

Control of hazards of public health and animal health importance through ante- and post-mortem meat inspection

Working Group on Animal Production Food Safety

Background

Food-borne disease and zoonoses are generally recognised as important public health problems and important causes of decreased economic productivity in both developed and less developed countries. Similarly, transmission of hazards of animal health importance via the food chain and associated by-products can result in highly significant economic loss in animal populations. Inspection of slaughter animals can also provide a valuable contribution to surveillance for specified diseases of animal health importance particularly exotic disease. Control and/or reduction of hazards of public health and animal health importance by ante- and post-mortem meat inspection is a core responsibility for government veterinary services.

Recent government policy changes in many countries reflect the demand for significantly increased resources to protect public health against food-borne diseases of animal origin. Along with this, rapidly increasing trade in food at both the local and international level is resulting in increased attention to biosecurity and the potential for transmission of diseases of animal health importance via the food and feed chain. In a global regulatory environment that is more and more intent on placing responsibility on industry for ensuring “biosecurity” in relation to human and animal health, government veterinary services must exercise these responsibilities in a cost-effective, independent, transparent and interdisciplinary manner.

Scope of this paper

Increased collaboration between the World Organisation for Animal Health (OIE) and the Codex Alimentarius Commission (CAC) in respect of food standards (see below) has led to the formation by OIE of the Animal Production Food Safety Working Group (APFS WG). It is the intent of OIE that the work of the APFS WG will result in the development of recommendations on several aspects of veterinary involvement in food safety. This document on ante- and post-mortem meat inspection controls provides a discussion paper on which to base future development of OIE guidelines. It is complimentary to a discussion paper on "The role and functionality of Veterinary Services in food safety throughout the food chain" that has been circulated to OIE Member Countries and has been discussed at the OIE General Session in May 2004.

International standards

International organisations involved with public and animal health include the World Trade Organization (WTO), Food and Agriculture Organization (FAO), and World Health Organisation (WHO). At the sector level, the international organisations developing "standards" (standards, guidelines and related texts) are the CAC and the OIE.

CAC

The CAC develops international food standards, guidelines and related texts (hereafter referred to collectively as "standards"). Standards concerned with food safety should be implemented within a generic framework for managing food-borne risks and should “recognise the need for flexibility ... consistent with the protection of consumers’ health”¹. The activities of Task Forces functioning in parallel with the Committee system also include risk-based approaches to food safety e.g. the goal of the *Ad Hoc* Intergovernmental Task Force on Animal Feeding is to ensure risk-based animal feeding practices at the level of primary production². National competent authorities are increasingly adopting this approach.

¹ Report of the Twenty-third Session of the Codex Alimentarius Commission. ALINORM 99/37. FAO 1999

² Code of Practice on Good Animal Feeding.

Although the establishment of national food regulatory systems is the responsibility of governments, the CAC has a strong interest in providing guidance on sound legislative frameworks and infrastructure. Official recognition of the equivalence of alternative measures in different scenarios is a key principle of food safety risk management.

The CAC seeks wider strategic alliances with other international organisations in working towards enhancing food control on a world-wide basis. In this respect, the strategic framework of the CAC for 2003-2007 has an objective to “promote linkages between Codex and other multilateral regulatory instruments and conventions”.

OIE

OIE develops international "standards" for animal health and zoonoses. These are primarily designed to prevent the introduction of pathogens to animals and humans into an importing country during trade. The Terrestrial Animal Health Code does not generally differentiate between measures intended to safeguard animal health and those intended to safeguard human health.

There has been a significant increase in OIE food safety activities in recent years. Historically OIE has mainly been concerned with zoonoses that cause disease in animals but has now accepted the challenge to be more active in the area of public health and consumer protection and has noted that this should include “zoonoses and diseases transmissible to humans through food, whether or not animals are affected by such diseases”. OIE intends developing new standards covering most relevant pathogens and contaminants that are dangerous for humans for inclusion into the *Terrestrial and Aquatic Animal Health Codes* and the *Manuals*.

Veterinary public health issues addressed by OIE to date include: inspection regimes for animals and products of animal origin; certification of meat; control of food-borne hazards during primary production e.g. the agent of BSE, *Salmonella* spp., *Trichinella spiralis*, cysticercosis, antimicrobial resistance and residues of veterinary drugs; and good veterinary practice at farm level. All these activities contribute to meat hygiene amongst other benefits.

Increased collaboration between OIE and CAC in respect of food borne zoonoses, particularly through the work of the OIE APFS WG, will result in standards and texts that bridge public and animal health interests across the ‘production to consumption’ continuum. It is the intent of OIE that collaborative work will result in increasing cross-reference to Codex in the *Terrestrial Animal Health Code*, and development of recommendations by OIE on several aspects of veterinary involvement in food safety. Similarly, it is expected that OIE will provide major contributions to the Codex codes of practice and other texts that incorporate a ‘production to consumption’ risk-based approach.

Codex Code of Hygienic Practice for Meat

A new Draft Code of Hygienic Practice for Meat³ has recently been completed by the Codex Committee on Meat Hygiene (CCMH) and is expected to be adopted in 2005 by the CAC. The Code constitutes the primary international standard for meat hygiene and incorporates a risk-based approach to application of sanitary measures throughout the food chain. Ante-mortem inspection is described as a primary component of meat hygiene pre-slaughter, and post-mortem inspection is described as a primary component of process control in post-slaughter meat hygiene.

³ Draft Code of Hygienic Practice for Meat. ALINORM 05/28/16. FAO 2005

The Draft Code of Hygienic Practice for Meat specifically recognises the duality of objectives that slaughterhouse inspection activities deliver in terms of public and animal health.

As the draft Code must serve as an international standard, it does not provide inspection measures for specific hazards or organoleptically detected abnormalities which remain the responsibility of national competent authorities. The public and animal health risks associated with slaughter populations are very different in different geographical regions and animal husbandry systems, and therefore the ante- and post-mortem inspection should be tailored to the individual country situation and their public and animal health objectives.

Other inputs to ante- and post-mortem meat inspection programmes arise from other Codex work. In particular, the Codex Committee on Food Hygiene (CCFH) develops overarching standards on food hygiene; the Codex Committee on General Principles (CCGP) develops general guidelines for risk analysis and for collaboration with OIE and the Codex Committee on Import and Export Inspection and Certification Systems (CCFICS) develops "horizontal" standards that guide implementation of national inspection programmes and certification.

Ante- and post-mortem inspection includes "any procedure or test conducted by a competent person...for the purpose of judgement of safety and suitability and disposition"⁴. Thus tests for compliance with the standards established by CAC for chemical residues, pesticides and contaminants may be included in these inspection activities. Similarly, the new microbiological risk assessment work of the Joint Expert Meeting on Microbiological Risk Assessment (JEMRA) will lead to specific risk management advice from CCFH on tests for microbial hazards e.g. *Salmonella* spp. in broilers, enterohaemorrhagic *Escherichia coli* in ground meats, *Listeria* spp. in manufactured meats.

Although the Draft Code provides a platform for development of meat hygiene systems that are based on risk assessment, it is recognised that currently there is a dearth of risk assessment models and other risk-based scientific information in this area. While this scientific information is being accumulated, ante- and post-mortem inspection systems will remain dependent on "traditional" approaches (Appendix II). A framework for developing risk-based procedures is presented in Appendix III.

Veterinary Services

Special editions of the OIE Scientific and Technical Review Series have illustrated the widely varying approaches to organisation of veterinary public health, veterinary animal health and public health services within national competent authorities⁵. Integrating all nationally-mandated food inspection systems under a single competent authority is promoted as having several advantages, including a reduction in overlap and improvement in service delivery⁶. While organisation structure can vary from country to country, it is essential that coverage, resources and scientific and technical capabilities deliver a continuously high standard of service. Further, credible public and animal health assurances are essential for access of animal products to international markets.

⁴ Draft Code of Hygienic Practice for Meat. ALINORM 05/28/16. FAO 2005

⁵ Scientific and Technical Review Series: Volumes 10 (4) 1991; 11 (1) 1992; 22 (2) 2003

⁶ The organisation of federal Veterinary Services in Canada: the Canadian Food Inspection Agency. Scientific and Technical Review Series: Volume 22 (2): 409-421. 2003

In respect of ante- and post-mortem inspection as a component of meat hygiene, responsibilities of national competent authorities who are usually Veterinary Services⁷ include:

- a) Risk assessment
- b) Establishment of policies and standards
- c) Design and management of inspection programmes to deliver public and animal health objectives which must involve a risk based approach
- d) Assurance and certification of appropriate delivery of inspection and compliance activities
- e) Dissemination of information throughout the food chain
- f) Notification of presence of notifiable diseases
- g) Conformance with WTO obligations
- h) Negotiation of mutual recognition and equivalence agreements with trading partners.

Ante- and post-mortem meat inspection programmes

Ante- and post-mortem meat inspection programmes are primary responsibilities of national Veterinary Services⁸. Wherever possible, inspection procedures should be designed according to a risk-based approach and management systems should reflect international norms.

Risk assessment

In a contemporary veterinary public health and animal health environment, Veterinary Services should utilise risk assessment to the greatest extent possible in the development of measures. National competent authorities are facing increased demands for technical expertise to develop domestic measures on this basis, while at the same time endeavouring to meet risk analysis obligations as assumed under international trade .

The unavailability of human risk assessment information for the whole food chain makes difficult the development of risk-based standards for food-borne zoonoses.

Risk assessment in meat hygiene

Ante- and post-mortem inspection programmes are aimed at achieving the designation of meat as being "safe and suitable". However, this is generally only a *qualitative* measure of freedom from hazards to human health. Post-mortem meat inspection cannot ensure freedom from grossly-detectable abnormalities, and sampling programmes for hazards have limited ability to detect randomly-occurring non-complying levels of residues and contaminants. More importantly, some transfer of microbiological contamination from the hide / fleece etc. to the carcass is inevitable in the slaughterhouse environment.

⁷ For the purposes of this discussion paper, "Veterinary Services" refers to veterinary public and animal health activities irrespective of the organisational arrangements of competent authorities at the national level.

⁸ OIE Animal Production Food Safety Working Group. "Role and functionality of veterinary services in meat hygiene throughout the food chain". 71st General Session of the OIE. 2003

There is only limited scientific evidence linking traditional ante- and post-mortem inspection with measurable outcomes in terms of human health. Additionally, there has been limited progress in tailoring inspection procedures to the spectrum and prevalence of the diseases/defects present in a particular class of slaughtered livestock from a specific geographical region. A risk assessment approach can be used to address these problems and facilitate the proportional allocation of meat hygiene resources and type of inspection and tests according to level of risk⁹.

Risk-based approaches to meat-borne risks to human health are also demonstrating that unseen microbiological contamination rather than grossly-apparent abnormalities detected at ante and post-mortem inspection, is the most important source of hazards. This has led to increasing demands for more systematic approaches to combat these hazards e.g. HACCP systems.

Microbiological, serological or other testing at single-animal and herd level as part of new, risk-based post-mortem inspection can support surveillance as well as risk assessment efforts related to priority foodborne hazards. Such data and typing information can be linked to human disease data, providing for assessment of efficiency of management options as well as a general evaluation of food sources of foodborne disease.

Risk assessment in animal health

The OIE *Terrestrial Animal Health Code* contains detailed provisions on import risk analysis. Regionalisation and surveillance for animal diseases in the exporting country provide important inputs to the risk assessment process. Unlike food safety, animal health risk assessment for control of endemic diseases of animal health importance in a regional environment is not commonly carried out. OIE standards for zoonoses are not generally based on human health risk assessments *per se*.

OIE defines risk assessment as "the evaluation of the likelihood and the biological and economic consequences of entry, establishment, or spread of a hazard within the territory of an importing country". For many of the standards, it is stated that there is "broad agreement concerning the likely risks", however, these are not linked to specific decisions on an appropriate level of protection (ALOP). The recently formulated OIE risk analysis process for antimicrobial resistance introduces a risk management framework very similar to that used in food safety¹⁰ (see below).

Generic framework for managing public health and animal health risks

Although food safety and animal health sectors have developed a different history and usage of risk analysis, many aspects are common¹¹. Application of a generic framework provides a systematic and consistent process for managing all "biosecurity" risks while accommodating different risk assessment methodologies as appropriate. This framework generally consists of four components:

⁹ Hathaway, S. C. (1993). Risk analysis and meat hygiene. OIE Scientific and Technical Review 12 (4): 1265-1290

¹⁰ Antimicrobial resistance: risk analysis methodology for the potential impact on public health of antimicrobial resistant bacteria of animal origin. OIE Scientific and Technical Review 20: 811-827

¹¹ Hathaway S.C. Risk analysis in biosecurity for food and agriculture. Consultant Report. *In*: Report of the Expert Consultation on Biosecurity in Food and Agriculture. FAO, Rome. September 2002

- a) Preliminary risk management activities
- b) Assessment of risk management options
- c) Implementation
- d) Monitoring and review.

A brief description of a generic risk management framework is provided in Appendix III.

Whatever the biosecurity issue, there should be a strategic, organisational and operational context for veterinary aspects of risk analysis. Appropriate inputs will be required to guide the process, which should be undertaken in a transparent and consistent manner.

Veterinary involvement in risk assessments associated with development of ante- and post-mortem inspection measures is essential. In this respect, the trend toward institutional approaches that bridge the animal and public health sectors / disciplines involved is increasingly gaining recognition at the national level and the traditional focus on regulating individual production systems is shifting to one of ensuring confidence in overall regulatory frameworks at all levels. Further, development of a more unified approach will assist general understanding of risk assessment across all biosecurity sectors and the optimisation of scarce technical resources in developing countries.

Establishment of policies and national measures

Meat hygiene

Meat hygiene is defined as "all conditions and measures necessary to ensure the safety and suitability of meat at all stages of the food chain"¹². In the context of meat hygiene, safety is defined in terms of appropriate application of measures to protect public health, and achievement of any quantitative outcomes for hazard control that may be required. Suitability is defined in terms of meat having been produced in a hygienic manner, and meeting any non-safety quantitative standards that may be identified.

Development of policies and standards for ante- and post-mortem inspection is predicated by these objectives. Technical justification, practicality and effectiveness of measures rely on veterinary public health inputs, as do establishment of competencies of inspection personnel and training requirements¹³. The national competent authority(s) must also provide an appropriate institutional environment for Veterinary Services to develop such policies and measures.

Measures for ante- and post-mortem inspection of meat include disposition judgements following detection of abnormalities. Judgements must be exercised by personnel who have the appropriate competence if dispositions are to achieve the "safety and suitability" objectives described above. However, sorting and removal of all abnormal tissues from the food chain without recourse to further examination/judgement as to safety or suitability is a practical alternative in many situations. In fact, a conservative policy in regard to disposition of abnormal carcasses and/or viscera is reflected in the precautionary approach inherent in any risk assessment process.

¹² Draft Code of Hygienic Practice for Meat. ALINORM 04/27/16. FAO, 2004

¹³ In the absence of a risk-based approach, inspection measures are prescribed according to long-standing practice: see Appendix I

Animal health

A further and vital component of ante- and post-mortem inspection is the detection and removal of hazards of animal health significance from the food chain where the food (or associated by-products) might be considered a means of transmission of that hazard e.g. transmission of diseases by feeding of meat scraps to animals, or transmission via meat with a designated non-human end-use e.g. uncooked petfood. This objective may be met by removal of live animals at ante-mortem inspection or by removal of specific tissues at post-mortem inspection.

Animal health surveillance and monitoring

Animal health surveillance constitutes "continuous investigation of a given population to detect the occurrence of disease for control purposes" and monitoring constitutes "on-going programmes directed at detection of changes in the prevalence of a disease in a given population"¹⁴. In this context, ante-mortem and organoleptic inspection of slaughter animals can provide an important sentinel function for zoonoses as well as other animal diseases of importance. Further diagnostic tests can be applied in the case of suspect animals and/or carcasses.

Animal health surveillance and monitoring allow Veterinary Services to identify and control significant endemic or exotic diseases within their territory, and substantiate reports on the animal health situation in their country. Both functions provide essential inputs to import risk analysis and certification for export.

As for meat hygiene, policies and measures applied at ante- and post-mortem inspection for the purposes of animal health surveillance and monitoring should be risk-based and should be feasible and practical in the slaughterhouse environment.

An example of risk-based monitoring of zoonoses is well illustrated in the OIE chapter for bovine spongiform encephalopathy (BSE)¹⁵. It is stated that surveillance strategies "should be determined by, and commensurate with the outcome of risk assessment" and have two primary goals: to determine whether BSE is present in a country, and once it has been detected, monitor development of the disease, direct control measures and monitor their effectiveness.

Integration of veterinary activities

It is clear that veterinary inputs to ante- and post-mortem inspection achieve a duality of public health and animal health objectives. Irrespective of the jurisdiction of the competent authorities involved, it is obvious that Veterinary Services should integrate their activities to the maximum extent possible and practicable so as to increase the efficacy of policies to prevent duplication of effort and unnecessary costs e.g. within the process of international certification.

In addition to sharing of routine inspection activities to achieve both public health and animal health objectives, other opportunities that arise for collaboration are: collection and integration of monitoring data, sharing of diagnostic facilities and methodologies, verification and enforcement of inspection requirements in an integrated manner, verification of relevant professional skills of inspectors, and pooling of technical expertise. Additionally, the primary role of industry in contributing to food safety can be enhanced, allowing cost-effective structural adjustments in Veterinary Services.

¹⁴ OIE Terrestrial Animal Health Code

¹⁵ OIE Terrestrial Animal Health Code. Chapter 2.3.13.1. 2004

Management of public and animal health inspection programmes

Competent Authority

In meeting veterinary public health and animal health objectives prescribed in national legislation or required by importing countries, Veterinary Services contribute in various ways "from the direct performance of necessary veterinary tasks to the evaluation of veterinary activities conducted by operators in the agro-industrial chain". It should be noted that "Veterinary Services" are no longer the sole managers of animal health protection and disease control, but rather guarantors that all parties involved in food production fulfil their respective obligations to guarantee safe food for the consumer"¹⁶. To this end Veterinary Services fulfil the role of "Competent Authority" and provide assurance both domestically and to trading partners guaranteeing safety standards have been met as well as those pertaining to suitability.

The CCMH recognises that while responsibility for meat hygiene always rests with Veterinary Services in the national Competent Authority, "flexibility should be allowed on how the service is delivered e.g. by the competent Authority or by an officially recognised competent body operating under the supervision and control of the Competent Authority"¹⁷.

The OIE Terrestrial Animal Health Code ascribes that the quality of Veterinary Services can be determined through an evaluation that ensures compliance with principles on professional judgement, independence, impartiality, integrity, objectivity, general organisation, quality policy, procedures/standards, communication, and self-evaluation. Whatever the activity, Veterinary Services must be able to demonstrate that no conflict of interest exists between public and/or animal health objectives and economic support for the meat production and processing industry.

Inputs to ante- and post-mortem inspection activities may also be provided by veterinarians employed by industry e.g. industry-led quality assurance programmes at the level of primary production may involve veterinary supervision and slaughterhouse information servicing. Individual health certification of groups of slaughter animals is a common practice in a number of countries e.g. for zoonotic diseases, veterinary drug residues and vaccination regimes. Veterinary ante-mortem inspection may also be provided at the level of livestock production¹⁸.

Quality assurance of systems

Those who benefit from inspection provided by Veterinary Services e.g. farmers and meat processing companies, are increasingly committing themselves to quality systems due to demand from their customers¹⁹. Consequently, these stakeholders are increasingly demanding inspection by competent authorities that is consistent and of high-quality.

¹⁶ Marabelli, R. The role of official Veterinary Services in dealing with new social challenges: animal health and protection, food safety and the environment. Scientific and Technical Review Series: Volumes 22 (2): 363-371. 2003

¹⁷ Report of the 10th Session of the Codex Committee on Meat Hygiene. ALINORM 04/27/16. FAO, Rome

¹⁸ McKenzie, A. I. and Hathaway S. C. The role of veterinarians in the prevention and management of food-borne diseases, in particular at the level of livestock producers. 70th General Session of OIE. 2002

¹⁹ Gary F. Accreditation of veterinary inspection systems. Scientific and Technical Review Series: Volumes 22 (2): 761-768. 2003

In some countries, formal quality assurance procedures are being put in place to assure competence and reliability of Veterinary Services on an on-going basis²⁰. Creating a quality system is a simple way of implementing the objectives contained in the quality policies that are written by veterinary managers. Tools such as quality accreditation are seen as necessary components of "modern economic management systems"²¹.

Quality assurance systems can be extended in the case of ante- and post-mortem inspection to "co-regulatory" systems that integrate industry and Veterinary Service activities²². In Australia, these systems are based on HACCP principles, are nationally uniform and extend from "production to consumption". Through a co-regulatory partnership arrangement, the official Veterinary Service is responsible for the broad design of the inspection system and its audits and sanctions, while the industry is responsible for further developing, implementing and maintaining the system. The veterinarian responsible for the specific slaughterhouse ensures that the meat safety quality assurance programme implemented by industry meets regulatory requirements on an on-going basis.

Use of non-veterinary inspection personnel

Use of private or public non-veterinary personnel to carry out ante- and post-mortem inspection activities is well established within many national programmes. However, all ante- and post-mortem inspection arrangements should satisfy the principles of independence, competence of inspectors and impartiality, and must be carried out under the overall supervision and responsibility of the official Veterinary Services. The Competent Authority should specify the competency requirements for all persons engaged in inspection and verify the performance of those persons²³.

Assurance and certification

Assurance and certification of appropriate delivery of inspection and compliance activities²⁴ is a vital function of Veterinary Services. International health certificates providing official assurances for trading of meat must engender full confidence to the country of importation.

Information networks

The SPS Agreement and the standards developed by the CAC and OIE all refer to the need for a systematic process to gather, evaluate and document scientific and other information as the basis for sanitary measures. This has long been recognised by Veterinary Services at the national level.

²⁰ Gerster, F., Guerson, N., Moreau, V., Mulnet, O., Provot, S. and Salabert, C. The implementation of a quality assurance procedure for the Veterinary Services of France. Scientific and Technical Review Series: Volume 22 (2): 629-659. 2003

²¹ Marabelli, R. The role of official Veterinary Services in dealing with new social challenges: animal health and protection, food safety and the environment. Scientific and Technical Review Series: Volumes 22 (2): 363-371. 2003

²² Butler R.J., Murray J.G. and Tidswell S. Quality assurance and meat inspection in Australia. Scientific and Technical Review Series: Volume 22 (2): 629-659. 2003

²³ Draft Code of Hygienic Practice for Meat. ALINORM 05/28/16. FAO, 2005

²⁴ Principles for Food Import and Export Inspection and Certification. CAC/GL 20 - 1995. FAO, Rome.

Organisation and dissemination of information throughout the food chain involves multidisciplinary inputs. Effective implementation of risk-based ante- and post-mortem inspection procedures is dependant on on-going monitoring and exchange of information. Animal identification, either as individuals or groups, is necessary in most situations and slaughtered animals should be able to be traced back to their place of origin as appropriate.

Veterinary inputs from primary production and slaughter are especially important to information networks servicing ante- and post-mortem inspection. As an example, it is likely that extrinsic cross-contamination as a result of slaughter, dressing and subsequent processing of meat is by far the most important source of hazards of public health importance. Bioloads of known food-borne pathogens that are transferred in this way are often a reflection of pre-harvest animal husbandry, the health status of the slaughter population, and pre-slaughter handling.

Conformance with WTO obligations

The World Trade Organisation (WTO) Sanitary and Phytosanitary (SPS) Agreement represents the best efforts of the global community to establish principles and guidelines governing the establishment and implementation of measures to protect public and animal health.

Veterinary Services should ensure that ante-and post-mortem inspection of slaughter is based on an overall assessment, as appropriate to the circumstances, "of the risks to human, animal, or plant life or health, taking into account risk assessment techniques developed by the relevant international organisations". Further, inspection procedures utilised in import/export programmes should be comparable to those used in domestic programmes.

In implementing the provisions of the WTO SPS and TBT Agreements, Veterinary Services have an increasing role in developing mutual recognition and equivalence agreements with trading partners. A risk-based approach to ante- and post-mortem inspection programmes allows the performance and equivalence of different meat inspection systems to be judged in terms of in meeting animal and public health objectives, thereby mitigating technical barriers to trade.

Appendix I

Ante-mortem inspection procedures²⁵

The health status of the farm of origin and the husbandry of slaughter animals has a significant effect on the safety and wholesomeness of meat. In this respect, all efforts should be made to collect and evaluate information that might have influence on ante-mortem and post-mortem inspection.

Ante-mortem inspection should be carried out in a systematic manner in accordance with routine procedures established by the controlling authority, and should ensure that animals found to be affected by a disease or defect that would render their meat unfit for human consumption are removed from the human food chain and so identified.

Ante-mortem inspection should ensure that animals whose meat may be fit for human consumption but that require special handling during slaughter and dressing, and animals that will require special attention during post-mortem inspection, are segregated and so handled or inspected.

Adequate animal identification and record keeping systems are essential if full use is to be made of on-farm information relevant to ante-mortem and post-mortem inspection. Data collection and recording systems should accurately reflect on-farm health status and allow meaningful epidemiological analysis. In addition, the data collection and recording system should be capable of responding to changes in local or regional human health and animal health status.

One of the most important functions of ante-mortem inspection is to ensure that animals are rested sufficiently so that signs important to inspection disposition are not masked. It also ensures that signs that are important to inspection disposition but that may be less readily observed (or not evident) at post-mortem inspection can be taken into account in reaching a decision as to the safety and wholesomeness of meat. When it is found on ante-mortem inspection that an animal is not fit to be slaughtered for human consumption, a judgement should be based on that finding and not delayed until after slaughter and post-mortem inspection. Ante-mortem inspection enables animals that require special handling on the slaughter and dressing floor (whether because of uncleanliness, disease or defect) to be identified and given that special handling, as well as permitting the identification of animals requiring special post-mortem inspection.

Post-mortem inspection procedures (traditional)

Post-mortem inspection procedures and tests should be established by the competent authority according to a science- and risk-based approach. In the absence of a risk-based system, procedures will have to be based on current scientific knowledge and practice.

Post-mortem inspection procedures based on current knowledge and practice vary considerably in different countries. The procedures that are presented in the following tables are only intended to provide general guidance in meeting public and animal health objectives, and should be adapted by the competent authority as appropriate. In particular:

²⁵ Codex Alimentarius Standard: CAC/RCP 41, 1993. "Ante-Mortem and Post-Mortem Inspection of Slaughter Animals and for Ante-Mortem and Post-Mortem Judgement of Slaughter Animals and Meat".

- a) Routine procedures may be supplemented by additional procedures to assist judgement.
- b) Young animals are likely to need less intensive inspection than older animals, although some diseases are confined to young animals e.g. omphalophlebitis.
- c) In the case of farmed game and farmed game birds, post-mortem inspection procedures established for similar domestic animals may act as a basis for their post-mortem inspection. These may need to be modified as necessary.
- d) In the case of killed wild game and wild game birds, post-mortem inspection procedures should reflect the particular circumstances of harvesting and transport to the establishment.
- e) Special post-mortem inspection procedures may need to be applied to animals that have reacted to screening tests, e.g., animals which have reacted positively to a tuberculin test should be slaughtered under special hygiene conditions and be subject to more intensive inspection procedures than non-reactor animals.
- f) Special post-mortem judgements may need to be applied to animals that have reacted to screening tests, e.g., irrespective of detection of lesions suggestive of infection, the udder, genital tract and blood of animals which have reacted positively to a brucellosis test should be judged as unfit for human consumption.

Table 1: Examples of procedures for routine post-mortem inspection of the head of animals intended for human consumption

	Cattle	Pigs	Sheep/goats	Horses	Deer	Poultry
External surfaces/oral cavity	V	V	V ^a	V	V	—
Submaxillary lymph nodes	V, I ^b	V, I	—	V, P	V, I	—
Parotid lymph nodes	V, I	—	—	V, P	V, I	—
Retropharyngeal lymph nodes	V, I	—	—	V, P	V, I	—
Tongue	V, P ^c	V	—	V, P	V, P	—
Muscles of mastication	V, P, I ^d	V, P, I	—	—	—	—
Other	—	—	—	— ^e		

V is visual inspection, P is inspection by palpation, I is inspection by incision.

^a Notwithstanding post-mortem inspection for animal health purposes, the head may be discarded if brains and tongues are not collected for human consumption

^b Incision of lymph nodes of the head is not necessary in calves

^c Palpation of the tongue is not necessary in calves

^d The muscles of mastication should be incised according to the potential for infestation with cysts of *Taenia* pp.

^e The nasal septum should be removed and examined if glanders is present in the slaughter population

Table 2: Examples of procedures for routine post-mortem inspection of the carcass of animals intended for human consumption

	Cattle	Pigs	Sheep/goats	Horses	Deer	Poultry
External surfaces	V	V ^a	V	V	V	V
Prescapular lymph nodes	V	—	V	—	V	—
Thoracic cavity/pleura	V	V	V	V	V	V
Abdominal cavity/peritoneum	V	V	V	V	V	V
Superficial inguinal lymph nodes	V, P	—	V, P	V, P	V, P	—
External/internal iliac lymph nodes	V, P	—	V, P	V, P	V	—
Supramammary lymph nodes	V, P ^b	V	V	V	—	—
Pre-pectoral lymph nodes	V, P	—	V, P	V, P	V, P	—
Popliteal lymph nodes	—	—	P	—	—	—
Renal lymph nodes	V, P	V, P	—	V, P	V	—
Diaphragm	V	V ^c	V	V	V	—
Other	— ^d	—	—	— ^e	—	—

V is visual inspection, P is inspection by palpation, I is inspection by incision.

Note: The umbilicus and joints of the limbs should be viewed and palpated in very young animals.

Note: A quality assurance system should be in place to ensure that all thyroid tissue has been removed from the throat.

^a Castration sites should be palpated

^b Supramammary lymph nodes should be incised in lactating animals

^c The muscles of the diaphragm should be incised according to the potential for infestation with cysts of *Taenia* spp.

^d The udder should be incised if it is intended for human consumption

^e The muscles and lymph nodes beneath one of the two scapular cartilages should be examined for melanosis in all grey and white horses

Table 3: Examples of procedures for routine post-mortem inspection of the viscera of animals intended for human consumption

	Cattle	Pigs	Sheep/goats	Horses	Deer	Poultry
Lungs	V, P ^a	V, P	V, P	V, P	V, P	V
Oesophagus	V	V	V	V	V	—
Trachea	V	V	—	V	—	—
Bronchial lymph nodes	V, I ^b	V, P	V, P	V, P	V, I	—
Mediastinal lymph nodes	V, I	V, P	V, P	V, P	V, I	—
Heart	V, P, I ^c	V, P, I ^c	V, P	V, P, I	V, P	V
Pericardium	V	V	V	V	V	V
Liver	V, P	V, P	V, P	V, P	V, P	V
Portal lymph nodes	V, P	V, P	V	V, P	V, P	—
Gall bladder	V, I ^d	—	V, P	—	V, P	—
Kidneys	V	P	V	V ^e	V	V
Renal lymph nodes	V	—	—	—	V	—
Spleen	V	V	V	V	V	—
Gastrointestinal tract	V	V	V	V	V	V
Mesenteric lymph nodes	V, P	V, P	V	V, P	V, P	—
Genital organs ^f	V	V	—	V	V	V

V is visual inspection, P is inspection by palpation, I

^a Incision of the diaphragmatic lobe can be used to examine the bronchii if lungs are intended for human consumption

^b Incision of the bronchial and mediastinal lymph nodes is not necessary in calves

^c The number and location of incisions in the heart muscle should be according to the potential for infestation with cysts of *Taenia* spp.

^d An alternative to incision of the bile ducts for the deletion of distomatosis is incision through the gastric surface of the liver. Inspection for distomatosis is not necessary in calves

^e Kidneys should be palpated if intended for human consumption; kidneys of grey or white horses should be incised

^f Palpation and incision should be carried out as appropriate if tissues are intended for human consumption e.g. uterus of heifers.

Appendix II

Risk-based ante- and post-mortem inspection procedures

Background

The Codex General Principles of Food Hygiene state that “in deciding whether a (food control) requirement is necessary or appropriate, an assessment of the risk should be made, preferably within the framework of the HACCP approach”. Many long-standing ante- and post-mortem meat inspection procedures are complex, labour-intensive, undifferentiated for different classes of slaughtered livestock, and poorly evaluated in terms of their relative contribution to reducing food-borne risks to public health. For these reasons, competent authorities in a number of countries are carrying out investigations into the scientific basis of current procedures.

A risk-based approach to meat inspection can achieve the following objectives:

- a) Determination of the level of consumer protection provided by specified inspection procedures;
- b) Relative measurement of the contribution of inspection to the overall level of control of hazards in meat (and risks to consumers), thereby allowing risk managers to allocate meat hygiene resources proportionate to their greatest benefit in preventing meat-borne risks;
- c) Comparison of the effectiveness of different inspection procedures applied for the same purpose and in the same context, e.g. positive predictive value;
- d) Provision of information that allows appropriate evaluation of different risk management options e.g. regionalisation of inspection programmes, feasibility and comparative costs of different inspection procedures, potential for cross-contamination;
- e) Full integration of inspection procedures into a “production-to-consumption” approach to meat hygiene.
- f) Provision of animal production data to enable linkages to foodborne disease data, e.g. through relevant serological, bacteriological and other testing to assess animal or herd prevalence, as well as isolates for typing purposes.

In the ideal situation, risk estimates will be quantified in terms of risks to human health, and risk management decisions on an appropriate level of protection (ALOP) will dictate the nature and intensity of the inspection procedures to be applied. However, risk assessment of microbiological hazards in meat is currently limited by a lack of quantitative risk assessment models. Nevertheless, appropriate assembly of scientific information and qualitative risk characterisation as to the probable impacts on human health can provide an objective basis for decision-making.

Principles

1. Inspection procedures should be evaluated for application within a specific context e.g. species and class of slaughtered animal, defined geographical region, defined animal husbandry system.

2. Where different inspection procedures that have the same purpose and context are being evaluated:
 - a) An objective basis for comparison of the level of control of hazards associated with these procedures, should be established;
 - b) The efficacy of each inspection procedure in detecting abnormalities and visible contamination affecting the safety of meat should be taken into account;
 - c) Other risk management factors should be taken into account as appropriate e.g. potential for inadvertent cross-contamination, feasibility, and practicality.
3. Where needed, representative and sufficiently large field trials should be undertaken to determine the performance attributes of specified inspection procedures e.g. sensitivity, specificity, and non-detection rates for abnormalities.
4. Where appropriate, laboratory investigations should be designed to detect the range of hazards of possible public health importance that have been described in hazard identification.
5. Routine application of inspection procedures should not inadvertently increase cross-contamination with microbiological hazards.
6. Irrespective of inspection delivery systems, the competent authority should be responsible for defining the role of personnel involved in inspection procedures, and verifying that any performance criteria are met.
7. Alternative inspection procedures (e.g. serology) may be utilised to complement post-mortem inspection, which might be reduced to visual inspection.
8. Surveillance through serological, bacteriological or other testing for priority foodborne hazards should be promoted in order to provide food production chain data for risk assessment and monitoring purposes.

Guidelines in developing a risk-based inspection system

Identification of the issues

A hazard identification process should be undertaken to determine the likely range of hazards of public health significance that may be present. Following this, field trials should be undertaken to determine the performance attributes of specified inspection procedures or new technologies relative to the hazards that may be present.

Field trials

Once the likely range of hazards has been established, field trials may be an appropriate means to establish the prevalence of these hazards in the animal population, the potential exposure of consumers to these hazards and the potential impact of different inspection procedures on this exposure. Field trials should be carried out under competent authority supervision and employing competent personnel. The number of animals examined by the inspection procedures under evaluation should give a statistically valid estimate of the detection rate of abnormalities achieved by specific post-mortem inspection procedures.

Sampling plans should be representative of the slaughter population, and cater for known biological variation in respect of the type and prevalence of abnormalities e.g. influence of animal age, geographical region, farming type and season.

Where different inspection procedures are being compared: all procedures should be applied to the same animals, each inspection station should be designed to provide independent results, and the trial should include enough samples so as to allow definite conclusions as to the consequences of changing inspection procedures.

Laboratory investigations e.g. microbiological examination and histology, should be designed to identify the range of hazards of possible public health importance that have been identified in the hazard identification process.

Performance attributes

An understanding of the level of consumer protection that is achieved by particular inspection procedures requires knowledge of the level of control of hazards that is attained in meat. These would be reflected in performance objectives and /or performance criteria where these have been defined. Performance attributes for inspection procedures should achieve these.

The performance attributes of inspection procedures under test (e.g. visual inspection, palpation, and/or incision) should be determined within appropriate statistical limits established by the Competent Authority. The intended end-use of the target tissues has an important influence on the development of risk-based inspection procedures.

The sensitivity of an inspection procedure is the probability of correctly identifying an animal or tissue that is likely to contain public health hazards. An inspection procedure with a high sensitivity will result in few false negatives.

The specificity of an inspection procedure is the probability of correctly identifying animals or tissues that do not contain public health hazards. An inspection procedure with a high specificity will result in few false positives.

Risk management decisions

Risk management decisions on the acceptability or otherwise of specified inspection procedures will generally be based on the worst case of non-detection included in an appropriate statistical confidence interval. In the general case, new or alternative inspection procedures should provide a level of consumer protection that is at least equivalent to that provided by existing procedures, unless there are strong mitigating factors that may influence a different risk management choice e.g. unacceptable introduction of new hazards, undue risks from occupational exposure.

Where detailed information on the health status of slaughtered animals is available from primary production, risk-based inspection procedures may be modified on a lot-by-lot basis, with the Competent Authority having responsibility for determining the frequency and extent of the procedures.

Appendix III

A generic risk management framework for biosecurity

Introduction

A risk-based biosecurity programme is one that is formulated according to some knowledge, whether quantitative or qualitative, on risks to health. A generic risk management framework provides the process whereby knowledge on risk, and evaluation of other factors relevant to health protection and the promotion of fair trade practices, are used to choose and implement appropriate controls.

Generic framework

The four key steps in application of a generic risk management framework are:

- a) Preliminary risk management activities
- b) Selection of risk management options
- c) Implementation of controls
- d) Monitoring and review.

This framework should be applied in a consistent, open, transparent and fully documented manner. Recognising the iterative and interactive nature of risk management is essential. Effective risk management incorporates a precautionary approach and relies on appropriate risk communication and stakeholder representation at all steps.

Preliminary risk management activities

Preliminary risk management activities include identification of health issues and assembly of information to guide further risk management activities. In this context, sources of knowledge on risk include: risk profiles, ranking processes for different hazard exposure pathways, “qualitative” or “quantitative” risk assessments, and health surveillance data. The risk manager may commission a detailed risk assessment as an independent scientific process so as to better inform decision-making. Once a risk assessment has been received, the last task in preliminary risk management activities is to consider the results for completeness and appropriateness.

Selection of risk management options

This is the process whereby potential risk management options are identified, and then selected according to appropriate decision-making criteria. The selection of preferred risk management options will primarily involve a systematic evaluation of the likely impact of different measures on preventing, eliminating or reducing risks to health. Factors other than risks to health can be taken into account if relevant and appropriate e.g. cost-effectiveness of a measure. Wherever possible and practical, a risk-based control system will use risk assessment information to establish regulatory “targets” at a particular step in the exposure pathway that delivers a defined level of health protection.

Implementation of controls

Implementation of food safety measures will usually involve regulatory standards and associated regulatory activities. In cases of urgency and “emerging” hazards, risk managers may have to implement interim controls on the basis of limited scientific information. Verification of measures will assure that the health protection goals are being achieved on an on-going basis.

Monitoring and review

This risk management activity is represented by the gathering and analysing of data on health so as to give an overview of outcomes of risk management decisions. Monitoring (which includes surveillance) should identify new health problems as they emerge. Where there is evidence that required health goals are not being achieved, redesign of controls will be needed.

Summary

Application of a generic risk management framework allows decisions to be taken that are proportionate to the health risks involved, facilitates innovation and flexibility in application of control measures, and allows due regard to be taken of costs as well as benefits. Regulatory input in a control programme should be broad enough to encompass all relevant components of the exposure pathway and ensure that control measures are applied where they will be most effective in reducing risks.
