

## **Humane Euthanasia of Animals**

The decision to humanely end the life of an animal may be necessary in cases of severe injury, disease, or as a result of disasters such as fires or floods. On-farm euthanasia may be the most practical and humane way to end an animal's pain and suffering if it is unfit to travel or to prevent drug residues from entering the food chain. On-farm euthanasia will be used when a foreign animal disease or other communicable disease is present.

The word Euthanasia comes from the Greek word "eu" meaning good and the word "thanotos" meaning death. Euthanasia is thus the process of inducing a "good death." This would be a death that is swift and would involve little pain or distress. In regard to animal euthanasia it means the euthanasia procedure should be conducted with the highest degree of respect for that animal with an emphasis on making that death as painless and easy as possible for an animal suffering from an incurable or painful disease. This paper will address the euthanasia of cattle and poultry.

Euthanasia should be conducted in such a manner and in such a location as to ensure public safety and to protect the public from having to witness euthanasia activities. The communications media can play an important role in the education of the public concerning disease eradication and in promoting public support for a disease eradication program, including the euthanasia process.

### ***Euthanasia of Cattle***

Euthanasia demands that an animal should be unconscious without agony or suffering prior to the cessation of vital life signs including cardiac and respiratory arrest and ultimately loss of brain function. Persons assigned this task must be technically proficient and have a basic understanding of the anatomical landmarks and equipment used for humane euthanasia of animals.

There are three physiological means for inducing euthanasia in cattle. Although there are several techniques that exist to accomplish euthanasia, all the techniques will fall into one of these three categories:

- Physical disruption of brain activity caused by direct destruction of the brain tissue (either by gun shot or penetrating captive bolt)
- Drugs that depress the central nervous system (anesthetics, barbiturates) and cause death due to lack of oxygen.
- Agents that induce unconsciousness followed by mechanisms that induce hypoxia (such as narcotics followed by exsanguination).

Indications for euthanizing cattle could be an irreparably fractured limb, severe trauma, loss of production and decreased quality of life due to chronic disease, inability to stand or walk, zoonotic disease such as rabies or a foreign animal disease that requires depopulation, advanced ocular cancer, debilitating or toxic conditions, prohibitive treatment costs, and poor prognosis.

When dealing with debilitated, injured, or disabled cattle the following actions may be taken: treatment, slaughter, or euthanasia. The decision making process as to which action to consider should include the following criteria:

- The level of pain and distress of the animal
- The possibility of recovery
- The ability of the animal to get to food and water
- Medications used on the animal
- Drug withdrawal times
- The economics of the circumstances
- The potential for condemnation
- Diagnostic information

If euthanasia is considered to be the appropriate alternative the following factors should be given careful thought when choosing an appropriate method:

- ***Human safety:*** This is always the first consideration in the choice of euthanasia. The use of a firearm or even a captive bolt gun may be dangerous to humans. The use of a barbiturate overdose may produce a calm animal being euthanized quietly and easily.
- ***Animal welfare:*** The method of euthanasia chosen should produce a rapid and painless death. However, certain environments and animal behavior may prevent the use of a more desirable technique. The technique chosen should be the method that is safest for both humans and animals alike.
- ***Animal Restraint:*** The availability of animal chutes or other methods of restraint may make some methods of euthanasia more practical than others. It may not be possible to euthanize an adult cow with a barbiturate without head restraint. The use of a gunshot or a captive bolt will also require appropriate restraint and training. In all cases firm but gentle restraint should be exercised.
- ***Practicality:*** The method of euthanasia must be practical to use. Not all persons working with livestock will have legal access to drugs such as barbiturates. Their use and storage requires a federal license and is generally limited to a licensed veterinarian.
- ***Skill:*** The use of a firearm or the use of a captive bolt will require skill and training to assure correct use and minimize danger to others. The person using a firearm must understand the potential for ricochet. Designated individuals should be appropriately trained in proper euthanasia techniques wherever livestock are housed.
- ***Expense:*** Some euthanasia equipment will be more expensive than others. Some techniques require more of an initial outlay such as a captive bolt gun or rifle, but continued use is inexpensive as long as the equipment is properly maintained.
- ***Aesthetics:*** Some methods of euthanasia appear more tolerable to observers than others. Some techniques result in involuntary motor activity of the animal, which could be misinterpreted as a painful response to observers inexperienced in bovine euthanasia. This could result in great emotional distress to those observing the procedure.

- **Diagnostics:** When tissues are submitted to a laboratory for analysis the means of euthanasia may be critical for obtaining a diagnosis (such as avoiding damage to brain tissue in cases of suspected rabies or BSE).

The following table summarizes the methods of euthanasia for bovine:

<b>Technique</b>	<b>Human Safety Risk</b>	<b>Required Skill</b>	<b>Expense</b>	<b>Aesthetic Concerns</b>
Gunshot	High	Moderate*	Low	Moderate: blood and movement
Captive bolt	Moderate	Moderate*	Low	Moderate: some blood and motion
Barbiturate overdose	Low	Moderate*	Moderate	Low
Exsanguination	Moderate	Moderate*	Low	High
Electrocution	High	Moderate*	High; Equipment	High

\* Moderate-operator training required

From Practical Euthanasia of Cattle, a publication of the American Association of Bovine Practitioners.

**1. Gunshot:** If a gunshot is to be used for the euthanasia of cattle, the firearm should be held 2-10 inches from the intended point of impact with the animal's head, and the bullet should penetrate perpendicular to the front of the skull to prevent ricochet. The gun should not be placed or held against the animal's head. The point of entry of the bullet should be at an intersection of two imaginary lines drawn from the inside corner of the eye to the base of the opposite horn (or slightly above the ear in an animal with no horns), Figure 1. For calves six months of age and younger, direct the shot at the intersection of lines drawn from the top base of each ear to the inside corner of the eye on the opposite side of the head (Figure 2).

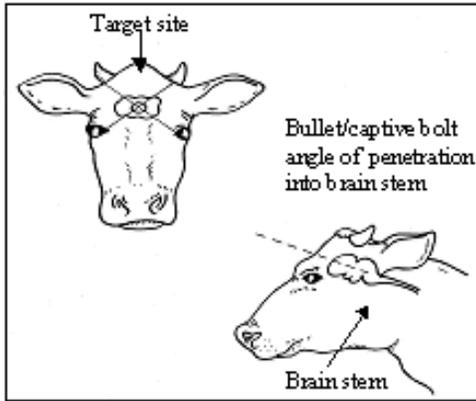


Figure 1

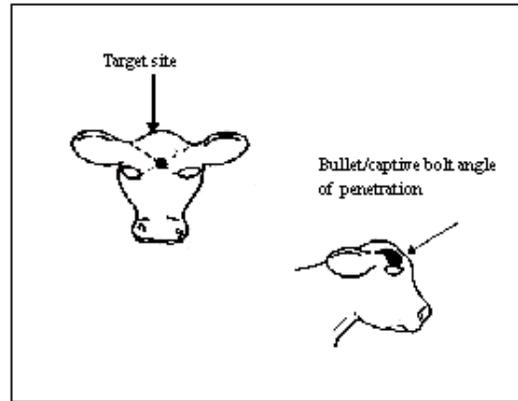


Figure 2

From G. Rietveld, On-farm Euthanasia of Cattle and Calves. October 2003.

[http://www.gov.on.ca/OMAFRA/english/livestock/animalcare/facts/info\\_euthanasia\\_cc.htm](http://www.gov.on.ca/OMAFRA/english/livestock/animalcare/facts/info_euthanasia_cc.htm)

This method requires the selection of an appropriate firearm and bullet with sufficient speed, force, and magnitude to pass through the skull and enter the brain. A .22 caliber long bullet fired from a rifle or pistol works well for most young animals. However a larger caliber bullet such as a .22 magnum, a 9 mm round, or even a .357 magnum bullet should be used on bulls, some adult cows, or elk due to the thickness of the skull. The use of a hollow point or soft-nosed bullet will result in increased tissue destruction. If performed by a skilled marksman, a gunshot will induce immediate unconsciousness, is inexpensive, and does not require close contact with the animal. This method should be used only by someone trained in the use of firearms and who understands the potential of ricochet. Care must be taken to minimize the risk to the operator, to bystanders, and to other animals. The operator must also be aware of any laws prohibiting the discharge of firearms in certain areas of the community.

**2. Captive bolt guns:** Captive bolt guns can be used to euthanize cattle. Captive bolt guns may be either penetrating or nonpenetrating. Penetrating captive bolt guns produce an immediate destruction of brain tissue. Both types of captive bolt guns will consistently cause stunning of the animal. A stunned animal will drop but will still exhibit respiration and sudden limb movements. An additional procedure such as exsanguination or chemical agent **IS NECESSARY** to assure death after the use of the non-penetrating type of captive bolt and is **RECOMMENDED** after the use of the penetrating captive bolt. A

nonpenetrating captive bolt should never be used as the sole means of euthanasia. Calves will be easily euthanized with a penetrating bolt gun.

The captive bolt gun must be placed *firmly* against the skull at the same point of entry as a bullet, that is, the point of entry of the captive bolt should be at an intersection of two imaginary lines drawn from the inside corner of the eye to the base of the opposite horn (or slightly above the ear in a cow with no horns). Since the captive bolt gun must be placed directly on the animal's skull good restraint and prior sedation or tranquilization may be required. Operator safety must be considered when using this technique.

Maintenance and cleaning directions provided by the captive bolt gun's manufacturer must be followed exactly. Selection of the appropriate strength of cartridge may vary, and the size of the animal will determine the appropriate strength cartridge that must be used.

**3. *Barbiturate overdose:*** An overdose of barbiturates, when properly administered by intravenous administration, (60-80 mg/kg of sodium pentobarbital IV), produces rapid unconsciousness and anesthesia followed by respiratory depression, hypoxia, and cardiac arrest. The drug selected should be potent, long acting, and stable in solution. Tissue residues can be high, so precautions should be taken to limit access to the carcass by pets or scavengers, as tissue levels may be high enough to cause their death.

**4. *Exsanguination:*** Exsanguination can be used in conjunction with stunning, anesthesia, or unconsciousness to ensure death but should *never* be used as the sole method of euthanasia. There are several methods to accomplish exsanguination. The most common method is to lacerate one or both carotid arteries. A sharp knife with a six-inch long rigid blade is fully inserted behind the point of the jaw, just below the neck bones, and directed downward until blood is flowing freely. The brachial artery can be lacerated by lifting a forelimb, inserting the knife deep at the point of the elbow, and cutting the skin and the vessels until the limb can be laid back against the thorax of the animal. A trained individual can sever the aorta via the rectum so that the blood flows into the abdominal cavity.

**5. *Electrocution:*** This method of euthanasia should only be used in a slaughter plant, as it requires specialized equipment that applies a minimum of 3.5 amps across the brain. A 120-volt electrical cord does not provide sufficient amperage to induce unconsciousness. Electrocution does involve electrical current as well as violent involuntary movement by the animal, so this method of euthanasia does pose risk to the operator.

**Confirmation of Death.** Regardless of the method of euthanasia used, confirmation of the death of the animal is essential. Personal safety must be kept in mind when confirming death because the animal may make sudden involuntary limb movements.

The following signs can be used to confirm death:

- Lack of a heartbeat
- Lack of respiration
- Lack of a corneal reflex

The absence of a heartbeat can best be evaluated using a stethoscope placed under the left elbow. Movement of the chest will be an indicator of respiration. Note that breathing can be very sluggish and irregular in unconscious animals. The corneal reflex can be tested by touching the eyeball and noting whether the animal blinks or not. A lack of a heartbeat and respiration for more than five minutes should be used to confirm death.

The euthanasia of calves and bulls may require special considerations. Because calves are small or more easily handled, they can be easily euthanized using a penetrating captive bolt gun, a gunshot, or barbiturate overdosing as long as legal restrictions are observed.

Bulls require special considerations due to their size, temperament, and the physical thickness of their skulls. Human safety is of primary concern in the euthanasia of bulls, and proper restraint is vital. Bulls may be euthanized using a heavy-duty captive bolt gun, firearms using at least a 9 mm round or by barbiturate overdose.

**Unacceptable Methods of Euthanasia.** The following is a list of euthanasia methods considered to be unacceptable for euthanasia of livestock due to ethical or humane considerations:

- Manual blunt trauma to the head.
- Injection of chemical agents into conscious animals, such as disinfectants, electrolytes such as potassium chloride or magnesium sulfate, or non-anesthetic pharmaceutical agents.
- Air embolism (injection of a large amount of air into the blood vessels).
- Electrocution with a 120-volt electrical cord.

Sites that routinely handle animals should have at all times the ability and the facilities to carry out emergency euthanasia. Penetrating captive bolt and firearms are the only two methods routinely available to non-veterinarians. Animal transporters should also be trained and should have the phone numbers of appropriate persons to contact in case of an emergency. Market and sale yards should have a written emergency procedure in place in case of an emergency and should have personnel trained in emergency euthanasia available for all work shifts. Euthanasia should be performed in an area that is easily accessible by removal equipment. An emergency action plan should be in place at all facilities wherever animals are handled.

### *Euthanasia of Poultry*

As in raising livestock it is unavoidable that some poultry may become ill, incapacitated, or injured. If the bird is not likely to respond satisfactorily to treatment, or if treatment is not practical because of economic or public health considerations, euthanasia may be the best option to prevent the bird from suffering. In addition, healthy spent hens may be euthanized on-farm for subsequent rendering because their low market value makes it financially impractical to send them to a processing facility. Producers, transporters, and veterinarians must make proper decisions regarding euthanasia and on-farm killing of poultry.

## Decision Making:

Several important criteria to be considered in deciding whether an ill, incapacitated or injured bird should be euthanized include:

- Pain or distress in the bird
- The likelihood of recovery
- Likelihood of disease transmission to other birds
- The possibility of successful treatment
- Suitability of the bird or its eggs for human consumption
- Suitability of meat and eggs for human consumption after drug withdrawal if treated.
- General economic considerations

The same considerations apply for poultry euthanasia as they did for cattle euthanasia, namely poultry welfare, human safety, restraint, skill, aesthetics, costs, and limitations of methods available to non-veterinarians.

- ***Poultry Welfare and Restraint:*** The method chosen for euthanasia should reduce the pain and suffering experienced by the bird. However, the choice of methods may be limited in certain environments. Proper restraint will help to reduce the bird's fear and distress. When possible, poultry should be held gently in an upright position with their wings closed to prevent flapping, not carried upside down by the legs. Covering the eyes with a hand or a piece of cloth exerts a calming effect on the bird, as does holding the bird in contact with the handler's body.
- ***Human Safety:*** The method chosen should not pose undue dangers to the person performing the euthanasia. Some methods are more hazardous than others, and should only be used under controlled environments with proper equipment or protection.
- ***Skill:*** Proper training of personnel is essential to ensure that poultry are euthanized appropriately. Untrained personnel in an emergency situation can use

some methods, while others, like cervical dislocation, require skill and training to carry out correctly.

- **Aesthetics:** Some methods may be objectionable to the person performing the procedure or to bystanders because of exsanguination or involuntary reflex movements by the bird. Personnel euthanizing birds should be trained to recognize how birds respond to certain euthanasia methods.
- **Cost:** Some methods are more expensive than others. Some have initial expenditures associated with the purchase of equipment, but are thereafter inexpensive.
- **Limitations:** Some methods may be appropriate for only certain ages or species of poultry. In addition, some methods involve administration of restricted drugs by a veterinarian.

The following table represents the methods of euthanasia available for use in poultry.

#### **Euthanasia Methods for Poultry**

<b>Euthanasia Method</b>	<b>Poultry Welfare</b>	<b>Human Safety Risk</b>	<b>Skill Required</b>	<b>Aesthetics</b>	<b>Cost</b>	<b>Limitations</b>
<b><i>Cervical Dislocation</i></b>	Acceptable if carried out by trained personnel	Low	Moderate	Terminal movements	Low; labor cost	Acceptable technique for young or small birds, but physically difficult to carry out properly with larger poultry like turkeys and ratites and adult waterfowl, or when large numbers of birds must be killed
<b><i>Argon</i></b>	Acceptable	Low	Low	Terminal movements	Moderate to high; cost of chamber and gas supply	Appropriate concentrations must be maintained (see below)
<b><i>Carbon Dioxide</i></b>	May be acceptable, but depends on	Low if used in an enclosed container	Low	Wing-flapping and other terminal movements;	Moderate to high; cost of chamber	Not acceptable for waterfowl; for other birds, proper levels

	type and age of bird; CO <sub>2</sub> is aversive	or area		gaspings	and gas supply	must be maintained (see below)
<b><i>Carbon Monoxide</i></b>	Acceptable	High	Low	Terminal movements possible	Moderate; cost of chamber and gas supply	Not acceptable for waterfowl
<b><i>Gunshot</i></b>	Acceptable if directed to head	Moderate to high	Moderate	Some blood and motion	Low to moderate; purchase of gun and bullets; safe storage	Can be used in an emergency to kill larger birds
<b><i>Captive Bolt</i></b>	Acceptable if carried out by trained personnel	Fair	Moderate	Some blood; wing-flapping; ratites kick	Low; purchase of captive bolt	Can be used for larger birds, particularly ratites and waterfowl; placement of bolt important
<b><i>Electrocution</i></b>	Good providing sufficient current passes through brain and heart to kill bird instantly	Low to moderate, depending on method	Moderate	Muscle contraction due to electricity	Purchase of equipment	None
<b><i>Exsanguination/Decapitation</i></b>	Only marginally acceptable unless bird is stunned first	Low	Moderate	Poor; very bloody	None, unless stunning equipment is purchased	None; should only be used in emergencies where other methods are Unavailable
<b><i>Anesthetic Overdose</i></b>	Good	Low	High	Good	High	Applicable agents available only to licensed veterinarians; some poultry (like broilers) may need higher doses; carcass disposal

From: Euthanasia of Poultry. The Center for Animal Welfare. College of Agricultural and Environmental Sciences. University of California, Davis.  
<http://animalwelfare.ucdavis.edu/publication/poultryeuth.html>

**1. Cervical Dislocation:** If carried out near the head area, dislocation of the neck vertebral column from the skull damages the lower brain region, causing rapid unconsciousness. In order to be humane, dislocation of the neck must cause separation of

the brain from the spinal cord and carotid arteries. This is best accomplished using a stretching motion rather than by crushing the vertebrae. Proper training of personnel is vital. Applying a rotating movement to the neck can dislocate small birds' necks. Adult poultry should be held by the shanks with one hand, and the head grasped immediately behind the skull with the other hand. The neck is then extended and dislocated using a sharp downward and backward thrust. The necks of larger or heavily muscled birds like broiler breeders, turkeys, geese, ratites, and waterfowl are extremely difficult to dislocate. It is therefore recommended that other methods like captive bolt or gas euthanasia be used for birds weighing more than 6.5 pounds. Wing flapping and other body movements may persist for several minutes after cervical dislocation, although if the vertebrae have been properly dislocated these are reflex reactions. Securing the bird's wings prior to performing the dislocation can prevent involuntary flapping. To ensure death, the bird's throat should be cut after cervical dislocation. If large numbers of birds are to be euthanized cervical dislocation is not an appropriate method because personnel performing the procedure rapidly become fatigued due to the physical effort that is required.

**2. Argon:** Argon gas is a satisfactory method for killing all poultry species except waterfowl, and is not irritating like CO<sub>2</sub>. Exposure to argon causes hypoxia. A concentration of 90% argon in air, or a mixture of argon and CO<sub>2</sub> should be used for euthanasia of newly hatched fowl chicks, ratites, and poults. Older birds should be euthanized using argon with less than 2% residual oxygen.

**3. Carbon Dioxide (CO<sub>2</sub>):** Carbon dioxide causes swift onset of anesthesia with subsequent death due to respiratory arrest. Death occurs in 2-5 minutes depending on the species and concentration of CO<sub>2</sub> used. Poultry can be euthanized using carbon dioxide gas by being placed in containers that are sufficiently airtight to maintain CO<sub>2</sub> at desired levels. Depending on how many birds are being euthanized, a circulation system may be necessary to ensure that the gas does not become stratified. Birds should be added to the chamber gradually so that proper CO<sub>2</sub> levels will be maintained. CO<sub>2</sub> should always be delivered from vapor delivery cylinders or, if a liquid delivery cylinder is used, vaporized first to prevent it from turning into dry ice. To meet the criteria for humane euthanasia,

birds already in the chamber must be unconscious before being overlain by other birds loaded after them, and unconsciousness must be maintained until death occurs.

Domestic fowl chicks should be euthanized using a concentration of CO<sub>2</sub> of at least 80% in air. Higher concentrations (at least 90%) are required for newly hatched turkey poults and ratite chicks. However, such elevated concentrations of CO<sub>2</sub> are objectionable to adult birds. Adult chickens should be killed using approximately 50% CO<sub>2</sub> in air. A mixture of 30% CO<sub>2</sub> and 60% argon or 90% argon (with less than 5% residual oxygen) is effective and less aversive to adult chickens than CO<sub>2</sub> alone. CO<sub>2</sub> is not a satisfactory method for killing waterfowl.

It is particularly important to verify death when birds are euthanized using gas, since they can appear dead but then regain consciousness. Containers in which birds are euthanized should be clear or have a window through which the birds can be observed.

When large numbers of poultry are to be killed, as during the depopulation of spent hen flocks, it is important that CO<sub>2</sub> be injected frequently into the chamber to maintain appropriate levels. A Modified Atmosphere Killing (MAK) System can easily be constructed for the euthanasia of spent hens. The MAK container holds about 200 hens when full.

A method has also been developed for the in-house euthanasia of large populations of chickens using plastic sheeting and CO<sub>2</sub> canisters. The conditions under which this would be used include disease and/or catastrophic weather, the misapplication of chemicals, or intentional poisoning. The method is quick, humane, and allows for easy removal of the birds.

Large plastic sheets 100 feet long and 5 mils thick are used along with 50# tanks of CO<sub>2</sub> (1 tank per 50 feet for the length of the house). Migration fencing is used to round up the birds in one end of the house. The plastic is unrolled outside and then carried into the house. One edge of the plastic at the side of the house is sealed by covering about two feet of the edge with litter. The litter should hold the plastic securely in place. This is repeated on the other side of the house with the other roll of plastic.

The CO<sub>2</sub> canisters are laid lengthwise down the middle of the house and distributed evenly along the house floor. The nozzles should be placed parallel to the floor. The valves on the canisters should be loosened before covering them with plastic to make them easier to turn on under the plastic.

After sealing the second sheet of plastic on the other side of the house with litter along its edge, roll the plastic back toward the sides of the house to allow for maximum migration of the birds back to the middle of the house. Migration of the birds is unto the litter, not unto the plastic. Move the birds slowly back to the middle of the house. Do not rush the birds or they will sit down. Migrate the birds to ¼ to ½ of the house.

Pull the free end of one plastic sheet across the width of the house over the birds. Repeat with the second sheet. Seal the edges of the front and back of the house with litter, but do not seal the edges of the sides after they are pulled across the house.

Turn off the house fans, locate the cylinders under the plastic and turn on all the CO<sub>2</sub> cylinders. Open the valves gradually but fully. Leave the house immediately. After 20 minutes the house fans can be turned back on and the curtains dropped. The house can be re-entered and the dead birds uncovered. The canisters will be frozen so they should not be handled with bare hands. The dead birds can then be removed.

**4. Carbon Monoxide (CO):** Carbon monoxide is a relatively rapid and effective method of euthanasia for birds. Carbon monoxide combines with the hemoglobin in the red blood cells in preference to oxygen, causing hypoxia. Only a pure, commercially compressed source of CO should be used. Exhaust fumes from a vehicle are *not* an acceptable source of CO for euthanasia because they are hot and contain contaminants. High levels of CO are deadly to humans, and chronic exposure of pregnant women to even low levels of CO can cause birth defects. Only well-trained personnel should therefore use carbon monoxide and then only under properly controlled conditions. The gas should be delivered into tightly sealed containers and the area around the containers monitored for leakage. Depending on how many birds are being euthanized, a circulation system may be necessary to ensure that the gas does not become stratified.

**5. Gunshot:** Larger birds like ratites can be euthanized by gunshot directly to the head, causing extensive brain damage. The gun must be correctly situated to ensure that the brain is destroyed. Care must be taken to ensure human safety when using firearms. It is recommended that the carotid arteries and jugular veins be severed immediately afterwards to make sure the bird is dead.

**6. Captive Bolt:** Captive bolt pistols intended for livestock can be used to euthanize larger poultry species like waterfowl and ratites. The pistol should be applied correctly to the head. Because there is motion after use of the captive bolt, it is prudent to restrain the bird to prevent injury to personnel. It is recommended that the carotid arteries and jugular veins of the bird be severed immediately afterwards to ensure death.

**7. Electrocutation:** Electrocutation is a quick and suitable method of euthanasia if sufficient current passes first through the brain to ensure unconsciousness, and then through the heart to induce cardiac arrest. Specialized equipment is required to ensure humaneness and personnel safety.

**8. Exsanguination/Decapitation:** Birds can be euthanized by severing the jugular veins, carotid arteries, and trachea. Full decapitation also results in a rapid decrease in blood pressure and brain stem trauma. However, the blood vessels in a bird may seal after being severed, delaying the onset of unconsciousness, and brain responses do persist for a brief period of time after decapitation. For this reason, exsanguination or decapitation should only be used as sole methods of euthanasia in extreme emergencies involving animal suffering where alternative methods are not feasible because of lack of equipment or trained personnel. Exsanguination and decapitation are acceptable methods of euthanasia when the bird is first stunned or anesthetized. Hand-held electrical stunning knives are available for stunning and exsanguinating chickens and turkeys, although these do pose personnel dangers if used in an area where there are wet surfaces. Birds can also be stunned first by administering a blow to the head.

**9. Anesthetic Overdose:** When properly administered via the intravenous route, barbiturate overdose produces rapid unconsciousness and anesthesia followed by

respiratory depression and cardiac arrest. Intraperitoneal route may be used for small birds if a vein is difficult to find or if intravenous injection would be stressful or dangerous. Federal regulations require these drugs to be purchased, stored, and used under the supervision of an individual registered with the U.S. Drug Enforcement Agency (DEA). This would usually be a veterinarian. Poultry euthanized using barbiturates must be properly disposed of in accordance with state regulations and must be kept away from pets or scavengers, as the consumption of their carcasses could cause death.

**Confirmation of loss of consciousness and death:** The confirmation of death of the bird is critical no matter what method of euthanasia is chosen. The termination of reflexes in the head area can be used to confirm loss of consciousness. The following methods can be used to confirmed unconsciousness:

- Lack of response to a hard pinch delivered to the comb, wattles, or snood
- Lack of blink reflex when the eye is touched

The following signs can be used to confirm death:

- Cessation of respiration
- Cessation of heartbeat

A lack of heartbeat and lack of respiration for five minutes should be used to confirm death.

**Euthanasia Action Plan:** As with cattle, all personnel who work with birds, including transporters, should be trained in correct euthanasia techniques and be provided with any equipment that might be necessary for euthanizing sick or injured birds in an emergency or for on-farm depopulation. A written action plan for routine and emergency euthanasia should be developed and followed wherever birds are housed. Since improved euthanasia methods for poultry, and particularly for on-farm depopulation, are currently under development, the action plan should be reviewed and updated regularly to incorporate these new methods as appropriate.

## *Mass Euthanasia*

Under unusual circumstances such as disease eradication or a natural disaster such as a truck wreck, the methods of euthanasia may be limited. In these conditions the most appropriate techniques that will minimize human and animal health concerns should be used. These options may include but may not be limited to carbon dioxide and physical methods such as cervical dislocation in poultry, gunshot, and penetrating captive bolt for bovine. The methods used should be humane, safe, and appropriate for the species involved, legal for the jurisdiction, and implemented according to current professional standards.

Persons making decisions concerning euthanasia should ideally be veterinarians and euthanasia team members should be individuals who have had training and/or experience with the species to be euthanized. For a truck accident the decision to euthanize may be determined by fractured limbs and other severe trauma, resulting in difficulty in the animal getting up or being safely removed from harm's way or presenting a danger to humans. The euthanasia unit must notify the owners or operators of the injured animals of the euthanasia procedures that will be used and must secure acceptance of these procedures. The euthanasia activities must be coordinated with the Appraisal and Compensation unit and the disposal unit.

In the case of a foreign animal disease the euthanasia of the animals should occur in a sequence that considers the risk the animals pose for the spread of the disease. Animals should be euthanized in descending order of priority, as follows:

1. Animals with the greatest propensity to shed the disease agent (infected swine are reported to shed a greater concentration of foot and mouth disease virus than do cattle).
2. Animals showing clinical sign of the disease of concern.
3. Animals that have contact with diseased animals.
4. Animals susceptible to the disease of concern.

Professional judgment should be used to determine exactly which animals are euthanized first. Humane issues, level of agitation of individual animals, and difficulty in handling individual animals should be considered.

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