dehorning the head is needed. The height of the dismantling rail should be 3.4 m or more. When using a conveyor-type built-in inspection table, the height must be 3.8 m or more.

In the skinning area, equipment to prevent carcass contamination during peeling is needed.

Disinfecting equipment for a carrier of internal organs is needed.

Carcass cleaning area and cleaning equipment are provided. Equipment that does not scatter the cleaning liquid is required.

The place for post-slaughter inspection (head inspection, visceral inspection, carcass inspection) must be enough space. And following requirements are needed.

- Table of structures and materials that can be quickly and hygienically inspected, other necessary equipment, and water and hot water supply equipment for cleaning and disinfecting them.

- Meat inspection equipment and water and hot water supply equipment for cleaning and disinfecting fingers are required.

- Pending carcass rail is required.

- Enough space of room or place is provided for final carcass inspection after of the carcass after splitting.

(2) internal organs handling room

The internal organs processing room has an appropriate size, and it is located in a convenient place for work.

A gastric lavage device and an intestinal lavage device are needed.

Edible places and inedible places are separated, and these places should be arranged appropriately.

(3) Skin storage room

A skin storage room should be installed not to affect the carcass and internal organs when skin is moved. The skin should not be removed from food outlets.

(4) Carcass refrigeration room

The refrigerating carcass room is enough space to inspect carcass products. And following requirements are needed.

The rail should be a 3.4 m or more height from the floor and 0.6 m or more distance from wall or machinery to prevent carcass contamination.

A holding cage with a lockable structure should be provided.

5) Meat processing room (boning room, retail cuts production, processed meat manufacturing)

At receiving raw materials place and transporting products place, meat processing room should not be connected directly to outside. The meat processing room has a cooling device for keeping room temperature (10 ° C or 15 ° C or less).

(6) Refrigerator for product storage

A dedicated refrigerator for product storage is required.

(7) Storage of packaging materials room

Storage for packaging materials room should be provided in a convenient place.

Packaging materials should be stored with shelves at 0.3 m or more height from the floor.

(8) Wastewater disposal facility

The sewage treatment facility should be located at an appropriate distance from the slaughterhouse and meat processing facility.

(9) Waste treatment facility

Waste treatment facilities should be located at the slaughterhouse and the meat processing plant.

The waste treatment facility must be constructed with impermeable material. Waste storage containers have a lid, and the container is easy to clean and with impermeable material. Sewage and sewage odorous in the container do not leak outside.

HAZARD ANALYSIS CRITICAL CONTROL POINT (HACCP)

What is HACCP?

Internal sanitary-related control and monitoring system in food plants to prevent/minimizing or eliminating health hazards to consumers. HACCP identifies, evaluates, and controls risks, which are significant for food safety. The characteristics of HACCP are:

- ☐ Potential for immediate prevention measures before or during production to counteract suspected or emerging health risks

- ☐ Exclusively aimed at health risks to consumers

Food plant internal control procedures based on HACCP principles have become an obligation worldwide in many countries with advanced food industries. The competent authorities impose HACCP procedures on relevant food plants, whose task is to assess and evaluate HACCP's

correct application and conduct. The food plants themselves are responsible for properly implementing HACCP, such as monitoring sensory, physical, and chemical parameters during production and immediate intervention in case of emerging health risks and recording results.

Requirements for the introduction of HACCP schemes are yet different from region to region. In several countries (e.g., EU, US), meat plants, in general, have to comply with HACCP, whereby for smaller plants or such specializing in limited activities or products, simplifications or exceptions exist. In some other parts of the world, HACCP schemes are not yet commonly introduced. However, it can be anticipated that such plants involved in the regional or global food distribution will also be obliged to comply with HACCP principles.

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, establish critical limits, and implement monitoring systems.

The HACCP scheme is subdivided into seven consecutive steps (“principles”).

Through these seven HACCP principles, a practical approach is provided to identify potential significant hazards to consumers’ health and to take relevant corrective actions:



Module # 03

Ante-mortem Examination

Ante mortem Examination

Learning objectives:

Upon completion of this module, the trainees will have will be able to learn about:

- Basic objective of conducting Ante-mortem in meat animals
- Procedure of conducting Ante-mortem in meat animals
- Various conditions which can lead to rejection of animals for slaughter
- Knowledge about reportable and notifiable diseases

1. Introduction

Purpose

The purpose of ante-mortem inspection is:

- to determine whether there is any sign of any condition which might adversely affect human or animal health
- to enable the Official Veterinarian (OV) to make the decisions as to whether the animal can be slaughtered for human consumption
- to inform possible adjustments during post-mortem inspection
- to determine whether any test should be carried out in relation to disease diagnosis or for residues of veterinary medical products
- to determine whether welfare has been compromised
- examination of food chain information

Particular attention should be given when zoonotic or notifiable diseases are a possible diagnosis.

Inspection tasks

The OV must carry out the ante-mortem inspection.

The Veterinary assistance (VA) may assist the OV with some pre-slaughter tasks. In relation to ante-mortem inspection and welfare checks they can make an initial check and help with purely practical tasks.

The VA must alert the OV to abnormal animals identified pre-slaughter.

Circumstances where ante-mortem inspection has been undertaken by an OV at the holding of provenance

Where the ante-mortem inspection has been carried out by an OV at the holding of provenance a VA can undertake the ante-mortem inspection required in the slaughterhouse on all species when certain criteria are met, under the responsibility of the OV, for example, without the OV being present.

The VA must alert the OV to abnormal animals identified pre-slaughter and the OV must then carry out the ante-mortem inspection.

VAs cannot be involved in ante-mortem inspections in the following circumstances:

- animals have undergone emergency slaughter.
- animals suspected of having a disease or condition that may adversely affect human health.
- bovine animals from herds coming from non-commercial farms or from farms outside the province (which they don't apply the cow book and identification system);
- bovine animals from herds from holdings that have not been declared officially free of zoonosis and transmissible diseases (as brucellosis, FMD, TB etc.) or the officially free status of which has been suspended.
- where animals are subject to stricter controls due to the spread of emerging diseases or particular diseases listed by the World Organisation for Animal Health.

Inspection and verification	By
Observing animals at unloading (random)	OV / VA
Initial checks	OV assisted by VA
Ante-mortem inspection	OV assisted by VA
Completion of ante-mortem record	OV / VA
Completion of pen cards	OV / VA

Enforcement	OV
Checks following ante-mortem at the holding of provenance	OV or VA acting under the responsibility of the OV

Verification of FBO responsibilities

Introduction

The FBO has a number of responsibilities that the Livestock department are required to verify are fulfilled. Informal or formal enforcement action may be necessary where these responsibilities are not met.

Ante-mortem inspection

The FBO must follow the instructions of the OV to ensure that ante-mortem inspection of every animal to be slaughtered is carried out under suitable conditions.

Where animals are slaughtered without ante-mortem inspection, the OV must declare the meat from such animals unfit for human consumption.

Where the FBO refuses to dispose of the meat, the OV must enforce the FBO at the higher level.

Ante-mortem inspection at the holding of provenance

The competent authority (livestock department) may allow ante-mortem inspection of all species of animals intended for slaughter to be performed at the holding of provenance. This must be first agreed by the food business operator responsible for the holding of provenance and the Livestock department.

The following checks must be carried out at the slaughterhouse:

- on records or documentation at the holding of provenance, including verification of the food chain information;
- to ascertain if there is evidence or reason to suspect that the animals may contain chemical residues in excess of the levels or residues of forbidden substances;
- for signs indicating problems related to animal welfare, including excessive dirtiness;
- that they were fit for transport.

The animals fit for slaughter shall be properly identified and separated from other animals and sent directly to the slaughterhouse together with the cow book and the health certificate completed by the OV.

Where animals are not slaughtered within three days from the date of issue of the health certificate then:

- where the animals have not been dispatched from the holding of provenance to the slaughterhouse, an additional ante-mortem inspection shall be carried out and a new health certificate shall be issued; or
- where the animals are already on their way to or are at the slaughterhouse, the slaughter may be authorised as soon as the reason for the delay has been assessed, provided that the animals undergo an additional ante-mortem inspection in accordance at the slaughterhouse.

Cleanliness of the livestock

The OV must verify that the FBO is presenting animals that have a clean hide, skin or fleece, so as to avoid any unacceptable risk of contamination of fresh meat during

slaughter. If dirty animals are presented for the AMI, the OV should not give the authorization to slaughter them

Health status and identity

The FBO must have procedures in place ensuring that each animal or batch of animals accepted into the slaughterhouse:

- are properly identified
- are accompanied by the relevant information from the holding of provenance (Owner declaration and/or cow book)
- are not from areas under disease control with movement restrictions unless the Competent Authority (CA) so permits
- are clean
- are healthy, as far as the FBO can judge
- are in a satisfactory state as regards to welfare

If the FBO is aware of any animals that do not comply with any of the above then the OV must be notified.

Isolation facilities must be used for suspect animals.

Animals accepted at the slaughterhouse

The FBO only accepts animals that are alive into the slaughter establishments, with the exception of:

- animals that have undergone emergency slaughter outside the slaughterhouse (cattle only)

Note: It is permitted to slaughter on farm in 'exceptional circumstances' such as those that would put human health or animal welfare at risk if the animals were transported live.

Acceptance of animals slaughtered on farm

Any animals (including bison) slaughtered on farm, must be inspected at ante-mortem by an OV as soon as practicable before the slaughter date.

Please note that the OV is a veterinarian designated by the CA to carry out specific official controls on holdings on its behalf.

The bodies must be accompanied by the relevant documents:

- Veterinary health certificate.
- Owner declaration
- Cow book

A Veterinary Surgeon can slaughter an animal for human consumption as part of their professional duties in exceptional circumstances (as long as there is not conflict of interest) or they can physically monitor and guide an expert animals handler to carry out this duty. Bodies of animals slaughtered on farm must be transported hygienically and without undue delay. If transport takes more than two hours, it should be under refrigeration.

If necessary, the animals may be eviscerated at the site of slaughter under the supervision of the OV.

Dead on arrival (DOA) and dead in lairage (DIL)

Bovines:

The FBO should report DOA and DIL bovines to the livestock department. The Authority will value to arrange for the body to be collected and tested for any zoonosis or transmissible disease (as Tb, FMD, brucellosis or TSE etc.).

Lairage period

Animals must be slaughtered without undue delay.

Movement from slaughterhouse

The animals cannot leave the abattoir lairage once unloaded and they must be slaughtered as soon as possible.

Procedures

Ante-mortem inspection procedures

Observations

The OV must observe each animal moving and at rest. The inspection must be sufficient to identify animals showing neurological symptoms, respiratory symptoms, alimentary tract abnormalities, change in gait, or external abnormalities.

Where there is a field lairage or buildings which they belong to the slaughterhouse, then animals can move freely between the slaughterhouse lairage and the field lairage.

Where animals are held in fields or buildings associated with the slaughterhouse but not officially belong to the slaughterhouse, the OV should under no circumstances carry out ante mortem inspection or any other Official duties in these areas. Animals cannot move from the slaughterhouse back to the field or buildings which they are not officially belong to the abattoir.

Initial check

Routine ante-mortem inspection may begin with an initial check done by the VA.

Where a suitably trained VA assists the OV in carrying out the initial check, the OV should subsequently observe all the animals interacting with each other in their pens during ante-mortem inspection.

The initial check, if undertaken by the OV, may suffice as to constitute an adequate ante-mortem inspection.

Clinical inspections

In addition to routine ante-mortem inspection, the OV is required to carry out a clinical inspection of all animals which do not appear to be 'normal' and those that the FBO or an VA may have put aside.

Note: Clinical inspection does not necessarily require the OV to undertake a clinical examination, although this should be undertaken if warranted.

Considerations

Two important variables must be taken into consideration by the OV when performing ante-mortem inspection:

- every slaughterhouse and lairage layout are different
- the OV may require different conditions for inspecting the different animals

Consequently, the OV must explain their ante-mortem requirements to the FBO to ensure that appropriate facilities and access are available.

Facilities and equipment requirements

To be able to carry out satisfactory ante-mortem inspections, clinical inspections and detailed examinations, the OV must have available the following facilities and equipment:

- adequate lighting
- adequate space
- adequate access
- adequate separate facilities for detailed examination (a crush or equivalent is desirable but not legally required – the OV should arrange suitable facilities with the FBO)
- isolation pen(s) or area for suspect animals with separate drainage and situated as to avoid contamination of other animals.
- staffing assistance (for handling or restraint)
- sufficient time
- proper equipment, for example, thermometer and stethoscope

Time of ante-mortem inspection

The inspection must take place within 24 hours of arrival at the slaughterhouse and less than 24 hours before slaughter. Where ante-mortem is carried out at the holding of provenance then it must be undertaken within 3 days of the animals being slaughtered. In some cases, ante-mortem inspection may need to be repeated. The OV may inspect the animal(s) at any other time.

Exception to OV ante-mortem inspection at the slaughterhouse

OVs must carry out ante-mortem inspection at the slaughterhouse except in the following situation:

- An appointed OV has carried out ante-mortem inspection at the holding of provenance and all the documents has been received by the FBO where additional checks will be carried out and may be conducted by a VA inspector as described above.
- The VA is satisfied that the:

The documents do not point to any possible problem for food safety checks indicate the animal's welfare has not been compromised the VA has checked the health certificate and found it to be satisfactory the OV must ensure, through regular checks that the VA is carrying out such actions properly.

Note: Animals that have undergone ante-mortem at the farm by an appointed OV must come with a health certificate.

Note: The VA must have undergone required training in these duties before undertaking this work.

Emergency slaughter at the slaughterhouse

If an animal has an accident in a slaughterhouse, it must have veterinary ante-mortem inspection either before or just after the accident in order for it to be slaughtered for human consumption. To protect animal welfare where such an accident occurs out of hours, and the OV is not available, the ante-mortem inspection may be carried out by another appointed OV.

The OV must complete and sign the certificate for emergency slaughter.

The FBO is responsible for any costs incurred in such a circumstance; the carcase and all body parts must be retained for cold inspection by the OV.

Meat from animals that undergo slaughter following an accident in a slaughterhouse may be used for human consumption if:

- the animal had a veterinary ante-mortem inspection either before or after the accident
- the post-mortem inspection is performed personally by the OV

- at post-mortem inspection, no serious lesions other than those due to the accident are found
- the meat went through drug residues (including bison)

Meat is to be declared unfit for human consumption if it derives from animals that have not undergone ante-mortem inspection.

FBO responsibility

The FBO shall ensure that any animal that has experienced pain or suffering during transport or following arrival at the slaughterhouse is slaughtered or killed immediately.

FCI

When the FBO passes all the documents to the OV, the OV should use their professional judgement and take into account the information provided when performing ante and post-mortem inspection.

Reference: When the documents and/or other data (from farm of origin or ante-mortem inspection) indicates possible risk to public health, animal health or animal welfare, the OV can instruct the FBO to mark/identify those animals for further inspection procedures (FIP) at post-mortem inspection to decide if the meat is fit for human consumption.

Examples: conditions in ante-mortem justifying FIP at post-mortem

For the majority of the conditions listed on the current ante-mortem inspection sheet there would be no need for pigs to be marked to undergo FIP at post-mortem.

However, the following may justify FIP:

- mastitis (if associated with general signs)
- moribund / recumbent
- Orchitis (marked to consider brucella, occupational zoonoses)
- suspect emaciation, poor condition
- suspect fever
- slaughtered in lairage

Note: the OV is not limited to these conditions and should use their professional judgement.

Cleanliness of animals for slaughter

The OV must verify that the FBO complies with his duty to slaughter only animals that are sufficiently clean and record the details, if in their opinion the animals are too dirty to be processed hygienically.

The procedures in place to deal with animals that are soiled and the ability of the FBO to process those animals must be taken into consideration.

Ante-mortem inspection records

The OV must keep records of the ante-mortem inspection and keep these records for an year time.

When animals can be moved from lairage to slaughter

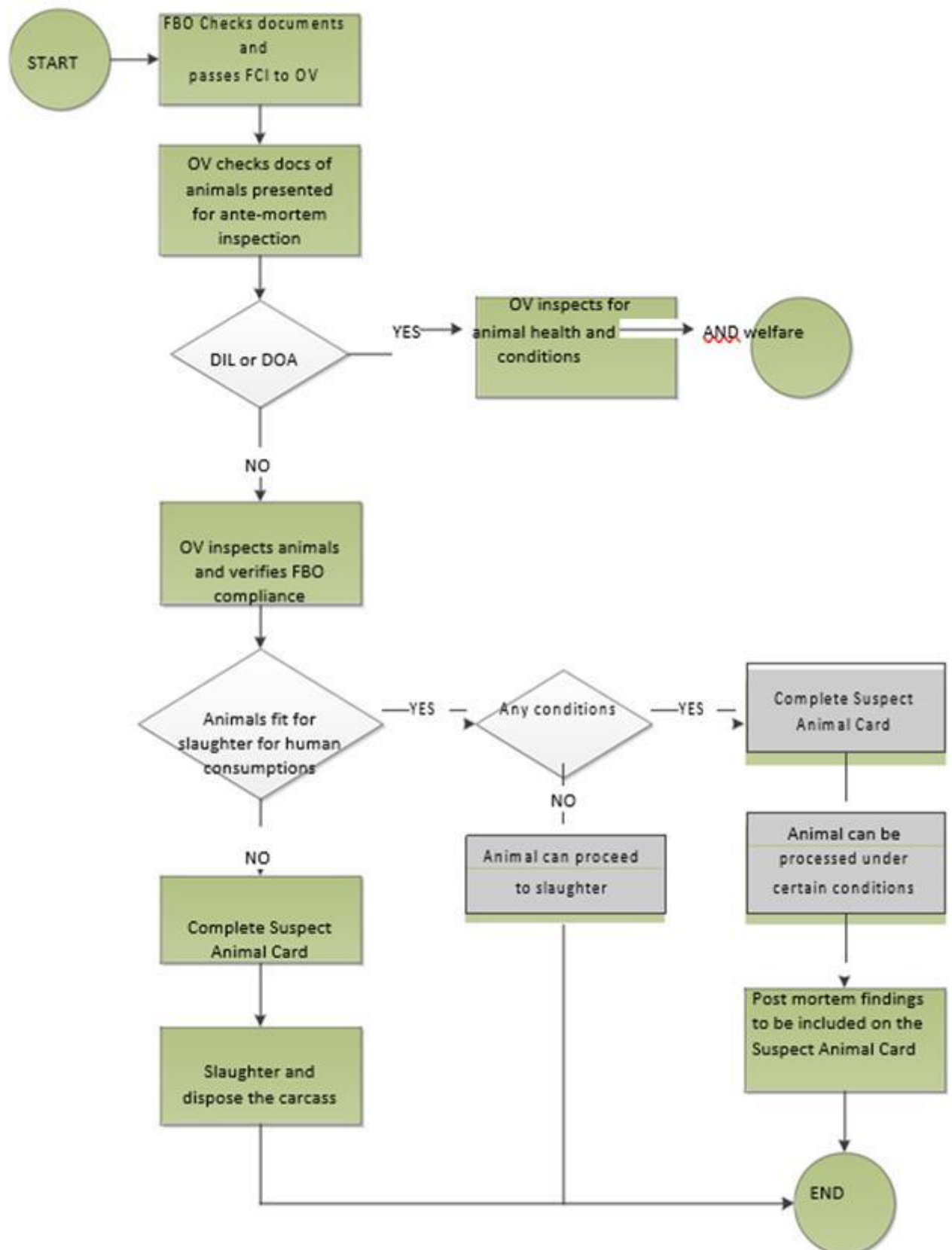
The OV must be satisfied that an effective positive release system is in operation to ensure that every animal that requires ante-mortem inspection:

- receives it when it is required
- is only slaughtered for human consumption when ante-mortem inspection has been carried out and has been passed fit for slaughter

Animals must not be moved from the lairage to be slaughtered for human consumption until:

- ante-mortem inspection has been completed, recorded and signed by the OV, and
- any conditions for suspect animals have been met

Ante-mortem inspection summary



The flowchart below summarises the procedure for ante-mortem inspection.

Suspect live animals

Slaughter of suspect animals

Suspect animals are to undergo detailed ante-mortem examination in order for the OV to make a decision whether the animal is fit for slaughter for human consumption.

The OV must defer the slaughter of animals suspected of having a disease or condition that may adversely affect human or animal health. The FBO should hold the animal(s) in isolation pending the OV's final decision.

All the animals coming from no-commercial farm or from farm outside the province and the Livestock competence area should be declared and approached as suspected animals.

OV judgement

Each OV should make a professional judgement based on the documents, ante-mortem inspection or any other information presented, as to which animal/s should be further examined. Such an examination may include taking of appropriate samples.

Examples of suspect animals

Examples where the OV might identify suspect animals are where:

- animals show clinical signs of illness, disease or disorder
- animals show clinical signs of a disease transmissible to man or animals, especially a notifiable disease
- animals show clinical signs of a disease or disorder likely to make fresh meat unfit for human consumption
- animals show signs of fatigue or stress
- Animals coming from no-commercial farm or from farm outside the province and the Livestock competence area.

Note: they must be rested for not less than 24 hours unless the OV has determined otherwise

OR

- there is evidence or suspicion that illegal or unauthorised substances have been administered, or there may be veterinary medicines in excess of maximum residue limits present in the animal

Veterinary medicines

Animals that might contain residues of veterinary medicinal products in excess of the levels allowed or residues of forbidden substances are to be sampled

OV action

Where a suspect animal has been identified the animal should be removed to an isolation pen and a suspect animal card completed.

The VA conducting the post-mortem inspection of a suspect animal must be informed of the circumstances by the OV to ensure that ante-mortem and post-mortem findings are correlated and recorded.

Emergency slaughter on farm**Authorities purpose**

The Livestock Department (LD) is the Authority for enforcement in the farm, during the transit of animals from the farm to the slaughterhouse and in the Market. The LD must be contacted by the OV if any breaches are suspected during the transport of the animals.

Definition

Meat from a red meat animal that has undergone emergency slaughter outside the slaughterhouse, following a veterinary ante-mortem, may be used for human consumption only if it is from an otherwise healthy animal that has suffered an accident that prevented its transport to the slaughterhouse for welfare reasons.

OV attendance

The OV needs to be present during the post-mortem inspection of any animal that has undergone emergency slaughter.

The OV should note any injuries that would indicate an on-farm welfare problem and if these are present, Live Stock must be informed.

Declarations

Where an ungulate is required to undergo emergency slaughter a health certificate is required to be completed indicating a favourable outcome of the ante-mortem and accompany the slaughtered animal to the slaughterhouse for examination by the OV.

Any observations relevant for subsequent meat inspection shall be recorded in the health certificate including details of any treatment administered by the Private Veterinarian to the animal.

Eligibility

Please follow the steps in the table below with regards to eligibility:

Step	Action
1	Confirm animal eligible by checking: - owner / keeper's declaration - veterinarian's health certification, must include details of ante-mortem and date and time of slaughter - verify that the identification of the animal matches that on the declaration and cow book passport of a bovine animal - transport time / chilling requirements complied with - any other eligibility regulations for human consumption (example TB restrictions on farm).
2	Check if any testing is required, for example, TSE, FMD, TB etc.
3	Post-mortem inspection must be carried out by an OV at the slaughterhouse. Note: The OV can require any additional tests.

Exceptional circumstances: bison

In exceptional circumstances, bison may be slaughtered on farm.

OV action in the case of discrepancy

The following table details the actions that the OV should take where discrepancies in eligibility occur.

Step	Action
1	In all cases, first contact the Private Veterinarian who attended the animal.
2	Where the Health certification is not completed correctly and in particular does not have the date and time of emergency slaughter completed, please refer to the section on Declarations (above) for appropriate action to be taken.
3	Keep the Private Vet Health certification received in a secure file and record the Circumstances.
4	Record the results of post-mortem Inspection and correlate with the Private Veterinarian health certification
5	Any welfare concerns should be reported to Livestock Department.
6	Where discrepancies in the health certification are identified and the Private Veterinarian is unable to supply a correct declaration, the carcass should not be declared fit for human consumption and must be rejected as unfit because it is not in compliance with the requirements of the legislation.

Examples of possible discrepancies

The following list is provided for illustrative purposes and is not considered to be exhaustive:

- The OV has verifiable evidence to support the opinion that the animal has not suffered a genuine accident.
- The health certification has been altered after completion without initials to confirm authenticity.
- The Private Veterinarian was not present at the time of slaughter of the animal and / or the health certification does not give enough information to the OV in order to be ensure that the animal had an accurate AMI and / or is not conform to the requirements described above, including failure to record the date and time of emergency slaughter.
- Transport / time / chilling requirements have not been adhered to.
- The number of animals received from a single source is excessive.
- The OV has obtained verifiable evidence to demonstrate animal welfare breaches.

Declaration

An animal may be accompanied by a farmer's declaration that the animal is known or suspected to be injured or showing signs of abnormality.

FBO responsibility

The farmer/owner who reared the animal must ensure that:

- A declaration stating the identity of the animal and indicating any veterinary products or other treatments administered to the animal, dates of administration and withdrawal periods, has accompanied the dead animal to the slaughterhouse. Also the cow book must be attached to the declaration.
- A veterinarian has carried out an ante-mortem inspection of the animal and completed a health certification (date and time, reason for the emergency slaughter and the nature of any treatment).
- The slaughtered and bled animal has been transported to the slaughterhouse hygienically and without undue delay. Removal of the stomach and intestines, but no other dressing, may have taken place on the spot, under the supervision of the veterinarian. Any viscera removed has accompanied the dead animal to the slaughterhouse and has been identified as belonging to that animal.

If more than two hours elapse between slaughter and arrival at the slaughterhouse, the animal must be refrigerated. Where climatic conditions so permit, active chilling is not necessary.

The FBO of the slaughterhouse must verify that all the above requirements have been followed. The FBO must provide all the above documents and details to the OV at the slaughterhouse and follow any instructions during the post-mortem inspection (including any additional tests required) concerning the use of the meat.

Slaughter of fractious animals

Domestic bovines that are considered fractious, dangerous or not handleable and which the FBO intends to enter into the human food chain can be slaughtered on-farm in exceptional circumstances.

It should be permitted on a case-by-case basis, where such animals cannot be transported because transportation would present either a health or safety risk to their handler or a welfare risk to the animal.

Authorisation by the Livestock department is required and must be informed in advance of the date and time of slaughter of the animal(s).

Other conditions that must be met are:

Step	Action
1	The owner of the bovine must submit a request to the FBO (at the slaughterhouse).
2	The herd undergoes regular Livestock inspection and details are available.
3	The circumstances are discussed between the Livestock department and the FBO and OV (at the receiving approved slaughterhouse) before any action is taken.
4	Prior agreement has to be reached between the OV at the slaughterhouse and FBO that the body of the animal can be consigned to the slaughterhouse for processing.
5	Animal welfare requirements are complied with.

6	The Veterinarian on-farm must issue a health certificate attesting to a favourable result of the ante-mortem inspection, correct slaughter and bleeding and the date and time of slaughter. This will require a Livestock Department OV to be present at the time of slaughter and bleeding. The health certificate is to accompany the slaughtered animal during transport.
7	The appropriate declaration must be duly completed by the farmer/owner who reared the animals, confirming their identity and indicating any veterinary products or other treatments administered, dates administered and any appropriate withdrawal periods. This must accompany the slaughtered animal to the slaughterhouse.
8	Correct animal identification must be provided (cow book up to date with readable silhouette and description of the bovines if any other identification system is not used)
9	Slaughtered and bled animals are transported to the slaughterhouse hygienically and without undue delay. If transport takes more than two hours, the animals are, if necessary, refrigerated. Where climatic conditions so permit, active chilling is not necessary
10	The OV must be present when the body arrives, and carry out the post-mortem inspection

Some of the reasons for declaring the meat unfit for human consumption may include;

- Where the document/declaration accompanying the animal fails to comply with the information requirements. This failure must result in the animal or meat from the animal being declared unfit for human consumption by the OV.
- If the decisions concerning live animals have not been complied with, the OV must declare the animal unfit for human consumption; this could include where the animal's identification is not reasonably ascertainable or where animals are subjected to treatment with veterinary medicinal products in excess of permitted levels or where there is suspected presence of veterinary residues because the required withdrawal period has not been complied with.
- Where any of the many decisions concerning meat have not been complied with, the meat must be declared unfit for human consumption: this may include failure to have undertaken an ante-mortem inspection (by the Vet on the farm); failure to have conducted a post mortem inspection (for example: when the offal has been discarded prior to post-mortem inspection) may also be a reason for declaring the animal or meat derived from it as being unfit for human consumption. The carcase and all by products would be required to be disposed of as Animal By Product.

Record keeping

Record keeping purpose

Purpose

- To record disease conditions for disease surveillance purposes (Livestock department uses it to map the region and organize inspections and future plans)
- To indicate to the FBO that the OV has passed or rejected the animal for slaughter for human consumption.

- To meet statutory obligations to maintain records and supply FBOs, producers, veterinarians and the Livestock department with relevant information.

Positive release pen card

Purpose

The pen card may be used to identify, to the FBO that the animals have been inspected and found as suitable to be slaughtered for human consumption without additional conditions. It should be clearly displayed on the pen after satisfactory ante-mortem inspection.

Completion

Plant operatives enter stock details.

The OV authorises slaughter by signing the positive release pen card.

Retention period

Completed pen cards should be retained for 6 months. They may be used to check that only animals which have undergone ante-mortem inspection are slaughtered.

Alternative arrangements

The pen card system may be unsuitable in some establishments. An equivalent system that achieves the same outcome may be used.

Suspect animal card

Purpose

This card must be used to identify animals considered suspect but which may still be suitable for slaughter. It must be completed by the OV and accompany the animal on transfer to an isolation pen.

Multiple suspect animals

Suspect animal cards may be used for groups of animals where the OV considers it impractical to use one card for one animal.

Where to display

The suspect animal card must be attached to a suitable position on the isolation pen.

Retention of suspect animal cards

The OV must notify the Meat Inspectors of any suspect animal and ensure the subsequent post-mortem findings are recorded.

The suspect animal card must be used to record the post-mortem findings and retained for 12 months.

Use of ante-mortem inspection records

Ante-mortem inspection records

An Ante-Mortem Inspection Record sheet must be used unless the FBO provides an alternative containing at least the same information. On the AMI record sheet, the OV should note the animal identification, the farm of origin and any observation about the health status of the animal.

Who completes the AMI record sheet

Competent lairage staff may complete details about the animal identification of the farm of origin. The OV must double check these information and write any animal observation.

Information to include

The OV must complete details of the date and time of inspection and the OV signs the AMI record sheet. The 'Comments / Action' column must include:

- details of any abnormalities noted and any subsequent actions required
- arrival of emergency slaughter animals

Note: ante-mortem details must be completed and the positive release box initialled by the OV to indicate that the animal and the documentation have been checked and found satisfactory; the VA may initial this box in the absence of the OV

- arrival of farmed game slaughtered on the farm

AMI

A daily Ante-Mortem Inspection Record sheet must be completed and signed by the OV on each day the establishment operates.

Information to include on the daily Ante-Mortem Inspection Record sheet

The OV must record:

- date and timing of the AMI
- one record sheet per batch of animals which they came together
- farm or owner details for traceability
- each occurrence of a condition identified at ante-mortem inspection
- each occurrence of a condition resulting in the animal not being processed for human consumption
- the total number of animals presented for ante-mortem inspection
- Any recommendation for the PMI

Note: The OV is to retain the completed daily form for a year time.

FBO daily ante mortem animals checks sheet.

Competent lairage staff may complete a form where all animals details are recorded as place of origin, transport details, species/number of the animals, any abnormality noticed, any issues noticed and where the animals are accommodated in the lairage.

4. Movements

Movement of live animals from slaughterhouse

OV action

Animals that are presented to a slaughterhouse for slaughter must be slaughtered there unless moved under the authority of a licence issued by Livestock department.

Unidentified animals

Animals whose identity cannot be reasonably ascertainable must be declared unfit for human consumption. They cannot be returned to their farms of origin.

Movement of cattle

Cattle sent to the wrong type of abattoir can be moved to a correctly authorised abattoir. The FBO should apply to Livestock Department for a licence. This applies to the following cases:

- cattle sent to an abattoir where there are not facilities to process such animal, may be moved to an appropriately approved abattoir

Fields and buildings used in connection with the slaughterhouse operations

Fields which are part of curtilage

Field lairages within the curtilage of the approved slaughterhouse are part of the slaughterhouse and therefore the responsibility of the FBO. These field lairages are part of the approved slaughterhouse and must have the same licence number.

Animals can therefore move into such a lairage.

The slaughter of the animals must not be unduly delayed, and the OV should monitor this, informing FBOs of their responsibilities.

Fields which are not part of curtilage

If the field (and this can also be extended to barns or other buildings used to keep animals) used in connection with the slaughterhouse business has a different licence number, then even if adjacent it is effectively a different holding and subject to different rules.

These adjacent fields (or buildings) are not part of the approved slaughterhouse and must not be included in the curtilage.

These adjacent fields (or buildings) must comply with rules for the farms or markets. They cannot serve as destination for animals moving direct to slaughter or via a slaughter market or collection while under standstill.

The OV must report to the Livestock department for the abattoir any instance where the movement from animals from these adjacent fields (or buildings) to the slaughterhouse occurs unreported.

The FBO would be considered responsible for two holdings and subject to the biosecurity rules pertaining to such situations, defining effective operational separation of the two.

Animals cannot move from the slaughterhouse back to these fields (or buildings).

5. Cleansing and disinfection for biosecurity

Introduction

Adequate C and D facilities and standards are essential for disease control and biosecurity.

This chapter includes the official verification of the C and D standards of:

- lairages (including any area within the curtilage of the slaughterhouse in which live animals are handled).
- vehicles transporting livestock.

Regulatory requirements

Red meat slaughterhouses must have adequate and hygienic lairage facilities or, climate permitting, waiting pens that are easy to cleanse and disinfect. The drainage of the wastewater must not compromise food safety.

There must be a separate place with appropriate facilities for the cleaning, washing and disinfection of livestock vehicles.

However, slaughterhouses need not have these places and facilities if the Livestock Department so permits and official authorised places and facilities exist nearby.

Immediately after emptying and, if necessary, before re-use, all equipment used for collecting and delivering animals must be cleansed, washed and disinfected.

There must be a separate place with the appropriate facilities for the cleaning, washing and disinfection of:

- a. transport equipment; and
- b. means of transport

However, these places and facilities are not compulsory if officially authorised places and facilities exist nearby.

Location of facilities

It is recommended to allow the approval of slaughterhouses without having C and D places and facilities if official authorised places and facilities exist nearby and the competent authority has given permission. Where this is the case, the FBO must have a high degree of control over the facilities which must be:

- capable of being reached easily
- situated within a reasonable distance from the slaughterhouse
- regarded by the FBO as part of the slaughterhouse
- possible for the OV to supervise.

Advice to FBO

The OV may provide the FBO with advice on C and D of their lairage and on the C and D facilities they must provide for livestock vehicles

OV action where the facilities are inadequate

When the facilities provided by the FBO are insufficient or fail to operate correctly, the OV must stop any unloading operation at the slaughterhouse.

C and D of lairages

Lairage C and D requirements

The FBO must keep the lairage easy to cleanse and disinfect. Lairages and yards are part of the food premises and the FBO must keep them clean and maintained in good repair and condition. Consideration must also be taken of the need to prevent animals becoming soiled, and of the welfare of the animals while they await slaughter.

As part of the FBO's legal responsibility for establishing procedures for the C and D of the establishment, the FBO should establish procedures for the C and D of the lairages and related areas (for example, unloading areas, races). The frequency and procedures including the disinfectant in use should be documented in the Standard Operational Procedures.

The frequency and standards of the C and D of the lairage should be established by the FBO based on risk. For example, slaughterhouses receiving animals from different regions/provinces or from non-commercial farms would require a more frequent C and D of the lairage.

In the case of specifically designated slaughterhouses for operating during outbreaks of exotic notifiable diseases, the designation conditions establish the minimum frequency for the C and D of lairage (for example, daily).

C and D of livestock vehicles

Introduction

C and D of livestock vehicles is essential for disease control and biosecurity, and not just with regard to zoonotic diseases. This topic details the requirements for ensuring compliance with C and D of livestock vehicles in red meat slaughterhouses.

The responsibilities of vehicle drivers and FBOs are outlined as well as the OV responsibilities in monitoring and enforcement of the C and D process.

Vehicle C and D requirements

A vehicle which has delivered livestock to a slaughterhouse must be C and D as soon as reasonably practicable after unloading.

Note: the transport of animals between the same two points (markets exclude) over the course of a single day and in a means of transport used exclusively for that purpose does not need to be C and D each time.

The C and D may take place at the slaughterhouse or elsewhere, in line with what is written above.

Before cattle are loaded for transport, the means of transport must have been previously cleaned and, where necessary, disinfected. Disinfection is required in all cases where the means of transport was last used to transport livestock or poultry. Soiled bedding and excreta must nevertheless be removed from the means of transport as soon as possible.

Method of C and D

The interior and exterior of the vehicle and any containers and equipment used to transport animals must be C and D.

In the case of animals not transported in a container, all the inside surfaces of those parts of the means of transport that the animals may have had access to during the journey must be cleansed whether or not they are soiled.

Any detachable fittings not used during the journey, any other part of the means of transport and any equipment must be cleansed if they are soiled.

The wheels, mudguards and wheel arches of the means of transport shall be cleansed whether or not they are soiled and whether or not the animals were transported in a container.

Overall, the only part of a vehicle specifically exempted is the driver's cab.

Disinfectant must be applied at the adequate after the full cleaning of those parts. The completion of C and D in a single operation is not satisfactory as disinfectant would not be effective in presence of organic material and the use of water during the disinfection would dilute the required concentration and / or contact time for the disinfectant.

Re-contamination of the lorry after disinfection should be prevented by ensuring an adequate separation, layout of establishment and procedures.

Approved disinfectants

Vehicles or means of transport for animals that need to be disinfected after cleansing must be done so using a disinfectant approved by the Livestock department

Enforcement responsibilities

Livestock responsibility

Livestock authorised staff are responsible for monitoring and enforcement of the C and D process in approved red meat slaughterhouses by:

- verifying the availability of C and D facilities, equipment and approved disinfectant (for example, adequate water supply, suitable space, tools)

These could be verified during the routine checks (during pre-operational checks or during ante-mortem inspection). The hierarchy of enforcement should be followed in case of failure to comply with this requirement

And by:

- undertaking random or targeted spot checks on the actual procedures followed for the C and D of vehicles transporting livestock.
- Issuing verbal warnings to the FBO and / or to the haulier where non-compliance of C and D rules has been observed.
- Serving an official notice to cleanse and disinfect a vehicle or container upon the person in charge of the vehicle or container where a means of transport, a container or any equipment either:
 - has not been cleansed and disinfected properly; or
 - needs to be cleansed and disinfected because it may give rise to a risk of transmission of disease.
- Immediately reporting to the Livestock department the details of any cases of non-compliance with C and D rules, including where an official notice has been served and has been disregarded, or needs to be followed up.
- Informing the FBO.

The actual number or proportion of vehicles to be checked will be dependent on the level of checks authorised to be carried out at the plant, Livestock Department authorised staff will have to undertake one of the following:

- Weekly checks – Livestock Department authorised staff are to undertake 1.5 hours of checks each week, this can be split over multiple days or can be carried out on one day. Information from these checks must be recorded.
- Monthly checks – Livestock Department authorised staff are to undertake 45 minutes of checks once a month within a set week. The OV can select any day within that set week but he/she must not select the same day as was selected in the previous month; for example, if in July checks were carried out on a Monday, in August checks can be carried out on any day but Monday. Information is to be recorded.

Note: There is no requirement to alternate days when checks are carried out if a plant only operates one day a week or vehicles only enter a premises on the same day each week. Checks carried out weekly / monthly must include either a check of vehicles being correctly cleansed or disinfected or that declarations of ‘off site’ cleaning are being handled correctly. A combination of both must be undertaken whenever possible if vehicles at plants undertake either. Checks carried out must be recorded and must include the number of vehicles checked for adequate C and D, any issues that arise and what action was taken. Copies of any notices served should be retained at the premises for one year.

The C and D record form should be filled writing the following information:

- the vehicle registration
- the name of the driver
- where possible the suspected destination
- details of the breach
- copies of any notices served

Module # 04
Slaughtering

Slaughtering

Learning objectives:

Upon completion of this module, the operators will be able to learn about:

- Ritual and non-ritual methods of slaughtering
- Basics of stunning methods used in the world
- Importance of bleeding for meat safety and hygiene
- Pakistan Halal Standards PS 3733

Animal slaughtering:

The act of killing animals for food is called slaughtering. Slaughtering is also done for diseased and unfit consumption animals.

Islamic Slaughter (Halal):

Halal is a Quranic term that means 'permitted, allowed, authorized, approved, sanctioned or lawful.' These guidelines for the slaughtering of animals and the preparation and handling of Halal food will have to be observed at all establishments involved in Halal food processing.

- a. Halal food and drinks are considered Najis if they are contaminated or have direct contact with things that Islam does not permit. Under no circumstances Najis (Unclean) such as pigs or dogs and their products are allowed inside the plant. Pigs and their products must never enter the plant's boundaries.
- b. All animals must be rendered unconscious before slaughter.
- c. The act of Halal slaughter should begin with an incision on the neck at some point just before the glottis for animals with normal necks but after the glottis for animals with long necks such as chicken, geese, turkeys, ostriches, camels, etc.
- d. The phrase "Bismillah Allahu-Akbar." (In the Name of Allah) is highly encouraged to be immediately invoked before the slaughter of each animal. In a certain school of thought, this invoking of the phrase "Bismillah..." is compulsory.
- e. The slaughtering must sever the trachea and esophagus, and jugular vein. The spinal cord should not be cut, and the head is not to be severed completely. This is to bring about immediate and massive hemorrhage and satisfactory/adequate bleeding.
- f. Slaughtering must be done only once. The 'sawing action' of the slaughtering is permitted as long as the slaughtering implement is not lifted off the animal during the slaughtering. Any lifting of the knife is considered as the end of one act of slaughter. Multiple acts of slaughter on one animal are not allowed.
- g. Bleeding must be spontaneous and adequate/satisfactory. Indications of death at the time of ritual slaughter include the absence of blood pulsing from the cut ends of the carotid arteries, the absence of capillary refill, and bleeding within the normal time.
- h. Dressing of carcasses should only commence after ascertaining that the animal is dead.
- i. Slaughtering implements, tools, and utensils must be utilized only for the slaughter of Halal animals.
- j. The Halal slaughterman must:
 - i. Be a Muslim;

- ii. Be authorized and be under the supervision of a certified Islamic organization;
- iii. Slaughter the animal according to Islamic rite
- iv. Ensure that the animal is well-fed and watered.
- v. Ensure that knife is sharp and clean.

Pakistan Halal Standard (PS 3733):

Halal food management system requirements for any organization in the food chain & or compliance to the organization of Islamic countries' general guidelines on halal food. The organizations must implement their Halal food management system as per requirements of Shariah Laws, Pakistan Halal Food Standard (PS 3733) & / OIC General Guidelines on Halal Food (OIC/SMIIC-1).

Key points for Halal food requirements as per Pakistan Halal Food Management System (PS 3733) are:

1. All sources of foods (animals, birds, aquatic animals, ingredients, additives etc.) Must be obtained from Halal Source
2. For Halal Production, the establishment of Halal Control Points should be done
3. Ensure the traceability of Halal Food products and ingredients throughout the food chain, including traceability to immediate customer and supplier
4. Slaughtering of animals should be done according to Islamic/Shariah Laws
5. All processed food should come from Halal sources of ingredients
6. Hygiene and sanitation should be maintained, and separation of Halal and non-Halal lines, equipment, storage etc.
7. Packing and labelling according to Pakistan Halal Food Standard (PS 3733) requirements mentioning product name, halal logo, trademark, list of ingredients, address, lot/batch, etc.
8. The product should meet the applicable federal, provincial & local government-enforced regulatory requirements, e.g., Pakistan Pure Food Laws, Punjab Pure Food Laws, PSQCA standards etc.
9. Documented statement of Halal Food Policy & Objectives & Procedures as required by Pakistan Halal Food Standard PS 3733
10. Internal Audit, Management Review, Emergency Preparations, Human Resource & Documentation requirements as per Pakistan Halal Food Standard (PS 3733)

Pre slaughter handling of animals:

Pre-slaughter handling of animals is the most crucial point in terms of stress alleviation. Stress occurs in many forms if the animals' handling is not done correctly, e.g., deprivation of food and water, rough handling, and mixing of different animals resulting in fighting. The most significant stress is travelling stress due to long distances between farm and abattoir. Overcrowding in summer weather causes severe stress, which leads to low glycogen levels in the body, slaughtering more lactic acid produced in muscles causing Rapid and fast protein denaturation that causes pale soft and exudative meat.

Handling of animals during transport and lairage:

In place of sticks, an electric goad should be used to prevent carcass bruising. Similarly, grabbing sheep by fleece also be avoided to avoid bruising. For stopping fighting, animals

must not be mixed during transport and also in lairage. For loading and unloading, fewer stepper ramps are used to avoid injury. Transportation trucks should be in good condition. Animals should not be overcrowded. During transportation, overloading causes brushing and stress, producing low-quality meat such as DFD.

Small pen lairage is recommended. Walking paths for animals must be curved so that animals can see a way forward. Animals must not be slaughtered in front of other animals because it also causes stress in animals. The supply of clean water must be abundant. The Lairage area should be well ventilated. Before slaughtering, water and food withholding reduce gastrointestinal content's volume; thus, the risk of carcass contamination during dressing is minimized. A proper rest period should be given to animals before slaughter. Slaughtering animals should be clean. All floors should be non-slippery to avoid any possible damage by slipping. An appropriate number of animals should be present in the lairage throughout the slaughtering without compromising animal welfare. Freely movement of animals in lairage can also reduce the stress of transportation.

Module # 05

De-hiding and De-Skinning

De-hiding and Deskinning

Learning objectives:

Upon completion of this module, the trainees will have will be able to learn about:

- Basics of de-hiding and deskinning methods
- Manual methods of De-hiding used in the industry
- Mechanical methods of De-hiding and its importance for food safety
- Equipment sterilization and hygiene techniques

1. Introduction

As soon as the blood has completely drained out and bleeding has stopped, the first flaying operation to remove the hide from the carcass starts. Before flaying commences, which should be as soon as possible after slaughter. If there is no reaction when the eyes of the animal are touched that is sufficient proof that it is dead. If the carcass has previously been elevated, it is lowered to the ground, generally with the back in a depression to prevent rolling over on its side, or placed on a metal cradle or skinning bed as is performed in abattoirs.

2. Importance in the food industry

Fresh meat is at risk from microbiological contamination through contact with food poisoning bacteria from skin or gut contents during dressing, as even healthy animals can carry bacteria, for example, *E. coli* O157, *Salmonella*, *Campylobacter*, *Yersinia*, and *Listeria*. Poor working practices will increase this risk. Meat can be contaminated with grease, dirt, specified risk material or with metal and other foreign bodies in meat plants. Contamination can be transferred from meat to other foods including ready-to-eat products. Procedures are needed to minimize the risk of such hazards causing illness in consumers.

3. Modern De-hiding and Flaying

Flaying is the removal of skin from the carcass. Generally, an attempt is made to keep the removed portion of skin intact and with very few cuts or no cuts at all. The type of flaying equipment also plays a major role in the production of good quality hides and skins. It's observed that hides and skins from underdeveloped facilities are of much lower quality because of the number of cuts and trims. In more organized slaughterhouses, hides and skins quality is taken into consideration by minimizing cuts. Flay cuts in hides and skins are caused by the careless use of the knife or by the use of unsuitable knives. Flay cuts constitute the most serious mechanical defects on hides and skins. Lack of proper tools like the rounded flaying knives,

lack of flaying skills and carelessness lead to loss of quality or outright rejection of raw hides and skins.

1. GENERAL INFORMATION ABOUT THE STATIC FLAYING FRAME (SFF)

Types of SFF

There are three models of SFF and each has its own purpose:

Basic SFF

The basic SFF has been designed for use in a small abattoir, which operates with the auxiliary of a production line where carcasses are processed vertically, rather than horizontally. The Basic SFF can be placed in the existing production line at the de-hiding station or if there is no de-hiding station because de-hiding is done horizontally before the carcass is hung from the production rail, then the SFF de-hiding station can be created after the carcass is hung from the production rail, before the interiors are being removed.



Stand-alone SFF

The Stand-alone SFF is used in abattoirs or slaughter slabs where there is no production line. It simulates the de-hiding station in a production line. The carcass is hoisted vertically after the carcass is bled and after the rip lines are applied and the belly portion of the hide is detached from the meat. The carcass is held from vertically rotating by a specially designed holding tool. Once the carcass is in place it can be de-hided. The advantage of the stand-alone SFF is, that it can be assembled and disassembled and moved in general, allowing it thus to serve multiple slaughter place. E.g., today it can work in slaughter slab A and tomorrow in B etc. With this possibility to be mobile a whole rural area can be covered.



Baby SFF

The Baby SFF is stand-alone and can be placed anywhere. The carcass of ovine animals is manually lifted to the holding hooks, where each of the hind legs is fixed.



Conventional use

The SFF has been designed and manufactured only to de-hide warm animal carcasses immediately after bleeding of the animal. The animals in question for the bovine version, both Basic and Stand-alone can be cattle, horse, donkey. On the ovine version animals that can be skinned are goat and sheep.

Safety

The SFF operator(s) must keep to the following safety procedures:

- Check that operative manoeuvres do not cause any danger and in case irregularities will occur, stop the skinning operation immediately;
- Check that the SFF working area is free from persons, dangerous objects, from oil, fat, intestines or any other slippery matter on the floor;
- The operator(s) must wear suitable protective working clothes and must not wear pendants such as bracelets etc., long hair must be protected and, in general, safety appliances must be used appropriate to the type of operation performed and in compliance with national safety dispositions.

GENERAL DESCRIPTION OF THE SFF



- FRONT PART OF THE SFF means the part where an animal is hoisted after it is stunned and bled.
- RIGHT SIDE OF THE SFF means looking at the machine from the back part.
- RIGHT SIDE OF THE SFF means looking at the machine from the back part.

Description of SFF components

Here to follow is a short description of the SFF components. The SFF can be considered divided into four different portions:

1. the main frame;
2. the platform
3. the rollers;
4. the electrical pulleys

The carcass preparation

The following operation is assumed to be executed with the animal lying on the floor but can be executed also in a vertical slaughter line.

Once the animal is completely bled the skinners are to apply the so-called rip lines

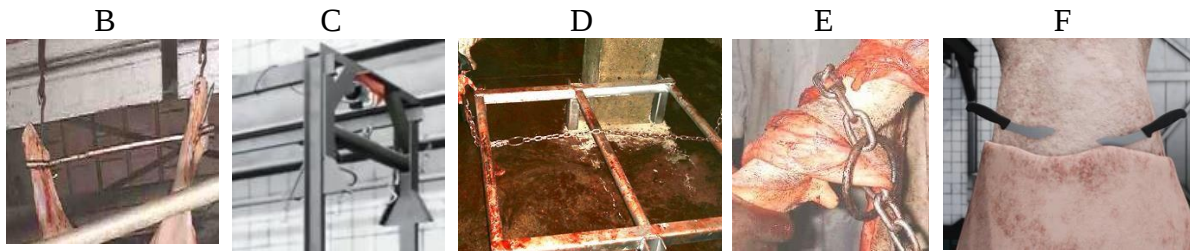
1. Over the belly from head to tail
2. From front leg to front leg
3. From hind leg to hind leg

Depending on local custom the head and legs can be removed or not

SFF Operation

Once checks and pulling chain length have been completed as indicated in previous chapters, once the carcass has been prepared, the SFF can be test run.

- A. make sure that all SFF components are in working condition and conform to the construction drawings;
- B. connect the hindlegs of the carcass to the carcass hoist beam by placing each beam hook on either leg by inserting the hook between the bone and the hindleg tendon;
- C. hoist the carcass and make sure that both ends of the hoist beam are safely positioned in their respective holders;
- D. take the pulling chain at the short leg side of the Y, and run it from under the back roller, over the middle roller and under the front roller and then up to the hindlegs of the carcass.
- E. capture the hide skinned from each hindleg in the chainloop of the two short legs of the Y;
- F. once the hind legs are properly captured by the two short legs of the Y, the operator standing on the platform can action the dehiding pulley, first just to apply tension and then, when the chainloop closes with strength aqround the hide, to actually start the pulling operation until the whole hide is pulled from the carcass
- G. it is fundamental that the operator on the platform assists the seperation of the hide from the carcas with a professional skinning knife.



OPERATOR SAFETY

- Slaughterhouse operators in general should wear protective clothing for cleanness and food safety. This consists of a hard hat (1), a rubber apron (2) and boots (3)
- For personal safety the operators who are dealing with knives (4) should wear appropriate gloves (5) that protect their hands from cuts.
- Operators working on the slaughter floor in front of the SFF need to stay clear of the carcass when it is hoisted to the SFF
- Operators engaged in the skinning operation on the SFF platform must stay clear of the pulling chain.

1





After the production of the hide/skin, the animal belly is opened and intestines and stomachs are removed. The intestines need to be cleaned for further use and their content properly disposed and where applicable used as fertilizer.

Maintenance

Daily checks and maintenance

- Cleaning and/or washing of the SFF with hot water to clean it from blood and fat and solid slaughter particles
- Check the overall integrity of the SFF that no rollers or beams are bent. If rollers are bent, substitute!
- Check the pulley cable that it runs smoothly and presents no knots;
- Check the rollbearings that no slaughter particles have entered the bearings;
- For the Baby SFF, check the smooth working of the gearbox and lubricate when appropriate.

Monthly checks and maintenance

- Check lubrication of the rollbearings and if necessary apply rollbearing fat;

- Check the pulling chain that it shows no ruptures. If it presents ruptures, substitute;
- Check the big rings at the chain finals that they are without ruptures. If they present ruptures, substitute;
- Check the pulley cable for integrity. If it presents ruptures, substitute;
- For the Baby SFF, check the smooth working of the gearbox.

Module # 06
Evisceration

Evisceration

Learning objectives:

Upon completion of this module, the operators will be able to learn about:

- Evisceration methods of large and Small Ruminants
- Various categories of offal obtained in an abattoir
- Handling and primary processing of different offal
- Hygiene issues regarding improper evisceration and its impact on meat safety and quality

1. Introduction

Evisceration is the process of removal of vital organs. A circumcision is made around the anus by a sharp knife, and the attachments of the large intestine are removed. This helps in the easy pulling of the intestines from the ventral aspect. The distal end of the anus is tied with a small rubber band to prevent carcass contamination by intestinal contents. A sharp knife is used to make a midventral incision from the midpoint of the pubic symphysis to the sternum level. After exposing the abdominal cavity, omental and mesenteric fats are removed, and abdominal contents are removed. Care should be taken not to puncture the visceral organs accidentally. The attachments of the diaphragm to the liver are cut to separate the liver without puncturing the gall bladder. Then the thoracic cavity is opened by a mid-ventral incision from the sternum to the midpoint of the neck. The diaphragm and the thoracic organs are removed. In cattle and buffalo carcass, larynx, trachea, lungs, heart, and liver are collectively known as 'pluck.' These are placed for post-mortem examination along with the carcass.

2. Evisceration of Small Ruminants (Sheep and Goat)

The first step in evisceration is to cut around the tied bung or rectum, free it entirely from all attachments, and drop it in the pelvic cavity. With the external structures, skin, feet, and head removed, the next step is to cut open the animal's body to dislodge the contents and produce the carcass. Try to avoid contamination of the carcass through accidental cuts or punctures of the stomach and intestines. For this, the carcass must be placed in the hanging position then tie off the rectum and oesophagus.

The exact process is followed for removing visceral organs as in cattle, but the composition of 'pluck' is slightly different in sheep/goats. Here, the 'pluck' includes the larynx, trachea, heart, liver, lungs, and spleen. Paunch, i.e., the stomach is first removed, then 'pluck' is removed. The kidneys remain attached to the carcass in sheep and goats until the carcass is split down the backbone. Generally, the sheep and goat carcasses are not split and sold entirely. Dressed carcass and offal are placed for post-mortem inspection.

3. Offal categories

The 'offal' means everything from slaughtering an animal that is not directly sold as consumable meat. 'By-product' is synonymous with offal and is used for a broader sense, whereas 'offal' is used for various visceral organs and parts other than a carcass. Based on utility as human food, the offal is classified as edible or inedible. Another basis of classification is appearance. The Red offal includes head, heart, liver, lungs, melt (spleen), sweetbreads, tail, thick skirt (diaphragm), and tongue. The White offal is fats, many plies (third stomach), set of guts and bladder, set of tripe (weasand, first, second and fourth stomach, and rectum), forefeet, and trimmings. Blood, hides, and pharmaceuticals are usually considered separate categories.

4. Gut Removal and Handling

The body cavity is entered into to sever the ureter connections to the kidneys while the intestines are loosened up further. The stomach and intestinal mass are then pushed slightly out of the midline opening. The liver is held out, severed of its connecting tissues, and then pulled out together with the freed contents of the abdominal cavity. It is placed into the tray of the portable cart with other edible offal. The gallbladder is cut from the liver, taking care not to spill its bitter contents onto the carcass. The heart, lungs, trachea, and oesophagus (i.e., the pluck) can be pulled out as a unit.

5. Offal handling

The offal must be inspected for abnormalities and disease conditions prior to further handling. They should be used immediately or stored at 4 -7°C in stainless steel containers. More attention must be given to the edible offal as it constitutes 20-30% of the live weight. Pancreas and endocrine glands should be collected in ice and preserved under frozen conditions. The intestines and stomach should be cleaned in the unclean section of the abattoir. Due to higher glycogen content and lesser fat covering, edible offal is more perishable than a carcass. Therefore, it is essential to remove the edible offal soon after slaughter. A high degree of care is to be taken to handle them to prevent contamination. Freezing the liver, heart, oxtail, and giblets are recommended to keep quality if not consumed fresh. Care must be taken that these organs are thawed in the refrigerator. Similarly, sweetbreads and brains are stored frozen, but thawing is done in hot water. The organs, including the kidney, tongue, and tripe, must not be kept under storage for more extended periods.

6. Significance of offal in meat safety

Microbial contamination of the carcass and internal organs is highly significant for meat and offal quality and shelf life. Contamination occurs either externally from the soil, water, equipment, utensils, handling by workers and during transportation, or internally from diseased animals. It may lead to zoonotic diseases of public health concern. Several diseases are well known to both the industry and the general public that are directly related to all the domestic meat species of beef, mutton, and lamb. The offal, if infected, may harbor the microorganisms and parasites of zoonotic importance. These include BSE (bovine spongiform encephalitis) from beef cattle, Scrapie from lamb and mutton, *Mycobacterium tuberculosis*, and *Cysticercus bovis* from buffalo meat. The microorganisms and related cysts are primarily found in the brain, heart, tongue, esophagus, and liver. That is why it is highly recommended that Offal must be inspected for abnormalities and disease conditions during postmortem examination prior to further handling.

7. Hygiene issues regarding improper evisceration

Evisceration should be carried out to prevent contamination of the carcass with the content of abdominal organs. The anal sphincter should be circumcised and the rectum tied before it is dropped into the pelvic cavity and the digestive track removed without incising the stomach or intestine. The oesophagus must be perfectly sealed to prevent spillage and draining of rumen contents. During the operation, care should be taken not to puncture any other organs such as the urinary bladder, gall bladder, and uterus. Faecal or other objectionable matter that may contaminate carcasses or edible offal during processing should only be removed by careful trimming.

If carcasses are to be washed for any reason, only running potable water (preferably chlorinated at 20-30 ppm) should be used. When washing is carried out prior to evisceration, water should not enter the thoracic or abdominal cavities. No paper, cloth, sponge, or brush should be used in washing carcasses. Meat contamination during skinning and eviscerating of short-haired species can usually be kept minimal if simple equipment for carcass suspension is available, such as wall hooks or racks with hooks (in small operations) or hooks or hooks or gambrels attached to an overhead rail in more extensive procedures.

Wash the internal surface of the abdominal and chest cavities with low-pressure cold water to remove gross visible gut contents. Trim all visible contamination from the surface of the carcass – continually cleaning and sanitizing the knife. Remove red offal in the usual manner. (If contaminated, discard after official inspection is completed). Before the final wash, cut the brisket bone and any other tissues contaminated, e.g., the shin, and discard. Rinse down the workstation with low-pressure water. Peel-off and discard the pleura from the inside rib cage. Trim and discard any other contaminated tissues.

Module # 07

Post-mortem Examination

Post-mortem Examination

Learning objectives:

Upon completion of this module, the trainees will have will be able to learn about:

- Important techniques to conduct the post-mortem
- verification of compliance with national and export regulations
- Sampling methods during the post-mortem for lab analysis

Post-mortem inspection

Purpose

The principal purpose of post-mortem inspection is to supplement ante-mortem inspection and to detect:

- diseases of public health significance
- diseases of animal health significance
- residues or contaminants in excess of the levels allowed
- the risk of non-visible contamination
- other factors which might require the meat to be declared unfit for human consumption or restrictions to be placed on its use
- visible lesions that are relevant to animal welfare such as beating or long-standing untreated injuries

2. Food Authority Role

Introduction to post-mortem inspection

Post-mortem inspection should:

- take into account ante-mortem inspection results
- view all external surfaces
- pay particular attention to the detection of zoonotic and notifiable diseases
- take into account the information provided in the owner declaration and the cow book
- take place without delay after slaughter
- include carcasses and accompanying offal

Contamination during inspection

During inspection, precautions must be taken to ensure that contamination of the meat by actions such as palpation, cutting or incision is kept to a minimum. Minimal handling of the carcass and offal should take place. Bovine animals under 8 months old can undergo visual only inspection if coming from commercial and semi commercial farms of the province.

Accuracy

The speed of the slaughter line and the number of inspection staff present must ensure proper inspection is completed and records maintained. Food business operators should be instructed to take immediate corrective action, including a reduction in the speed of slaughter, where: contamination is detected on external surfaces of a carcass or its cavities and the food business operator does not take appropriate action to rectify the situation; or if good hygiene practices are jeopardised. Meat Inspector (MI) post-mortem inspection is for defect detection. OV post-mortem inspection is for disease diagnosis.

Additional examination requirements for post-mortem inspection

Where it is thought necessary, additional examinations are to take place such as palpation and incision of the carcase and offal and laboratory tests to:

- reach a definitive diagnosis
- detect the presence of:
- an animal disease
- residues or contaminants in excess of the levels allowed
- non-compliance (NC) with microbiological criteria
- other factors that might require the meat to be declared unfit for human consumption or restrictions to be placed on its use.
- Note: Special attention should be taken in the case of animals having undergone emergency slaughter
- assess whether animal welfare is being compromised

OV presence (on the line)

The OV need not be present at all times on the line during post-mortem inspection if:

- an MI carries out post-mortem inspection and puts aside abnormal meat with uncommonly occurring conditions and all other meat from the same animal
- the MI documents their procedures and findings in a manner that allows the OV to be satisfied that standards are being met
- the OV subsequently inspects all such meat

Abnormal meat

To consider an abnormal carcase meat/offal as ‘uncommon’, we could take into consideration different aspects such as:

prevalence of the condition in the area where the farm of origin is located

prevalence of the condition in the flock / herd (degree of infection or infestation). Endemic conditions.

the possible human health implications of the condition (such as zoonosis)

the possible animal health implications of the condition (such as lesions which may indicate a possible notifiable disease such as TB, foot and mouth disease)

possible animal welfare problems on farm, during transport or in the lairage

the need to refer it to the veterinarian to do a differential diagnosis

economic importance of the condition for the farming industry (degree of infestation)

Based on all the above, the MI will need to make a judgement and notify the OV of the findings.

Examples of abnormal conditions that can be classified as common or uncommon

The table below outlines abnormal conditions and their classification.

Abnormal condition	Comments	Occurrence
Septicaemia Toxaemia	Very prevalent condition. It represented about 14.75% of total conditions found during the PMI	Common
Mastitis in older cattle	Common condition in cows. No need to inform the OV. The farmer should be made aware of it and he/she should receive notification from Livestock department when they will be informed about the PMI findings.	Common
Cattle (30 month or younger) fascioliasis	Common in ungulates. The OV does not need to be informed. The disease is of great economic importance because of liver condemnations. Farmer should be informed when he receives notification of the post-mortem inspection findings.	Common

pleurisy / pneumonia	Inflammation of the pleurae is a common meat inspection lesion. It requires the stripping of the pleura or removal of the rib cage but carcase condemnation is not normally necessary. There is positive correlation between the number of carcasses requiring lung condemnation and the number of those requiring pleura stripping. The OV does not need to be informed.	Common
Anthrax	Normally identified at ante-mortem inspection if a suspect animal is found dead in the lairage. It is a notifiable disease and it is a zoonosis. The OV must be informed and should immediately inform the Livestock Department for immediate actions.	Uncommon
Cattle sarcocystis	The incidence is higher in older cattle but is an uncommon condition. Depending on the degree of infestation, the carcase and viscera have to be rejected. The OV should be informed.	Uncommon

Food Authority Duties

The following table outlines the duties of the Food Authority with regard to post-mortem inspection.

Role	By	Frequency
Carry out post-mortem inspection	An OV or MI appropriately authorised by the Food Authority	All carcasses and accompanying offal without delay after slaughter
Carry out post-mortem inspection for animals subject to emergency slaughter outside the slaughterhouse	An OV only; this cannot be delegated to a MI	All carcasses and offal as soon as possible. Note: where an animal has been subject to emergency slaughter outside normal operational hours, cold post-mortem inspection is currently permissible. In these cases, the establishment does not need specific approval to carry out cold inspection of emergency slaughter carcasses only.
Carry out PM for animals accompanied by a farmer's declaration	OV or MI	All carcasses and offal as soon as possible
Record post-mortem inspection results	OV or MI	At the time of post-mortem inspection

Role	By	Frequency
Declare the meat fit for humans consumption and apply so a “Health Mark or identification mark” in order to differentiate it from the meat unfit for humans consumption	The Health Mark must be applied under the supervision of the OV	Immediately after post-mortem inspection if the OV is satisfied about the meat Status. It means that the meat can be put on the market
Disease sampling / testing	OV or MI	When disease is suspected
Monitoring sampling / testing	OV or MI	When monitoring of disease is required, for example, TSE.

Post-mortem inspection guidelines

Splitting carcasses

Carcasses of bovine animals over eight months old must be submitted for post-mortem inspection split lengthways into half carcasses down the spinal column. However, to take account of particular eating habits, technological developments or specific sanitary situations, the official veterinarian may authorise the submission for post-mortem inspection of carcasses of bovine animals more than eight months old that are not split in half. In low-capacity slaughterhouses the official veterinarian may, for sanitary reasons, authorise the cutting into quarter carcasses of adult bovine animals before post-mortem inspection. The OV may also require any head or any carcase to be split lengthways if the inspection so necessitates.

Caution: Splitting the head of cattle carries a health and safety risk, and if the animal is required to be sampled for BSE it may only take place after the sample has been taken.

Minimal handling by inspectors

During inspection, precautions must be taken to ensure that contamination of the meat by actions such as palpation, cutting or incision is kept to a minimum.

Note: Whilst still allowing for adequate post-mortem inspection care must be taken not to de-value the carcase or offal when making post-mortem incisions.

Visual inspection only

Carcasses and offal of Bovine animals under 8 months old can undergo visual only inspection if coming from commercial and semi commercial farms of the province. Further inspection procedures (FIP) (palpation and / or incision) can be carried out when one of the following indicates a risk to public health, animal health or animal welfare:

checks on the cow book and the owner declaration

checks on any other data from the holding of provenance

ante-mortem or post-mortem findings

Note: Further inspection can also be carried out if gathering of evidence is required for enforcement purposes (for example, welfare investigation).

Examples of conditions found in 8 months old bovines at ante-mortem that might justify further inspection procedures at post-mortem

For the majority of the conditions listed on the current ante mortem inspection sheet there would be no need for bovine animals under 8 months old to be marked to undergo FIP at post-mortem.

However, the following may justify FIP:

mastitis (if associated with general signs)

moribund / recumbent

orchitis (marked to consider Brucella, occupational zoonosis)

suspect emaciation, poor condition

suspect fever

slaughtered in lairage

Note: the OV is not limited to these conditions and should use their professional judgement.

Examples of conditions found in 8-month-old bovines at post-mortem that might justify FIPs

For localised conditions on the carcasses, FIPs are not normally justified unless a generalised and-or septic condition is also observed / suspected.

The following localised conditions may justify detaining the carcass for FIP at post-mortem:

multiple abscesses

TB like lesions (in cases of enlarged lymph nodes)

When the OV / MI suspects a generalised condition, in some cases the appropriate decision about the fitness of the meat for human consumption cannot be made without further examinations.

If any of the following conditions is observed / suspected, this may justify detaining the carcass or offal for FIP at post-mortem inspection:

anaemia (may be part of other generalised condition)

badly bled (may mask some other post-mortem signs)

contamination gut content (may mask other conditions)

emaciation / generalised oedema

generalised TB, tumours, melanosis

jaundice

polyarthritis

septic peritonitis

septic pleurisy

suspect pyaemia

suspect uraemia / abnormal odour

suspect fever / septicaemia

suspect residues

Note: The OV / MI is not limited to these conditions and should use their professional judgement.

Decisions concerning meat

Animal carcasses for which a 'suspect animal card' was completed

The OV, carrying on the AMI, must have a suitable system in place to inform the person(s) performing the post-mortem inspection of any condition that may help in the post-mortem judgement for that carcass. This includes any animals for which a 'Suspect Animal Card' has been completed by the OV and also animals identified at ante mortem inspection as requiring further post-mortem inspection procedures other than visual inspection as for example all the bovines coming from other provinces, regions or non-commercial farms. The OV should inform the MI on which PMI apply carcass by carcass.

Possible outcomes

After the inspection, the OV/MI can:

pass the meat as fit for human consumption

declare the meat unfit for human consumption

detain the meat for further examination following rectification (tests)

Reasons for declaring meat unfit

Meat may be declared unfit for human consumption if it:

derives from animals that have not undergone ante-mortem inspection.

derives from animals the offal of which has not undergone post-mortem inspection.

derives from animals which are dead before slaughter, stillborn, unborn or slaughtered under the age of seven days.

results from the trimming of sticking points.

derives from animals affected by animal diseases.

derives from animals affected by a generalised disease, such as septicaemia, pyaemia, toxaemia or viraemia

is not in conformity with microbiological criteria.

exhibits parasitic infestation.

contains residues or contaminants in excess of the levels allowed. Any overshooting of the relevant level should lead to additional analyses whenever appropriate

derives from animals or carcasses containing residues of forbidden substances or from animals that have been treated with forbidden substances

consists of the liver and kidneys of animals more than two years old from regions where it was revealed the generalised presence of heavy metals or high pollutants in the environment

has been treated illegally with decontaminating substances

has been treated illegally with ionising or UV-rays

contains foreign bodies.

exceeds the maximum permitted radioactivity levels

indicates patho-physiological changes, anomalies in consistency, insufficient bleeding or organoleptic anomalies, in particular a pronounced sexual odour

derives from emaciated animals

contains specified risk material,

shows soiling, faecal or other contamination

consists of blood that may constitute a risk to public or animal health owing to the health status of any animal from which it derives or contamination arising during the slaughter process

in the opinion of the OV, after examination of all the relevant information, it may constitute a risk to public or animal health or is for any other reason not suitable for human consumption

Where there is total rejection the whole carcase, offal and blood and the rest of body parts must be disposed of as an ABP.

Meat declared unfit

Where the OV is not satisfied that the meat is fit for human consumption, the health mark / identification mark must not be applied. The FBO should be asked to voluntarily surrender meat rejected as unfit for human consumption. Where surrender is not forthcoming, the OV should put in writing the reasons why they are formally declaring the meat unfit for human consumption.

Further inspection required

If the OV / MI considers that the carcase and offal require further inspection, the carcase and the associated offal must be detained and kept under control of the OV pending the inspection.

When partial rejection may be appropriate

Partial rejection of the meat or offal may be appropriate where only part of the carcase or a single organ is affected. Reject only the affected carcase part or offal and the tissue immediately surrounding it as an ABP waste.

Detention procedure

When detaining a carcase for further inspection it is important to maintain correlation of the detained carcase and all relevant parts until post-mortem inspection has been completed and any additional examinations have taken place. The detention method and any other examinations that are carried out must be done in a manner that prevents the risk of cross-contamination with meat intended for human consumption, for example, prevention of contact between carcasses.

Rectification FBO responsibility

It is the responsibility of the FBO to present carcasses and offal to the Food Authority Staff for final inspection free from contamination by faeces, gut content, hair, wool, bile and any other pollutants in accordance with the FBO's procedures based on HACCP principles.

Storage facilities

There are lockable facilities for the refrigerated storage of detained meat and separate lockable facilities for the storage of meat declared unfit for human consumption.

After post-mortem inspection

the tonsils of bovine animals must be removed hygienically

meat declared unfit for human consumption must be removed as soon as possible from the clean sector of the establishment

meat detained or declared unfit for human consumption and inedible by-products must not come into contact with meat and offal declared fit for human consumption

- Transmissible spongiform encephalopathy
- Brucellosis
- Cysticercus bovis
- Tuberculosis
- Arthritis
- Tumours in bovines
 - Enzootic Bovine Leucosis (EBL)
 - Anthrax
- Foot and Mouth Disease
- Bluetongue Virus Disease (BTV)

Judgements at meat post-mortem inspection

It is the duty of the OV, or the MI acting under their authority, during post-mortem inspection to make a judgement based on the specific case presented. The prompt identification and notification of certain animal diseases (transmissible notifiable) allows the Food Authority, the Livestock Department, the local and central Government to take action to prevent the spread

of the disease. Any person who suspects a notifiable disease has a duty to report it to the Duty Veterinary Officer (VO).

The list of the most important bovine notifiable diseases in the world includes:

Anthrax, BSE, Bluetongue, Brucella abortus, Brucella melitensis, Contagious Agalactia, Contagious Bovine Pleuro-pneumonia, Contagious Epididymitis, Enzootic Bovine leucosis, Epizootic Haemorrhagic Virus Disease, Epizootic Lymphangitis, Foot and Mouth Disease, Lumpy Skin Disease, Pestes des Petits Ruminants, Rinderpest, Tuberculosis, Vesicular Stomatitis, West Nile Virus.

The OV must immediately report to LLD suspicious signs of notifiable disease in carcasses and offal. If the OV is not present the MI must consult an OV before reporting a notifiable disease, provided that such consultation will not cause undue delay.

Note: * If the Duty OV agrees the possibility of a Notifiable Disease, the premises should be treated as contaminated, until proven otherwise. The Food Business Operator (FBO) should:

- not bring more susceptible animals on to the premises
- not slaughter live suspect animals (so the OV can sample them)
- isolate suspect / potentially contaminated carcasses

Module # 08
Chilling and Storage

Chilling and Storage

Learning objectives:

Upon completion of this module, the operators will be able to learn about:

- Principles involved in chilling of meat and meat products
- Various issues related to chilling temperature and its effects on meat safety and quality
- Cleaning and hygiene of chilling equipment, refrigerated vans, and cold stores
- Importance of proper chilling in the meat industry with reference to meat safety

1. Introduction

At chilling and storage, temperature control and sanitation measures ensure the microbial load reductions affected by the interventions are maintained. Temperature control limits pathogen multiplication, and sanitary measures prevent re-contamination. The best practices during chilling are within one hour of animals bleed out. Variety meats have to start chilling within one hour of removal from the carcass. To have a dedicated refrigerator for storing products as carcasses. The bottom of the suspended carcass should be located at least 0.3m above the refrigerator floor.

USDA: After chilling the carcass, 10 °C within 5 hours on the carcass surface, and 4.4 °C within 24 hours on the carcass surface.

Japan: Carcass was kept below 10 °C.

2. Chilling temperature and monitoring (Cold Shortening, Electronic Stimulation)

Implement temperature control and sanitation procedures to maintain the microbial reductions achieved by the antimicrobial intervention treatments. Define and monitor refrigeration parameters so that carcasses reach a temperature of 4.4°C or less within 24 hours and so that this temperature is maintained on all products. Take and record carcass temperature from 5 randomly spaced locations, usually 1 mm under fascia on the inside round. Maintain finished product storage areas at 4.4 °C or lower.

The cold chambers where chilling takes place must have a low air temperature, a high airspeed, relative humidity, and a high refrigerating capacity. The air temperature must be in the region of 0°C, with no decrease below -1°C, which could freeze the meat surface and impair its appearance. Airspeed can range from 0.25 to 3.0 m/s. However, for economic reasons, the most common speeds in use are from 0.75 to 1.5 m/s in the empty section of the cold chamber. Relative humidity during the chilling operation should be kept relatively high to prevent excessive weight loss. The recommended rate is between 90 and 95 percent, though this is the most challenging factor to control. Primary chilling is completed when the warmest point of the carcass has reached a temperature of about 7°C (3°C for edible offal). With current technology, these temperatures can be arrived at in 16–24 hours in small carcasses and less than 48 hours in large carcasses (centre of the hind leg). Average and surface temperatures are much lower, reaching 0°C on the surface within four hours; this is important to slow microbial proliferation.

3. Storage area for carcass and offal

Provide adequate distance between carcasses (offal), walls, and equipment to prevent cross-contamination and allow for efficient air circulation to prevent or minimize condensation. Ventilate coolers with negative-pressure systems to prevent cross-contamination from airflow from slaughter operations.

4. Cleaning, maintenance, and hygiene of chilling equipment

Cleaning and sanitizing or sterilizing equipment and hand tools are routinely used to remove contamination or make cuts into the carcass. Cleaning and sanitizing equipment between each dirty cut and between each carcass are most effective. Carcasses should be brought into the refrigerator after washing water the carcass has been drained sufficiently. The refrigerator

should be cleaned regularly and necessary because to maintain the hygiene of the carcasses. Open and close the refrigerator and freezer doors quickly. Stored chilled meat is mainly intended to serve as buffer stock between production and shipment or consumption. During storage, ageing (ripening) of the meat also occurs, progressively increasing tenderness and developing taste through the proteolytic activity of meat enzymes. Ageing depends on temperature and can be accelerated by increasing it, but it is recommended that 4°C be used with a relative humidity of 85–95 percent for hygienic reasons. In these conditions, ageing takes place in four days for mutton and two weeks for beef.

The preservation of edible offal requires different conditions: -1°C rather than 0°C and relative humidity close to saturation to avoid surface blemishes. Organs intended for therapeutic purposes, such as thyroid, pancreas, ovaries, pituitary, and so on, must be frozen immediately to preserve their active principles. Air circulation inside industrial chambers should be at a rate of 20–35 times per hour the volume of the empty cold room. When the chambers are used to store offal, it is advisable to use natural air circulation to maintain high humidity levels. Carcasses should be hung on rails so that they are aligned in the direction of air circulation, avoiding contact with each other. Whenever a new product at a different temperature is placed in the store, the product should be distributed around the room rather than concentrated in one place.

5. Cleaning and hygiene of chilling equipment

Cleaning removes dirt and organic substances, such as fat and protein particles, from surfaces of walls, floors, tools, and equipment. Many microorganisms (90% and more) present on the mentioned objects will be removed through the cleaning procedures. However, many organisms stick very firmly to surfaces, particularly in tiny, almost invisible layers of organic materials, so-called biofilms, and will not entirely be removed even by profound cleaning but persist and continue multiplying. Inactivating those microorganisms requires antimicrobial treatments carried out in food industries through hot water, steam, or disinfectants. Disinfectants are chemical substances that kill microorganisms but should not affect human health through hazardous residues and not cause equipment corrosion. The application of disinfectants is called disinfection.

When starting cleaning and disinfection/sanitation measures, all meat products must be removed from the area because physical cleaning with pressurized water may stir up dirt or produce contaminated water droplets (aerosol), contaminate meat present in such rooms. Cleaning and disinfection procedures in the meat industries are complex processes depending on the surfaces to be treated and the kind of contamination to be removed. The selection of suitable chemicals for cleaning or disinfection may require special knowledge. Cold chambers for meat chilling and chilled storage must be strictly hygienic as microbial invasion is a grave risk. Immediately eliminate all waste in a cold room each time a room is emptied. After rewarming rooms at low temperature, wash floors and walls with detergent and hot water, rinse them with clean water, and spray with a solution containing active chlorine (0.3%) clean pallets and storage containers every four months. Disinfect chilled storage rooms for 48 hours at least twice a year and frozen product rooms when emptied.

6. Loading and transportation of chilled meat

When loading refrigerated carcasses and/or meat, make sure that there is no cross-contamination. Refrigerator cars keep clean, and the refrigerator can keep the set temperature.

Loading docks ease the handling and transfer of whole carcass or primal cuts to and from the cold stores and transport vehicles, so most stores are provided with loading/ unloading docks adapted to road transport. The dock height corresponds with average vehicle height: for trucks, it will be about 1.40 m, but it will be as low as 60 cm for distribution vans. Leveling facilities will adjust the dock to any vehicle height; the dock and truck platform thus corresponding at any time of the loading/ unloading operation.

The transport of meat in a chilled or frozen state must be undertaken at a controlled temperature not to exceed the threshold that encourages microbial development or starts thawing or recrystallization in frozen meats. Transport vehicles are classified into three categories: insulated, refrigerated, and mechanically refrigerated. Insulated vehicles should be used only for short distances and for short distribution periods when not much door opening is involved. Only mechanically refrigerated vehicles should be considered at present for long-distance transport. Insulation should be thick enough to give low values for the overall heat transfer coefficient without reducing load space.

The size of the forecourt of the loading docks will depend on traffic and the size of the trucks, but it should be at least 35 m wide when high traffic is expected, and trucks can line up at right angles to the dock. Trucks with an overhead rail should be used for carcass transport. Rails should be standardized to ease transfer from the cold store to the truck, eliminating additional handling. Chilled carcasses must not be piled on the floor

7. Transportation

Effective temperature control during transportation is becoming increasingly important as the shelf life of products is extended and legislation increases. Shipboard transportation of chilled vacuum-packed primal cuts to distant markets is now common practice. However, meat temperatures must be maintained at $-1\pm0.5^{\circ}\text{C}$ to avoid bacteria growth or freeze to achieve the required shelf life. Most International Standard Organization (ISO) containers for food transport are either 6 or 12 m long, hold up to 26 tons of product, and can be 'insulated' or 'refrigerated.' The refrigerated containers incorporate insulation and have refrigeration units built into their structure. The units operate electrically from an external power supply onboard the ship or dock or a generator on a road vehicle. Insulated containers utilize plug-type refrigeration units or are connected directly to an air-handling system in a ship's hold or at the docks.

If products have been cooled to the correct temperature before loading and do not generate heat, they only have to be isolated from external heat ingress. Surrounding them with a blanket of cooled air achieves this purpose. Care has to be taken during loading to avoid any product contact with the inner surfaces of the vehicle because this would allow heat ingress during transport. Many trucks are now being constructed with an inner skin that forms a return air duct along the sidewalls and floor, with the refrigerated air being supplied via a ceiling duct. Control during local delivery is important if meat temperatures are maintained when the meat is transferred to a retail display. If carcass meat is thoroughly chilled before transportation, thermal inertia helps maintain the desired temperature during transport. Studies have revealed the difficulty of maintaining the temperature of consumer packs of chilled meat products in local delivery vehicles. These vehicles have a limited refrigeration capacity and can be subjected to up to 70 doors openings during an 8-hour delivery round in high ambient temperatures.

8. Importance of proper chilling in the meat industry

When meat is chilled so that its temperature falls below about 10°C while its pH is still above 6.2, the muscle will contract. This is called cold shortening, and the meat becomes challenging in proportion to the amount of shortening. If the muscle pH is less than 6.0, it can be cooled fairly rapidly without shortening, although it may shorten when thawed and again become tough if it is frozen. The rate of pH fall can be increased by holding the meat at a high temperature during the early part of the cooling process; this ensures that there is enough time for aging to take place before the meat is chilled, frozen, or consumed.

Module # 09

Carcass and Meat Grading

Carcass Grading

Learning objectives:

Upon completion of this module, the trainees will be able to:

- Understand the basics of Carcass grading and meat cuts grading
- Concept and calculations of dressing percentage for better profitability
- Identification of Primal and Sub-primal beef cuts and market value of each cut
- EUROP® carcass grading system and its role in the marketing of carcasses
- Procedure regarding Meat Standards Australia grading system and its application in industry

1. Introduction

Meat standards and grading are terms that require some definition for accurate discussion as, together with classification, they are often used interchangeably in discussing carcass appearance, cuts, estimated yield, and eating quality. Classification is defined as a set of descriptive terms describing features of the carcass that are useful to those involved in the trading of carcasses. On the other hand, grading is defined as the placing of different values on carcasses for pricing purposes, depending on the market and requirements of traders. Generally, this involves ranking carcasses in a hierarchy for the traits of interests.

2. Carcass Grading

Classification is a means of describing beef carcasses in terms that indicate the suitability and value of a carcass for a particular end usage like retail sale, processor, or exporter. The main elements of the carcass grading system for beef are conformation and fatness.

2.1 Conformation

- Describes carcass shape in terms of convex/concave profiles
- Indicates the amount of flesh in relation to the size of bones

2.2. Fatness

The amount of fat on the outside of the carcass, visible to the assessor

EUROP® carcass grading as per fatness score

3. Beef Carcass Classification

Combining scores for conformation and fat determines the market most suited for each type of carcass, i.e., retail or export.

3.1 Beef Carcass Grading Standards Japan

The grading system used in Japan shows yield grade (A, B, or C) and meat quality grade (1-5). These two indicators combined show the grading of beef, “A5” for the best yield grade and meat quality grade. The grading is judged by Japan Meat Grading Association (in Japanese).



Yield Grade	A	A1	A2	A3	A4			A5 (Best)					
	B	B1	B2	B3	B4			B5					
	C	C1	C2	C3	C4			C5					
Meat Quality Grade		1	2	3	4			5					
BMS		1	2	3	4	5	6	7	8	9	10	11	12

Because yield grade shows how much meat could be taken from the carcass, it is mainly for producers and distributors to set the price. Consumers, who eat Wagyu as little pieces, do not have to worry about this yield grade much. What matters more to consumers is meat quality grade. Meat quality grade is graded by how it looks. Therefore, it does not assure the taste of meat; at least, a higher grade means that it contains more marbling, providing a “melting” experience in your mouth.

Yield Grade (A, B, OR C)

Yield grade indicates how much meat could be taken from carcass compared to standard.

Yield Rate	Meaning	Yield Score
A	Yield is higher than standard	Greater than or equal to 72
B	Carcass has a standard yield	Greater than or equal to 69, less than 72
C	Yield is lower than standard	Less than 69

Yield grade is given based on the yield score, calculated from the rib eye area, short ribs, subcutaneous fat thickness, and half carcass weight. Area and thickness are measured by cutting between the 6th and 7th ribs of the left carcass.

Yield Score

$$\begin{aligned}
 &= 67.37 + 0.130 * \text{area of rib eye (cm}^2\text{)} \\
 &\quad + 0.667 * \text{thickness of short ribs (cm)} \\
 &\quad - 0.025 * \text{weight of half carcass (kg)} \\
 &\quad - 0.869 * \text{subcutaneous fat (cm)} \\
 &\quad + 2.049 (\text{if meat breed(a)})
 \end{aligned}$$

Yield grade may be downgraded if:

- Intermuscular fat is thick compared to that of cattle with the same weight of carcass and/or area of rib eye
- Thigh is not thick enough, and shoulder and thigh are significantly unbalanced

Meat Quality Grade (1 to 5)

Meat Quality Grade is graded by four factors of meat quality: marbling, color, texture, and fat. Grades of 1-5 would be given to all four factors, and the lowest grade of all four would be the Meat Quality Grade of a cattle. 5 is the best, 1 is the worst.

Marbling: Beef Marbling Standard (BMS)

Marbling (サシ (sa-shi) in Japanese) is one of the main characteristics of wagyu, and it is the flecks of fat in the meat. There is a Beef Marbling Standard (BMS) to know how much marbling wagyu includes. BMS has No. 1 to No. 12 given by checking the marbling of rib eye and its surroundings. BMS No. 12 has the most marbling, and BMS No. 1 means there is no marbling.

Marbling is graded to 1-5 based on this score, as shown in the following table.

Marbling Grade	1	2	3		4			5				
BMS (No.)	1	2	3	4	5	6	7	8	9	10	11	12

BMS of No. 10 or higher is often served at the most prestigious restaurants.

Color: Beef Color Standard (BCS)

Grade of color is determined by the color and gloss of the red meat. Color is scored No. 1 to 7 using the color chart below. This score is called Beef Color Standard (BCS).

Color is graded to 1 to 5 based on the BCS and gloss of meat, as shown in the following table.

Color Grade	Color (BCS)	Gloss
5	No.3 to 5	Excellent
4	No.2 to 6	Good
3	No.1 to 6	Standard
2	No.1 to 7	Close to standard
1	Everything else	

Texture

Grade of texture is given by checking the firmness and texture of meat. Being firm does not mean that meat is stiff; it means that meat has decent moisture.

Texture Grade	Firmness	Texture
5	Excellent	Excellent
4	Good	Good
3	Standard	Standard
2	Close to Standard	Close to Standard
1	Loose	Coarse

Fat: Beef Fat Standard (BFS)

The grade of fat is determined by its color, its gloss, and its quality. Color is scored No. 1 to 7 using the color chart below. This score is called Beef Fat Standard (BFS).

Fat is graded to 1 to 5 based on the BCS and gloss of meat, as shown in the following table.

Color Grade	Color (BCS)	Gloss and Quality
5	No.1 to 4	Excellent
4	No.1 to 5	Good
3	No.1 to 6	Standard
2	No.1 to 7	Close to Standard
1	Everything else	

4. Meat Standards Australia (MSA)

MSA grading aims to assure consumers that a cut of beef will eat to the quality shown on an MSA label. This simple description system can form a basis for retail pricing and generate product confidence. This has been lacking, with consumers unable to select beef of the desired quality reliably. Research shows that this lack of product confidence has restricted sales volume and price. MSA is the most modern meat grading system accepted internationally in several countries and is easy to adopt. MSA beef is graded based on the following main factors:

- Fat Color
- Meat Color
- Marbling
- Backfat thickness
- Rib Eye Muscle Area
- pH

Chiller Assessment was developed to enable AUS-MEAT accredited processors to assess, grade, or class carcasses using uniform standards under controlled conditions. The scheme provides a means of describing meat characteristics and of classifying products before packaging. These characteristics include the color of meat and fat, marbling, eye muscle area, rib fat thickness, and the carcasses' maturity. Qualified assessors and results make assessments are allocated to the carcass. This provides a means of (carcass) selection according to individual characteristics contained in specifications.



Meat Colour (MC)

Meat Colour is the predominant colour of the rib eye muscle. Meat Colour (Beef and/or Veal) is assessed on the chilled carcass at the bloomed rib-eye muscle area and is scored against the AUS-MEAT Meat Colour reference standards.

**Beef Fat Colour (FC)**

Fat Colour is the colour of the intermuscular fat lateral to the rib-eye muscle and adjacent to the M. iliocostalis; it is assessed on the chilled carcass and scored against the AUS-MEAT Fat Colour reference standards from 0 to 9

**Marbling (MB)**

Marbling is the fat that is deposited between muscle fibres (intramuscular fat). Marbling is assessed on the chilled carcass at the M.longissimus dorsi muscle and scored against the AUS-MEAT / MSA Marbling reference standards. The AUS-MEAT Marbling system provides an indication of the amount of marbling in beef measured from 0 (least) to 9 (most). AUS-MEAT Marbling is assessed against the proportion of marbling to meat depicted in the Marbling reference standards. Where Chiller Assessors consider marbling

scores 7-9, they must hold a high marbling endorsement. The MSA grading system uses MSA marbling scores in the prediction of eating quality.



Rib Fat



Measurement (RF)

Rib fat is the measurement of the thickness of subcutaneous fat measured in millimetres at the specified rib. The MSA Grading System uses Rib Fat in the prediction of eating quality.

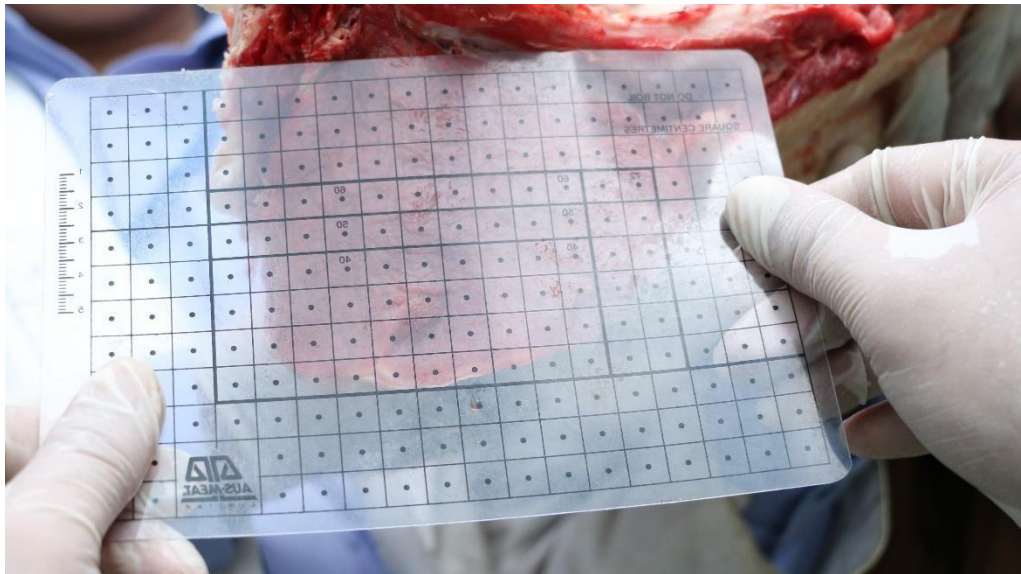
Eye Muscle Area (EMA)

Eye Muscle Area is the area of the surface of the M.longissimus dorsi at the ribbing site and is calculated in square centimetres. EMA may be measured at the 10th, 11th, 12th, or 13th rib. EMA is measured manually using a plastic grid.

Maturity / Ossification (OSS)

Maturity scoring provides a scale for the assessment of the physiological age of a bovine animal. The term, ossification, refers to the cartilage turning to the bone in the spinous processes in three sections along the backbone - sacral (tail), lumbar (loin), and thoracic (head). The process starts in the sacral region in red spots and, as the process increases,

turns
to
hard,



yellow bones.

The shape and colour of the rib bones are also used to determine maturity. Maturity is measured in standardised increments, with the lowest being 100 and the highest being 590. Maturity is used as part of the Chiller Assessment Language for beef when determining eligibility for 7 and 8 tooth carcasses to be packed under the Minimum Standards for Grain Fed Beef (GF). The MSA grading system uses a Maturity score as an indication to determine the eating quality outcome of a carcass.