

**Animal Euthanasia Practices
and
Current Guidelines**

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What is Euthanasia

- Derivation of the word “euthanasia”
 - Gr. *eu* = well or good; *thanatos* = death
 - Good death
- Definitions
 - A quiet or easy death
 - Painless death
 - Mercy killing: the act or practice of killing or permitting the death of hopelessly sick or injured individuals (as persons and animals) in a relatively painless way for reasons of mercy

What is Euthanasia

From Wikipedia:

- **Animal euthanasia** is the act of putting to death painlessly.....an animal suffering from an incurable, especially a painful, disease or condition. Euthanasia methods are designed to cause minimal pain and distress.
- Euthanasia is distinct from **animal slaughter** and **pest control**, which are **performed for purposes other than an act of mercy**, although in some cases the killing procedure is the same.

What is Euthanasia

- Australian Government National Health and Medical Research Council ***Australian code of practice for the care and use of animals for scientific purposes*** 2004
- **Euthanasia:** the humane killing of an animal, in the interests of its own welfare, to alleviate pain and distress.
- **Humane killing:** the process of killing an animal with minimal pain and distress.

Why are animals euthanized or humanely killed?

- To relieve suffering due to debility, terminal illness...
- The animal is no longer needed/wanted
- For population control
- Animal is required to be destroyed by law
- For disease control (avian, swine flu, etc)
- In a scientific research project, to collect blood, tissues for the study or when it is done
- For food and/or fibre

Why are animals euthanized or humanely killed?

- Regardless of the reason for the death, every attempt should be made to minimize distress, fear, or pain when animals are killed
- Ideally, animals should not be killed in the presence of another animal, especially of the same species

Practical considerations

- Must consider the safety of the persons involved in the killing
- Must be performed in a way that allows for useful, appropriate information to be collected PM
- Must consider the sensitivities of the personnel who are involved in the killing
- Must consider the environmental impact of the method used for killing, and the disposal of the carcass
 - Secondary poisoning from barbiturates, other chemicals
 - GM animals **must not** enter environment or food chain

Mechanisms of Euthanasia

- Euthanasia agents cause death by 3 basic mechanisms:
 - Direct depression of neurons necessary for life function (eg barbiturate overdose)
 - Hypoxia (eg inhalant anesthetic overdose)
 - Physical disruption of brain activity (eg captive bolt)

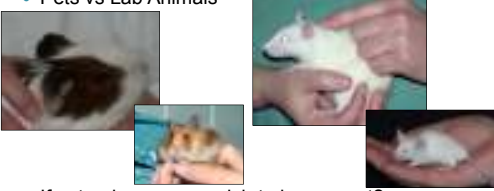
In all cases DEATH MUST BE CONFIRMED before disposal of the carcass

Species of Animals to be Covered


- Rodents
- Rabbits
- Birds
- Reptiles
- Amphibians and Fish

Euthanasia of Rodents

- Pets vs Lab Animals



- If pet – does owner wish to be present?
- Does the owner wish to view or take the body?




Euthanasia of Rodents

Acceptable Methods

- Deeply anesthetize with isoflurane, using an induction chamber, then do one of the following:
 - inject pentobarbital sodium intracardiac (best)
 - inject pentobarbital sodium intraperitoneal (takes longer)
 - exsanguinate via cardiac puncture – take enough out


Ensure death by exsanguination (if not already done) OR opening the chest OR cervical dislocation (depends on if owners want to view body)



Euthanasia of Rodents

Acceptable Methods

- IP injection of barbiturates; CCAC recommends using buffered, diluted barbiturates, combined with a fast acting local anesthetic (eg, equal parts Euthanyl 240 mg/ml and 2% lidocaine)
<http://www.ccac.ca/Documents/Standards/Guidelines/Euthanasia.pdf>



- In all cases, death must be ensured by a second method such as exsanguination via cardiac puncture OR cervical dislocation OR opening the chest

Euthanasia of Rodents

CCAC Conditionally Acceptable Methods

- Gradual-fill CO₂ (only if other methods are not practical)
- Cervical dislocation (with anesthesia if possible)
- Decapitation (with anesthesia if possible)

Above methods must be followed by a second method to ensure death such as opening the chest, exsanguination, or severing the cervical spinal cord

Euthanasia of Rodents

CCAC Conditionally Acceptable Methods

- Gradual-fill CO₂ (used for lab animals; only if other methods are not practical)
 - anesthetize with inhalant first if possible; introduce CO₂ soon after loss of consciousness to ensure rapid death
 - use gradual-fill rate of 20% to 30% of chamber volume per minute (monitored using a gas flow meter) until loss of consciousness, then increase flow for more rapid death
 - use compressed CO₂ gas in cylinders only
 - flush chamber with air between groups to avoid increased concentration of CO₂ at the bottom
 - confirm death with a second method, such as opening chest or cervical dislocation

Euthanasia of Rodents

CCAC Conditionally Acceptable Methods


- Gradual-fill CO₂ (used for lab animals; only if other methods are not practical)



Euthanasia of Rodents

CCAC Conditionally Acceptable Methods

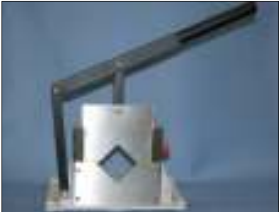
- Manual cervical dislocation (mice) with prior anesthesia if possible



Euthanasia of Rodents

CCAC Conditionally Acceptable Methods

- Anesthesia and decapitation



Euthanasia of Rodents

All Methods – in lab animals

- require thorough review by ACC
- must assure competency of personnel
- requires strict, written SOP's
- requires written records of use
- requires regular post-approval review

Euthanasia of Rodents

Unacceptable methods:

- intracardiac injection without anesthesia
- exsanguination by cardiac puncture without anesthesia
- thoracic compression (suffocation)
- car exhaust
- freezing

Euthanasia of Rabbits

- Pets vs Lab Animals



- If pet – does owner wish to be present?
- Does the owner wish to view or take the body?

Euthanasia of Rabbits

Acceptable Methods

- Barbiturates injected IV (ear; lateral saphenous)
- Overdose of inhalant anesthetic (takes a long time sedate first)
- Deep anesthesia followed by IC barbiturates
- Nonpenetrating captive bolt - eg Zephyr gun (for lab or meat rabbits)

Ensure death by exsanguination OR opening the chest OR cervical dislocation OR decapitation OR severing the cervical spinal cord (depends on if owners want to view body)

Humane Alternative Developed for Rabbit Stunning

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the University of Guelph have developed an efficient, economical and humane device called the Zephyr, for stunning rabbits at processing plants. The Zephyr is based on a pneumatic stun gun brought in from the United Kingdom. The UK model was modified and tested by OMAFRA, and is now in use at a number of abattoirs.

The Zephyr stun gun uses a compressed air driven, non-penetrating captive bolt to humanely and effectively stun rabbits of all weights and sizes.

Tony Hughes, OMAFRA President, advised several of the gun's use and is prepared to loan them to any government department willing to demonstrate and promote their use in rabbit abattoirs. Alberta Agriculture, Food and Rural Development took up the offer, testing the Zephyr gun in Alberta processing plants. The Alberta Meat Inspection Regulatory Services Branch intends to purchase four guns and provide them to plants as needed.

This device was developed by the Ontario Farm Animal Council (OFAC) to address issues in Ontario in 2001 to enable them to meet new Meat Regulations prohibiting the use of other means to stun rabbits in Ontario. Abattoir systems could apply for a refund of 50% of the value of the Zephyr from OMAFRA.



Zephyr Humane Stun Gun

Look for more information on the Zephyr in further research in underway on page 8.

OFAC - www.ofac.org
CanFACT - www.canfact.ca

Nonpenetrating Captive Bolt



Zephyr pneumatic stun gun Developed by OMAFRA and University of Guelph



Training required for use of air compressor, and use and position of stun gun (OMAFRA video, pamphlet, cadaver use)

Advantages of a nonpenetrating captive bolt

- Human safety – provided properly trained
- No need for exemption for controlled drug use as with barbiturates,
- Eliminates operator fatigue seen with manual methods
- Minimal risk of operator error
- Not harmful to the environment
- Relatively inexpensive
 - Zephyr ~ \$500 (must also purchase an air compressor)

Nonpenetrating Captive Bolt



Rabbit Zinger™
Developed by therabbitwinger.com
(\$200 USD plus shipping, duty
etc; no compressor needed)

Euthanasia of Rabbits

CCAC Conditionally Acceptable Methods

- Manual cervical dislocation (< 1 kg; or with small #)
- Commercial cervical dislocator (>2 kg; or if large #)



- T61 injected IV (with prior sedation if possible)
Ensure death by exsanguination OR opening the chest OR cervical dislocation (depends on if owners want to view body) OR decapitation OR severing the cervical spinal cord

Euthanasia of Birds

- Pets vs Poultry vs Captive birds for research



- If pet – does owner wish to be present?
- Does the owner wish to view or take the body?

CCAC: Acceptable Methods of Euthanasia for Birds (chicken, pigeon, etc)

- Barbiturates injected IV or diluted, buffered and mixed with a local anesthetic and injected IP (avoiding air sacs)
- Overdose of inhalant anesthetic (for species that do not breath hold)
- Anesthesia and decapitation

Above methods must be followed by a second method to ensure death such as exsanguination, a sharp blow to the head, cervical dislocation, decapitation, or severing the cervical spinal cord

Opening chest alone DOES NOT confirm death in birds!!!

- Poultry only
 - inert gases (Ar, N₂) with air or CO₂ <30%; as long as O₂ <2%
 - Captive bolt concussion followed by immediately by exsanguination, injection of compressed air into cranium, pithing, decapitation

CCAC: Conditionally Acceptable Methods – Birds

- CO₂ (only if there are no other practical alternatives) followed by another method to ensure death
- Cervical dislocation (birds <3 kg only) followed by immediate decapitation or high flows of CO₂ if separation of the head and spine is not complete
- Decapitation without anesthesia
- Maceration (chicks within 2 days of hatching only)

Current Literature – Use of Zephyr

- Recent publication supports the use of a pneumatic nonpenetrating captive bolt (Zephyr – originally developed for on-farm euthanasia of meat rabbits) for on-farm euthanasia of turkeys
 - Using time to insensibility and estimated time of death to evaluate a nonpenetrating captive bolt, cervical dislocation, and blunt trauma for on-farm killing of turkeys. Poultry Science (2010) 89, 1345-1354; Erasmus, Lawlis, Duncan, Widowski (Canada).



Erasmus et al (Canada)

- Compared Zephyr, blunt force trauma, manual cervical dislocation, cervical dislocation using a burdizzo
- Zephyr (discharged twice) and blunt force trauma (single hit with metal pipe or bat) were similarly effective at causing immediate insensibility
- Neither method of cervical dislocation caused immediate insensibility
- **Zephyr has the advantage of consistency of force independent of the operator, and is not affected by operator fatigue**

Euthanasia of Reptiles

- Pets, zoo, occasionally used in research
- Confirmation of death can be challenging
- Heart beat is normally very slow
- Turtle's heart will continue to beat after decapitation!



Euthanasia of Reptiles

Acceptable Methods

- IV or IP injection of barbiturates (ventral abdominal vein in some lizards). IP takes a really long time to die so may need to keep overnight if owner wants body back.
- Penetrating captive bolt (for larger species)

Above methods must be followed by a second method to ensure death such as exsanguination, a sharp blow to the head, cervical dislocation, decapitation, or severing the cervical spinal cord

Opening chest alone DOES NOT confirm death!!

Acceptable Methods – Reptiles

- CCAC does not list any
- For small reptiles, blunt trauma to the head to destroy brain would work if drugs were not available
- Overdose of gas anesthesia doesn't work well in reptiles since they can breath hold for extended periods of time

Euthanasia of Amphibians and Fish

- Kept as pets and used in research (esp fish!!)
- Tiger salamander most common in Sask.



CCAC: Acceptable Methods of Euthanasia for Fish and Amphibians

- MS 222 (TMS) immersion (or injection – amphibians); buffer at concentrations ≥ 500 mg/L
- Benzocaine immersion (or injection - amphibians)
- Etomidate (Aquacalm ®) – fish only
- Metomidate (Marinil) – fish only
- Clove oil – fish only

Above methods must be followed by a second method to ensure death such as pithing, exsanguination, a sharp blow to the head, decapitation, or severing the cervical spinal cord

- Maceration (for fish less than 2 cm in length)

Euthanasia of Amphibians and Fish

- MS 222 immersion is used for both anesthesia and humane killing of fish & amphibians



CCAC: Acceptable Methods of Euthanasia for Fish and Amphibians

- Amphibians: Barbiturates injected into lymph sac
- Amphibians: Overdose of inhalant anesthetic (for species that do not breath hold)

Above methods must be followed by a second method to ensure death such as pithing, exsanguination, a sharp blow to the head, decapitation, or severing the cervical spinal cord

CCAC: Conditionally Acceptable Methods – Fish, Amphibians

- Concussion (ie blow to the head), followed immediately by physical destruction of the brain, pithing, decapitation, or freezing
- Species-specific amphibian guidelines also mention decapitation followed immediately by pithing

Current Literature – Rapid Cooling

- Recent publications support the use of rapid cooling as a humane method of killing specific types of fish:
 - Humane killing of fishes for scientific research: a comparison of two methods. *Journal of Fish Biology* (2010) 76, 2571 – 2577; Blessing, Marshall, Balcombe (Australia)
 - Evaluation of rapid cooling and tricaine methanesulfonate (MS222) as methods of euthanasia in zebrafish (*Danio rerio*). *Journal of the American Association for Laboratory Animal Science* (2009) 48(6), 785-789; Wilson, Bunte, Carty (USA)

Blessing et al (Australia)

- Compared benzocaine OD to ice-water slurry (0-2 °C) in bony bream (a small-medium sized warm-water fish)

	Ice-water	Benzocaine
Loss of equilibrium	6 ± 1.2 sec	121.2 ± 78 sec
Death	20.4 ± 4.8 sec	216 ± 96 sec
Distress behaviours	0%	100%

- Provided compelling evidence favouring the use of ice-slurry over benzocaine as a method of humane killing for this specific fish
- Body size and species-specific thermal tolerance are important in determining the effectiveness of ice-slurry for the humane killing of fish

Wilson et al (USA)

- Compared immersion in ice-water (≤ 4 °C) with buffered and unbuffered MS222 overdose (250 mg/L) in zebrafish > 6 months old

	Ice-water	UMS222	BMS222
Loss of righting R	4.9 ± 0.33 s	25.90 ± 2.61 s	
Death	7.13 ± 0.27 s	53.52 ± 11.32 s	
Distress behavior	39%	100%	100%

- Concluded that rapid cooling results in more rapid, less distressful and more effective euthanasia than MS222 in zebrafish
- All animals exposed to BMS222 displayed similar signs of distress to those treated with UMS222 at this concentration (250 mg/L)

Advantages of Ice-Water

- Safe for human exposure
- Can humanely kill many fish at once
- Minimal risk of operator error
- Readily available
- Not harmful to the environment
- Inexpensive
- Shown to be more humane than MS222 or benzocaine in some species

Summary

- Regardless of whether the animal is a pet, used for research, is a zoo animal or is injured wildlife, and regardless of the reason for the death, every attempt should be made to minimize distress, fear, or pain when animals are killed

Every animal, especially one that is used by humans in some way, deserves a humane ending to its life!

Questions?