# Table of Contents

**FOREWORD**........................................................................................................................................ III

1. **INTRODUCTION**........................................................................................................................................ 1

2. **OBJECTIVE**................................................................................................................................................ 2

3. **GENERAL PRINCIPLES**.......................................................................................................................... 2

4. **INSPECTION METHODS**.............................................................................................................................. 3
   4.1. **TRADITIONAL INSPECTION PROCEDURES AND ASSESSMENTS**.................................................. 4
   4.2. **RISK-BASED INSPECTION PROCEDURES**....................................................................................... 6

5. **GUIDELINES FOR MINIMUM MEAT INSPECTION REQUIREMENTS**.......................................................... 7
   5.1. **HEADS**................................................................................................................................................ 7
   5.2. **VISCERA**............................................................................................................................................ 8
   5.3. **CARCASS**......................................................................................................................................... 10
   5.4. **SUPERVISION OF HYGIENIC DRESSING OF CARCASSES**.............................................................. 12

**ANNEX 1. GENERAL PATHOLOGICAL CONDITIONS**.................................................................................... 13

**ANNEX 2: LABORATORY TECHNIQUES**........................................................................................................ 35

**REFERENCES**............................................................................................................................................... 40
Foreword

This technical document entitled “Meat Inspection Guideline” is one of the documents in a series of guidelines and Standard Operating Procedures (SOPs) developed by the Ministry of Agriculture (MoA) in collaboration with the Ethiopian Sanitary and Phytosanitary and Livestock and Meat Marketing (SPS-LMM) Program. SPS-LMM program is financed by USAID and is implemented by the Norman Borlaug Institute for International Agriculture, Texas A&M University System. The main goal of the SPS-LMM program is to increase exports of meat and livestock to benefit Ethiopian livestock producers and exporters and to promote national economic development.

This guideline and SOP is intended to assist public meat inspectors in ensuring meat hygiene and safety at municipal and export abattoirs.

At this point, the Animal and Plant Health Regulatory Directorate (APHRD) would like to thank the SPS-LMM program and USAID for developing and publishing this guideline and SOP.

Last but not least, I would like also to thank Drs. Nega Tewolde and Wondwosen Asfaw for preparing this guideline and SOP.

Berhe G/ Egziabher (PhD)
Head, Animal and Plant Health Regulatory Directorate (APHRD)
Ministry of Agriculture (MoA)
Addis Ababa, ETHIOPIA
1. Introduction

Meat inspection is part of the wider process of screening animals and meat for fitness for human consumption. It can follow traditional or risk based approaches.

In areas where diseases such as tuberculosis, Cysticercus bovis, fascioliasis, etc are prevalent, the traditional approach of meat inspection involving incision and palpation are the best means of revealing these diseases. However, there is a widespread recognition that the traditional approaches may introduce or spread contamination as they involve detailed inspection of tissues, particularly lymph nodes, through multiple incision and palpation.

In situations where zoonotic diseases that produce gross pathological lesions have been eradicated or are controlled, the major hazard in meat is microbiological such as Escherichia coli, Salmonella in beef, etc. In this situation, the traditional inspection methods may not detect these hazards. Rather, a risk-based approach to meat inspection may be deemed more appropriate.

Therefore, the type of inspection system to be applied must reflect local disease risk situations.

In general, meat inspection covers the inspection of the carcasses and parts of meat used for human consumption. It takes place after ante-mortem inspection, and after the animal has been slaughtered. It covers the whole slaughter process that begins at stunning and ends at the step where the carcass is placed in the cooler.

The decision as to whether meat is fit for human consumption or not will utilize many skills of observation and evaluation, and should take into consideration the results of ante-mortem inspection, as well as any available information on the disease history of the herd or region of origin of the animals.

Following meat inspection, regulatory decisions and enforcement of actions should follow available regulations, directives, and notices of MoA.
2. **Objective**

The purpose of meat inspection is to protect the public and animal health by ensuring that the carcasses and parts are healthy, hygienic or wholesome. This means that any carcasses or parts that are unfit for human consumption will not enter the food chain.

3. **General principles**

Meat inspection should provide necessary information for the scientific evaluation of pathological lesions pertinent to the wholesomeness of meat. In general, meat inspection systems should be carried out based on the following principles.

- It has to be carried out without delay after dressing of the carcass is complete. Some lesions may fade with time. Conversely, it should be possible to set suspect carcasses aside for re-inspection later, as some lesions will intensify with time.
- Apart from skin (plus heads and the penis from all species, where these organs are not intended for human consumption), no part of the animal should be removed from the premises until meat inspection is completed and any samples required for further testing have been obtained.
- If blood is collected for human consumption, it is subject to inspection and subsequent passing as fit or unfit in the same way as edible meat and offal. Where blood or offal from several animals is collected in the same container, the batch must be rejected if any single animal is unfit. Conversely, if batched blood shows a condition requiring rejection of a carcass, all carcasses donating the batched blood are rejected.
- It is essential that correlation of a carcass with its separated offal be maintained until inspection is finished because the result of inspection of either carcass or offal will have implications for the action required to be taken on the other part. An effective labelling system is thus required for both carcasses and offal.
- Parts that contain lesions (e.g. abscesses, inflamed lymph nodes, cysts), exhibit a condition deemed inappropriate in edible meat, or present evidence of adulteration must be detained and labelled as such, until further inspection is completed.
- Marking of carcasses passed as fit for human consumption must follow immediately after the completion of
inspection. The mark must be clearly visible and unambiguous; unfit carcasses are not marked in this way.

- Some localized conditions (abscess, arthritis, bruising, contamination, etc) may require partial rejection of a carcass or organ, with only the affected part and tissue in the immediate vicinity being separated and classed as unfit.
- Many conditions exhibit a range of severity ranging from localized to general, acute to chronic, and there is a corresponding range of measures that apply to address the health risk. For example, arthritis can be mild with little damage to the cartilaginous surfaces, non-septic and limited to one joint, which can then be passed as fit for consumption. Or, passing through many intermediate stages, it can be severe and septic, with abscesses around several joints and thus requiring rejection of the whole carcass. Decisions on rejection have to be made on a case-by-case basis, after assessing the significance of the findings.

4. **Inspection methods**

In general, meat inspection systems should include:

- Procedures and tests that are risk-based to the extent possible and practicable;
- Confirmation of proper stunning and bleeding;
- Availability of inspection as soon as is practicable after completion of dressing;
- Visual inspection of the carcass and other relevant parts, including inedible parts, as determined by the competent authority;
- Palpation and/or incision of the carcass and other relevant parts, including inedible parts, as determined by the competent authority according to a risk-based approach;
- Additional palpation and/or incisions, as necessary to reach a judgement for an individual carcass and other relevant parts, and under appropriate hygiene control;
- More detailed inspection of edible parts intended for human consumption compared with inspection of those parts for indicator purposes alone, as appropriate to the circumstances;
- Systematic, multiple incisions of lymph nodes where incision is necessary;
- Other organoleptic inspection procedures, e.g. smell, touch;
• Where necessary, laboratory diagnostic and other tests carried out by the competent authority or by the establishment operator under instruction;
• Performance criteria for the outcomes of organoleptic inspection;
• Regulatory authority to slow or halt processing so as to allow adequate post-mortem inspection at all times;
• Removal of specified parts if required by the competent authority, e.g. “specified risk materials” for BSE; and
• Proper use and secure storage of equipment for health marking.

Professional and technical knowledge must be fully utilized in performing the following tasks during meat inspection.

• Viewing, incision, palpation and olfaction techniques;
• Classifying lesions into one of two major categories – acute or chronic;
• Establishing whether the condition is localized or generalized, and the extent of systemic changes in other organs or tissues;
• Determining the significance of primary and systemic pathological lesions and their relevance to major organs and systems, particularly the liver, kidneys, heart, spleen and lymphatic system;
• Coordinating all the components of antemortem and post-mortem findings to make a final diagnosis;
• Submitting the samples to the laboratory for diagnostic support, if the abattoir has holding and refrigeration facilities for carcasses under detention.

4.1. Traditional inspection procedures and assessments

Meat inspection should utilize many body senses, including sight, smell and touch. Incision into organs and lymph nodes will allow more detailed inspection of these parts. First, a general visual inspection of the carcass, offal and, where appropriate, blood, should be made to detect bruising, oedema, arthritis, condition of peritoneum and pleura and any swelling or abnormality. Other procedures are species and/or age-specific.

a. Bovines

Head. Detailed examination of lymph nodes by incision is needed, the nodes being the submaxillary, retropharyngeal and parotid. The cheek muscles are inspected using deep incisions: two parallel incisions are made in the masseter muscle and a single longitudinal incision in the pterygoid muscle. The
mouth and tongue are visually inspected and the tongue is also palpated.

**Lungs and trachea.** If the lungs are intended for human consumption, incision is additional to visual and palpation inspection required for lungs generally. The trachea and bronchi are opened by knife and the lower ends of the suspended lungs are incised. The bronchial and mediastinal lymph nodes are incised.

**Heart and pericardium.** Following visual examination of the heart and pericardium, the former is incised down its long axis, cutting through the interventricular septum to expose the ventricular chambers.

**Liver.** A combination of visual and palpation inspection procedures to include the hepatic and pancreatic lymph nodes. Incision of the caudate lobe of the liver is also required to expose the bile ducts. The presence of fascioliasis lesions should also be checked.

**Alimentary tract.** Visual inspection of the tract and mesentery accompanied by palpation of the gastric and mesenteric lymph nodes and incision if deemed necessary.

**Spleen.** Visual/palpation. Good practices for the meat industry.

**Kidneys.** Visual and detailed examination of renal lymph nodes if necessary.

**Diaphragm.** Visual inspection.

**Genital organs.** Visual inspection.

**Udder.** If intended for human consumption, each half is incised by a deep cut extending to the lactiferous sinuses and the lymph nodes are incised. Otherwise, visual inspection and examination of the lymph nodes through palpation.

**b. Sheep and goats**

Inspection of small ruminants is less detailed than for cattle. The following procedures are generally required:

**Head:** if destined for human consumption, the throat, mouth, tongue, retropharyngeal and parotid lymph nodes are examined;

**Lungs:** examine for parasites, particularly nematode worms and hydatid cysts;
**Carcass:** palpate to detect inoculation abscesses;

**Heart:** incise lengthways;

### 4.2. Risk-based inspection procedures

In certain circumstances, the competent authority may allow the use of a risk-based system of inspection instead of the traditional inspection procedures outlined above. In traditional systems, each individual animal is fully inspected, whereas a risk-based system may allow random full inspection of a proportion of the animals presented for slaughter. For a risk-based system to ensure wholesomeness of meat, the animals presented must be uniform slaughter-generation (i.e. young) animals, of known health status. Older, cull animals would not be acceptable in such a system, as they carry a high risk of carrying diseases and pathogens. To fulfil the requirement of known health status, an integrated rearing system would be needed, so that the disease history and management details of the herd/flock are known to the official carrying out meat inspection, including results of previous meat inspections. From this information, the official would be able to make a judgment on the risk posed by the animals presented, and modify the meat inspection regime accordingly. Therefore, if the risk were microbiological only, minimizing cross contamination and preventing fecal contamination would be the priority, so the inspection would be predominantly visual. However, if the risks were pathological, there would be a case for returning to traditional meat inspection procedures to allow removal of high-risk tissues and carcasses.
5. Guidelines for minimum meat inspection requirements

5.1. Heads

General

View the external surfaces, the oral and nasal cavities.

Lymph nodes

Submaxillary, parotid and retropharyngeal: view and incise (Figure 1).

Tongue

View and palpate. View only in calves up to six weeks of age.

Other

As part of inspection of cattle for *Cysticercus bovis*, the muscles of mastication should be viewed and one or more linear incisions made parallel to the lower jaw into the external and internal muscles of mastication; in addition one incision should be made into *Musculus triceps brachii* 5 cm behind the elbow.
5.2. Viscera

Lungs

View and palpate. The bronchi should be opened up by a transverse incision across the diaphragmatic lobes. The larynx, trachea and main bronchi should also be opened along their length.

Lymph nodes

Incise bronchial (tracheobronchial) and mediastinal.

Heart

View after the removal of the pericardium. The heart of cattle should be inspected for Cysticercus bovis either by making one or more incisions from base to apex or by everting the heart and making shallow incisions that enable the cardiac valves and muscle tissue to be inspected.
Liver

View and palpate entire surface (both sides). View the gall bladder. For cattle over six weeks of age, incise as deemed appropriate to detect liver flukes. Open large bile ducts. For sheep, pigs and game, incise as deemed appropriate for parasites. Lymph nodes. Portal (hepatic), view and incise.

Spleen

Palpate.
Gastro-intestinal tract

View and incise mesenteric lymph nodes. View and incise if any lesions are observed in the submaxillary lymph nodes.

Kidneys

View after enucleating.

Uterus (adults)

View.

5.3. Carcass

General

Examine carcasses (including musculature, exposed bones, joints, tendon sheaths, etc.) to determine any signs of disease or defect. Attention should be paid to body condition, efficiency of bleeding, colour, condition of serous membranes (pleura and peritoneum), cleanliness and the presence of any unusual odours.
Lymph nodes

The main carcass lymph nodes – being the precrural, popliteal, anal, superficial inguinal, ischiatic, internal and external iliac, lumbar, renal, sternal, prepectoral, prescapular and atlantal nodes, as well as the lymph nodes of the head and viscera – should be incised and examined in all animals in which systemic or generalized disease is suspected, positive to a diagnostic test for tuberculosis and in which lesions suggestive of tuberculosis are found at post-mortem inspection. In all animals the following examination techniques should be used for specific lymph nodes:

- Superficial inguinal (male) – palpate;
- Supramammary (female) – palpate and incise when udder is or has been in lactation, or in the case of mastitis;
- External and internal iliac – palpate;
- Prepectoral – palpate;
- Popliteal – palpate (only sheep/goats);
- Renal – palpate (cattle) or incise if disease is suspected;
- Prescapular and prefemoral – palpate (only sheep and goats).

Figure 8. Medial view of carcass with relevant lymph nodes
5.4. Supervision of hygienic dressing of carcasses

During dressing, the carcass is exposed to contamination from:

- the abattoir environment, including implements used and the hands of the operators: a variety of bacteria, fungi and yeasts are present in the abattoir environment.
- the hides of the animals: hides are heavily contaminated parts of the animal.
- the stomach and gastro-intestinal contents: gastro-intestinal contents have the heaviest load of micro-organisms.

Therefore, during meat inspection it is an important duty of the inspecting officer to ensure that:

- the implements used during slaughtering, dressing and meat inspection are well sanitized periodically, or whenever they are likely to be contaminated;
- during cutting into the hide and exposure of the carcass, the external surface of the hide does not come into contact with the carcass meat;
- the viscera are not accidentally opened during the dressing procedures or during evisceration.

If a carcass or part is contaminated with faeces or visceral contents, such areas should be trimmed off. The opened viscera should be separated from the rest of the carcass as quickly as possible. The introduction of a Hazard Analysis and Critical Control Point (HACCP) concept can be helpful to maintain high standards of slaughter and dressing hygiene based on an assessment of the risks to human and animal health.
Annex 1. General pathological conditions

Abscess

It is a localized, encapsulated collection of pus in a cavity formed by disintegrating tissue. Pus is a collection of dead disintegrating tissue cells and the body’s own inflammatory cells. In size, abscesses may vary from microscopic to almost unlimited dimensions. The general appearance of pus can be described as viscous, cream colored fluid.

Causes

- Invasion of tissue by bacteria, fungi, protozoa and even helminths.
- Poor hygiene technique during injection procedures (leg muscles).
- Penetrating wounds.
- Pyemia (pus forming bacteria in the blood)
- Pyogenic bacteria – Corynebacterium and Pseudomonas spp.

Judgment

A single abscess may be removed if no further spread of infection or contamination with pus to the rest of the carcass can be determined. In case of multiple abscesses in various organs – total carcass condemnation is required.

Anemia

Is a condition where the quantity of red blood cells in a given volume of blood is less than normal (quantitative) or when there is a deficiency of hemoglobin in the red blood cells (qualitative). Clinically, an animal shows weakness, exercise intolerance and paleness of the mucosa.

Causes

Regenerative:

Post Hemorrhagic

- trauma (cuts)
- hemorrhagic enteritis
- hemolytic – breakdown of red blood cells by bacterial toxins, parasites etc. (redwater – Babesiosis or Gallsickness – Anaplasmosis)
Non regenerative:

- Nutritional – deficiency in protein and minerals (chronic emaciation, cachexia)
- Aplastic – suppression of red blood cells synthesis in the bone marrow.

**Judgment**

Depends on severity or cause. Condemn in case of an infectious disease or extreme anaemia.

**Arthritis/arthrosis**

Arthritis is inflammation of the joint and arthrosis is degeneration of the joint. Inflammation results in conformation changes of articular cartilage. Usually occurs in joints where weight bearing is the greatest or where there are abnormal movements.

**Causes**

Bacterial

- haematogenous spread (by blood); (septicaemia, bacteremia)
- penetrating wounds, faulty transport.
- from surrounding infected tissue (osteomyelitis, hoof abscess)

Abnormal weight bearing and conformation of joints.

**Judgment**

Judgement will be determined by the extent of the lesions, and the condition of the animal. Conditional or total condemnation may be done.

**Bacteraemia**

The presence of bacteria in the bloodstream that may give rise to septicaemia and pyemia.

**Bruising**

Discoloration and hemorrhage at the site of injury. In the first 12 hours after injury, the bruise is bright red, in 24
hours it is dark red, in 24–36 hours it loses its firm consistency and becomes watery and at 3 or more days it is an orange-red color and has a soapy feel. This is one of the most common conditions seen during meat inspection and is a serious disadvantage in the meat trade.

**Causes**

Trauma during incorrect transportation, improper handling in lairages, etc.

**Judgment**

Bruising should in all cases be removed and special attention should be given to deeper damage that may not be very prominent. Extensive bruising could merit the total condemnation of the carcass.

**Emaciation**

Emaciation is associated with gradual diminution in the size of organs and muscular tissue as well as oedema in many cases. The organs and muscular tissue appear thinner, moist and glossy. Emaciation is a post-mortem descriptive term that should be differentiated from thinness.

**Cause**

- Malnutrition
- Chronic debilitated animals
- Verminosis

**Judgment**

Total condemnation of the whole carcass.

**Cacexia**

The above process will also happen when an animal become acutely sick and it stops eating. The difference however is that the fat becomes jelly-like and will not coagulate during chilling. In this case however the animal is acutely sick with sometimes signs of fever but sometimes not. This condition is more dangerous because the animal may harbor micro organisms in the blood steam that may be harmful to the consumer.

**Cause**

Bacteria, viruses
Judgment

Total condemnation of the whole carcass.

Calcification

Chronic lesions often become calcified. It is the deposition of calcium (lime) salts in dead and degenerating tissues also known as dystrophic calcification. Parasitic infections and Tuberculosis lesions show a marked tendency to undergo calcification. Calcification of the brisket occurs after degeneration of the fat due to pressure (animal resting on hard surfaces)

Judgment

Removal and condemnation of the affected parts if localized. If widespread condemn whole carcass. Condemnation due to aesthetic reasons.

Caseation

This degenerative change is manifested by the conversion of firm, dry necrotic tissue into a cheesy, pasty mass composed of fine fat droplets and protein. Where the defensive mechanism of the body is adequate the caseated material tends to become encapsulated, and eventually calcified. It is a diagnostic characteristics of TB.

Cirrhosis/fibrosis

Pathology of the liver whereby the normal lobular architecture is damaged and replaced with fibrous strands of connective tissue. This connective tissue can constrict and partition the organ into irregular nodules. The liver often has a lighter color with a distinctive cobblestone appearance on the surface (hobnail liver).

Causes

• Chronic heart failure
• Bile duct inflammation - migrating parasites
• Toxicosis - poisonous plants
• Chronic inflammation

Judgment

Condemnation of the liver with careful examination of the rest of the carcass.
Degeneration

Damage to cells leading to reversible changes. Organs with degenerative changes may have a Parboiled appearance and are slightly swollen and have lost their healthy looking appearance. Fatty changes are intracellular accumulation of fat and is a degenerative process (fatty degeneration). It is mostly seen in the:

- Liver – light brown color and soft/friable/ crumbly.
- Kidneys – slightly swollen, light brown colour.
- Myocardium – light dull brown color.

Causes

- Hipoxia – insufficient oxygen supply to the tissues
- Toxic – plant toxins, mycotoxins and chemical toxins
- Metabolic – stress related causes

Judgment

Condemnation of affected organ or muscle group.

Emphysema

A pathological accumulation of air in tissues. This can be seen as air bubbles between the muscle fibres, or under the skin or in the lung tissue. When palpated the affected areas has a “crackling” like consistency.

Causes

- Trauma – penetration through sharp wounds, rupture of the alveoli.
- Bacterial – gas producing organisms (E coli, Clostridia) – black quarter in cattle.

Judgment

Affected areas are condemned due to aesthetic reasons. If it is due to an infectious cause with systemic or generalized lesions, total condemnation of the carcass is suggested.

Enteritis

Inflammation of the intestinal mucosa resulting in clinical signs of diarrhea, sometimes dysentery, abdominal pain and dehydration coupled with electrolyte loss / imbalance. The
intestines are usually very red, inflamed and swollen. The contents may be catarrhal to hemorrhagic. Enteritis is most commonly seen in young animals less than three months of age.

**Causes**

- Poisoning. Either plants or minerals. There are large numbers of these, which irritate the bowel and cause enteritis.
- Stress. When animals are subjected to stress, their resistance is lowered and normal germs in the intestines that otherwise would not cause any harm, attack the membrane of the intestines and cause inflammation, and possibly even septicemia. Such stress factors include transportation, cruelty, starvation, thirst, etc.
- Contagious diseases. Many diseases cause a serious inflammation of the bowels—diseases such as Paratyphoid, Swine Fever, Anthrax, Colibacillosis, etc.
- Worms. Especially in sheep and young animals may cause injury and irritation of the bowels.
- Dietary changes. Young animals are especially prone to develop enteritis due to changes of diet. This dietetic enteritis is in itself not serious but due to irritation of the bowel, germs often penetrate the damaged intestinal wall and cause septicemia.

Enteritis like most inflammations may be either acute or chronic. In arsenical poisoning, for example, the inflammation is usually so severe as to cause massive hemorrhage in the bowels.

**Judgment**

There are so many factors to be taken into account in judging a carcass with enteritis that it is not always easy. In general if only the intestine is affected and the rest of the carcass is normal, only the intestines are condemned. If, however, the enteritis is coupled with general disease signs such as fever, enlargement of the lymph glands, hepatitis or nephritis etc., then the whole carcass is condemned.

**Fatty degeneration**

It is a condition in which globules of fat become deposited in the cells of a tissue. It is commonly found in the liver, kidneys, heart, and muscles—which have sustained serious injury. It is known to follow mild inflammations when it is usually preceded by a condition known as cloudy swelling, and it is also very often seen in organs from animals which have
been affected with chronic tuberculosis. Certain poisonous substances such as arsenic and phosphorous also bring about fatty degeneration when ingested for long periods in considerable doses.

**Fatty infiltration**

It is found in fat animals with fat accumulation around the kidneys and in the mesentery, which shows up as white areas as if small pieces of chalk have been strewn therein. This condition is not of any pathological consequence and is caused by crystals of fatty acids.

**Fever**

Fever is an abnormally high body temperature. It is a cardinal sign of acute inflammation caused by a noxious agent. Other signs of inflammation are redness, swelling, pain and loss of function.

**Causes**

- Infectious agents – viruses, bacteria, fungi, protozoa, parasites.
- Chemical and physical trauma

During meat inspection, certain changes in the carcass will give an indication that the animal was suffering from a fever.

- An abnormal redness of the carcass
- Meat darker than usual
- Blood filled intercostal blood vessel and peritoneal capillaries
- The onset of rigor-mortes is more rapid
- Blood vessels generally are more injected with blood
- Poor bleeding out

**Judgment**

Due to the possibility of underlying disease and the fact that the high level of blood in the meat reduces shelf life drastically, total condemnation of the carcass is suggested.

**Gangrene**

The death of body tissue (necrosis), generally in considerable mass, usually associated with loss of vascular supply and followed by bacterial invasion and putrefaction. It occurs most frequently in tissues susceptible to contamination, e.g.
skin, lungs, intestine, vagina, uterus and those in penetrating wounds. Although it usually affects the extremities, gangrene sometimes may involve the internal organs. Signs are fever, pain, darkening of the skin, and an unpleasant odor of the affected site. Two forms are known: dry and wet (gas).

- **Dry gangrene** – little to no blood supply to the area, lesions are dry, light brown in color and have a leathery appearance.
- **Gas or wet** – Anaerobic spore forming bacteria (Clostridia) form gas. Lesions which are gas filled may also contain blood tinged serum. Putrefaction of necrotic tissue causes foul smelling – color is purple-green-brown to black color.

**Causes**

- Mainly poor blood supply (hypoxia) – Freezing, snares etc.
- Foreign body drawn into the lungs
- Torsion of organs
- Contaminated wounds

**Judgment**

Unless the gangrene is very localized and there is no evidence of toxemia the carcass and offal is rejected.

**Hepatitis**

It is inflammation of the liver. If severe there can be liver dysfunction. On inspection the liver may be swollen, with rounded borders.

**Causes**

- Infections – viruses, bacteria, parasites.
- Toxins – plant or chemical toxins.

**Judgment**

Condemnation of the liver with careful scrutinizing of the rest of the carcass for signs of associated pathology.

**Hydronephrosis**

Caused by the mechanical obstruction to the flow of urine along the ureters. Common in pig but seen in all animals. The
ureter and pelvis of the kidney are dilated and urinary pressure may lead to eventual obliteration of the kidney tissue, with the formation of a large thin-walled cyst containing urine.

**Hypostatic staining (hypostasis)**

Animals that are sick or dying and lying down for some time may suffer from poor or stagnant circulation in parts of the body or organs nearest to the ground. This is usually seen as an affect of gravity and is more pronounced in large animals. The lungs and thoracic abdominal peritoneum nearest to the ground, will be engorged with blood and stained.

**Causes**

Gravity induced in animals where the blood circulation is extremely poor or non existent.

**Judgment**

Carcass condemnation as the animal was moribund (dying) or dead before slaughter.

**Icterus**

Icterus is the yellow discoloration of tissues (notably white tissue - e.g. membranes, serous surfaces, cartilage, fat as well as the endothelial lining of blood vessels) by an excess of bilirubin, a pigment derived from red blood cell breakdown (destruction) in the blood.

- **Pre-hepatic jaundice**: Pre-hepatic jaundice occurs following excessive destruction of red blood cells. Tick-borne diseases such as Babesia ovis and anaplasmosis cause this type of icterus, which is one of the main causes of carcass condemnation. Overproduced blood pigment, which cannot be metabolized in the liver, builds up in the blood (haemoglobinaemia). It is excreted by the kidneys into the urine (haemoglobinuria). Normal urine color changes and becomes bright red to dark red.

- **Hepatic jaundice**: Hepatic jaundice occurs due to direct damage to liver cells as seen in liver cirrhosis, systemic infections, and in chemical and plant poisoning. In sheep, jaundice may have been caused by phytopgenic chronic copper poisoning. Liver function is impaired and the liver is unable to secrete bile pigments. Obstructive jaundice occurs when the drainage of the bile pigment bilirubin is blocked from entry into the intestine. This
usually occurs due to the obstruction of the hepatic ducts by a tumor, by parasites such as flukes or by gall stones. Obstruction may also occur due to an inflammation of the bile ducts. In hogs, mature ascarides may occlude the bile ducts.

**Causes**

- **Haemolitic** - Severe haemolysis (break down) of red-blood cells due to chemical, toxic or physical causes as well as blood parasites (Babesia or Anaplasmosis) gives rise to excessive production of bilirubin in the blood stream.
- **Obstructive** - Parasites or other obstructions, usually of the bile ducts, cause damage to the liver impairing its ability to remove bilirubin from the blood.
- **Hepatic disease** - excessive liver damage from disease or parasites resulting in the inability of the liver to remove these pigments from the blood.

**Judgment**

Animals suspected to have icterus should be treated as “suspects” on ante-mortem examination. On meat inspection, the carcass and viscera with haemolytic, toxic icterus and obstructive icterus are condemned. Less severe cases are kept in the chiller for 24 hours. Upon re-examination, the carcass may be approved or condemned depending on the absence or presence of pigment in the tissue. If the obstructive icterus disappears after 24 hours, the carcass and viscera can be passed for human consumption. A simple laboratory test will help to make an objective test for bile pigment icterus. Two drops of serum are mixed on a white tile with two drops of Fouchets agent. A blue/green precipitate is positive for bile icterus.

**Incomplete bleeding**

Incomplete bleeding can be caused by stress, ineffective stunning techniques (stun time to long or short, the stun to bleeding time too long) or an ineffective bleeding cut (throat cut or thoracic “sticking”). All the visible blood vessels may be blood filled causing the carcass to have an overall darker red color. This is also true for organs such as the liver which may be dark purple-red in color.

**Judgment**

Meat from such a carcass will have poor lasting qualities and is condemned.
Immaturity

The Standing Regulations prescribe that no person shall slaughter a calf, lamb, kid, pig or any other animal unless it is at least 21 days old and is in a well-nourished condition. Meat of very young animals is less valuable because (a) water content is high, (b) there is very little fat and (c) there is more bone than meat.

Signs of immaturity include:

(a) Meat

(i) Watery, soft can be torn with the fingers
(ii) Greyish pink
(iii) Muscle development is weak. Jelly between muscles
(iv) Little or no fat round kidney, plus Oedema.

(b) Animal (calves)

(i) Eight teeth not all at same height
(ii) Navel cord still attached.

Infarcts

Usually seen in kidneys. Cone-shaped, yellow or white areas of necrosis. Base of cone on the surface of organ and slightly raised. Apex of cone extends into tissue. The cause of infarction is obstruction of capillaries and starvation of the cells and tissue area serviced by those capillaries resulting in the death of the cells and tissue in a conical shaped area. The term “embolism” is also associated with this condition.

Inflammation

Inflammation is a localized protective response, which serves to destroy, dilute or wall off (isolate) both the injurious agent and the injured tissues. Inflammation is both a cellular and vascular response. The classic signs of inflammation are heat, redness, swelling, pain and loss of function. There are three major components of this process.

- Changes in the caliber of blood vessels and the rate of flow through them.
- Increased capillary permeability.
- Leucocytic exudation.
Causes

- Physical damage – injuries
- Thermal – heat or cold, radiation (sun burn) etc
- Chemical agents – caustic agents, toxins etc.
- Biological agents – bacteria, viruses, protozoa, parasites e.g.

The inflammatory changes seen have one or more of the following characteristics:

- Discoloration – When the injury occurs, small blood vessels relax and more blood flows to the area, giving a red appearance.
- Heat – Due to increased blood flow the area becomes warmer than the surrounding tissues.
- Swelling – Increased blood flow and relaxation of the blood vessels in the inflamed area, allows more fluid to escape from the blood vessels into the surrounding tissues causing swelling.
- Pain – Due to above mentioned processes nerve endings are irritated, pressure is brought to bear on nerves and also chemicals are released by the system which evokes pain.
- Lack of function – Pressure on organs, nerves and blood supply may cause temporary and in severe cases, permanent loss of function of an organ. For instance swelling may cause a gland to stop secreting as ducts from the gland are blocked. General impairment of the body's function in the effected areas can be experienced.

Inflammation can be classified as acute or chronic. In acute inflammation, the typical symptoms of redness, swelling, heat, pain and loss of function are severe. In chronic inflammation a great deal of connective tissue has been deposited, manifested by adhesions and hardening of organs as in chronic inflammation of the liver or also known as cirrhosis of the liver.

Judgment

Condemnation of the affected organs or tissue. Total condemnation if the inflammatory response is wide spread through the whole body.

Mastitis

Inflammation of the udder, more often seen in dairy cows. The udder is swollen, hot and painful to the touch and changes are noted in the normal color and consistency. The milk usually
contains small lumps, which can be seen when the milk is drained through a sieve. Mastitis can occur in chronic as well as acute forms which may be gangrenous and involve systemic changes.

Cause

Primary as well as secondary infections involving:-

- Bacteria
- Fungi
- Yeasts

Judgment

In chronic cases, the udder is removed and condemned. As chronic mastitis is not easily identified on the slaughter floor, it may be assumed that all adult udders, which have lactated, may be infected and should as a rule be condemned. Bear in mind that an udder with any grade of infection constitutes a source of contamination through exuding milk and fluids. Acute or gangrenous mastitis warrants the condemnation of the whole carcass if systemic changes are indicated or the lymph nodes indicate spreading of the infection.

Metastasis

This is the transfer of disease from one organ or part to another not directly connected with it. It may be due either to the transfer of pathogenic (disease causing) bacteria or of abnormal cells, as in malignant tumors.

Causes

- Pathogenic bacteria.
- Fungi or foreign material.
- Emboli of tumor cells.

Judgment

Condemnation of the affected part or whole carcass (abscessation).

Meat odors

Each species has a natural distinctive smell, which in male animals, especially billy goats and boars are very strong. Other unnatural odors may be caused by feed or foreign substances or systemic reasons.
Causes

- Feed ingredients – Fishmeal, sojameal, other plants.
- Medications – Turpentine, iodoform.
- Metabolism – Abnormal metabolism – acetomia.
- Environment – Paint, insecticides, decomposing matter, freezer burn etc. will affect stored meat.

Judgment

- Detainment of carcass for 24 hours – Aesthetic reasons condemn or pass.
- Medications – Condemn. (Withdrawal periods not adhered to).
- Test procedures – Detain the carcass or meat for 24 hours. Boil a piece including some fat and test if smell or taste is still present and objectionable.

Melanosis

Melanin is a natural pigment, which occurs in the skin, hair, nails and membranes. The excessive abnormal deposition of Melanin in a carcass is called Melanosis. It is most common in the lungs where it should be distinguished from anthracosis, which is an abnormal accumulation of dark carbon pigment (smoke). There are two types of conditions, which involves an excess of melanin:

- Melanoma – a benign deposition of melanin in an organ or part of the body.
- Melanosarcoma – a malignant tumor which undergoes metastasis to other parts of the body

Judgment

Organs with an excess of melanin can be condemned for aesthetic reasons.

Metritis

Inflammation of the uterus caused by a bacterial infection.

Judgment

Carcasses are condemned if it is affected with acute metritis which is associated with septicemia or toxemia. In chronic cases where no toxemic signs are present, the carcass may be passed after being detained and a thorough secondary inspection done.
Myopathy

It is any disease or pathological process that causes changes to the muscle fibers such as degeneration, necrosis, hypertrophy, atrophy, and fibrosis. The muscles may show distinctive changes in colour i.e. chicken flesh coloured areas in red meats or steaks or white calcified areas. The muscle fibers may also be very swollen accompanied with various discoloration of red to black or excessive infiltration of fibrous connective tissue in a chronic process.

Causes

- Capture Myopathy/trauma – Excessive or poor handling on the farm.
- Nutritional – Vit E/Selenium deficiency

Judgment

Affected areas should be carefully evaluated and severely affected carcasses totally condemned due to aesthetic reasons. Smaller areas can be trimmed.

Necrosis

Necrosis is the death of cells while the body as a whole is still alive. Cells are irreversibly damaged. Normal tissue is shiny and translucent while dead tissues become dull, opaque with a loss of color and is usually sunken from the surrounding tissue.

Causes

- Infection – certain pathogenic bacteria and viruses.
- Disturbance of blood supply – thrombus, pressure
- Pressure – over extended period of time (sternum necrosis in cattle)
- Toxins – organic / inorganic
- Trauma – injuries etc.
- Thermal – excessive heat or cold (cooking or frost bite).
- Interference with a nerve supply – due to injury, pressure etc.

Judgment

Condemnation of the affected part or total condemnation if pathogenic or zoonotic organisms are involved.
Nephritis

Infection of the kidneys causing swelling and bulging and red coloration of the organ.

*Cause*

Disease – Bacteria, fungi, viruses

*Judgment*

Will depend on level of infection and whether the carcass is uraemic or otherwise affected.

Nephrosis

Due to blockages, enlarged water filled areas (cysts) form within the kidney. This condition is not necessarily associated with infection and the unaffected parts of the kidney may appear and function normally.

*Cause*

Build up of urate crystals causing damage to the organ.

*Judgment*

Will depend on complications affecting the rest of the carcass.

Neoplasm (tumour)

The term is derived from a Latin word meaning “new growth” or “new formation”. A neoplasm is an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of normal tissues. It persists in the same excessive manner after the cessation of the stimuli which evoked the cause. Tumors are either malignant or benign. Malignant tumors grow quickly and expansively and infiltrate the surrounding tissue usually causing severe damage. They may undergo metastasis. Benign tumors like warts usually stay in one area and may disappear after time.

Types of tumours:

- Adenoma – growing in connection with a gland.
- Angioma – formed by a mass of small blood vessels, or spaces in which blood or lymph circulates.
- Chondroma – mainly composed of cartilage.
• Osteoma – mainly composed of bone etc.

**Causes**

• Toxins – Industrial, plant, organic / inorganic.
• Viruses

**Judgment**

Trim or condemn affected part due to aesthetic reasons. If wide spread (metastatic), total condemnation.

**Oedema**

An excessive accumulation of fluids in the intercellular spaces and body cavities

• Accumulation of fluid in the thoracic cavity – hydrothorax
• Accumulation of fluid in the abdominal cavity – ascites
• Accumulation of fluid in the intercellular subcutaneous tissues – anasarca
• Accumulation of fluid in the pericardium – hydropericardium
• Accumulation of fluid in the kidney – hydrenephrosis

**Causes**

• Malnutrition
• Internal parasites e.g. worms
• Heart failure in all species
• Liver cirrhosis (excessive connective tissue laid down in liver
• Chronic nephritis
• Infectious diseases like pulpy kidney in sheep and horse sickness, etc.
• Anemia

**Tests for oedema**

The alcohol flotation test on bone marrow determines the percentage of water in the bone marrow.

**Judgment**

Depending on the cause–partial or total condemnation.
**Omphalophlebitis**

Inflammation of the umbilical vein, and is commonly present in the early stages of navel ill.

**Oversticking**

In-sticking, back-bleeding. Caused when slashing of the heart or severance of blood vessels of the thorax when sticking pigs. A clot of blood forms in the thorax, staining the tissues, and necessitating the removal of the parietal pleura.

**Pericarditis**

This is an inflammatory process around the pericardium. It can be thickened or be covered with a cream, fibrous membrane indicating an infectious process. In severe cases the pericardium may be adhere to the heart and interfere with the function.

**Causes**

- Infections – bacterial, fungi, viruses.
- Mechanical – migration of wire or metal, and other sharp objects from the stomach.

**Judgment**

Total condemnation, as this may be an indication of a Septicemia. Condemnation of the organs (heart, liver intestines) if only a localized process.

**Peritonitis**

An inflammatory process of the membrane of the abdomen (peritoneum). In early stages it may just be red. Depending on the cause, floccules of pus or adhesions between the organs and the abdominal wall may be evident or an accumulation of oedema may be present.

**Causes**

- Infections – bacterial fungi.
- Trauma – penetrating wounds or objects (from the stomach)
- Spread from other inflammatory processes – (pericarditis)
Judgment

Total condemnation of the carcass if it is septicaemic.

Petechia/echimosis/suggilations

These are descriptive terms for haemorrhages seen on surfaces of the body or organs. Petechia are the smallest pin point haemorrhages < 1mm. Echimosis are larger. Suggilations are large areas which look as if it has been painted. They can all be seen sometimes in or on one surface.

Causes

Trauma, necrosis of blood-vessel walls, rupture of blood-vessel walls, hipotention, increased permeability of blood-vessel endothelium, interference with the coagulation process.

Judgment

Depending on the cause and other changes of the carcass partial or total condemnation (viraemia).

Pleuritis

Inflammation of the inner lining of the thoracic cavity (pleura). Acute or chronic as in peritonitis

Poorness

The animal becomes emaciated due to lack of sufficient food (winter or drought). Body fat will disappear. Muscles and fat around the kidneys is initially firm (not watery). May develop cachexia (in extreme cases—condemn)

Purulent

It is a process characterized by pus. Pus is a creamy yellow white liquid that may be thin or very thick. It is an accumulation of neutrophyllic polymorphonuclear /granulocytes.

Causes

- Bacteria – Psuedomonas, Coryne bacterium.
- Fungi.
**Judgment**

Condemnation of the affected part if localized. If the condition is wide spread or associated with wide spread contamination by pus, then total condemnation.

**Pyaemia**

The spreading of puss forming bacteria through the blood stream resulting in metastatic abscessionation in other parts of the body is known as Pyemia.

- Muscles → lungs
- Stomach → liver

**Causes**

All pus forming (purulent) organisms:

- Bacteria – Psuedomonas, Coryne bacterium.
- Fungi.

**Judgment**

Total condemnation if carcass is pyemic.

**Rigor mortis**

This is stiffening of the muscles of the body. It takes place due to a lack of ATP (energy molecule) when the myosin filaments “lock”. It sets in 1-8 hours after death and starts at the most active muscles. Muscle becomes hard, opaque and shrinks. Temperature rises a little at first, then drops to that of surrounding air. It disappears 20–30 hours later due to lysis of proteins.

Rigor mortis is influenced by three factors:

- Glycogen reserves in muscles – for well-fed animals it takes longer to set in.
- pH of the muscle – it sets in sooner at a low pH (acid).
- Temperature – chilling of the carcass retards the development of rigor.

It is important in the industry to evaluate the keeping quality of meat which is related to pH and the proper setting in of rigor.
Septicaemia (blood poisoning)

A condition where pathogenic organisms are present in the bloodstream. If bacteria penetrate the body, they usually do so through a wound or through the intestine or respiratory canals. An animal with septicaemia has fever and numerous small haemorrhages on serous membranes. The liver and kidneys are usually pale and the spleen enlarged, and various organs may be infected.

**Cause**

There are many kinds of germs that can cause blood poisoning, but those that are of special importance in meat inspection, are those that can cause disease in humans (the so called zoonotic diseases or zoonoses). These include diseases such as Anthrax or Salmonellosis (food poisoning).

**Telangictasis**

Occurs in the livers of older cattle. Cause unknown. Visible as dark purple red sunken areas of the liver commonly called “plum pudding liver”. In serious cases the liver is condemned only for aesthetic reasons.

**Toxaemia**

The spreading of toxins produced by bacteria via the bloodstream. Lesions or changes depend on the type of toxins and its affinity for organs or systems in the body.

**Cause**

Bacterial mostly – Clostridium, E. coli, Salmonella.

**Judgment**

Total condemnation.

**Uraemia**

The presence of urinary constituents in the blood, and the toxic condition produced thereby. Typical smell of urine in the meat (test by boiling)
Valvular endocarditis

Cauliflower-like masses on the heart valves (right atrium and ventricle) caused by bacteria. It is usually dark shiny red and black.

Causes

Bacterial – Via bacteraemia (bacteria in the blood) – bacteria lodge in the heart valves.

Judgment

This condition may indicate a generalized infection in the body therefore the inspector must carefully inspect the rest of the carcass for any signs of infection.
Annex 2: Laboratory techniques

Although a meat inspector is not trained as a laboratory technician, there are a few tests that could be performed with just the basic skills and equipment. These tests are mostly diagnostic procedures that can assist the veterinarian in making his judgment of a detained carcass.

1. Preparation of blood-smears

- Bloodsmears are made to examine a blood sample for the presence of protozoa, e.g. Babesia, Anaplasma, etc., for the presence of bacteria, especially anthrax bacilli and also for conditions such as anaemia.
- Bloodsmears should be made as soon as possible after the death of the animal, especially if the smear is to be used for cytological studies.
- Blood for blood-smears is usually collected by cutting a small vein on the ear or under the tail of the animal.
- A small drop of the blood is then picked up with the edge of a glass slide.
- Pick up a second slide and hold it between the thumb and index finger and place second slide on the flat surface of the first slide at an angle of approximately 45° so that the drop of blood spreads along the entire edge at the back of the first slide.
- Smear the blood over the surface of the second slide with a single quick stroke.
- Air-dry the film of blood by waving it through the air until completely dry.
- Fix in methyl alcohol for 3 minutes.
- Stain for 30 minutes in 10% Giemsa stain or 5 minutes in 50% Giemsa.
- Air-dry and examine under the oil immersion lens of the microscope.

2. Phase test for icterus

- Place 2 g of kidney fat (free from connective tissue and blood) in a test tube.
- Add 5 ml of a 5% aqueous solution of sodium hydroxide (Na+OH−).
• Clamp the test tube in a thong and heat slowly and carefully over the flame of a Bunsen burner.1
• Boil for 1 minute until all the fat has dissolved.
• Cool down the contents of the tube by holding the tube under running tap water until the tube can just be comfortably held in the hand without burning.
• Slowly add 5 ml of di-ethyl ether and shake carefully.
• Allow the suspension to stand for a few minutes until the phases has separated, i.e. a water soluble phase at the bottom of the test tube and an ether soluble phase on top.
• If bile salts was present in the fat, it will form a water soluble salt in the bottom phase which will then be greenish-yellow in colour.
• If the fat was yellow due to plant pigments (mainly carotin) the ether phase on top will show a yellowish discoloration because plant pigments are insoluble in water.
• Plant pigments in the fat do not justify condemnation of the carcass.
• If both the ether and water soluble phases show a yellow discoloration, both plant pigments and bile salts was present in the fat and condemnation of the carcass is then justified because of the presence of bile salts.

3. Alcohol-flotation test for oedema

• This test is used to determine the water content of bone marrow, e.g. when judging an oedematous carcass. The water content of normal bone marrow of bovines is below 25%.
• Three reagents are needed, namely 32%, 47% and 52% ethanol.
• Pour 30 ml of each of the 3 reagents into separate glass beakers.
• Collect bone-marrow from the suspected carcass and float a pea-sized piece in each of the 3 beakers.
• If the marrow sinks to the bottom in all 3 beakers, the water content is more than 50% and the carcass is condemned for oedema.
• If the marrow floats in 32%, but sinks in 47% and 52%, the water contents are between 40 - 50% and the judgment will depend on the physical appearance of the suspected carcass after overnight chilling.

1NB: always keep the mouth of the test tube away from yourself and from bystanders because sodium hydroxide reaches its boiling point very suddenly and with a stormy reaction.
• If the marrow floats in 32% and 47%, but sinks in 52%, the water contents is between 25 - 40% and the judgment will also depends on the physical appearance of the carcass after overnight chilling.
• If the marrow floats in all three beakers, the water contents is below 25% and the carcass could be passed.

4. Determining the chlorine contents of water

The most convenient method for determining the chlorine content of water is by using the Lovibond Comparator Method. Three chlorine values is of importance in meat hygiene, namely

• Total Residual Chlorine (the amount of chlorine originally put into the water),
• Free Chlorine (the amount of usable chlorine left in the water) and
• Combined Chlorine (the amount of chlorine that was used up to kill micro-organisms in the water).

Of these 3 values, the free chlorine content is the one most frequently used.

To determine the chlorine content of water, you will need the following equipment and reagents:

• Lovibond Comparator 2000
• Comparator Chlorine discs
• DPD Tablets No 1 and No 3

• Aseptically collect a water sample from an appropriate source on the slaughter floor.
• Fill the left hand tube of the Comparator with 10 ml of the sample.
• Rinse out the other tube with the sample but leave about 2ml in the tube.
• Add to these 2 ml of sample one DPD No 1 Tablet and allow to dissolve or crush with a stirring rod.
• Make the volume up to 10 ml with the sample, mix and place in the right hand compartment of the Comparator.
• Immediately hold the Comparator against a bright white light and rotate the disc until a colour match is obtained.
• Record the reading as p.p.m. of free chlorine.
• To obtain a total residual chlorine reading, proceed as described above but use one DPD No 1 and one DPD No 3 tablet together.
• Record the reading as p.p.m. of total residual chlorine.
• To obtain a combined chlorine reading, deduct the free chlorine reading from the total residual chlorine reading.
• Potable water should preferably have a free chlorine reading of at least 2 p.p.m. chlorine, whereas the water in a poultry spin chiller should have a free chlorine reading of at least 50 p.p.m. chlorine.

5. pH Determination of Meat

The pH-value of a live muscle is about 7,0 - 7,1. After slaughtering, disintegration processes commence which cause a gradual lowering of the pH-value from the initial 7,0 to values between 5,0 and 6,0 after 24 hrs.

pH-1 values (1 hour after death) are used as an early detection of PSE and DFD meat and pH-24 values (24 hours after death) of normal carcasses are used to determine the following requirements.

- Cattle - 6,3
- Sheep - 6,3
- Goats - 6,3
- Pigs - 6,4

When the pH-24 value of a carcass is higher than the above mentioned requirements, the freshness of the carcass should be re-evaluated by the Veterinarian. Provided the bacteriological test results are negative, such meat may be passed or conditionally passed by him.

- Apparatus and materials needed are as follows:
  - Portable pH meter
  - Suitable meat piercing electrode
  - Piercing tool
  - Standard Buffer Solutions pH 7 and pH 4
  - Wash bottle containing distilled water
  - The best measuring site is on the M. Longissimus dorsi directly across the last pair of ribs. Alternatively triceps brachi, gracilllis.
  - Prior to every series of readings, calibrate the pH meter in the buffer solutions according to the manufacturers instructions.
  - Pierce a hole in the muscle with the piercing tool.
  - Wipe the electrode with a soft tissue and insert the electrode into the prepared hole.
  - Make and record the pH reading.
• Remove the electrode from the muscle, rinse the tip of the electrode with distilled water and wipe dry with a tissue. This must be done between every reading.
• Repeat the procedure on other carcasses.

6. Sampling for dispatch to other laboratories

Where pathological or other samples have to be dispatched to a laboratory for analyses, the sampling procedures, use of suitable containers, etc. should be according to those prescribed by National Animal Health Diagnostic Investigation Centre.
References


**RSPH (2006):** Qualifications in Meat Hygiene and Inspection, Royal Society for the Promotion of Health, Royal Society for Health, 38a, St. George's Drive, London SW1V 4BH.