Captive Bolt Technology

Captive Bolt Stunner

“Impacting Animal Welfare”
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Animal Welfare
Euthanasia

Euthanasia
The term euthanasia is derived from the Greek terms *eu* meaning good and *thanatos*, meaning death. A “good death” would be one that occurs with minimal pain and distress.

Animal Euthanasia
Animal euthanasia is the act of inducing humane death in animals.
Motivation

Undercover Videos
The nonaesthetic treatment of farm animals depicted in undercover videos emotionally engage the general public.

Farm Animal Euthanasia
The specific graphic nature of some of the current animal euthanasia techniques, although technically humane, may be considered aesthetically offensive to the general public.

Corporate Customers
Separate from public perception, animal welfare is the systematic concern for animal well-being. Corporate customers are demanding animal welfare compliance throughout the supply chain.

Welfare Audits: Example - Global Animal Partnership, 5-Step Program: Step 2.16
The following euthanasia methods are permitted:

a) penetrating and non-penetrating captive bolt pistols
b) gunshot directed to the head
c) turkeys <14 days, manual (non-mechanical) cervical dislocation
d) turkeys 15 days < 5 weeks of age, mechanical stunning followed by cervical dislocation
e) turkeys 5 weeks - 10 weeks, stunning immediately followed by cervical dislocation
f) overdose of injectable anesthetics
g) gas stunning and killing

American Veterinary Medical Association, AVMA
AVMA publishes guidance on farm animal euthanasia for the U.S. The AVMA considered recent scientific studies and aesthetics as reasons for moving away from blunt-force trauma and cervical dislocation. Blunt-force trauma and cervical dislocation are considered best applicable for smaller / younger subjects.
AVMA Euthanasia Guidelines

Approved Methods

- Injectable anesthetics*
- Inhaled agents
- Cervical dislocation
- **Captive bolt**
- Decapitation
- Manual blunt force trauma
- Electrocution
- Gun shot

Evaluation of Methods

In evaluating methods of euthanasia, consider the following criteria:

- Time required to induce loss of consciousness
- Reliability
- Safety of personnel
- Irreversibility
- Compatibility with requirement and purpose
- Emotional effect on observers or operators
- Compatibility with subsequent evaluation, examination, use of tissue
- Drug availability and human abuse potential
- Compatibility with species, age, and health status
- Ability to maintain equipment in proper working order
- Safety for predators/scavengers should the carcass be consumed

* Only method approved without conditions, AVMA Guidelines on Euthanasia
Euthanasia Evaluation

**Insensible**
- Complete loss of consciousness
- Lacking sensory perception or ability to react

**Irreversible**
- Brain trauma sufficient so that the subject does not return to consciousness

**Physical Signs of Insensibility**
The absence of brainstem reflexes are indicative of loss of brain function in animals, e.g. pupillary light and corneal reflexes

1) The pupillary light reflex is a reliable indicator of complete insensibility and is present when there is pupil constriction in response to light shone in the eye.

2) The corneal reflex can easily be observed as blinking or movement of the nictitating membrane.

3) Absence of the corneal reflex in addition to a fixed, dilated pupil indicates that there is reduced blood flow to the brainstem.

4) Behavioral indicators, such as the absence of neck tension.
Captive Bolt Technology
The Captive Bolt

Mode of Operation
Production of concussion and trauma to the cerebral hemisphere and brainstem, sufficient to induce sudden loss of consciousness and subsequent death.

Captive Bolt (CB)
The modern captive bolt device and a conventional automobile engine have a similar means of converting the potential energy released from burning fuel: the piston. The CB piston is connected to the bolt. The piston-bolt assembly is held “captive” in the cylinder and cycles from one end of the cylinder to the other with each firing.

The energy produced from the burning fuel is carried by the moving piston-bolt assembly and transferred to the subject by the bolt. A sufficient energy impulse from the exposed bolt will cause instant irreversible insensibility.
Operator Safety
Operator safety is the highest design priority. Multiple and redundant safety interlocks help ensure the CB device is not fired unintentionally. The ideal safety system automatically returns the device to “SAFE” without operator intervention after each firing.

To confirm the CB device is located on the subject, patented CB devices feature a safety interlock know as an activator (highlighted below). The activator arms the CB trigger when subject contact is confirmed. By ensuring close contact with the subject, the activator also enhances stunning repeatability across operators.

The TED activator is in compliance with ANSI-SNT-101-2002, SECTION 3.3.2: full sequential action.
The TED Firing Sequence

The Activator Based Safety Interlock
- The TED activator slides from position (1) to position (2), when contact with the subject is confirmed.
- The firing trigger is armed only when the activator is in position (2).
- Position (3) shows the bolt travel when fired; contacting the subject.
- After firing, the bolt and activator automatically return to position (1).
ANSI Mission
To enhance both the global competitiveness of U.S. business and the U.S. quality of life by promoting and facilitating voluntary consensus standards and conformity assessment systems, and safeguarding their integrity.

The TED actuation system is in compliance with ANSI-SNT-101-2002, SECTION 3.3.2: full sequential action.

Full sequential action systems have more than one operating controls that must be activated in a specific sequence to actuate the device. Additional actuation can occur only when all operating controls are released and re-activated in the same sequence.
Stunning Energy: Species & Age

Adapting Captive Bolt Devices for Species and Age
The amount of stunning energy required to produce irreversible insensibility (death) relates to the species and age of the subject. Large subjects require more stunning energy than small subjects.

The stunning energy received by the subject is determined by:
• Controlling the amount of energy initially generated or,
• Controlling the amount of energy transferred during bolt contact.

Subject: Large Birds or Small Pigs
The subject adapters (SA) varying in length to controlling the amount of energy transferred during bolt contact. For example, older subjects require more stunning energy than younger subjects. SA#1 allows the greatest bolt travel and transfers the maximum energy to the subject.

Subject: Small Bird
The small bird adapters have a curved contact-end that fits securely behind the comb and matches the contour of the small head.
Stunning Energy: Subject Restraint

What Type of Material is Supporting the Subject?
The amount of stunning energy required to produce irreversible insensibility relates to the species, age, and restraint of the subject. Restraining the subject includes consideration of the type of material under the subject.

Adapting Captive Bolt Devices for Subject Restraint
Operators are encouraged to change the subject adapter (SA) to adjust the total stunning energy transferred, depending on the type of material immediately under the subject.
• Softer floors subtract from the total stunning energy transferred, therefore more total stunning energy is needed: use SA#2.
• Since a concrete floor would not subtract from the total stunning energy transferred: use SA#3.

Beyond Effectiveness... Consider Aesthetics
• Assume SA#2 is effective on a litter floor. SA#2 will likely have excessive subject damage on a concrete floor. Therefore, decrease stunning energy by changing to SA#3.