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**REPORT OF THE FIRST MEETING OF
THE OIE AD HOC GROUP ON THE HUMANE KILLING OF ANIMALS
FOR DISEASE CONTROL PURPOSES**

Paris, 14-16 October 2003

The OIE *ad hoc* Group on the humane killing of animals for disease control purposes held its first meeting at the OIE Headquarters from 14-16 October 2003.

The members of the OIE *ad hoc* Group are listed in [Appendix I](#). The Agenda adopted is given in [Appendix II](#). Dr John Galvin was appointed Chair of the *ad hoc* Group.

On behalf of the Director General of the OIE, Dr David Wilson welcomed the members of the *ad hoc* Group and thanked them for their willingness to be involved in addressing the new mandate of the OIE for animal welfare. He recalled the outcomes of the first meeting of the Working Group on Animal Welfare and explained that the OIE planned to hold a meeting of each *ad hoc* Group dealing with the prioritised animal welfare issues prior to the OIE Global Animal Welfare Conference (to be held in February 2004). He also noted the recommendation of the Working Group that *ad hoc* Groups initially develop more detailed statements on policies and principles, specific to their subject, as a bridge between the generic OIE statement on policies and principles, and specific animal welfare standards.

The *ad hoc* Group discussed the scope of its work, noting that the animal welfare aspects of disease control procedures needed to be addressed within broader constraints, including those posed by human safety and biosecurity considerations. Within this scope, it examined and made recommendations on operational procedures for the killing of animals and the required competencies of personnel, to minimise adverse welfare impacts. The *ad hoc* Group confined its considerations to the procedures that need to occur from the time that the decision is taken to kill animals for disease control purposes, until the animals are dead, and to the killing of cattle, sheep, goats, pigs and poultry.

The agreed terms of reference for the *ad hoc* Group are at [Appendix III](#).

The *ad hoc* Group addressed the general principles of humane killing, organisational structure, the responsibilities and competencies of personnel working on affected premises, planning the humane killing of animals, and recommends various killing methods. The recommendations do not contain detailed, specific operating procedures as these are available elsewhere in emergency disease control plans and equipment manufacturer recommendations. This level of detail was considered beyond the scope of the *ad hoc* Group's terms of reference. The recommendations also include comments on operator safety and biosecurity, as these two factors cannot be separated from the killing of animals.

Appendix XXX (contd)

The recommendations aim to give those personnel responsible for the killing of animals, information on which to decide the most humane procedures applicable to the particular circumstances they face, noting that the circumstances will usually be less than ideal, and operations will generally need to be conducted within short timeframes.

The *ad hoc* Group recognised that using competent personnel is critical to ensuring the highest possible animal welfare standards. The *ad hoc* Group identified veterinarians as the best-qualified generalists in animal welfare matters but recognised the need for specialist knowledge when supervising the humane killing of livestock for disease control purposes. The *Official Veterinarian* needed to be aware of the welfare attributes of the available methods and the justification for their selection to meet the specific circumstances on the premises. The *ad hoc* Group believed that Continual Professional Development (CPD) programmes (that contain elements of animal welfare and the scientific research that underpins the preferred killing methods) should be available for *Official Veterinarians*.

The *ad hoc* Group considered that the team leader and veterinarian within the operational groups also require a training programme that is explicit to the operation of the team and their defined roles. Detailed training should include humane killing methods and focus on the welfare evaluation of the use of the methods with cattle, sheep, goats, pigs and poultry. Formal training and assessment of competency should also be introduced for animal handlers and slaughtermen.

The *ad hoc* Group also recognised that the principles developed for killing animals for disease control purposes may also be applicable for the killing of animals following natural disasters and in emergency slaughter situations.

The *ad hoc* Group drafted guidelines for the humane killing of animals for disease control purposes, commencing with general principles and following with more specific recommendations relating to species and methodologies adopted. The draft guidelines are at Appendix IV.

**MEETING OF THE OIE AD HOC GROUP ON
HUMANE KILLING OF ANIMALS FOR DISEASE CONTROL PURPOSES**

Paris, 14 – 16 October 2003

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**MEETING OF THE OIE AD HOC GROUP ON
HUMANE KILLING OF ANIMALS FOR DISEASE CONTROL PURPOSES**

Paris, 14 – 16 October 2003

Approved Agenda

- 1) Introduction
 - Discussions in OIE Working Group on Animal Welfare
 - Other relevant discussions
 - 2) Discussion on context, scope, timetable
 - 3) Drafting of specific guiding principles and standards
 - 4) Drafting of operational procedures
 - 5) Work programme
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**OIE AD HOC GROUP ON
HUMANE KILLING OF ANIMALS FOR DISEASE CONTROL PURPOSES**

Terms of reference

- First output – draft guiding principles (rather than a prescriptive approach to procedures) specifically addressing depopulation for disease control purposes, based on the generic OIE guiding principles and policies for animal welfare
- Final output – draft standards / guidelines for OIE *Code* based on these guiding principles
- Address appropriately religious and cultural dimensions and the needs of pregnant animals
- Identify future directions in which the *ad hoc* Group might need to move
- Produce drafts for review by Animal Welfare Working Group and then by Code Commission

Species to be covered

- cattle, sheep, goats
- pigs
- poultry

The species below will be addressed as resources permit and/or expertise is available

- horses
- other farmed ungulates, including deer and camelids
- ratites
- rabbits
- fish

Working Group member as point of reference

- Dr Andrea Gavinelli
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DEFINITIONS

Stockmanship

good stockmanship means a professional and sympathetic response to an animal's welfare requirements.

Stunning

means immediate loss of consciousness.

Death

means irreversible loss of brain activity as demonstrated by loss of brain stem reflexes.

Pitbing - means the physical destruction of the brain and upper regions of the spinal cord, through the insertion of a rod or cane through the shot hole.

RMS - (Steve Wotton to provide)

**GUIDELINES FOR THE HUMANE KILLING OF ANIMALS
FOR DISEASE CONTROL PURPOSES**

Article 1

General principles of humane killing

- 1) Disease control contingency plans should be in place at a national level and should contain details of management structure, disease control strategies and operational procedures; animal welfare considerations should be addressed within these disease control contingency plans.
- 2) Disease control strategies should also address the animal welfare issues that may result from animal movement controls.
- 3) The following principles apply after a decision to kill the animals has been made.
- 4) All personnel involved in the humane killing of animals should have the relevant skills and competencies.
- 5) As necessary, operational procedures should be adapted to the specific circumstances operating on the premises and should address, apart from animal welfare, operator safety and biosecurity.
- 6) Following the decision to kill the animals, killing should be carried out as quickly as possible and normal husbandry should be maintained until the animals are killed.
- 7) The handling and movement of animals should be minimised and when done, it should be done in accordance with the operational procedures described below.
- 8) Animal restraint should be sufficient to facilitate effective killing, and in accordance with animal welfare and operator safety requirements; when restraint is required, killing should follow with minimal delay.
- 9) When animals are killed for disease control purposes, methods used should result in immediate death or immediate loss of consciousness lasting until death; when loss of consciousness is not immediate, induction of unconsciousness should be non-aversive and should not cause anxiety, pain, distress or suffering in the animals.
- 10) For animal welfare considerations, young animals should be killed before older animals; for biosecurity considerations, infected animals should be killed first, followed by in-contact animals, and then the remaining animals.
- 11) There should be continuous monitoring of the procedures to ensure they are consistently effective with regard to animal welfare, operator safety and biosecurity.
- 12) When the operational procedures are concluded, there should be a written report describing the practices adopted and their effect on animal welfare, operator safety and biosecurity.
- 13) To the extent possible to minimise public distress, killing of animals and carcase disposal should be carried out away from public view.
- 14) These general principles should also apply when animals need to be killed for other purposes such as after natural disasters.

Article 2

Organisational structure

The operational activities should be led by an *official veterinarian* who has the authority to ensure that animal welfare standards are adhered to and who should ensure that the personnel involved has the required competencies.

The *official veterinarian* should be responsible for all activities across one or more affected premises and should be supported by coordinators for planning (including communications), operations and logistics to facilitate efficient operations.

The *official veterinarian* should provide overall guidance to personnel and logistic support for operations on all affected premises to ensure consistency in adherence to animal welfare standards.

A specialist team, led by a designated team leader, should be deployed to work on each affected premises. The team should consist of personnel with the skills and competencies to conduct all required operations. In considering the animal welfare issues associated with killing animals, the key personnel, their responsibilities and skills required are described in Article 3.

Article 3

Responsibilities and skills of the specialist team

Team leader

- Responsibilities
 - plan overall operations on an affected premises
 - determine and address requirements for animal welfare, operator safety and biosecurity
 - organise, brief and manage team of people to facilitate humane killing of the relevant animals on the premises in accordance with national regulations and these guidelines
 - determine logistics required
 - monitor operations to ensure animal welfare, operator safety and biosecurity requirements are met
 - report upwards on progress and problems
 - provide a written report at the conclusion of the killing, describing the practices adopted and their effect on animal welfare
- Skills
 - specialised training in relevant skills and procedures
 - skills to manage all activities on premises and deliver outcomes on time
 - awareness of psychological effects on farmer, team members and general public
 - effective communication skills

Appendix XXX (contd)

Appendix IV (contd)

Veterinarian

- Responsibilities
 - plan and implement procedures to ensure that animals are killed without avoidable pain and distress
 - determine and implement requirements for animal welfare, including the order of killing
 - minimise the risk of disease spread within and from the premises and supervise other biosecurity personnel
 - continuously monitor animal welfare and biosecurity procedures
 - in cooperation with the leader, prepare a written report at the conclusion of the killing, describing the practices adopted and their effect on animal welfare
- Skills
 - ability to assess animal welfare, especially the effectiveness of stunning and killing
 - ability to assess biosecurity risks

Animal handlers

- Responsibilities
 - review on-site facilities in terms of their appropriateness
 - design and construct temporary animal handling facilities, when required
 - move and restrain animals
- Skills
 - good stockmanship
 - awareness of animal behaviour
 - experience of animal handling in emergency situations and in close confinement

Slaughterers

- Responsibilities
 - ensure humane killing of animals through effective stunning and killing
- Skills
 - when required by regulations, licensed to use necessary equipment or licensed to be slaughterers
 - competent to use and maintain relevant equipment
 - competent to use techniques for the species involved
 - competent to assess effective stunning and killing

Carcase disposal personnel

- Responsibilities
 - ensure efficient carcase disposal to ensure killing operations are not hindered
- Skills
 - competent to use and maintain available equipment and apply techniques for the species involved

Farmer / owner / manager

- Responsibilities
 - assist where possible
- Skills
 - specific knowledge of his/her animals and their environment

Article 4

Operational procedures

Planning the humane killing of animals

Many activities will need to be conducted on affected premises, including the humane killing of animals. The team leader should develop a plan for humanely killing animals on the premises which should include consideration of:

- Minimising handling and movement of animals
- Killing the animals on the affected premises; however, there may be circumstances where the animals may need to be moved to another location for killing
- The species, number, age and size of animals to be killed, and the order of killing them
- Methods of killing the animals, and their cost
- Housing and location of the animals
- The availability and effectiveness of equipment needed for killing of the animals
- The facilities available on the premises that will assist with the killing
- Biosecurity issues
- The health and safety of personnel conducting the killing
- Any legal issues that may be involved, for example where restricted veterinary drugs or poisons may be used, or where the process may impact on the environment, and
- The presence of other nearby premises holding animals.

In designing a killing plan, it is essential that the method chosen is consistently reliable to ensure that all animals are humanely and quickly killed.

Appendix XXX (contd)

Appendix IV (contd)

Article 5

Table summarising killing methods

Method	Procedure	Induction of unconsciousness	Animal welfare concerns	Key requirements	Applicable species
Mechanical	free bullet	immediate	targeting, calibre	accuracy	cattle, sheep and goats, pigs and poultry
	captive bolt - penetrating, followed by pithing or bleeding	immediate	targeting, velocity of bolt, physical destruction of CNS, vessels severed	restraint, accuracy	cattle, sheep and goats, pigs
	captive bolt - non-penetrating	immediate	velocity of bolt	restraint	poultry
	cervical dislocation (manual and mechanical)	not immediate	pain to animal	restraint and repeatability	poultry
	percussive blow	immediate	potential for pain to animal	restraint, accuracy and repeatability	neonate sheep, goats and pigs; poultry
	decapitation	not immediate	pain to animal	restraint and suitable equipment	poultry
	maceration	immediate	speed of entry and particulate size	restraint and suitable equipment	neonate poultry and eggs
Electrical	split application	immediate	electrode positions, current and voltage	restraint and suitable equipment	calves, sheep, goats and pigs
	single application (including waterbath)	immediate	electrode positions; current and voltage	restraint and suitable equipment	calves, sheep, goats and pigs; poultry
Gaseous	CO ₂ air mixture	not immediate	CO ₂ concentration	suitable equipment	poultry and neonate sheep, goats and pigs
	inert gas CO ₂ mixture	not immediate	CO ₂ concentration	suitable equipment	poultry
	inert gases	not immediate	O ₂ concentration	suitable equipment	poultry
	CO	not immediate	impurities	suitable equipment	piglets and poultry

Method	Procedure	Induction of unconsciousness	Animal welfare concerns	Key requirements	Applicable species
Lethal injection	barbiturates and others	not immediate	dosage and route of application	restraint and accuracy	cattle, sheep and goats, pigs and poultry
Other	addition of anaesthetics to feed or water	not immediate	dosage	application methodology	poultry

Article 6

Free bullet

Introduction

A free bullet is a projectile fired from a shotgun, rifle, handgun or purpose-made humane killer.

A free bullet should be aimed to penetrate the skull or soft tissue at the top of the neck of the animal, to cause irreversible concussion and death.

Requirements for effective use

- The marksman should take account of human safety in the area in which he/she is operating
- The marksman should ensure that the animal is in the correct position to enable accurate targeting
- The correct cartridge, calibre and type of bullet for the different species age and size should be used
- Shot animals should be checked to ensure the absence of brain stem reflexes

Advantages

- Used properly, it provides a quick and effective method for killing
- It requires minimal or no restraint and can be use to kill from a distance
- It is suitable for killing agitated animals in open spaces

Disadvantages

- Potentially dangerous to humans and other animals in the area
- Potential for non-lethal wounding
- Destruction of brain tissue may preclude diagnosis of some diseases
- Leakage of bodily fluids may present a biosecurity risk
- Legal requirements may preclude or restrict use
- Unavailability of competent personnel

Appendix XXX (contd)

Appendix IV (contd)

Recommendations

- A suitable method for cattle, sheep and goats, pigs and poultry, including large animals in open spaces

Article 7

Penetrating captive bolt

Introduction

A penetrating captive bolt is fired from a gun powered by either compressed air or a blank cartridge. There is no free projectile.

The captive bolt should be aimed on the skull in a position to penetrate the cortex and mid-brain of the animal. The impact of the bolt on the skull produces unconsciousness. Physical damage to the brain caused by penetration of the bolt may result in death, however pithing or bleeding should be performed immediately after the shot in order to ensure the death of the animal.

Requirements for effective use

- The operator should ensure that the animal's head is accessible
- The operator should fire the captive bolt at right angles to the skull in the optimal position
- The cartridge strength and calibre, and the length of the bolt should be appropriate to the species and type of animal
- A back-up gun should be available in the event of an ineffective shot
- Captive bolt guns should be frequently cleaned and maintained in good working condition
- Pithing or bleeding should be performed immediately after stunning to ensure the death of the animal
- Animals should be restrained, as a minimum free-standing in a pen
- Animals should be monitored to ensure the absence of brain stem reflexes

Advantages

- Mobility of equipment
- Immediate onset of a sustained period of unconsciousness
- Improved operator safety over use of a free bullet

Disadvantages

- Misfirings and inaccuracies may result in poor animal welfare
- Need for suitable restraint facilities on-site

- Post stun convulsions may make pithing difficult and hazardous
- Difficult to apply in agitated animals
- Repeated use may result in over-heating of the gun
- Leakage of bodily fluids may present a biosecurity risk
- Destruction of brain tissue may preclude diagnosis of some diseases

Recommendation

A suitable method for cattle, sheep, goats and pigs.

Article 8

Captive bolt - non-penetrating

Introduction

A non-penetrating captive bolt device is designed and constructed to deliver a percussive blow to the head of birds, which results in immediate unconsciousness and death.

Requirements for effective use

- Birds should be restrained in cones, shackles, crushes or by hand (provided operator safety is not compromised by the design of the gun). The comb or sides of the beak should be held between thumb and forefinger. The gun barrel should be placed firmly onto the rear of the head behind the comb before firing. The bird's head should be allowed to be propelled out of the hand upon firing
- Captive bolt guns should be frequently cleaned and maintained in good working condition

Advantages

- Immediate induction of unconsciousness (≥ 40 psi) followed by death of the bird through profound brain dysfunction and physical damage
- The air-powered device is inexpensive to operate and requires minimum training of operators
- Multiple air-powered devices can be powered by a single compressor

Disadvantages

- Should only be applied to small poultry whilst they are restrained manually or on a shackle (turkeys/geese can be humanely killed whilst free-standing).
- Laying hens in cages have to be removed from their cages and all birds have to be restrained
- Produces post stun/kill convulsions

Recommendations

- A suitable method for large numbers of chickens, turkeys, geese and ducks, following their manual removal from the house or yard.

Appendix XXX (contd)

Appendix IV (contd)

Article 9

Cervical dislocation (manual and mechanical)

Introduction

Poultry may be killed by either manual cervical dislocation (stretching) or mechanical neck crushing with a pair of pliers. Both methods result in death from asphyxiation and/or cerebral anoxia, and neither is likely to produce immediate unconsciousness.

Requirements for effective use

- Animals need to be handled and restrained
- Personnel performing the kill need to be trained and competent
- Killing should be performed under veterinary supervision
- Killing should be performed in one stretch to sever the spinal cord; mechanical pliers should be used to crush the cervical vertebrae with consequent major damage to the spinal cord; breathing should then stop and pupils should be dilated
- Consistent results require strength and skill so the personnel should be rested regularly to ensure consistently reliable results

Advantages

- It is the cheapest method for killing poultry, not requiring equipment
- It is a non-invasive killing method

Disadvantages

- Requires animal handling, restraint and inversion
- Neck stretching / pliers do not consistently stun poultry
- Since death caused by cerebral anoxia in poultry takes a longer time (more than 1 minute), poultry are not immediately rendered unconscious and there may be pain and/or distress during the process
- Consistent and reliable results are difficult to achieve if large numbers of poultry need to be killed
- Operator fatigue
- The method is more difficult in larger birds
- The method may not be aesthetically pleasing

Recommendations

- This method should only be applied on small numbers of poultry on a premises (less than 1000) where other methods are unavailable.

Article 10

Percussive blow

Introduction

- A percussive blow to the head kills animals by causing depression of the CNS and destruction of brain tissue.
- Its use should be limited to poultry and neonatal sheep, goats and pigs which have thin cranial bones.

Requirements for effective use

- A single sharp blow should be delivered to the central skull bones, either by an implement (such as a hammer or a commercially-available poultry killer)
- It is essential that the central skull bones and underlying brain tissues be destroyed during the procedure
- The procedure should be carried out only by trained and competent personnel
- The procedure should be closely monitored to ensure consistent accuracy

Advantages

- Results in immediate death
- Requires no specialized equipment and can be implemented quickly
- Powered equipment minimises operator fatigue

Disadvantages

- Poor technique or operator fatigue can cause pain and distress to the animal
- Animals need be handled extensively
- The method is not aesthetically pleasing and may distress personnel

Recommendations

- Killing by a single, sharp percussive blow to the head is an acceptable method for poultry and neonatal sheep, goats and pigs.

Article 11

Decapitation

Introduction

Decapitation results in death by cerebral ischaemia, however some residual brain activity continues after severance (for a considerable time in some species) which raises animal welfare concerns. Decapitation requires the rapid severing of the head from the body, using a guillotine or sharp blade.

Appendix XXX (contd)

Appendix IV (contd)

Requirements for effective use

- Animals should be manually restrained
- The equipment should be kept in good working order
- Personnel must be competent in the procedures
- Continuous monitoring is required

Advantages

- The technique is quick and easy

Disadvantages

- Decapitation does not produce immediate unconsciousness
- Death is not immediate in any species and is prolonged in poultry
- Blood contaminates the working area
- Procedure is not aesthetically pleasing and may distress personnel
- The necessary handling and restraint will distress the poultry
- Operator safety issues

Recommendation

- This method should be considered only for killing poultry.

Article 12

Maceration

Introduction

Maceration causes immediate death through the destruction of the brain (and other) tissues.

Requirements

- Maceration requires specialised equipment which must be kept in excellent working order
- Personnel trained in the use and maintenance of the equipment
- Neonate poultry and eggs are fed into the equipment via a hopper and the rate of introducing the birds should not allow the equipment to jam, birds to rebound from the blades or the birds to suffocate before they are macerated

Advantages

- Procedure results in immediate death
- Large numbers can be killed quickly

Disadvantages

- Not aesthetically pleasing
- Specialised equipment is required
- Operator safety issues

Recommendation

- Maceration should be used only for killing neonatal poultry and eggs.

Article 13

Electrical – split application

Introduction

A split application of an electric current comprises two parts - an application of current to the head by scissor-type tongs, immediately followed by an application of the tongs across the chest in a position that spans the heart.

The application of sufficient electric current to the head will induce 'tonic/clonic' epilepsy and unconsciousness. Low frequency electric currents applied across the chest will induce ventricular fibrillation (cardiac arrest) resulting in death. The latter should only be applied to unconscious animals to prevent unacceptable levels of pain.

Requirements for effective use

- Appropriate protective clothing (including rubber gloves and boots) should be worn
- Two operators are required, the first to apply the electrodes and the second to manipulate the position of the animal to allow the second application to be made
- Animals should be restrained, as a minimum free-standing in a pen, close to an electrical supply
- The stunner control device should generate a low frequency (30 – 60 Hz) current with a minimum voltage of 250 volts true RMS under load
- A stunning current should be applied via scissor-type stunning tongs in a position that spans the brain for a minimum of 3 seconds; immediately following the application to the head, the electrodes should be transferred to a position that spans the heart and the electrodes for a minimum of 3 seconds
- Electrodes should be cleaned regularly and after use to enable optimum electrical contact to be maintained
- Animals should be monitored to ensure the absence of brain stem reflexes

Appendix XXX (contd)

Appendix IV (contd)

Advantages

- Immediate in action
- Particularly effective with pigs, where post-stun convulsions are minimised
- Non-invasive technique minimises biosecurity risk

Disadvantages

- Requires a reliable supply of electricity.
- The electrodes must be applied and maintained in the correct positions to produce an effective stun and kill
- The procedure may be physically demanding leading to operator fatigue
- Potential for painful and lethal shocks to the operator

Recommendations

- A suitable method for calves, sheep and goats, and especially for pigs (over one week of age)

Article 14

Electrical –single application

Introduction

Method 1 comprises the single application of sufficient electrical current (either head-to-back or head-to-body) to simultaneously stun the animal and fibrillate the heart. Provided sufficient current is applied in a position that spans both the brain and heart, the animal will not recover.

Method 2 stuns/kills by drawing inverted and shackled poultry through an electrified waterbath. Electrical contact is made between the 'live' water and earthed shackle and, when sufficient current is applied, poultry will be stun/killed.

Method 1

Requirements for effective use

- Method 1 should only be used on sheep, goats and pigs that are appropriately restrained
- A low frequency (30 – 60 Hz) stunner control device should generate a minimum voltage of 250 volts true RMS under load
- Animals must be restrained as maintenance of physical contact between the stunning electrodes and the animal is necessary for effective use
- Appropriate protective clothing (including rubber gloves and boots) should be worn
- A single operative is required to apply the electrodes mounted on a handset in a position that spans both the brain and the heart

- The front electrodes should be applied in a position that is forward of the eyes and the rear electrode to the back, above or behind the heart, with current applied for a minimum of 3 seconds
- Electrodes should be cleaned regularly between animals and after use to enable optimum electrical contact to be maintained
- Where sheep are stun/killed, water or saline should be used to improve electrical contact with the animal
- An effective stun/kill should be verified by the absence of rhythmic breathing

Advantages

- Immediate in action
- Particularly effective with pigs, because post-stun convulsions are minimised
- Low running costs

Disadvantages

- Requires appropriate animal restraint
- Regular maintenance and testing of the handset, electrodes, connecting cable and control unit is a requirement for both operator safety and animal welfare
- The electrodes must be applied in a position that spans the brain to produce an effective stun
- Not recommended for piglets under 1 week of age

Recommendations

- The induction of ventricular fibrillation at the point of stun offers a very effective killing method, however appropriate animal restraint is required in order to ensure good electrical contact.
- A suitable method for calves, sheep and goats, pigs (over 1 week of age) and poultry

Method 2

Requirements for effective use

- Birds need to be manually removed from their cage, house or yard, inverted and shackled onto a line which conveys them through a waterbath
- A low frequency (50 Hz) current applied for a minimum of 10 seconds is necessary to stun/kill the birds
- Required minimum currents to stun/kill are:
 - Quail - 100 mA
 - Chickens – 160 mA
 - Ducks & Geese – 200 mA
 - Turkeys – 250 mA
- An effective stun/kill should be verified by the absence of rhythmic breathing.

Appendix XXX (contd)

Appendix IV (contd)

Advantages

- Immediate in action
- Capable of processing large numbers of birds reliably and effectively
- Low running costs
- Simple to clean/disinfect

Disadvantages

- Relatively high capital investment
- Requires a supply of mains electricity or built-in generator
- Handling, inversion and shackling of birds are required

Recommendations

A very effective method of stun/killing large numbers of birds however, the procedure requires the removal of birds from their husbandry system, their inversion and shackling.

Article 15

CO₂ / air mixture

Introduction

Gas killing is performed by exposing animals to a predetermined gas mixture either while contained within a room or via the gas being brought into the animal house.

Inhalation of carbon dioxide (CO₂) induces respiratory and metabolic acidosis and hence reduces the pH of cerebrospinal fluid (CSF) and neurones thereby causing unconsciousness and, after prolonged exposure, death.

Requirements for effective use

- When CO₂ is introduced into a house containing poultry, the house should be gradually filled until all birds are exposed to a concentration of >40% until they are dead
- When animals are exposed to the gas individually or in small groups in a room, the equipment used should be designed, constructed, and maintained in such a way as to avoid injury to the animals and allow them to be observed; animals should be introduced into the room after it has been filled with the required CO₂ concentration and held in this atmosphere until death is confirmed
- Operators should ensure that there is sufficient time allowed for each batch of birds to die before subsequent ones are introduced into the room
- Rooms should not be overcrowded and measures are needed to avoid animals climbing on top of each other while entering the room to prevent suffocation

- Houses and rooms should have devices whereby the gas concentration can be easily and accurately measured

Advantages

- Applying gas to animals *in situ* eliminates the need to manually remove live animals
- CO₂ is readily available
- Application methods are simple

Disadvantages

- Welfare problems in the induction phase due to the aversive nature of high CO₂ concentrations
- Difficulty in maintaining adequate concentrations of CO₂ in some poultry houses and rooms
- Difficulty in verifying death while the animals are in the poultry house.

Recommendation

Suitable for use in poultry and neonatal sheep, goats and pigs, especially when applied *in-situ* to poultry housed in closed-environment sheds

Article 16

Inert gas / CO₂ mixtures

Introduction

Carbon dioxide may be mixed in various proportions with an inert gas eg nitrogen or argon, and the inhalation of such mixtures leads to hypercapnic-hypoxia. This method involves the introduction of a mixture into a poultry house or piggery or introduction of animals into a room containing the gases. Such mixtures do not induce immediate loss of consciousness, therefore the aversiveness of various gas mixtures and the respiratory distress occurring during the induction phase are important animal welfare considerations.

Pigs and poultry appear not to find 30% by volume of carbon dioxide strongly aversive, and therefore, a mixture of nitrogen and / or argon with up to 30% by volume of carbon dioxide has been used for stunning / killing pigs and poultry.

Requirements for effective use

- The room in which animals are exposed to the gas, and the equipment used should be designed, constructed, and maintained in such a way as to avoid injury to the animals and allow them to be supervised, and have devices whereby the gas concentration can be easily and accurately measured
- If animals are to be introduced into a room, it should be only after it has been filled with the required gas mixture concentration such that the oxygen concentration is below 2%
- Animals should be immersed in the required gas concentration as fast as possible and remain in this atmosphere until death is confirmed

Appendix XXX (contd)

Appendix IV (contd)

- Care is needed to ensure that there is sufficient time allowed for each batch of birds to die before subsequent ones are introduced into the room
- Rooms should not be overcrowded and measures are needed to avoid animals climbing on top of each other while entering the room
- If gas mixtures are used to kill pigs or poultry in their houses, they should be administered in such a way that they gradually fill the houses from the floor to a level well above the heads of animals in a 'monolayer' housing systems (e.g. pig sheds and poultry on deep litter)

Advantages

- Additional handling and restraint may not be required
- CO₂ in combination with an inert gas produces an increased rate of induction of unconsciousness

Disadvantages



- Possible aversiveness of various gas mixtures
- Some mixtures may not lead to immediate loss of consciousness, and exposure times required to kill pigs and poultry are considerable
- Need for a properly designed room
- Maintenance of gas mixtures to produce less than 2% O₂ is difficult in houses

Recommendation

A suitable method for poultry and neonatal sheep, goats and pigs, especially when applied in-situ in closed-environment sheds.

Article 17

Inert gasses

Introduction

This method involves the introduction of inert gases such as xenon, krypton and argon which have anaesthetic properties into a poultry house or piggery or introduction of animals into a room containing the gases. The gas leads to anaesthesia, unconsciousness and death resulting from hypoxia.

Xenon is an anaesthetic gas under normal atmospheric pressure, whereas argon and krypton have anaesthetic properties only under hyperbaric conditions. However, owing to the high costs associated with the use of xenon and krypton, argon- or nitrogen-induced hypoxia at normobaric conditions is commercially used to stun or stun / kill poultry.

Research has shown that hypoxia is not aversive to pigs and poultry and it doesn't induce any signs of respiratory distress prior to loss of consciousness

Requirements for effective use

- The room where the animals are exposed to the gases should be designed, constructed, and maintained in such a way as to avoid injury to the animals and allows them to be supervised
- If the animals are introduced into the room, it should be only after it has been filled with 100% of inert gases
- The concentration of residual oxygen in the room should be continuously monitored to ensure that it remains at less than 2% by volume
- Animals should remain in the room until they are dead

Advantages

- Replacement of oxygen by inert gases is not aversive to animals
- It can induce unconsciousness without causing distress and suffering before the animals are dead
- Additional handling and restraint may not be required

Disadvantages

- Need for a properly designed room
- High cost of gases
- Prolonged exposure to these gases can be harmful to personnel

Recommendation

A suitable method for poultry and neonatal sheep, goats and pigs, especially when applied in-situ in closed-environment sheds.

Article 18

Carbon monoxide

Introduction

Carbon monoxide (CO) induces unconsciousness and death through cerebral anoxia.

Requirements for effective use

- A closed-environment poultry house which can be sealed or a room designed, constructed, and maintained in such a way as to avoid injury to the animals and allowed them to be supervised
- If the animals are introduced into a room, it should be only after it has been filled with a CO concentration of at least 1% by volume
- The concentration of CO should be continuously monitored

Appendix XXX (contd)

Appendix IV (contd)

- If the CO is produced by a diesel engine, the gas should be cooled to ambient temperature and filtered to remove impurities in the gas
- Animals should remain in the room until they are dead
- An efficient exhaust or ventilation system needs to be provided
- The risks to human health need to be advised to all personnel and preventive measures put in place

Advantages

- If a closed-environment poultry housing is available, it is a relatively easy way to kill poultry without moving and handling them
- Application methods are simple

Disadvantage

- CO is a highly toxic gas, which is harmful to humans
- If the gas is produced by a diesel engine, impurities in the gas can be aversive prior to unconsciousness being induced

Recommendation

CO should only be used after a careful assessment of all hazards and in a well ventilated area. CO is suitable for use in poultry and neonatal sheep, goats and pigs, especially when applied *in-situ* to poultry housed in closed-environment sheds.

Article 19

Lethal injection

Introduction

A lethal injection using high doses of anaesthetic and sedative drugs causes CNS depression, unconsciousness and death. In practice, barbiturates and combinations of hypnotic and curareform drugs are commonly used.

Requirements for effective use

- Doses and routes of administration that cause rapid loss of consciousness followed by death should be used.
- Prior sedation may be necessary for some formulations
- Intravenous administration is preferred but intraperitoneal or intracardiac administration may be appropriate, especially if the agent is non-irritating
- Animals should be restrained to allow effective administration
- Animals should be monitored to ensure the absence of brain stem reflexes

Advantages

- The method can be used in all species
- Death can be induced smoothly

Disadvantages

- For practical reasons, the method may be most applicable for use in small animals
- Highly trained personnel is required for administration
- Restraint and/or sedation may be necessary prior to injection
- Some routes of administration (eg intra-cardiac) may be painful and should only be used in unconscious animals
- Legal requirements may restrict use to veterinarians

Recommendation

A suitable method for killing cattle, sheep, pigs and poultry

Article 20

Addition of anaesthetics to feed or water

Introduction

An anaesthetic agent which can be mixed with poultry feed or water may be used to anaesthetise poultry in houses or wild birds, which are then killed by another method

Requirements for effective use

- Sufficient quantities of anaesthetic need to be ingested rapidly for effective response
- Intake of sufficient quantities is facilitated if the animals are fasted
- Must be followed by killing if birds are only anaesthetised

Advantages

- Suitable for wild species which would otherwise not be able to be killed
- May result in death
- May be biosecurity advantages in the case of large numbers of diseased birds

Disadvantages

- Non-target animals may accidentally access the medicated feed or water when provided in an open environment
- Dose taken is unable to be regulated and variable results may be obtained
- Animals may reject adulterated feed or water due to illness or adverse flavour
- May need to be followed by killing.

Appendix XXX (contd)

Appendix IV (contd)

- Care is essential in the preparation and provision of treated feed or water, and in the disposal of uneaten treated feed/water and contaminated carcasses

Recommendation

A suitable method for wild birds and may be suitable for poultry in houses.
