AUSTRALIAN VETERINARY EMERGENCY PLAN

AUSVETPLAN

Operational Manual

Destruction of animals

A manual of techniques of humane destruction

Version 3.2, 2015

AUSVETPLAN is a series of technical response plans that describe the proposed Australian approach to an emergency animal disease incident. The documents provide guidance based on sound analysis, linking policy, strategies, implementation, coordination and emergency-management plans.

Agriculture Ministers' Forum

This operational manual forms part of:

AUSVETPLAN Edition 3

This manual will be reviewed regularly. Suggestions and recommendations for amendments should be forwarded to:

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AUSVETPLAN is available on the internet at:
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DISEASE WATCH HOTLINE

1800 675 888

The Disease Watch Hotline is a toll-free telephone number that connects callers to the relevant state or territory officer to report concerns about any potential emergency disease situation. Anyone suspecting an emergency disease outbreak should use this number to get immediate advice and assistance.

Preface

This operational manual for the destruction of animals (with techniques for humane destruction) is an integral part of the **Australian Veterinary Emergency Plan**, or **AUSVETPLAN (Edition 3)**. AUSVETPLAN structures and functions are described in the **AUSVETPLAN Overview Document**.

This manual describes management considerations and best-practice procedures for achieving euthanasia of various animal species. Procedures for humane destruction were initially approved in February 1991 by the then Australian Agricultural Council. Upgraded procedures were approved by the Agriculture and Resource Management Council of Australia and New Zealand in January 1996. The procedures in this manual were approved by the Primary Industries Ministerial Council out-of-session on 15 June 2006 for use in an animal health emergency.

The manual incorporates best-practice techniques from around the country and internationally (United Kingdom, United States, Europe and New Zealand). The *Australian Model Codes of Practice for the Welfare of Animals*[1] and the Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART) Facts Sheets[2] are key references for most species.

Guidelines for the field implementation of AUSVETPLAN are contained in the disease strategies, operational manuals, management manuals and wild animal response strategy. Industry-specific information is given in the relevant enterprise manuals. The full list of AUSVETPLAN manuals that may need to be accessed in an emergency is shown below. The complete series of manuals is available on the Animal Health Australia website.[3]

AUSVETPLAN manuals

Disease strategies

- Individual strategies for each of 35 diseases
- Bee diseases and pests
- Response policy briefs (for diseases not covered by individual manuals)

Operational manuals

- Decontamination
- Destruction of animals
- Disposal
- Livestock welfare and management
- Valuation and compensation
- Wild animal response

Enterprise manuals

- Artificial breeding centres
- Feedlots
- Meat processing
- Pig industry
- Poultry industry
- Saleyards and transport
- Zoos

Management manuals

- Control centres management (Parts 1 and 2)
- Laboratory preparedness

Overview document

1 www.publish.csiro.au/nid/22/sid/11.htm
2 www.adelaide.edu.au/ANZCCART/publications/facts.html
3 www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ausvetplan/

Nationally agreed standard operating procedures[4]

Nationally agreed standard operating procedures (NASOPs) have been developed for use by jurisdictions during responses to emergency animal disease incidents and emergencies. These procedures underpin elements of AUSVETPLAN and describe in detail specific actions undertaken during a response to an incident.

4 www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/nasops/

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1 Introduction

The word 'euthanasia' is derived from the Greek terms *eu* (meaning good) and *thanos* (meaning death). Euthanasia is defined as a death with minimal pain and distress, and is synonymous with a rapid loss of consciousness and a loss of brain function. Death may result from cardiac or respiratory arrest or from destruction of the brain. The humane destruction techniques described in this manual seek to achieve euthanasia.

For an animal to experience pain, its cerebral cortex and subcortical structures must be functional. If the cerebral cortex is nonfunctional because of hypoxia, depression by drugs, electric shock or concussion, the animal does not experience pain. From an animal welfare perspective, the process of anaesthesia (causing unconsciousness with minimal stress to the animal) is the key to euthanasia. The choice of a terminal procedure to cause death after anaesthesia is less important, provided the animal does not regain consciousness.

It is important that the death of the animal be confirmed at an appropriate interval after killing procedures and before moving the carcase for disposal (see Section 3). It is the responsibility of all in the destruction team to ensure that animals are correctly assessed to be dead.

In an emergency animal disease (EAD) outbreak, it may be necessary to destroy a large number of animals quickly. It is essential that these animals are speedily and humanely slaughtered and that they are indeed dead before the disposal of their carcases begins. Speed is essential in most outbreaks, because live animals will continue to produce and possibly disseminate the pathogen.

Demonstrating a high standard of euthanasia and respect for the animals is an essential consideration during an EAD response. A person experienced in slaughter of the species, and appropriately trained in animal welfare aspects of destruction, must be present at all times during the destruction process.

The purpose of this manual is to provide clear guidance on acceptable euthanasia techniques for use on most species in most likely situations. Skilful application of the techniques described here will ensure compliance with animal welfare legislation and with the *Australian Model Codes of Practice for the Welfare of Animals*.

It is not possible to cover all possibilities, and professional judgment and ethics must be used. Use of techniques *not* described in this manual may not gain the support of animal welfare agencies — novel techniques should only be used with the approval of the state coordination centre (SCC).

The livestock owner, industry liaison officer and animal welfare officer may all be able to make a useful contribution to the planning and execution of animal euthanasia, and should be consulted where possible as suggested in the action plan.

There will be considerable media interest, at least initially, in the destruction or killing of animals as part of an EAD response. Positive media coverage of animal welfare will boost staff morale and increase community support for the eradication campaign.

Health and safety considerations for euthanasia teams are a key consideration. Officers in charge of operations (usually site supervisors) must be aware of the impact that animal

destruction will have on all people involved. They must quickly determine the knowledge, skills and experience of their assistants, and brief and train them appropriately. Supervisors must also be aware that some people will not be able to handle the mental and physical stress of euthanasia procedures.

The livestock owner and their family may be present during the slaughter process and may experience considerable distress. Expert counselling, welfare assistance and assessment will be available through the welfare liaison officer from the local control centre. The site supervisor of the infected premises should ensure that those who need help receive it (see the **Control Centres Management Manual**, Part 1).

2 Organisation of operation

2.1 Action plan

Planning is essential to ensure that the destruction task is carried out efficiently and is not impeded by lack of resources. An action plan should be drawn up by the animal destruction team leader in consultation with the owner or the owner's agent and other officers.

The following procedures form a checklist for the animal destruction team leader, and should be followed.

- Consult with the infected premises (IP) or dangerous contact premises (DCP) site supervisor, the property owner/manager, and the local control centre (LCC) animal welfare specialist and industry liaison officer to establish:
  - property layout, facilities and equipment
  - the number, species and location of animals to be destroyed
  - the destruction technique to be used and an alternative technique
  - the timeframe for animal destruction operations.
- Complete an occupational health and safety risk assessment.
- Consider any necessary actions to limit possible environmental impacts of the operation.
- Consider closing airspace, especially if shooting. Contact the Civil Aviation Safety Authority to issue a 'Notice to Airmen' (NOTAM).
- Advise the IP site supervisor of immediate resources needed to move and secure animals to prepare for their destruction.
- Create good handling systems for live and dead stock.
- When practicable (and applicable), move animals to the centre of the IP or to areas furthest from other susceptible animals, including wild animals.
- Ensure that animals not to be destroyed, including domestic pets, are confined.
- Decide on the appropriate methods and facilities needed for the safe, humane and efficient destruction of the animals.
- Consult with the officer in charge of the disposal team to determine the disposal method(s) and, if necessary, identify centrally located carcase disposal sites as close as practicable to the site of destruction. Coordinated destruction and disposal operations should ensure that both occur efficiently and safely.
- Provide the IP site supervisor with a concise written plan for approval, including:
  - destruction methods (see Section 3)
  - destruction sites (see Section 2.2)
  - order of destruction (see Section 2.3)
  - timeframe
  - personnel required

  - facilities and equipment needed
  - OHS risk assessment.
- Details of the destruction operation should be included on a diagram of the IP or DCP.
- Confirm that the site supervisor has a complete inventory of all animals on the property that are to be destroyed. Destruction should not be delayed because there has been no agreement on valuation. However, where possible, all animals should be valued before destruction.
- If there is a delay in reaching agreement on valuation with the owner or their agent, authority to destroy should be sought from the LCC controller (see the **Valuation and Compensation Manual**). A signed legal order to destroy is mandatory.
- Brief the destruction teams, and then supervise and coordinate their activities. Ensure that staff are familiar with the behaviour and handling of the animals and with the destruction technique.
- If possible, destruction should take place away from public view.
- Destruction facilities, methods and working conditions must be consistent with personal safety.
- Destruction must be humane, and animals must not be removed for disposal until they are dead.
- Destruction teams must receive adequate rest and meal breaks.
- Make every effort to avoid damage to property. Any damage must be recorded and reported promptly to the IP site supervisor who will draw it to the attention of the owner/manager.
- Check all destruction against the authorised inventory to ensure that all variations are accounted for (eg births and natural deaths) and that all susceptible animals scheduled to be destroyed on the day have been destroyed.
- Provide the site supervisor with a situation report at the end of each day, using the Animal Health Emergency Information System (ANEMIS) Daily Situation Report — Slaughter.
- Advise the site supervisor of resource requirements.
- Advise the site supervisor immediately destruction has been completed, so that other tasks, such as disinfection, can be started without delay.

2.2 Selection of destruction site

The factors that need to be considered in selecting a destruction site are:

- facilities available on site
- additional facilities and equipment required
- animal security
- proximity and ease of access and transport requirements to the disposal site
- safety of all personnel on the site and in the immediate vicinity
- acceptability to the owner/manager
- likelihood of damage to property and services

- protection/screening from public view.

2.3 Order of destruction

The order of destruction will be determined after consultation with the LCC. The order will be determined by disease control requirements, but is likely to be:

- affected animals
- their direct contacts
- other susceptible animals, in descending order of epidemiological importance.

Disease-specific considerations may apply. For example, in an outbreak of foot-and-mouth disease, pigs should be destroyed before other species because of their capacity for generating virus aerosols, then cattle, goats and sheep in that order.

In determining priorities for euthanasia, some animal welfare requirements could override disease eradication considerations. For example, animals that cannot obtain feed or water, or whose shelter has been compromised, must be euthanased before better managed populations. Sick and distressed animals may require immediate euthanasia and should be killed before healthy animals. Unweaned stock must be euthanased in a timeframe that takes into account their nutritional requirements; young stock would normally be killed first. Animals in parturition or late pregnancy should also be given special consideration. Death of the foetus in utero, following the death of the dam, is not an animal welfare concern and is preferable to handling newborn animals. Fractious and potentially dangerous animals, such as bulls, sows with litters, and boars, should be destroyed first.

3 Methods of destruction

This section lists and describes methods of destruction of animals.

Preferred and acceptable methods for particular species are discussed in Section 4. Appendix 1 lists unacceptable agents and methods of destruction.

3.1 Choice of method

The final choice of a method will depend on many factors, including:

- the animal species and the age grouping
- the number of animals (individuals versus large numbers)
- the state of domestication (tame, handled animals versus wild animals)
- the status of the animal (pet versus production farm animal)
- the type of facilities available, including occupational health and safety aspects
- firearm safety — proximity of people and infrastructure
- the efficiency and acceptability of the method
- the practicality of the method, including the availability of proficient operators
- the training required by operators to reach proficiency
- the overall level of stress on the animal, including whether it is fit or unwell
- the future use of the carcase and any risk to consumers (including people and nontarget scavengers).

After safety, animal welfare is the main consideration. Within these constraints, the best euthanasia method for the species and the circumstances must be selected. Methods of euthanasia are not ranked in this manual, because important but variable factors may determine the final choice of a method.

The aim of any destruction technique is to achieve euthanasia in a single treatment by a rapid loss of consciousness, leading to death with no return to consciousness, and with an acceptable, minimal level of stress to the animal before its death. Some techniques produce loss of consciousness but not always death. These techniques must be followed with a terminal technique such as pithing (Section 3.9.1) or exsanguination (Section 3.9.2).

Where euthanasia has been performed, animals must always be assessed for vital signs (see Section 3.2). If there is any doubt that the animal is dead, it should be treated again; if it is merely unconscious, it should be subjected to a terminal procedure.

In some circumstances, special disease or sampling considerations apply. For example, rabid or suspected rabid animals should be shot in the heart with a firearm to preserve the brain (which is the best diagnostic specimen), to avoid contamination of personnel with potentially infective brain or saliva, and to avoid the risks of handling a rabid animal. Similarly, animals with suspected bovine spongiform encephalopathy (BSE), scrapie and other nervous system conditions generally should not be shot through the head, as brain tissue is required for diagnostic testing. They may be shot through the cervical spinal

column (neck shooting), but an accurate shot for humane destruction requires expert anatomical knowledge. For suspect BSE cases, a technique for brain shooting is described in the National Transmissible Spongiform Encephalopathy Surveillance Program (NTSESP) National Guidelines for Field Operations.[5]

If animals are highly infectious and/or are very sick, it is desirable not to move them off their home property. Destruction in situ reduces the risk of spreading the agent, the extent of cleaning and decontamination required, and risks to the welfare of the animal. While the use of abattoirs is usually not an option for exposed animals, it should be considered where possible.

3.2 Assessing death

Knowledge of the vital signs of life is important in certifying death. Different euthanasia techniques used for different species may result in different final behaviours, and it is necessary to understand what is 'normal'. For example, an animal that has recently died may display an 'agonal struggle' (uncoordinated limb movements and gasping), but this is not a welfare concern. Using a terminal technique helps guarantee death but does not remove the responsibility of slaughter personnel to check their subjects.

At least two of the following signs of death must be observed in each animal:

- loss of consciousness (not enough in itself, as the animal may only be stunned)
- absence of rhythmic respiratory movements (may also be temporary respiratory failure)
- loss of eye-protection reflex (corneal reflex) or 'blink' (also happens in heavily anaesthetised animals)
- pupillary dilation (difficult to assess in some species)
- glazing of the eyes (cornea becomes opaque, dry and wrinkled)
- absence of heartbeat (requires expertise to detect; heartbeat may persist for some minutes)
- absence of a pulse (requires expertise as for heartbeat)
- loss of colour in the mucous membranes, which become pale and mottled, without refill
- lack of response to painful stimuli (withdrawal reflex — not reliable)
- lack of jaw muscle tension and slack tongue (may be difficult to judge)
- rigor mortis (onset after several hours).

Return of rhythmic breathing is the main sign that an animal is only stunned and requires retreatment. Lack of any respiratory movement is the best indication of death.

3.3 Firearms (rifles, shotguns and hand guns)

Firearms are an acceptable method of euthanasia, especially for larger animals, and particularly where these animals cannot be safely handled and restrained. The bullet should

[5] www.animalhealthaustralia.com.au/wp-content/uploads/2011/03/NTSESP-Field-Guidelines-2011-12.pdf

normally be placed to destroy the brain. Heart or lung shots can only be justified where the accuracy required for a brain shot cannot be achieved or where there are disease or diagnostic considerations.

Recommendations for the most suitable type of ammunition should always be obtained from experienced personnel. Appendix 2 contains more specific guidance on ballistics; Section 4 gives aiming points for individual species.

Firearm licensing requirements vary from state to state and must be complied with. Only licensed operators may use firearms. Firearms require registration in the relevant state or territory.

The following aspects of firearm safety should be considered:

- All firearms are potentially hazardous and should be treated as if they are loaded: safety first.
- All firearm users require appropriate training and proof of expertise.
- When shooting at short range in stockyards, shooters should use relatively low-velocity hollow-point or soft-point ammunition matched to the size of the animals. Solid-point ammunition should be avoided because solid projectiles can penetrate the skull and exit at high velocity, endangering personnel in the area. Hollow-point or soft-point ammunition deforms when entering the target, destroying brain tissue more effectively. If animals are to be shot in their paddocks, shooters should use high-velocity ammunition adequate to the task.
- People other than the shooters and their assistants should be cleared from the area or should stand well behind the shooters. The direction of fire must be chosen to prevent accidents or injury from stray bullets or ricochets. It may be necessary to construct a suitable backstop (examples of effective ranges are: 7.62 mm rifle — 2750 m or 0.22" rifle — 1300 m).
- For maximum impact and the least possibility of misdirection, the range should be as short as circumstances permit. For handled animals, this should be 5–20 cm, but the barrel of the firearm should not be placed directly against the animal's forehead.
- The police should always be notified before firearms are used near populated areas.
- Tranquilliser dart guns may be useful for unapproachable animals in populated areas.

The *advantages* of using firearms are:

- Experienced, proficient operators can achieve a clean kill, usually with no need for a terminal procedure.
- Handling individual animals is not necessary.
- Shooters can destroy animals from a distance.
- Firearms and ammunition are readily available.
- Many people are proficient in the use of firearms.

The *disadvantages* of using firearms are:

- They are potentially the most dangerous of the methods of destruction.
- High-powered ammunition is unsuitable for use close to populated areas.

3.4 Captive-bolt pistols

Captive-bolt pistols are an acceptable alternative to firearms where animals, particularly ruminants and pigs, can be adequately restrained. **Use of a follow-up terminal procedure to guarantee death (Section 3.9) is mandatory**. Provisions of the firearms legislation apply in some jurisdictions.

There are two types of bolt: penetrating and nonpenetrating ('mushroom'). Penetrating bolts concuss and traumatise the cerebral hemisphere and brainstem, resulting in loss of consciousness and usually death. A terminal procedure is required. Nonpenetrating bolts are mainly used for religious slaughter in abattoirs under tightly controlled conditions and are not suitable for field use, as they require the animal to be bled.

With an effective stun, the animal becomes immediately senseless, collapses and exhibits tonic limb contractions followed by gradual relaxation and involuntary kicking movements. Many animals so treated will be dead, but stunning must be followed up with a terminal procedure.

Blank cartridges for the captive-bolt pistol are colour-coded according to the amount of charge they contain. The most widely used is the 'Cash Special' — a single-shot, .22 calibre, captive-bolt pistol which uses one of three loads:

- Pink: 1.25 grains (weaners, young stock to 100 kg);
- Purple: 2.5 grains (sheep, pigs);
- Green: 3 grains (cattle to 600 kg, boars, mature sows etc).

Further details are available in Appendix 2. It is essential to follow the manufacturer's recommendations for the most appropriate cartridges for different farm animals. If there is doubt, a more powerful charge should be used.

Regular (daily) maintenance of the captive-bolt pistol is essential for efficient stunning. Spare weapons and parts should be on hand.

Captive-bolt pistols are designed to be pressed firmly to the animal's head before being discharged. If a follow-up shot is necessary, it should be in a different spot, not far from the ideal impact site.

The *advantages* of captive-bolt pistols are:

- Although the pistols are dangerous, there is no free projectile and this aspect of operator safety is increased compared with firearms.
- More than one operator can safely work in the same area.
- Both pistols and ammunition are readily obtainable.
- They are easy to use.
- Operators need not be expert shooters.

Despite these advantages, captive-bolt pistols must still be aimed accurately (see Section 4 for species-specific aiming diagrams).

The *disadvantages* of captive-bolt pistols are:

- They may only stun larger animals (as a rule of thumb, cattle over one year old, sows, boars, billy goats and rams), which must then be pithed or exsanguinated to ensure death (see Section 3.9).
- Some animals have to be individually restrained.
- The method is relatively slow, especially when large numbers of animals are to be destroyed.

3.5 Other physical methods

3.5.1 Water-based foam

This method works by generating a water-based foam and delivering it to floor-based chickens in a confined space so that a blanket of foam covers the birds and mechanically occludes their airways, resulting in hypoxia and death due to asphyxiation. The process of foam generation uses a pump to shift water from a suitable water source into a foam generating system. Foam concentrate is inducted into the water stream, and this solution is forced through a double-mesh screen to mix with air. Replacement of the air with carbon dioxide gas (CO_2) in the foam bubbles yields no euthanasia advantage and carries with it an additional workplace health and safety hazard; its use is not recommended. The destruction technique offers advantages in the management of zoonotic diseases such as avian influenza because it reduces human exposure to live birds.

The use of water-based foam is increasing since its use was first explored overseas for mass depopulation of poultry (Alphin et al 2010, Benson et al 2007).

3.5.2 Dislocation of the neck

Dislocation of the neck may be suitable for poultry and smaller laboratory animals. Suitable methods are by burdizzo (castrating pincers), forceps, or by hand. Burdizzos are particularly useful when large numbers of poultry with strong necks (geese, ducks etc) are to be destroyed. To achieve consistent results, proficient and motivated operators are required. Damage to the brainstem results in an acceptable death. The instrument must be applied close to the cranium.

3.5.3 Electrical stunning or electrocution

Electrical stunning is used widely in abattoirs for pigs, sheep and lambs, but its field use is currently not practical.

Electrocution of a stunned animal using alternating current ('AC') causes death by cardiac fibrillation and resulting cerebral hypoxia, but may be unreliable in small animals (<5 kg). Animals should be unconscious before being electrocuted, as death will take 10 to 30 seconds. The use of this method as a terminal technique is questionable.

3.5.4 Decompression

Decompression is now regarded as unacceptable.

3.5.4 Exsanguination

Exsanguination is an important terminal technique (see Section 3.9).

3.5.5 Decapitation

Decapitation by trained operators using knives, guillotines, bone cutters or secateurs is suitable only for small rats and mice. There are concerns about the humaneness of this technique, due to length of time that the severed brain is active.

3.5.6 External trauma

A blow to the head can be a humane method of euthanasia for neonatal animals with thin craniums. More acceptable techniques are gassing or injection of an anaesthetic overdose. Specific jurisdictional requirements for instrument choice and use of a terminal technique must be adhered to.

3.5.7 Immersion anaesthesia

Tricaine methane sulfonate (TMS, MS–222) can be used for euthanasia of amphibians and fish in an immersion solution (see Section 4.12).

Drowning or suffocation of any species is not acceptable (unacceptable techniques are listed in Appendix 1).

3.6 Gaseous agents

Inhalation agents cause loss of consciousness followed by respiratory depression and death from hypoxia. Any gas that is to be inhaled must reach a certain concentration in the alveoli, blood and brain before it can be effective; therefore, euthanasia will take some time. Suitability of an agent depends on whether the animal experiences distress before it loses consciousness.

Neonatal animals appear to be resistant to hypoxia; therefore, they take longer to die than adults and should receive a longer treatment or a terminal procedure once unconscious.

3.6.1 Carbon dioxide gas

CO_2 at 70% minimum concentration is the method of choice for destroying most poultry species in large numbers, and for many smaller livestock and laboratory animal species (see Appendix 4 for large-scale use). It is colourless, heavier than air and nearly odourless, and is easy to use and safe in well-ventilated areas. Normal atmosphere is composed of nitrogen (N), 78%; oxygen (O_2), 21%; and carbon dioxide (CO_2), 1%.

CO_2 has rapid depressant, analgaesic and anaesthetic effects; it depresses the central nervous system by lowering the pH in brain tissue. At low concentrations in inspired air (7.5%), CO_2 increases the pain threshold, and at higher concentrations (>30%) it has a rapid anaesthetic effect in about one minute. Animals must be exposed to an atmosphere of at least 30% CO_2 to ensure loss of consciousness, and then at least 70% CO_2 to kill them.

To achieve this, animals should be placed in a container prefilled with the gas, and exposed to a continuous inflow of 100% CO_2 to maintain a minimum concentration of at least 70% for at least three minutes. An optimal flow rate is one that will displace 20% of the chamber volume per minute. In birds, anaesthesia typically occurs within 20 seconds. Animals may be left in the container until rigor mortis ensues or they may be removed once unconscious and killed by a terminal technique.

For adult poultry, an exposure time of one minute is usually necessary, but up to 20 minutes exposure may be needed to ensure death. The period between unconsciousness and death will be even longer in neonatal or juvenile animals, which are more tolerant of CO_2. They may require 30 minutes exposure or longer. Species that normally live in water, control their respiration or hold their breath may also require a longer exposure.

Animals must be checked to ensure that they are dead before the procedure is complete.

Compressed CO_2 gas in cylinders is the only recommended source. CO_2 released from the cylinder is cold and has the potential to chill animals on direct contact. If cylinders of gas are not available, dry ice may be used for small numbers of small animals. The dry ice is placed in the bottom of a deep container under a gauze floor, so that there is no direct contact between the animals and the ice. Animals are then placed into the container, and left there until unconsciousness or dead.

In situ CO_2 gassing in sheds or cages is difficult to do and is not recommended unless stringent operating conditions are met.

The use of a CO_2/O_2 mixture (70/30) may decrease the discomfort of hypoxia before the onset of anaesthesia and narcosis. However, there appears to be no advantage to combining O_2 with CO_2 for euthanasia. The combined use of inert gas mixtures incorporating nitrogen or argon ('controlled atmosphere') has some application in abattoirs but its use in field situations is problematic.

3.6.2 Gaseous anaesthetic agents

Gaseous anaesthetic agents, which include halothane, enflurane, isoflurane and methoxyflurane, can be used to produce anaesthesia and death in small animals (<7 kg).

These agents can be used in exactly the same way as CO_2, but there should be no direct contact between the animal and the anaesthetic in its liquid form. Animals may be left in the anaesthetic chamber until dead, or may be removed once unconscious and killed by one of the physical terminal methods or even by injection of an overdose of barbiturate (see Section 3.7).

The major disadvantage of these agents is that they are expensive and restricted (Schedule 4) drugs that should only be used in a well-ventilated room or, preferably, in a fume cupboard. Prolonged exposure, even at low concentrations, may harm the health of personnel.

Ether is not recommended. Induction of anaesthesia is slow and stressful because the high concentrations necessary to produce unconsciousness irritate the skin and mucous membranes. Ether is also hazardous to personnel because of its explosive properties during use and during disposal of carcases.

Nitrous oxide (N_2O) used alone does not induce anaesthesia and is not suitable. On its own, it produces hypoxia before respiratory or cardiac arrest, and animals may become distressed before losing consciousness.

3.6.3 Hydrogen cyanide gas

Hydrogen cyanide gas is a humane and highly effective method of destroying poultry and other small animals. However, human safety considerations restrict its use. It should only be used by experienced commercial operators.

3.6.4 Carbon monoxide

Carbon monoxide gas is a humane and highly effective method of destroying poultry and other small animals. However, because it is a colourless and odourless gas with cumulative effects, human safety considerations restrict its use. It should only be used from a commercially bottled source; petrol engine exhaust fumes are not acceptable and are unlikely to be approved for use.

3.6.5 Methyl bromide

Methyl bromide is effective for killing poultry, but is now regarded as unacceptable because of operator safety requirements and environmental concerns.

3.7 Injectable agents

3.7.1 Injectable euthanasia solutions

Injectable euthanasia solutions (hypertonic solutions of barbiturates) are a rapid and reliable way to euthanase individually handled animals. An overdose can be used as a primary means for euthanasia, ideally by the intravenous (IV) route in large animals, but other routes may be more practical in smaller animals. These agents are restricted by law and must only be used by a veterinarian or under direct veterinary supervision. Expertise and anatomical knowledge are required to successfully inject at the different sites. Care is needed to avoid needlestick injuries and self-injection.

Barbiturates depress the central nervous system, beginning with the cerebral cortex, with loss of consciousness progressing to anaesthesia. With an overdose, deep anaesthesia progresses to apnoea, followed by cardiac arrest. An effective kill is judged by limpness (lack of muscle tone), lack of rhythmic breathing and absence of a corneal reflex. A partial dose may cause excitement and can be dangerous in equines.

Commercial euthanasia solutions are available (sodium pentobarbitone 170–400 mg/mL; 18% = 200 mg/mL), and are usually administered intravenously at dose rates greater than 100 mg/kg. These preparations should not be used in conscious animals by the intrathoracic, intraperitoneal, subcutaneous or intramuscular route, as at this concentration they are extremely irritating to tissues.

Pentobarbitone at the normal concentrations used for anaesthesia (60 mg/mL) may be used, but larger volumes will be required. Intracardiac, intraperitoneal or intrahepatic injection via a fine needle is acceptable for all young animals up to a month old, including piglets and lambs. Destruction of cats, rabbits and some birds by intraperitoneal sodium pentobarbitone, at normal anaesthetic concentrations, may be accompanied by an excitement phase, and animals should be confined and handled with extreme care in such circumstances.

Often the choice of injection route is governed by circumstances, such as the nature and size of the animal and the skill of the person injecting. The best method for rapid effect is intravenous, followed by intracardiac, intrahepatic, intraperitoneal, intramuscular and subcutaneous. If the animal is excitable or vicious, or if facilities are lacking, other tranquillisers can be administered to chemically restrain the animal; these drugs (ketamine, xylazine etc) can be given by the subcutaneous or intramuscular route. A terminal overdose of barbiturate can then be given intravenously or by any other route to kill the animal, but the drug should be directed where it will be absorbed rapidly. The use of a method incorporating anaesthesia is described more fully in the section below.

3.7.2 Anaesthesia and other techniques combined

A combination of anaesthesia, captive bolt and pithing, or some other terminal technique, is suitable for a variety of situations. These situations may include those in which free projectiles are undesirable; it is desirable to move animals to an alternative, adjacent destruction site; facilities are inadequate for individual restraint; and/or access to the available destruction site is compromised. Reasonably large numbers of animals can be handled in a day. Because no machinery is needed to move animals immediately from the destruction site, destruction can usually proceed soon after disease is detected and may be completed before disposal arrangements are finalised.

Animals are worked through a race or otherwise confined and injected with a suitable drug, such as xylazine. For animals over 100 kg, 10% xylazine is recommended. For younger stock, 2% is more appropriate (a dose of 10% xylazine is very small and difficult to measure accurately; overdosage leads to calves going down too quickly). Animals are moved directly from the race to the destruction site, which could be an adjacent paddock, a pit, another yard or a single-deck livestock transport. Tranquillisation should occur within 3–5 minutes of injection.

As anaesthesia deepens, the animals lie down. The captive-bolt operator then moves among them and stuns them. Immediately the captive-bolt operator moves away from a stunned animal, another slaughterman moves in and piths it. All pithed animals should be marked with a stock marker.

Alternatively, the anaesthetised animals can be shot at close range with an appropriate firearm or subjected to a terminal procedure as described in Section 3.9.

Once this process is completed for one batch, the next batch can be injected and let into the destruction area. Alternating between two destruction sites can speed up the operation.

3.8 Oral agents

Oral agents fall into two categories: poisons, and sedatives or anaesthetics. There is no justification for using a poison on managed stock.

In some controlled circumstances, an oral sedative agent may reduce animal stress and allow better delivery of euthanasia. To protect animal welfare, close supervision is required. Sedative agents include diazepam for mammals and alpha-choralose for birds (licences or permits may be required). In poultry, the effects may be inconsistent because partial effects reduce consumption.

3.9 Terminal procedures

Terminal procedures cause death but are not usually acceptable methods of euthanasia in their own right. The procedures below should *only* be used on unconscious (stunned or anaesthetised) animals.

3.9.1 Pithing

Pithing is the process of destroying nervous tissue in and around the brain stem to ensure death. Pithing incapacitated but conscious animals is an unacceptable, inhumane method of destruction.

Pithing is usually done by inserting a metal or plastic rod through a hole made with a captive-bolt pistol in the animal's head. The rod is pushed down through the foramen magnum and into the spinal cord. Pithing can also involve severing the spinal cord between the atlas and axis (that is, between the first and second bones of the neck).

The pithing process stimulates violent involuntary movements of the animal's legs and head. People standing in the wrong place could sustain injury, but this can be avoided by following the procedure described in Appendix 3.

Pithing is normally preferable to exsanguination.

3.9.2 Exsanguination

Exsanguination ('bleeding out') is a useful procedure but is undesirable because of the release of infectious material and because the destruction site becomes slippery, making work dangerous. The operation can be performed by cutting the main blood vessels at the top of the heart via the thoracic inlet ('chest stick') or in the neck ('neck stick'); the former method is more effective. If necessary, large animals can be exsanguinated by severing the abdominal aorta per rectum; appropriate care is required.

Some religions require exsanguination as a primary means of slaughter. This practice is only acceptable under strictly controlled conditions for some animal species (sheep, goats and poultry), and requires a high level of training and specialised equipment. It is generally not acceptable for slaughter in the field.

3.9.3 Injectable terminal agents

The death of a stunned or anaesthetised animal may be caused by an injected overdose of anaesthetic agent or other specific chemical.

Barbiturate euthanasia solutions are accepted primary euthanasing agents. The best effect is achieved by delivering them intravenously (see Section 3.7). They can be given to an unconscious animal by the cardiac, thoracic or peritoneal route. At anaesthetic concentrations (60 mg/mL), delivery by any route is acceptable.

Potassium chloride and magnesium sulfate as supersaturated solutions, injected intravenously or intracardiacly, and neuromuscular blocking agents (nicotine and succinyl choline) are acceptable for use on anaesthetised animals as a terminal procedure only. They produce hypoxia without loss of consciousness first; they are not acceptable as a primary killing method.

3.9.4 Other physical methods

Methods such as cervical dislocation, decapitation, thoracic compression and blunt external trauma to the head can be used successfully on smaller unconscious animals.

4 Destruction of particular species

This section discusses the preferred methods of destruction for various domestic species in managed situations, and the factors that determine the choice of methods.

Some guidance is also given on preferred methods of destruction for various wild species. Further discussion can be found in the **Wild Animal Response Strategy** or the current edition of the *Australian Model Code of Practice for the Welfare of Animals: Destruction or Capture, Handling and Marketing of Feral Animals*. The distinction between wild and domestic animals may be unclear in some extensive production systems.

4.1 Cattle and buffalo

Under most circumstances, cattle and buffalo will be mustered into yards and headshot using firearms at the closest possible range. In extensive areas where 100% musters cannot be achieved, unmustered animals will be shot in paddocks after as many as possible have been mustered.

Captive-bolt pistols (see Section 3.4) are most suitable when animals can be adequately restrained. Injectable agents may be most suitable for small numbers of calves, such as on hobby farms; various other options are also available for calves. Anaesthetisation with xylazine, followed by a terminal injection procedure, is recommended for well-handled small herds or in urban situations.

The normal sequence of events for cattle killed by brain trauma begins with immediate collapse, followed by several seconds of tetanic spasms, occasional gasping, slow, uncoordinated hindlimb movements that increase in frequency, loss of menace or blink response, and pupillary dilation. Return of normal, rhythmic breathing indicates that the animal is not dead.

4.1.1 Firearms or captive bolt: frontal method

The firearm should be directed at the point of intersection of lines taken from the base of each horn or upper side of the base of the ears (or equivalent position in a polled animal), to the opposite eye, aiming at the spine (see Figure 4.1, location 'a'). For bulls or older animals, the bullet should enter about 1 cm to the left or right of this point and hard-point or jacketed ammunition may be necessary.

Small calves may be shot just behind the nuchal crest (poll) in the midline, aiming directly at the muzzle (see Figure 4.1, location 'c'). Alternatively, a captive-bolt pistol may be used.

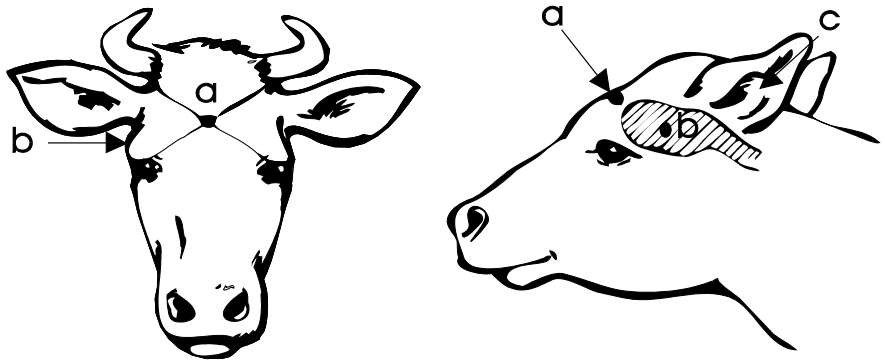

Figure 4.1 Humane destruction of cattle: (a) recommended position for frontal method (suitable for firearm or captive-bolt pistol); (b) recommended position for temporal method (only suitable for firearms); (c) recommended alternative poll position for small calves.

4.1.2 Firearms: temporal method

Temporal shooting is possible with a firearm, but not with a captive-bolt pistol. The animal is shot from the side, so that the bullet enters the skull midway between the eye and the base of the ear. The bullet should be directed horizontally and at ninety degrees to the side of the head (Figure 4.1, location 'b').

4.1.3 Firearms or captive bolt in yards

Ideally, only personnel who have had previous experience at shooting in yards should undertake the task. They should be fully briefed on humanitarian and safety aspects of destruction before beginning work. Only hollow-point or soft-point ammunition should be used. The minimum round size should be .22 magnum; maximum should be .44 magnum or .375.

Twelve-gauge shotguns with full choke are effective weapons for close-range frontal head shots (to 5 m, but preferably at 5–25 cm). Any shot size down to No. 6 can be used. Shotgun projectiles have a reduced risk of dangerous ricochet.

Operators should shoot from the top rail, preferably in a small yard. It is not practical to shoot in a crush unless few animals are involved and the crush is equipped with a side-opening gate, in which case a captive-bolt pistol should be considered.

4.1.4 Paddock or extensive-area destruction

Shooting from helicopters is usually the most effective and humane method of destroying unmusterable cattle in extensive and difficult terrain. The aerial platform has limitations, however, and a high degree of pilot and shooter proficiency is required to deliver euthanasia.

Civil Aviation Safety Authority approval is needed before rifles may be used from helicopters. Such shooting should be carried out only by experienced personnel specifically trained, and with current proficiency, in this type of operation. Untrained personnel should undergo a training course and pass a practical and written test at its conclusion before shooting from a helicopter.

Minimum recommended calibre is .308 (7.62 mm), using military-type semiautomatic rifles (eg M14, SLR or MIA) and suitable projectiles.

Shots aimed to destroy the brain are preferred, but for practical reasons this is not usually possible from helicopters, so well-directed heart/lung shots can be used. Any head or spinal shots must be followed up with a heart/lung shot, even if the animal appears dead (as it may only be stunned). 'Overkill' is the only acceptable option, and this means 'flyback' for all shot animals. Flyback means:

- as soon as possible after each animal is shot, the helicopter must fly back to ensure that the animal is dead
- the animal should be shot again, in one or more vital areas.

Cost of ammunition and extra flying time must not deter shooters from this procedure.

4.1.5 Anaesthesia and other techniques combined

The use of xylazine as an anaesthetic agent that can be delivered intramuscularly with a relatively short induction time can be valuable in certain circumstances. See discussion in Section 3.7.

4.1.6 Stud and pet cattle

Stud and pet animals can be anaesthetised as above, or given an intravenous barbiturate overdose as the primary or terminal procedure. Injection into the jugular vein with an 18-gauge needle is preferred.

4.1.7 Calves

The recommended techniques for killing calves are an intravenous dose of barbiturates, penetrating captive bolt and terminal procedure, or headshooting with a .22 calibre rifle in the frontal position (see Figure 4.1, position 'a'). Small calves may also be shot just behind the nuchal crest (poll) in the mid-line, aiming directly at the muzzle (see Figure 4.1, position 'c'); alternatively, a captive-bolt pistol may be used.

Day-old calves can be killed by external trauma using a short-handled 1.2 kg hammer or an instrument of similar weight, skilfully applied to the crown. Use of the tranquilliser xylazine may be considered in some circumstances. Specific jurisdictional requirements must be adhered to.

4.1.8 Buffalo

Destruction techniques for buffalo are as for cattle, with the following exceptions:

- Captive bolts are not effective on adult buffalo because of the animals' heavier frontal bone structure.
- Hard-point or jacketed ammunition is preferable for large animals (eg 7.62 mm, 168-grain, full metal jacket).
- When small numbers are to be shot and the use of semi-automatic rifles is not possible, heavier calibre or magnum rifles may be used.
- If buffalo are to be shot from the frontal position, operators should keep the angle of impact in mind, because the animals will often lift their noses.
- .22 calibre firearms are not suitable, except for young stock at close range.

4.2 Sheep and goats

The preferred method of destruction for sheep and goats is by .22 rifle or captive-bolt pistol for adults, and by barbiturates for young animals.

- Rams and adult male goats — it may be easier to use a .22 magnum rifle, depending on facilities. If a captive-bolt pistol is more practical, heavy-duty cartridges should be used (see Section 3.4).
- Wethers/ewes/does — sheep must be packed tightly as destruction proceeds. This can be achieved using light portable panels or mesh.
- Newborn lambs/kids — young animals should be drafted off and administered sodium pentobarbitone euthanasia solution (intracardiac 3–5 mL) through automatic syringes. Larger lambs or kids may be subjected to the captive bolt in the frontal position.

4.2.1 Firearms or captive bolt: hornless sheep

The top of the head (Figure 4.2, position 'a') (centre of upper forehead, between poll position and forehead) is a suitable position, with the firearm or captive bolt aimed towards the animal's gullet. Alternatively, the instrument may be placed just behind the poll and aimed in the direction of the animal's muzzle (Figure 4.2, position 'b').

Figure 4.2 Humane destruction of hornless sheep: recommended positions and direction of fire for captive-bolt pistol or firearm

4.2.2 Firearms or captive bolt: horned sheep and all goats

When a firearm is used, the operator should shoot at a point in the middle of the face just above the level of the eyes, while aiming towards the spine as shown in Figure 4.3 (position 'a'). In mature goats, the brain is located well back in the skull compared with other livestock, and the poll position is preferred (see Figure 4.4).

With a captive bolt, the frontal position used for hornless sheep may not be suitable, in which case the instrument may be placed behind the poll and aimed in the direction of the animal's muzzle (see Figure 4.3, position 'b'), using a heavy-duty cartridge.

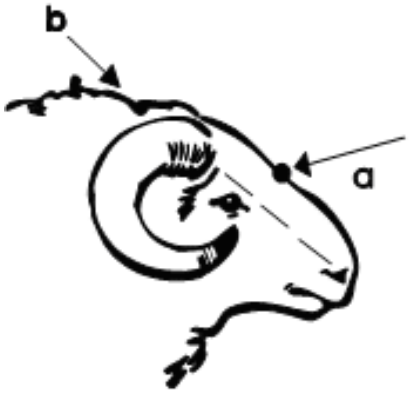

Figure 4.3 Humane destruction of goats and horned sheep: recommended position and direction of fire for captive-bolt pistol or firearm

Figure 4.4 Humane destruction of mature goats: recommended position and direction of fire for captive-bolt pistol or firearm

4.2.3 Injectable options

Barbiturate overdose (pentobarbitone sodium 80 mg/kg) by the jugular vein with an 18-gauge needle is the recommended option for injectables. Parting or removal of the wool may be necessary at the injection site. Sedation with xylazine followed by a terminal procedure may be the preferred approach for pet animals.

4.3 Pigs

Pigs are particularly difficult to destroy; sows with litters are particularly fractious and hard to handle.

Captive-bolt pistols should be used for housed pigs, to avoid the danger of ricochets. Housed pigs may also be moved outside and destroyed using firearms. Pigs in paddocks can be shot using firearms. It is preferable, wherever possible, to move pigs out of their sheds before euthanasia. Removal of dead pigs from sheds is usually difficult and slow, and requires a lot of labour or partial shed dismantling. Movement of pigs 'under their own steam' to euthanasia pens outside their sheds will usually speed up the process considerably.

Sodium pentobarbitone is suitable for unweaned pigs. Intracardiac, intravenous or intrahepatic injection of euthanasia solution, using automatic syringes, is satisfactory.

In a typical piggery, large numbers of pigs of varying sizes may need to be killed. Depending on the size of the pigs and the housing system, a number of methods are available, but for safety reasons the use of firearms inside buildings is not recommended. If feed is limited, operators should begin with the largest animals, and lactating sows and their piglets should be killed concurrently.

4.3.1 Small pigs under 5 kg liveweight

Small pigs are most likely still nursing and therefore in a confined system (farrowing crates) where they can easily be caught and killed by either external blunt trauma to the head or by gassing with carbon dioxide. Small numbers of animals could also be killed by intracardiac injection of barbiturate solution. Piglets from extensive production systems (pasture farrowing) will need to be caught after being restrained in the sow house. Caution with the sow will be needed while removing piglets.

4.3.2 Weaned pigs between 5 kg and 25 kg

Weaned pigs will likely be loose-housed in groups of 20–250 per pen. Using temporary panels to confine a small number at a time will allow operators to use captive bolts. Small numbers of pigs may also be killed by intracardiac barbiturate injection. Unless the animals are free-ranging in large outdoor runs and cannot be caught easily, firearms are not appropriate.

4.3.3 Grower/finisher pigs between 25 kg and 100 kg

Grower and finisher pigs will be loose-housed in groups of 20–250 per pen. If small pens are available, the animals can be crowded and stunned with captive-bolt pistols. Consideration should be given to performing this procedure in a single-deck livestock transport to assist with disposal. If animals cannot be crowded together, firearms may be appropriate.

Intravenous barbiturate injection is appropriate if pigs can be restrained using snares, and if the operator is skilled in intravenous injections via either an ear vein or the anterior vena cava.

The use of carbon dioxide is not appropriate for animals of this size.

4.3.4 Gilts, sows and boars over 100 kg

If larger pigs can be restrained in small groups, the use of the captive-bolt method is acceptable. It is essential that the captive bolt be placed accurately against the animal's head. Intravenous barbiturates are acceptable for small numbers of sows and boars that can be snared. Free-ranging sows and boars that cannot be restrained may be destroyed using firearms.

Nursing sows within farrowing crates can be destroyed using a captive bolt, but getting the carcase out of the crate will be very difficult. For this reason, it is best to move the sow to a small, confined area before her slaughter. Caution is required because nursing sows can be fractious.

Tusked boars must *always* be treated with caution.

4.3.5 Handling tips

- Weaned pigs — The operators should use standard captive-bolt cartridges (see Section 3.4). It is preferable to have the animal caught and held over the rail of the yard while it is destroyed. A wheelbarrow can then used to move it to a front-end loader.
- Growers/finishers — The operators should pack the animals tightly in the pen, begin destruction by working around the perimeter, and then climb in to finish the group.
- Sows — These animals should not be yarded too tightly, as they become upset if jammed and will start climbing on rails. The operators should work steadily and without hurrying, using heavy-duty cartridges in captive-bolt pistols.
- Boars — Operators should use heavy-duty cartridges in captive-bolt pistols or, if this is too difficult, a .22 magnum rifle.

4.3.6 Tranquillisation

Sedative drugs may be useful in difficult circumstances where small numbers of pigs must be killed. Drugs include xylazine, azaperone and alpha-choralose, alone or in combination with other agents. Sedation may allow subsequent intravenous barbiturate overdose by the ear vein or jugular vein.

4.3.7 Firearms or captive bolts: frontal method

Shooting from the front with a firearm or captive-bolt pistol is the preferred method. The instrument should be directed at a point about midway across the forehead and (for adult pigs) about 2 cm above the level of the eyes and slightly off centre (Figure 4.5, position 'a'). Pithing is required, particularly for adults.

4.3.8 Firearms: temporal method

The temporal method is only suitable for firearms. The pig is shot from the side so that the bullet enters the skull at a point midway between the eye and the base of the ear. The bullet should be directed horizontally into the skull and at ninety degrees to the side of the head (Figure 4.5, position 'b'). With adult pigs, this method has some advantages because the bone structure at the front of the skull is heavier.

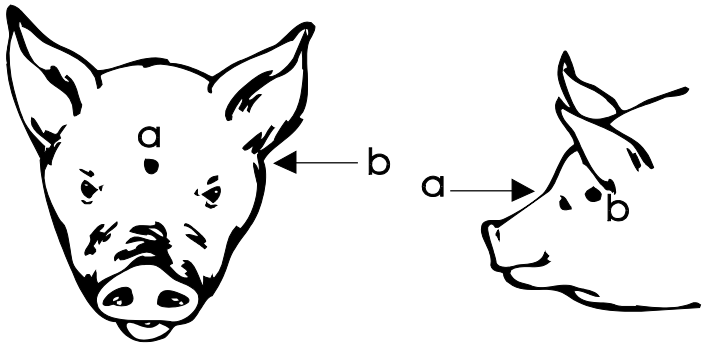

Figure 4.5 Humane destruction of pigs: recommended position and direction of fire for (a) frontal method (suitable for captive-bolt pistol or firearm) and (b) temporal method (suitable for firearm only)

4.4 Horses, donkeys and mules

Equines can be destroyed either by intravenous injection of barbiturates or by shooting, as detailed below. Recommended minimum rifle round for horses is hollow-point .22 magnum. Use of captive bolts is not recommended in field situations because of shying, and because some horses rear before the operator can withdraw the bolt or move out of danger.

Premedication with tranquillising agents such as xylazine (1 mg/kg IV; 2 mg/kg IM) or acetyl promazine (0.04–0.1 mg/kg IM or IV) may aid handling and improve safety by reducing the excitation phase of barbiturate induction. Incorporation of the paralytic agent succinyl choline (0.1 mg/kg IV) into an injection of a commercially available barbiturate euthanasing solution may also reduce movements. The full dose of the euthanasing solution must be given; dilution with other agents is not recommended.

Succinyl choline may also be used IM in unbroken horses, followed immediately by IV barbiturate or headshooting.

Feeding the animal on the ground may induce a better and steadier presentation of the head for shooting.

4.4.1 Firearms: frontal method

From the front, the firearm should be directed at the point of intersection of diagonal lines taken from the base of each ear to the opposite eye, aiming at the spine (Figure 4.6, position 'a').

4.4.2 Firearms: temporal method

From the side, the bullet should enter the skull midway between the eye and the base of the ear (Figure 4.6, position 'b'). The bullet should be directed horizontally and at ninety degrees to the side of the head.

4.4.3 Paddock or extensive area destruction

Paddock destruction of equines is the same as for cattle and buffalo (see Section 4.1), but the behaviours of wild equines must be considered in order to make killing more efficient and less stressful for the animals. Preferential destruction of the last animal in a 'string' of

running animals, or of the 'boss' mare, are some of these considerations. Unweaned animals must be targeted before others, as they may separate from the mob and be difficult to find.

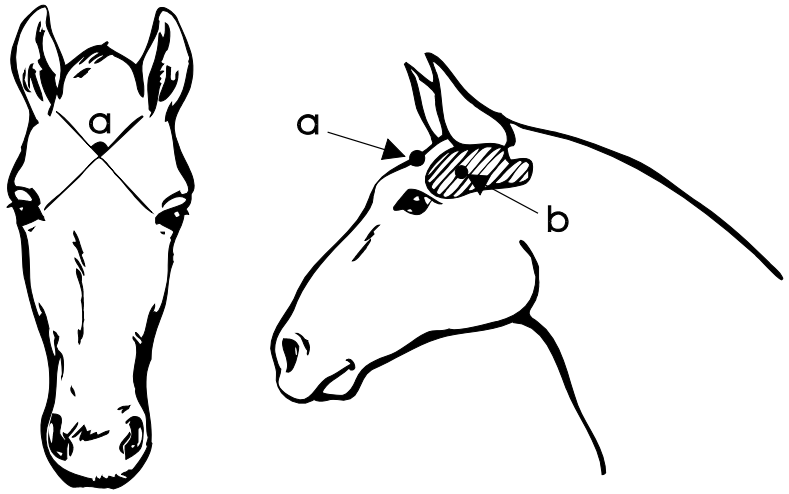

Figure 4.6 Humane destruction of horses: recommended position and direction of fire for (a) frontal method and (b) temporal method

4.5 Camelids

4.5.1 Llama, guanaco, vicuna, alpaca

Camelids may be restrained by an arm around the animal's neck before destruction with injectables. If the animal is to be shot, it may be restrained with a halter or chukker rope (Figure 4.7), or cross-tied in a chute or crush.

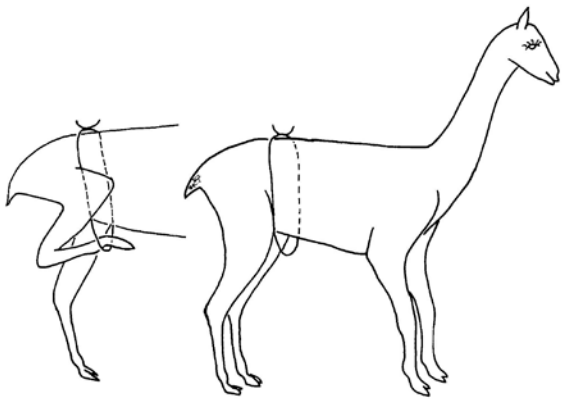

Figure 4.7 Restraint using a chukker rope: both hind legs are placed into a rope tied around the abdomen (Fowler 1998)

Injectable agents

Intravenous barbiturate overdose is the method of choice for the destruction of South American camelids. On a bodyweight basis, the dose is the same as for sheep (see Section 4.2.3).

It is essential that an assistant restrains the camelid in a relaxed manner so that the neck is upright, not rotated, and held on the midline, thus allowing the jugular vein to fill with blood.

The jugular vein may be accessed high near the ramus of the mandible or low nearer the thoracic inlet (Figure 4.8). South American camelids do not have an obvious jugular furrow (the vein is covered by the sternotrachealis muscle), but the vein lies just medial to the ventral projection of the transverse process of the cervical vertebrae. Neck fibre may be clipped to allow easier palpation of landmarks. The needle should be inserted upwards and at an angle of 30 degrees to the skin.

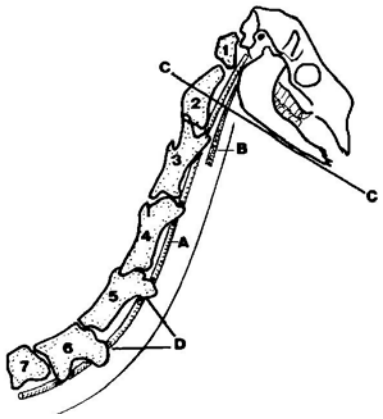

Figure 4.8 Sites for accessing the jugular vein in South American camelids: (a) jugular vein; (b) tendon of sternotrachealis muscle; (c)site for upper access; (d) sites for lower access (Fowler 1998)

Firearm

An alternative method of destruction is the use of a .22 calibre bullet to the head, as illustrated in Figure 4.9.

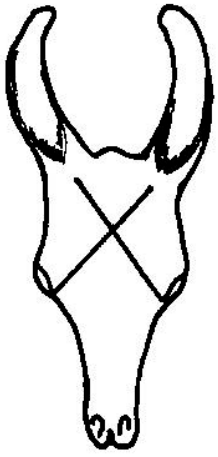

Figure 4.9 Camelid: site of placement of a bullet to the skull (Fowler 1998)

4.5.2 Camels

Whenever camels are being handled, and particularly during mustering and transport of untrained camels, an experienced operator, equipped to perform humane destruction, must

be available. Quiet camels should be sat down prior to euthanasia. Camels can be euthanased by firearm or captive bolt by the frontal or poll method or by lethal injection.

When using a firearm from in front of a camel, the aim point is a point where two imaginary lines drawn from the base of the ears to the opposite eyes intersect. If the operator is standing above the head of the camel, the aim point is approximately 4 cm above this point and the projectile is directed perpendicular to the forehead. Recommended minimum rifle caliber is 0.22 magnum.

The aim point for the poll method is the intersection of the skull and the neck. In this case, the aim is perpendicular to the neckline. New operators should be trained in these procedures, initially on skulls taken from dead camels. The use of captive-bolt pistols and the frontal method is suitable for younger stock. For mature bull camels and especially for bulls in rut, the captive bolt is applied to the base of the skull or alternatively a firearm can be used. Bulls in rut develop thick glands on the top of their heads that prevent the effective use of the captive bolt by the frontal method (Figure 4.10).

Figure 4.10 Humane destruction of camel — recommended position for frontal and poll methods

When the animal has been stunned using a captive-bolt pistol, it must be either pithed or bled out by severing the major vessels of the neck as soon as it collapses to the ground. The operator should stand behind the neck to avoid injury due to the animal's involuntary leg movements. Euthanasia by overdose of an anaesthetic administered by a veterinarian or other trained person is acceptable. Culling programs for feral camels must comply with the Australian Code of Practice for the Welfare of Animals — Feral Livestock Animals.

4.6 Deer

Deer may be destroyed using a firearm or captive-bolt pistol directed at the forehead, at the point of intersection of lines taken from the base of each ear to the opposite eye (Figure 4.11, position 'a'). A firearm should be fired horizontally into the forehead. If using a captive bolt on adult stags, heavy-duty cartridges are necessary.

If the deer are disturbed when approached from the front, an equally effective method is to fire the instrument through the skull just behind the base of the antlers (poll method). The weapon should be aimed in line with the animal's muzzle (Figure 4.11, position 'b').

Recommended round for head shooting is .22 magnum. Some jurisdictions prescribe minimum legal calibres for field shooting.

Figure 4.11 Humane destruction of deer: recommended position and direction of fire for (a) firearm or captive-bolt pistol and (b) alternative position for disturbed deer

4.7 Birds

Birds vary considerably in their size and structure. Many species will require expert handling for euthanasia, and it is recommended that careful planning and consultation be carried out first. Generally, carbon dioxide (CO_2) gassing or barbiturate overdose are the methods of choice for euthanasia.

For the euthanasia of small numbers of birds (eg fancy breeds and pigeons), the preferred methods are dislocation of the neck (using burdizzos, forceps or bare hands), or intravenous, intracardiac or intrahepatic injection of sodium pentobarbitone.

Euthanasia of cassowaries, emus, ostriches, brolgas and other unusual/difficult birds requires expert assistance. The preferred options for large birds are lethal injection (for managed birds) and firearms (for free-ranging birds).

Fertilised eggs can be destroyed by cooling them to < 4 °C for four hours.

For large numbers of birds in commercial poultry units, the preferred, available method is gassing with CO_2. See Appendix 4 for details of this method.

Birds can be caught by teams of 10–15 labourers (experienced catching teams are preferable). Chicks are easily caught under heaters, and are transferred in plastic garbage bins to waste skips for CO_2 gassing. Broilers on the ground are driven, using a movable hessian wall, to the catching area where they are caught and placed directly into skips. Some enterprises have automatic catching systems that load broilers into crates.

Caged birds are more difficult and progress will be slower. Each catcher removes three or four birds from cages and carries them by the legs to skips, or places them in stackable plastic crates on trolleys for transfer to skips.

Layers on perches are best caught at night or in low light, when they are quiet.

Skips should be filled to a level (between 70 and 90%) where the remaining CO_2 gas layer will effectively kill the last layer of birds and the truck is not overloaded. The skip is then sealed and transported to the disposal site. Care must be taken to ensure that no bird is still

alive when dropped into the burial pit. Any surviving bird must be caught immediately and killed humanely.

Day-old chickens and eggs can be macerated using commercial macerators.

Water-based foam has been used successfully in Australia since 2012 for emergency depopulation of floor-based chickens. Use of foam depopulation for other poultry species should only be considered after careful assessment and mitigation of animal welfare, zoonotic and disease risks.

The method works by generating water-based foam and delivering it to floor-based chickens in a confined space so that a blanket of foam covers the birds and mechanically occludes their airways, resulting in hypoxia and death due to asphyxiation. This destruction process takes approximately 3 minutes in chickens (Benson et al 2009, 2012), which is comparable to CO_2 gassing.

Histopathological studies demonstrate that poultry do not drown, and corticosteroid levels are comparable to the stress levels associated with routine management practices such as 'catching stress' (Benson et al 2007).

This destruction technique offers advantages in the management of zoonotic diseases such as avian influenza because it reduces human exposure to live birds by reducing or eliminating handling of live poultry.

The (then) Animal Welfare Committee in 2009 agreed that type A wet foam (water-based foam) can be used for the depopulation of chicken sheds for emergency destruction where birds are confined to the floor. They also advised that the current foam techniques are not suitable for the destruction of caged poultry.[6]

The United States Department of Agriculture has conditionally approved the use of water-based foam for situations where birds are infected with a potentially zoonotic disease, are experiencing an outbreak of a rapidly spreading infectious disease that cannot be easily contained, or are housed in structurally unsound buildings.

Key foam quality parameters to manage animal welfare risks are bubble size, depth, persistence and fluidity.

In an EAD outbreak, the combat jurisdiction should ensure that a person experienced in the slaughter of the species, and appropriately trained in animal welfare aspects of destruction, is present at all times during the destruction process.

More information on the use of the foam depopulation unit, including *Standard Operating Procedure: Depopulating Poultry with a Foam Depopulation Unit*, is available from the Victorian Department of Environment and Primary Industries.

[6] It is worth noting that the Animal Welfare Committee advised that there is insufficient research information to endorse the use of shed ventilation shut-down as a humane depopulation technique.

The AUSVETPLAN resource document *Methods for the Destruction of Poultry, Pet/Zoo Birds and Aviary Species*[7] provides further information on the destruction methods that can be used for birds.

4.8 Dogs and cats

Injectable agents are the best method of destruction for dogs and cats that can be handled. Intravenous concentrated sodium pentobarbitone (dose 40 mg/kg) via the cephalic or jugular vein using a 20-gauge needle is ideal. Intracardiac injections are favoured for puppies and small dogs.

Other sedative drugs — for example xylazine (2 mg/kg), ketamine (20 mg/kg), medetomidine (50–150 micrograms/kg) — may first be given subcutaneously, intramuscularly or intravenously, if necessary by using a tranquilliser gun or pole syringe. Once the dog is sedated, intravenous barbiturates can be used to kill it.

Without a tranquilliser gun or pole syringe, injection by any route will be too dangerous for some totally unmanageable dogs, and for rabid or suspect rabid dogs. A lasso on a pole may be useful to help catch and control such dogs. Including a sedative (eg sodium pentobarbitone) in the animal's food may be an appropriate preliminary to an injectable agent.

Dogs may have to be restrained with muzzles or tape before destruction. Some free-ranging dogs will have to be shot through the head or the heart.

Cats that are not easy to handle may have to be put in a hessian bag, injected through the bag and left in a cage until dead. Alternatively, they can be placed in a plastic bag into which any of the anaesthetic gases (including CO_2) is piped, with oxygen as the carrier gas. Anaesthesia is usually quick and quiet, but death may take some time (at least 20 minutes with CO_2 but less with some of the other anaesthetic gases). Once the animal is unconscious, it may be removed and killed with an overdose of barbiturate. Tranquilliser guns are not suitable for cats, which make a small and fast-moving target.

4.9 Rats, mice, guinea pigs

Any of the physical or chemical methods described above can be used in a laboratory, but the common method of choice is CO_2 gassing. Newborns are resistant to CO_2 and need prolonged exposure, or a combination of CO_2 and cervical dislocation as a terminal procedure. If pentobarbitone is used, it should be given by the intraperitoneal route (rats and mice 100 mg/kg; guinea pigs 90 mg/kg).

4.10 Rabbits

Physical methods such as cervical dislocation should only be used by skilled personnel and only on rabbits weighing less than 1 kg. The preferred method for laboratory rabbits is

[7] www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ausvetplan/resource-documents

intracardiac pentobarbitone (60 mg/kg). Intravenous barbiturate injections of the very concentrated barbiturate euthanasia solution into the ear vein are often painful and may be distressing; therefore, standard anaesthetic solutions should be used. Rabbits should be restrained because an excitement phase may occur, especially if an intraperitoneal or intravenous injection is incorrectly administered.

Induction of anaesthesia with CO_2, as described for birds and cats, is not recommended: rabbits appear to become apprehensive before unconsciousness supervenes. Overdosage with other inhalation anaesthetic agents may be used.

4.11 Primates

Chemical restraint by means of ketamine (20 mg/kg IM), followed by an overdose of barbiturate given by the intravenous or intracardiac route (50 mg/kg), is recommended for laboratory primates (see Reilly 2001).

4.12 Fish

A detailed description of destruction methods suitable for marine species (including molluscs and crustaceans) is part of the AQUAVETPLAN series of operational manuals.[8]

4.13 Bees

See Section 3.1 of the **Bee Diseases and Pests Strategy** document.

4.14 Circus and zoo animals

The assistance of a veterinarian with experience in handling (and destroying) circus and zoo animals should be sought. If none is available, the methods outlined above should be extrapolated appropriately for the species involved.

4.15 Wild animals

See the **Wild Animal Response Strategy** for feral domestic species (cats, dogs etc). The *Australian Model Code of Practice for the Welfare of Animals: Destruction or Capture, Handling and Marketing of Feral Animals* relates to livestock species (cattle, horses, pigs etc). Seek appropriate expert advice.

Humane destruction techniques for native wildlife are discussed more fully in the 2001 ANZCCART euthanasia review (Reilly 2001). Seek appropriate expert advice. The Australian Government Department of the Environment and Heritage is also developing standard operating procedures for identified pest animal species, native and introduced.

[8] http://www.daff.gov.au/animal-plant-health/aquatic/aquavetplan/destruction

Appendix 1 Unacceptable agents and methods of primary killing

Agent or method	Reason agent or method is unacceptable
Air embolism	Animal welfare
Blow to the head	Also referred to as 'external trauma'. Unacceptable except in specific circumstances detailed in this manual, and as a terminal procedure for smaller animals.
Burning (chemical or thermal)	Animal welfare
Carbon monoxide	Occupational health and safety
Car exhaust gas	Occupational health and safety. Car exhaust is a poor source of carbon monoxide and carbon dioxide.
Chloral hydrate	Limited use under permit for bird control; unacceptable in small mammals.
Chloroform	Occupational health and safety. Chloroform is a hepatotoxin and carcinogen.
Cyanide, hydrogen cyanide	Occupational health and safety (gas). Delivery problems (oral route).
Decompression	Animal welfare
Drowning (in any liquid)	Animal welfare
Electrocution	Occupational health and safety. Adequate equipment not generally available except in abattoirs.
Ether	Occupational health and safety. Flammable and toxic.
Exsanguination	A terminal procedure to be used only in stunned/anaesthetised animals.
Formalin	Animal welfare
Household products and solvents	Animal welfare
Hypothermia	Not acceptable for warm-blooded species, reptiles or amphibians.
Methyl bromide	Occupational health and safety and environmental concerns
Microwave	Household microwaves do not deliver sufficient energy.
Neuromuscular blocking agents — nicotine, magnesium sulfate, potassium chloride, succinyl choline and all curareform agents	Magnesium sulfate, potassium chloride and succinyl choline may be used as a relatively cheap terminal treatment in unconscious animals.
Perishing (denial of water)	Animal welfare
Pithing	A terminal procedure to be used only in stunned/anaesthetised animals.

Agent or method	Reason agent or method is unacceptable
Poisoning (of managed, controlled stock)	Animal welfare; other methods available.
Poisoning (using unapproved agents)	Animal welfare
Primary hypoxia (oxygen starvation)	Animal Welfare
Rapid freezing (eg in liquid nitrogen)	Animal welfare; brain is insulated.
Suffocation by any means	Animal welfare
Shutdown of cooling and ventilation systems	Animal welfare
Stunning	Can sometimes kill in its own right but must be followed by a terminal procedure.
Wounding	Animal welfare
Any other method	Any destruction method not detailed in this manual will require approval before use.

Appendix 2 Firearms, ammunition and ballistics

Firearm ballistics

Firearm ballistics is a specialised subject, and the following is only a brief explanation of some of its main aspects. Expert advice should be sought when choosing firearms and ammunition. The *Australian Model Code of Practice for the Welfare of Animals: Destruction or Capture, Handling and Marketing of Feral Animals* contains additional recommendations for field shooting. At long ranges, factors such as variations in range, the difficulties of estimating animal size, weather conditions and vegetation make choosing an appropriate firearm–ammunition combination a matter for careful assessment and judgment.

In killing with a free projectile, the mechanism involved is the transfer of energy, in a short time, from the bullet to the animal's brain. Destruction or concussion of the cerebral cortex will result in loss of consciousness, and destruction of the brainstem will lead to respiratory arrest and prevent any possibility of recovery. With heart/lung shooting, the bullet must be capable of penetrating the chest to intersect with the vital structures and cause fatal haemorrhage.

Bullets used for humane destruction must be able to transfer sufficient energy to concuss the animal and penetrate the skull to the level of the brainstem, or penetrate the chest and intersect the heart, without exiting and becoming dangerous ricochets. The amount of damage or penetration depends on the mass of the projectile, its design and construction, its velocity, the angle of incidence and the nature of the target.

A bullet energy of at least 150 joules (J) is recommended for close-range killing (headshots) of young stock, including pigs to 25 kg. At least 200 J is recommended for large animals to 100 kg. Bulls, pigs heavier than 100 kg, deer and horses require a minimum of 500 J. Table A2.1 gives some examples of ammunition that will develop these bullet energies.

Loss of bullet energy is only a problem for long-range, ground-based shooting in extensive areas. Loss of bullet energy is not a major consideration for short-range shooting for EAD control purposes. However, the performance capability of .22 calibre ammunition should be checked, as there is a very large range available.

Shotguns should be considered for close-range shooting under 20 metres (they are less likely to produce ricochets), but they should not be used at longer ranges.

Kinetic energy (KE, energy of movement) is the product of half the mass (m) of an object and the square of its velocity (v), as expressed by the formula $KE = \frac{1}{2}mv^2$. Bullet energy is expressed in joules (J), mass in kilograms (kg) and bullet velocity in metres per second (m/s). In imperial measures, energy is in foot pounds (ft/lbs), mass in grains and velocity in feet per second (fps).

For the purposes of the comparison in Table A2.1, the velocity of the projectile as it exits from the barrel of the weapon (muzzle velocity) has been used to compare ammunition, but the bullet kinetic energy is the relevant measure. The bullet accelerates in the barrel, but will always lose speed after leaving the weapon, and ammunition with heavier bullet weight may develop less velocity and deliver less energy (see the .22 magnum example in Table A2.1). Changes to bullet velocity have a greater effect on the amount of energy delivered than changes to bullet mass. For ranges of 100 metres and more, the bullet energy for the

range should be compared, not the muzzle energy. Commercial software is available to calculate bullet energies for various powder–calibre–weight–range combinations.[9]

For euthanasia, terminal ballistics (what the bullet does when it hits the target) is the key consideration. Bullet design is a major factor determining the degree of penetration and resulting effect on the animal. Recommendations of the Winchester controlled expansion performance ('CXP') system, or similar projectile rating systems, should be followed to choose projectiles appropriate for the task.

Table A2.1 Comparison of example bullet energies

Ammunition	Bullet/ shot weight (g)	Velocity (m/s) at muzzle	Energy (J) at muzzle
12-gauge shotgun Winchester XSHV12L2 No. 2 steel shot	44.1	508.5	5701
12-gauge shotgun Winchester XSM123BB	48.5	415.0	4176
12-gauge shotgun Winchester XXT12L6 No. 6 shot	79.4	377.3	5651
.410 shotgun Winchester X414 No. 4 shot	17.6	408.5	1468
.22 long rifle Winchester W22LRB, 40 gr lead hollow-point	2.6	377.3	185
.22 long rifle Winchester X22LRPP, 40 gr Super X power point, lead hollow-point	2.6	420.0	229
.22 magnum rifle Winchester S22WM 34 gr supreme, jacketed hollow-point	2.2	695.5	532
.22 magnum rifle Winchester X22WM 40 gr supreme, jacketed hollow-point	2.6	626.6	510
5.56 rifle (.223 Remington) Winchester 64 gr supreme power point plus	4.1	1013.8	2107
7.62 rifle (.308) Winchester 150 gr supreme ballistic silvertip	9.7	921.9	4122
7.62 rifle (.308) Winchester 180 gr superX silvertip	11.7	859.6	4323
7.62 rifle (.308 Win) PMC308D 168 gr full metal jacket / boattail	10.9	853.0	3965
7.62 rifle NATO PMC 308B 147 gr full metal jacket / boattail	9.5	912.0	3950

[9] For example, Oehler Research, Ballistic Explorer, http://www.oehler-research.com/explore.html.

Table A2.2 Cartridge selection for captive-bolt pistols: .22 calibre Powerloads

Model	Calibre	Cartridge	Animal	Attention
710 Cash Special Captive Bolt	.22	1.25 Grain Pink	Small animals – 100 kg	The continual use of Green Powerloads on small animals will result in premature failure.
	.22	2.5 Grain Purple	Small cattle, pigs, goats	
	.22	3.0 Grain Green	All average cattle up to 600 kg	
8000C Cow Puncher Captive Bolt	.22	3.0 Grain Green	All average cattle – 600 kg	The continual use of Red Powerloads on normal, average-sized beasts will result in premature failure.
	.22	4.0 Grain Red	Very heavy cattle and bulls	
9000CS Euro Magnum Captive Bolt	.22	3.0 Grain Green	Cattle – 300 kg	The continual use of Black Powerloads on normal, average-sized beasts will result in premature failure.
	.22	4.0 Grain Red	All average to heavy cattle	
	.22	4.5 Grain Black	Very heavy animals and bulls only	

Some information on ricochets includes:

- A ricochet occurs when a projectile strikes a surface then rebounds one or more times.
- If a projectile strikes at an angle of less than 30° to the surface and does not disintegrate, it may ricochet at an angle of up to 45° in any direction from the line of fire.
- A projectile that strikes short of its maximum ricochet range can skip on up to the maximum range of the weapon.
- The angle to which a projectile will ricochet laterally depends on the type of surface struck. The lateral ricochet distance for hard and soft surfaces is the same in most instances, because of the loss of kinetic energy after deflection.

Table A2.3 Ammunition safety factors

Ammunition	Maximum ranges		Ricochet distance (metres)	Height (metres)	
	Low elevation	High elevation		Air danger height	Maximum height
.22 inch	1300	1550	80	150	970
7.62 mm	2750	4000	400	300	2700
.303 inch					
.30 inch					
5.56 mm					

Appendix 3 Instructions for pithing

Key points in the conduct of pithing are as follows:

- Stock are to be presented for slaughter in a way that ensures safe handling and humane destruction.
- Animals may be presented individually in a veterinary crush (cattle), individually physically restrained (sheep, pigs), in races (sheep), or chemically restrained by a sedative or anaesthetic agent in small groups (cattle and pigs).
- The need to pith and check that stock are dead within short timeframes precludes the pen destruction of cattle and other than small pen lots of sheep and pigs.
- Occupational health and safety considerations also preclude the pen destruction of cattle in small pens.
- Stock that are to be pithed are to be stunned beforehand by trained persons using well-maintained equipment and approved techniques for stunning.
- All cattle and pigs must be immediately pithed and confirmed dead following stunning.
- All sheep must be immediately checked for death after stunning, pithed if death is not confirmed, and then rechecked to confirm death.
- All suckling lambs must be immediately pithed or euthanased by an alternative terminal procedure.
- All *shooters* must have current training and certification or be able to demonstrate equivalence. Refer to Section 4 of this manual for aiming points for particular species.
- *Pithing operators* must have previous significant experience in the destruction of livestock or feral animals and livestock handling, but not necessarily with pithing.

Pithing rods

- A pithing rod is a light, flexible rod approximately 800 mm long and 5 mm in diameter.
- Pithing rods are suitable for cattle, sheep or pigs.
- Commercial pithing rods must be used where available.
- If commercial pithing rods are not available, selection of an alternative must consider the following criteria:
  - The rod must not be brittle, as it is important that it does not fracture and injure the operator.
  - Heavy and inflexible materials may also injure operators if the animal thrashes during pithing.
  - There should be no sharp edges and the rod tips should be rounded.

Note: *do not use any wire or steel rod that is too heavy or inflexible*. These materials may cause injury if they are let go when the animal thrashes whilst being pithed.

Sheep alternative

- A T-shaped reusable pithing tool can be made from a 150-mm length of 5-mm steel rod, with a 120-mm length welded on one end as the handle.
- Ensure that the end of the rod is smooth to prevent laceration.

Stock marker

As animals are being destroyed, they must be marked following pithing and confirmation of death. A spraypack of commercial stock marker or a crayon is suitable for the purpose. All stock confirmed as dead are to be marked.

Procedure for cattle

Pithing should occur within 60 seconds of shooting of sedated animals or within 30 seconds of shooting of unsedated animals.

Operator to stand in a safe place to undertake pithing

Animal on its side with head extended

- The operator should stand just in front of the animal's poll or just behind the head and in front of the shoulder.
- The operator should *not* stand in front of the legs or straddle the animal.
- The operator should have sufficient space behind to step back if the animal moves forward when the rod is inserted.

Animal on its sternum with head outstretched

- The operator should stand in front of the head and slightly to one side, depending on whether they are right- or left-handed, and should *not* straddle the animal.
- There should be sufficient space behind for the operator to step back if the animal moves forward when the rod is inserted.

Animal on its sternum with head along its side

- The operator should stand against the animal on the opposite side of the body to the head, ensuring that there is enough space to step back if the animal rolls or lurches when the rod is inserted.
- The animal's head should be restrained by grasping the head under the jaw with one hand and using the forearm and body weight to hold the head against the animal's body.
- Alternatively, a set of nose pliers with a short rope can be applied to the muzzle, allowing the operator to pull on the rope to restrain the head while inserting the rod with the other hand.
- The operator should *not* wrap the rope around the hand.

Inserting the pithing rod

- The rod should be directed through the captive-bolt hole towards the foramen magnum and the spinal canal.
- The tissue is very soft, so there should be little resistance. If there is resistance, the rod is off-line and should be withdrawn a little and redirected.

- Moving the muzzle of the animal slightly may assist in aligning the pithing rod with the spinal canal, but no attempt should be made to lift the head.
- If the operator cannot insert the rod using minor manipulation, the shooter should reshoot the animal, aiming the shot towards the foramen magnum.
- The operator should be able, with little effort, to insert the rod its full length down the spinal canal.
- The operator should macerate the spinal cord by pushing the rod up and down in the spinal canal several times.

Confirming that the animal is dead

- After pithing, the operator should assess that the animal is dead. This is confirmed by:
  - absence of respiratory movements
  - dilation of the pupils of the eyes.
- After the animal is pithed and assessed as dead, its head is to be marked with stock marker.

Procedure for sheep

Sheep are usually poll shot, and the shot will usually kill the animal. However, they must always be checked to ensure that they are dead. This is confirmed by:

- absence of respiratory movements
- dilation of the pupils of the eyes.

The shooter may confirm death before moving to the next animal, but assessment by the shooter may slow down the destruction process because time is needed to allow the signs of death to develop.

It is more efficient for the shooter to move on to the next animal and for the operator to follow the shooter to assess death.

If signs of death cannot be confirmed, the animal must be pithed. The pithing operator must ensure that the shooter is more than one metre away from the sheep to be pithed.

Assessment of death and pithing, if needed, should be completed within 30 seconds of shooting.

Note: *all lambs at foot must be pithed, or destroyed using a terminal procedure such as barbiturate anaesthetic overdose*.

Operator to stand in a safe place

The operator should stand in front of the sheep if the head is outstretched, or behind the shoulder opposite the head if the sheep is lying on its sternum with the head angled back along the body. In the latter situation, the head should be held with one hand while the rod is inserted, to prevent the sheep swinging its head around.

Inserting the pithing rod

If pithing is necessary, the rod is inserted through the captive-bolt hole.

It may be necessary to move the head (nose downwards) to assist in directing the rod down the spinal canal, as the preferred direction of the shot is at an angle to the line of the spinal canal.

Lambs and some young sheep are rarely killed by captive bolt, and pithing or barbiturate injections are indicated.

Use of the T-shaped pithing tool

To use the T-shaped pithing tool, the operator holds the cross-piece of the tool, inserts the stem through the bolt hole to the base of the cranial cavity and into the brain stem, and then macerates the brainstem using a stirring motion of the pithing tool.

After the animal is pithed and/or assessed as dead, its head is marked with stock marker.

Procedure for pigs

Immediately the pig has been shot, the shooter and handler must move away from the animal, which must be pithed immediately. Pithing should be completed within 15 seconds of stunning.

Operator to stand in a safe place

Animal on its side

- The operator should stand just in front of the animal's head or just behind the head and in front of the shoulder.
- The operator should *not* stand in front of the legs or straddle the animal.

Animal on its sternum

- The operator should stand in front of the head and slightly to one side, depending on whether they are right- or left-handed.
- The operator should *not* straddle the animal.

Inserting the pithing rod

- The pithing rod should be directed through the captive-bolt hole towards the foramen magnum and the spinal canal.
- The tissue is very soft, so there should be little resistance. If there is resistance, the rod is off-line, and should be withdrawn a little and redirected.
- Moving the snout of the animal slightly may assist in aligning the pithing rod with the spinal canal, but no attempt should be made to lift the head.
- If the operator cannot insert the rod with minor manipulation, the shooter should reshoot the animal, aiming the shot towards the foramen magnum.
- The operator should be able, with little effort, to insert the rod its full length down the spinal canal, and macerate the spinal cord by pushing the rod up and down in the canal several times.

Confirming that the animal is dead

After pithing, the operator should assess that the animal is dead. This is confirmed by:

- absence of respiratory movements
- dilation of the pupils of the eyes.

After the animal is pithed and assessed as dead, its head should be marked with stock marker.

Appendix 4 Destruction of birds using carbon dioxide

This appendix is a summary of two standard operating procedures prepared by Kevin Cooper (NSW), Mark Cozens (Queensland) and Mike Jeffers (Victoria). For more detail of the procedures, resources, and occupational health and safety warnings relating to gassing poultry, refer to NSW Department of Primary Industries Standard Operating Procedures (obtain address, user name and password from the NSW Chief Veterinary Officer). An Australian Pesticides and Veterinary Medicines Authority permit (permit 7472, due to expire on 31 Dec 2010 but to be renewed) has been issued for use of CO_2 for destruction of birds.

Procedures for gassing in containers (skips or truck trays) and in sheds are given. In both cases, the objective is the humane destruction of large numbers of birds in as short a time as is practical. The aim is to render birds unconscious within one minute and dead within 3–5 minutes.

Occupational health and safety

Gassing has a number of potential occupational health and safety risks, which should be minimised through the following procedures:

- Inexperienced operators should be given training in each step of the operation before it begins.
- A safety officer and a first aider should be appointed.
- CO_2 is dangerous. When gassing in containers, personnel stationed near the skip or truck tray must wear a CO_2 monitor and may need to be rotated to avoid prolonged exposure to gas. When gassing in sheds, personnel must not be allowed to enter a shed after gassing until the all-clear is given, and must wear a monitor in areas where gas concentrations might be high.
- Trained personnel with breathing apparatus must be in attendance where CO_2 is used.
- Gas cylinders are heavy, and trolleys or forklifts should be used to move them.

Gassing in containers

When using containers to gas birds, the rate of kill will be limited largely by the ability to catch the birds and move them to the containers. It will be more efficient if personnel with experience in handling and catching birds are deployed for this task. Inexperienced personnel can be employed with low-level supervision in other parts of the operation after brief training.

The method described here can be adapted to containers ranging in size from a small plastic box (for a small number of small birds) to large commercial industrial waste bins and truck trays.

Operating teams

Operating teams include the following personnel:

- team leader — coordinates all activities and takes advice from the safety officer
- catchers — catch and present birds to the skips (one is deployed to catch birds that escape)

- gas cylinder resuppliers — move cylinders into position and set up
- gas cylinder operators — control freezing and ensure adequate gas flow
- recorder — records the numbers of birds killed
- animal welfare person — checks that birds are handled and killed humanely.

Personnel must wear CO_2 monitors and avoid exposure to the gas.

Site planning

The team has the following planning tasks:

- Develop an on-site plan for best access to the birds for catchers and for vehicles delivering or removing skips, trucks and cylinders.
- Adjust shed systems to minimise bird movement during catching and provide the best operating environment for personnel.
- Close the shed (subject to weather conditions), using existing blinds, to minimise dispersal of dust and feathers.
- Shut down or adjust feed and water systems to allow ready movement around the shed.
- Shut down electricity if this does not affect ventilation in the shed.
- Ensure that no birds can escape from the shed.

Skips/tray set-up

- Position skips/tray near the shed entry/exit and so that birds can be easily placed into them without falling a long distance to the bottom. This may require a ramp or step.
- Seal gate and holes and, if moving off site, line according to transport regulations.
- Cover the top of the skip/tray with plastic and seal, leaving a hinged flap access to place birds and, once they are loaded, to complete the seal.

Gas delivery system for a skip

- Position CO_2 cylinders at opposite ends of each skip and secure.
- Fit a regulator and a regulator heater to each cylinder.
- Smear regulator and hose line with Vaseline, especially if no in-line heater is available (in which case, use hot water to prevent freezing).
- Place hose from cylinders into skip, keeping it at least 300 mm above the layer of birds, adjusting as the skip is filled.

Gas delivery system for a truck tray

- Link two banks of approximately five cylinders to a delivery hose system that evenly distributes gas to the tray or use a bulk CO_2 tank with vaporiser.
- The hose system can include in-line control valves for each line off a T-piece.
- Use cylinder banks alternately to control freezing.
- Set a bulk CO_2 tank (with a vaporiser) on a platform and connect to hose delivery system.

- Position the vaporiser to encourage condensation to run off.

Catching and loading

- Catch birds (with catching frames if appropriate), handling with care to minimise trauma.
- Carry birds and place into the skip/tray.
- Load skip/tray until there is a single, even layer of birds on the bottom, with no stacking.
- Catchers move to the next skip/tray to allow gassing of the loaded skip/tray.
- Close opening of skip/tray with clear plastic, allowing air to escape as CO_2 gas is fed in.

Gassing

- Open the regulator (with in-line heater) to provide a steady flow of gas and avoid freezing. Thaw frozen regulators with hot water.
- Confirm adequate levels of CO_2 in the skip/tray with a CO_2 monitor or lighter.
- Leave regulator open for approximately 20 minutes.
- Inspect the skip/tray to confirm that all birds are dead.
- Build layer upon layer of dead birds in each skip/tray, filling to a level (70–90%) where the CO_2 gas layer will effectively kill the last layer of birds and the truck is not overloaded.
- Securely seal plastic cover of filled skip/tray to prevent access by scavengers.
- Where bulk CO_2 is used, close the valve between the tank and the vaporiser before closing the distribution valves. Failure to do so may cause personal injury, or damage to the vaporiser, during disconnection of hoses.

Gassing in sheds

Destruction of birds in the shed in which they live is preferred. This method reduces the exposure of personnel to infected material, eliminates the need to handle large numbers of live birds, reduces dispersal of dust, provides the opportunity for disposal by composting in the shed, and should be more cost-effective than methods that require birds to be caught individually.

The procedure below is best applied in broiler or similar sheds, in which the birds are at or near ground level. It should be adaptable for use in controlled-environment sheds. It may require further adaptation for layer sheds, where its use for layers in cages may be compromised by shed design. It will be difficult to remove birds from conventional cages.

The rate of kill may be limited by environmental conditions and availability of resources, such as a CO_2 vaporiser or bulk CO_2 gas.

Consideration should be given to composting the carcases in the shed after destruction. This will require the addition of a carbon source, and appropriate management to ensure that the composting process is completed satisfactorily. Refer to the **Disposal Manual** and NSW Department of Primary Industries Standard Operating Procedures for composting.

Planning

Preparation of sheds must not begin until it has been confirmed that sufficient bulk gas is available to complete the task.

The weather forecast for the period of the destruction operation, including preparation time, should be noted. The procedure is best carried out in cool, still conditions (temperature <15–20 °C, wind speed <5–10 kph), which will help contain the gas in the shed.

The weather, the age of the birds, and the time between shed preparation and gassing can affect animal welfare. For older birds (eg >21–28 days), closing the shed during hot weather (>30 °C) may lead to heat stress unless adequate measures are taken.

Shed preparation

- Before and/or while the shed is wrapped, a minimum number of suitably dressed personnel should enter the shed and turn off any necessary services, such as electricity, water and feed.
- Drinking and feed systems should be raised to their maximum height.
- Place CO_2 warning devices to show gas levels one metre above bird height.
- Remove records from the shed (and treat as infected).
- In controlled-environment sheds, the air supply should be shut down when the CO_2 is ready for injection into the sheds. If the air supply is to be shut down after most of the shed is wrapped, care should be taken not to cover the air supply and/or exhaust until the air delivery system is shut down.
- Close the shed as much as possible using normal procedures (eg shut the blinds).
- Wrap the shed in plastic from ground level to 2–2.5 m above the lower edge of the shed (for a broiler shed). The shed does not need to be airtight — rather, it should be well wrapped without any obvious and large openings. The final wrap may be a mix of mechanical application down the sides and hand wrapping around the ends of the shed. The bottom edge of the plastic should be weighted to restrict gas escape.
- There is no need to cover any openings above the height of the plastic.
- While the shed is being wrapped, position gas delivery hoses.
- Height of gas delivery in the shed should be one metre above the floor. CO_2 is a heavy gas and will flow through openings to the lowest point.
- Post warning signs on the shed and access ways.
- Wrapping of controlled-environment sheds should not be necessary. Inspect to confirm that gas will not leak out.

Gas injection

Begin injecting gas only when:

- the current and predicted weather for the duration of the task is within the above limits
- the team leader or site supervisor is satisfied that the shed is adequately wrapped
- all personnel, including owner, staff and contractors, are outside the shed, present and accounted for
- suitably qualified breathing apparatus personnel are in attendance

- adequate supplies of CO_2 gas to complete the task have been confirmed.

When gas injection is begun, the time should be recorded so that the minimum injection period is completed. Gas injection should fill the shed in 30–60 minutes. The following points need attention:

- Deliver the gas quietly to prevent birds packing up.
- Deliver the gas one metre above the birds, so that it flows down to the floor and across it.
- At start-up of gas flow, the delivery valves should be closed and the vaporiser open. The valve from the tank to the vaporiser is then rapidly opened three-quarters of the way. Should a line freeze, dismantling may be required to clear it.
- Once the injection time is completed, check audible alarms and candles to confirm that the gas has reached the desired level. Monitor leakage from the shed with a portable CO_2 monitor.
- Close the gas flow from the tank to the vaporiser while the delivery valve is open, so that pressure is released.
- Leave the shed closed for at least two hours. The birds can then be inspected by personnel in breathing apparatus to confirm that all birds are dead. Where small numbers of birds (<100) are still alive, these can be killed by an alternative method, such as neck dislocation.
- Ventilate the shed (remove plastic and raise blinds) for at least four hours, to allow gas to escape from the feathers of the birds. Sensor readings must be checked for clearance of CO_2 before personnel without breathing apparatus enter the shed. Personnel with breathing apparatus must stand by until it is established that the shed is clear of CO_2. The loading and transport of birds should be in accordance with the relevant standard operating procedures.

Glossary

Agriculture Ministers' Forum	The council of Australian national, state and territory and New Zealand ministers of agriculture that sets Australian and New Zealand agricultural policy (formerly the Standing Council on Primary Industries). *See also* Animal Health Committee
Animal byproducts	Products of animal origin that are not for consumption but are destined for industrial use (eg hides and skins, fur, wool, hair, feathers, hooves, bones, fertiliser).
Animal Health Committee	A committee whose members are the Australian and state and territory CVOs, the Director of the CSIRO Australian Animal Health Laboratory, and the Director of Environmental Biosecurity in the Australian Government Department of the Environment. The committee provides advice to the Agriculture Ministers' Forum on animal health matters, focusing on technical issues and regulatory policy (formerly called the Veterinary Committee). *See also* Agriculture Ministers' Forum
Animal products	Meat, meat products and other products of animal origin (eg eggs, milk) for human consumption or for use in animal feedstuff.
Ammunition – hard point	Hard metal ammunition; passes through tissues cleanly and can leave the target at high velocity, causing danger to other people/animals in the area.
– soft/hollow point	Ammunition made of softer metal, or with a hollow point that tends to flatten on impact, causing greater damage to tissues but not exiting the target.
Approved processing facility	An abattoir, knackery, milk processing plant or other such facility that maintains increased biosecurity standards. Such a facility could have animals or animal products introduced from lower risk premises under a permit for processing to an approved standard.
At-risk premises	A premises in a restricted area that contains a live susceptible animal(s) but is not considered at the time of classification to be an infected premises, dangerous contact premises, dangerous contact processing facility, suspect premises or trace premises.
Australian Chief Veterinary Officer	The nominated senior veterinarian in the Australian Government Department of Agriculture who manages international animal health commitments and the Australian Government's response to an animal disease outbreak. *See also* Chief veterinary officer

AUSVETPLAN	*Aus*tralian *Vet*erinary Emergency *Plan*. A series of technical response plans that describe the proposed Australian approach to an emergency animal disease incident. The documents provide guidance based on sound analysis, linking policy, strategies, implementation, coordination and emergency-management plans.
Burdizzo	Castrating pincers.
Captive-bolt pistol	Humane animal killer — takes either a blank cartridge that delivers a knockout blow to the skull; or a penetrating bolt that is driven a short distance into the brain. The operator does not have to be a good shot, as the instrument's muzzle is firmly pressed against the animal's skull before firing.
Chief veterinary officer (CVO)	The senior veterinarian of the animal health authority in each jurisdiction (national, state or territory) who has responsibility for animal disease control in that jurisdiction. *See also* Australian Chief Veterinary Officer
Compartmentalisation	The process of defining, implementing and maintaining one or more disease-free establishments under a common biosecurity management system in accordance with OIE guidelines, based on applied biosecurity measures and surveillance, in order to facilitate disease control and/or trade.
Compensation	The sum of money paid by government to an owner for livestock or property that are destroyed for the purpose of eradication or prevention of the spread of an emergency animal disease, and livestock that have died of the emergency animal disease. *See also* Cost-sharing arrangements, Emergency Animal Disease Response Agreement
Consultative Committee on Emergency Animal Diseases (CCEAD)	The key technical coordinating body for animal health emergencies. Members are state and territory CVOs, representatives of CSIRO-AAHL and the relevant industries, and the Australian CVO as chair.
Control area (CA)	A legally declared area where the disease controls, including surveillance and movement controls, applied are of lesser intensity than those in a restricted area (the limits of a control area and the conditions applying to it can be varied during an incident according to need).
Cost-sharing arrangements	Arrangements agreed between governments (national and states/territories) and livestock industries for sharing the costs of emergency animal disease responses. *See also* Compensation, Emergency Animal Disease Response Agreement
Dangerous contact animal	A susceptible animal that has been designated as being exposed to other infected animals or potentially infectious products following tracing and epidemiological investigation.

Dangerous contact premises (DCP)	A premises, apart from an abattoir, knackery or milk processing plant (or other such facility) that, after investigation and based on a risk assessment, is considered to contain a susceptible animal(s) not showing clinical signs, but considered highly likely to contain an infected animal(s) and/or contaminated animal products, wastes or things that present an unacceptable risk to the response if the risk is not addressed, and that therefore requires action to address the risk.
Dangerous contact processing facility (DCPF)	An abattoir, knackery, milk processing plant or other such facility that, based on a risk assessment, appears highly likely to have received infected animals, or contaminated animal products, wastes or things, and that requires action to address the risk.
Declared area	A defined tract of land that is subjected to disease control restrictions under emergency animal disease legislation. There are two types of declared areas: restricted area and control area.
Decontamination	Includes all stages of cleaning and disinfection.
Depopulation	The removal of a host population from a particular area to control or prevent the spread of disease.
Destroy (animals)	To kill animals humanely.
Disease agent	A general term for a transmissible organism or other factor that causes an infectious disease.
Disease Watch Hotline	24-hour freecall service for reporting suspected incidences of exotic diseases — **1800 675 888**
Disinfectant	A chemical used to destroy disease agents outside a living animal.
Disinfection	The application, after thorough cleansing, of procedures intended to destroy the infectious or parasitic agents of animal diseases, including zoonoses; applies to premises, vehicles and different objects that may have been directly or indirectly contaminated.
Disinsectation	The destruction of insect pests, usually with a chemical agent.
Disposal	Sanitary removal of animal carcasses, animal products, materials and wastes by burial, burning or some other process so as to prevent the spread of disease.
Emergency animal disease	A disease that is (a) exotic to Australia or (b) a variant of an endemic disease or (c) a serious infectious disease of unknown or uncertain cause or (d) a severe outbreak of a known endemic disease, and that is considered to be of national significance with serious social or trade implications. *See also* Endemic animal disease, Exotic animal disease

Emergency Animal Disease Response Agreement	Agreement between the Australian and state/territory governments and livestock industries on the management of emergency animal disease responses. Provisions include participatory decision making, risk management, cost sharing, the use of appropriately trained personnel and existing standards such as AUSVETPLAN. *See also* Compensation, Cost-sharing arrangements
Endemic animal disease	A disease affecting animals (which may include humans) that is known to occur in Australia. *See also* Emergency animal disease, Exotic animal disease
Enterprise	*See* Risk enterprise
Enzyme-linked immunosorbent assay (ELISA)	A serological test designed to detect and measure the presence of antibody or antigen in a sample. The test uses an enzyme reaction with a substrate to produce a colour change when antigen–antibody binding occurs.
Epidemiological investigation	An investigation to identify and qualify the risk factors associated with the disease. *See also* Veterinary investigation
Epidemiology	The study of disease in populations and of factors that determine its occurrence.
Exotic animal disease	A disease affecting animals (which may include humans) that does not normally occur in Australia. *See also* Emergency animal disease, Endemic animal disease
Exotic fauna/feral animals	*See* Wild animals
Exsanguination	Severe loss of blood.
Fomites	Inanimate objects (eg boots, clothing, equipment, instruments, vehicles, crates, packaging) that can carry an infectious disease agent and may spread the disease through mechanical transmission.
Free bullet	A projectile fired from a firearm.
General permit	A legal document that describes the requirements for movement of an animal (or group of animals), commodity or thing, for which permission may be granted without the need for direct interaction between the person moving the animal(s), commodity or thing and a government veterinarian or inspector. The permit may be completed via a webpage or in an approved place (such as a government office or commercial premises). A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements. *See also* Special permit
Hypoxaemia/hypoxia	Lack of oxygen in the arterial blood and tissues, respectively.
In-contact animals	Animals that have had close contact with infected animals, such as noninfected animals in the same group as infected animals.

Incubation period	The period that elapses between the introduction of the pathogen into the animal and the first clinical signs of the disease.
Index case	The first case of the disease to be diagnosed in a disease outbreak. *See also* Index property
Index property	The property on which the index case is found. *See also* Index case
Infected premises (IP)	A defined area (which may be all or part of a property) on which animals meeting the case definition are or were present, or the causative agent of the emergency animal disease is present, or there is a reasonable suspicion that either is present, and that the relevant chief veterinary officer or their delegate has declared to be an infected premises.
Infected premises operations team	Team appointed by the LCC controller to coordinate/supervise operations at the infected premises.
Injection sites	
– intracardiac	into the heart
– intraperitoneal	into the peritoneal (abdominal) cavity
– intramuscular	into muscle (the needle is passed deeply into the substance of a muscle before the fluid is injected)
– intrathoracic	into the thoracic (chest) cavity
– intravenous	into a vein
– subcutaneous	under the skin (hypodermic)
Local control centre (LCC)	An emergency operations centre responsible for the command and control of field operations in a defined area.
Monitoring	Routine collection of data for assessing the health status of a population or the level of contamination of a site for remediation purposes. *See also* Surveillance
Movement control	Restrictions placed on the movement of animals, people and other things to prevent the spread of disease.
National management group (NMG)	A group established to approve (or not approve) the invoking of cost sharing under the Emergency Animal Disease Response Agreement. NMG members are the Secretary of the Australian Government Department of Agriculture as chair, the chief executive officers of the state and territory government parties, and the president (or analogous officer) of each of the relevant industry parties.
Native wildlife	*See* Wild animals
Nuchal crest	Transverse bony ridge across the back margin of the roof of the vertebrate skull.

OIE Terrestrial Code	OIE *Terrestrial Animal Health Code*. Describes standards for safe international trade in animals and animal products. Revised annually and published on the internet at: www.oie.int/international-standard-setting/terrestrial-code/access-online/
OIE Terrestrial Manual	OIE *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*. Describes standards for laboratory diagnostic tests and the production and control of biological products (principally vaccines). The current edition is published on the internet at: www.oie.int/international-standard-setting/terrestrial-manual/access-online/
Operational procedures	Detailed instructions for carrying out specific disease control activities, such as disposal, destruction, decontamination and valuation.
Outside area (OA)	The area of Australia outside the declared (control and restricted) areas.
Owner	Person responsible for a premises (includes an agent of the owner, such as a manager or other controlling officer).
Pithing	The destruction of the brainstem in an unconscious animal by the insertion of a rod through an impact wound in the head, or by transection of the proximal spinal cord at the base of the skull.
Poll	Crown of the head.
Polymerase chain reaction (PCR)	A method of amplifying and analysing DNA sequences that can be used to detect the presence of viral DNA.
Premises	A tract of land including its buildings, or a separate farm or facility that is maintained by a single set of services and personnel.
Premises of relevance (POR)	A premises in a control area that contains a live susceptible animal(s) but is not considered at the time of classification to be an infected premises, suspect premises, trace premises, dangerous contact premises or dangerous contact processing facility.
Prevalence	The proportion (or percentage) of animals in a particular population affected by a particular disease (or infection or positive antibody titre) at a given point in time.
Quarantine	Legal restrictions imposed on a place or a tract of land by the serving of a notice limiting access or egress of specified animals, persons or things.
Resolved premises (RP)	An infected premises, dangerous contact premises or dangerous contact processing facility that has completed the required control measures and is subject to the procedures and restrictions appropriate to the area in which it is located.
Restricted area (RA)	A relatively small legally declared area around infected premises and dangerous contact premises that is subject to disease controls, including intense surveillance and movement controls.

Risk enterprise	A defined livestock or related enterprise that is potentially a major source of infection for many other premises. Includes intensive piggeries, feedlots, abattoirs, knackeries, saleyards, calf scales, milk factories, tanneries, skin sheds, game meat establishments, cold stores, artificial insemination centres, veterinary laboratories and hospitals, road and rail freight depots, showgrounds, field days, weighbridges, garbage depots.
Schedule 4 drugs	Standard for the uniform scheduling of drugs: Schedule 4 — Poisons that should, in the public interest, be restricted to medical, dental or veterinary prescription or supply, together with substances or preparations intended for therapeutic use, the safety or efficacy of which requires further evaluation (NHMRC 1993).
Sensitivity	The proportion of truly positive units that are correctly identified as positive by a test. *See also* Specificity
Sentinel animal	Animal of known health status that is monitored to detect the presence of a specific disease agent.
Seroconversion	The appearance in the blood serum of antibodies (as determined by a serology test) following vaccination or natural exposure to a disease agent.
Serosurveillance	Surveillance of an animal population by testing serum samples for the presence of antibodies to disease agents.
Serotype	A subgroup of microorganisms identified by the antigens carried (as determined by a serology test).
Serum neutralisation test	A serological test to detect and measure the presence of antibody in a sample. Antibody in serum is serially diluted to detect the highest dilution that neutralises a standard amount of antigen. The neutralising antibody titre is given as the reciprocal of this dilution.
Slaughter	The humane killing of an animal for meat for human consumption.
Special permit	A legal document that describes the requirements for movement of an animal (or group of animals), commodity or thing, for which the person moving the animal(s), commodity or thing must obtain prior written permission from the relevant government veterinarian or inspector. A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements. *See also* General permit
Specificity	The proportion of truly negative units that are correctly identified as negative by a test. *See also* Sensitivity
Stamping out	The strategy of eliminating infection from premises through the destruction of animals in accordance with the particular AUSVETPLAN manual, and in a manner that permits appropriate disposal of carcasses and decontamination of the site.

State coordination centre (SCC)	The emergency operations centre that directs the disease control operations to be undertaken in that state or territory.
Surveillance	A systematic program of investigation designed to establish the presence, extent or absence of a disease, or of infection or contamination with the causative organism. It includes the examination of animals for clinical signs, antibodies or the causative organism.
Susceptible animals	Animals that can be infected with a particular disease.
Suspect animal	An animal that may have been exposed to an emergency disease such that its quarantine and intensive surveillance, but not pre-emptive slaughter, is warranted. *or* An animal not known to have been exposed to a disease agent but showing clinical signs requiring differential diagnosis.
Suspect premises (SP)	Temporary classification of a premises that contains a susceptible animal(s) not known to have been exposed to the disease agent but showing clinical signs similar to the case definition, and that therefore requires investigation(s).
Swill	Also known as 'prohibited pig feed', material of mammalian origin, or any substance that has come in contact with this material; it does not include: • milk, milk products or milk byproducts, either of Australian provenance or legally imported for stockfeed use into Australia • material containing flesh, bones, blood, offal or mammal carcases that is treated by an approved process • a carcass or part of a domestic pig, born and raised on the property on which the pig or pigs that are administered the part are held, that is administered for therapeutic purposes in accordance with the written instructions of a veterinary practitioner • material used under an individual and defined-period permit issued by a jurisdiction for the purposes of research or baiting.
Swill feeding	Also known as 'feeding prohibited pig feed', includes: • feeding, or allowing or directing another person to feed, prohibited pig feed to a pig • allowing a pig to have access to prohibited pig feed • the collection and storage or possession of prohibited pig feed on a premises where one or more pigs are kept • supplying to another person prohibited pig feed that the supplier knows is for feeding to any pig.
Terminal procedure	A treatment that causes death in an unconscious animal.
Tonic seizure	Seizure characterised by rigid muscle contractions.

Trace premises (TP)	Temporary classification of a premises that contains susceptible animal(s) that tracing indicates may have been exposed to the disease agent, or contains contaminated animal products, wastes or things, and that requires investigation(s).
Tracing	The process of locating animals, persons or other items that may be implicated in the spread of disease, so that appropriate action can be taken.
Unknown status premises (UP)	A premises within a declared area where the current presence of susceptible animals and/or risk products, wastes or things is unknown.
Vaccination	Inoculation of individuals with a vaccine to provide active immunity.
Vaccine	A substance used to stimulate immunity against one or several disease-causing agents to provide protection or to reduce the effects of the disease. A vaccine is prepared from the causative agent of a disease, its products, or a synthetic substitute, which is treated to act as an antigen without inducing the disease.
Vector	A living organism (frequently an arthropod) that transmits an infectious agent from one host to another. A *biological* vector is one in which the infectious agent must develop or multiply before becoming infective to a recipient host. A *mechanical* vector is one that transmits an infectious agent from one host to another but is not essential to the life cycle of the agent.
Veterinary investigation	An investigation of the diagnosis, pathology and epidemiology of the disease. *See also* Epidemiological investigation
Viraemia	The presence of viruses in the blood.
Wild animals	
– native wildlife	Animals that are indigenous to Australia and may be susceptible to emergency animal diseases (eg bats, dingos, marsupials).
– feral animals	Animals of domestic species that are not confined or under control (eg cats, horses, pigs).
– exotic fauna	Nondomestic animal species that are not indigenous to Australia (eg foxes).
Zero susceptible species premises (ZP)	A premises that does not contain any susceptible animals or risk products, wastes or things.
Zoning	The process of defining, implementing and maintaining a disease-free or infected area in accordance with OIE guidelines, based on geopolitical and/or physical boundaries and surveillance, in order to facilitate disease control and/or trade.
Zoonosis	A disease of animals that can be transmitted to humans.

Abbreviations

AAHL	Australian Animal Health Laboratory
ANEMIS	Animal Health Emergency Information System
ANZCCART	Australian and New Zealand Council for the Care of Animals in Research and Teaching
AUSVETPLAN	Australian Veterinary Emergency Plan
CCEAD	Consultative Committee on Emergency Animal Diseases
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVO	chief veterinary officer
DAFF	Department of Agriculture, Fisheries and Forestry (Australian Government)
DCP	dangerous contact premises
EAD	emergency animal disease
IM	intramuscular
IP	infected premises
IV	intravenous
LCC	local control centre
NMG	national management group
NOTAM	notice to airmen
NTSESP	National Transmissible Spongiform Encephalopathy Surveillance Program
OIE	World Organisation for Animal Health
PIMC	Primary Industries Ministerial Council
SCC	state coordination centre
TMS	tricaine methane sulfonate

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Further reading

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Video/training resources

See the **Summary Document** for a full list of training resources.