

Technical Note No 12

Gas Killing of Chickens and Turkeys

Summary

Although the majority of birds slaughtered in UK processing plants are stunned using electrical waterbath systems, an increasing number of plants are slaughtering poultry using gas. This process has the potential to eliminate some of the welfare concerns associated with electrical waterbath stunning, including such issues as unloading the birds which can cause handling stress, inversion, live shackling, pre-stun electric shocks and ineffective stunning.

Any person involved with the stunning, slaughtering or killing of poultry has a legal obligation to ensure that *'animals shall be spared any avoidable pain, distress or suffering during their killing and related operations'*. All staff involved with these procedures must have the knowledge and skills necessary to understand fully the operation of the equipment they are using and how to deal with any problems that might arise.

This leaflet focuses on the principles of gas killing and the advantages and disadvantages of the different types of gas mixture used during the slaughter of chickens and turkeys in the UK. It aims to provide constructive, practical advice to maximise bird welfare.

Operators must be trained to identify signs of an ineffective slaughter process and must know the appropriate action to be taken to prevent birds from suffering unnecessarily.

Humane Slaughter Association

The Old School. Brewhouse Hill
Wheathampstead. Herts AL4 8AN, UK
t 01582 831919
f: 01582 831414
e: info@hsa.org.uk
w: www.hsa.org.uk

Registered in England Charity No 1159690 Charitable Incorporated Organisation

Background

Gas systems are increasingly being used for the killing of poultry. Controlled Atmosphere Stunning (CAS) systems kill birds by exposure to an anoxic gas mixture (a gas mixture that does not contain oxygen), which rapidly renders them insensible to pain or distress. Although the name 'CAS system' suggests that birds are only stunned whilst in the gas, UK legislation demands that birds must be killed whilst they are still in the gas mixture and before they are shackled.

Extensive research has been carried out since the 1980s into the most appropriate gas mixtures for use in a commercial environment. Based on this research, the first system became available in the UK in 1996.

CAS systems eliminate a number of bird welfare issues associated with the use of electrical waterbath systems including the:

- stress of unloading birds
- stress of shackling and inverting live birds
- problem of pre-stun electric shocks
- possibility of variation in current within a multiple-bird electrical waterbath
- possibility of birds missing the electrical waterbath stunner

Comparisons of different stunning techniques also show that gas mixtures give a lower incidence of broken bones at killing compared to electrical stunning, therefore improving carcase quality.

Legislation

Legal requirements include:

- birds must be killed by exposure to an anoxic gas mixture which rapidly renders them insensible to pain or distress
- gas mixtures can be either –
 - (i) any mixture of argon, nitrogen or other inert gases with a maximum of 2% total oxygen by volume (2% total oxygen by volume is the proportion of oxygen in a 90% inert gas, 10% air mixture, as the amount of oxygen in air is 20.9%) or
 - (ii) carbon dioxide with any mixture of argon, nitrogen or other inert gases with a maximum of 2% oxygen by volume, provided that the carbon dioxide does not exceed 30%.
- Devices must be fitted so that carbon dioxide or oxygen (as appropriate) can be measured by volume at the point of maximum concentration.
- Once in the chamber, the bird has to be conveyed to the point of maximum concentration of the gas mixture within a maximum period of 10 seconds.

- A mechanism must be in place which stops the entry of birds into the chamber if gas concentrations:
 - i) rise above 2% for oxygen or
 - ii) above 30% for carbon dioxide
- There must be a means of visually monitoring birds in the chamber
- Visible and audible warning systems must indicate when:
 - (i) oxygen levels rise above 5% for more than 30 seconds in the inert gas mixture or
 - (ii) carbon dioxide levels rise above 30% for more than 30 seconds in the other mixture
- There must be a means of flushing the chamber with atmospheric air with the minimum of delay
- Birds must be killed by the gas to prevent them being shackled before they are dead

Principles of gas killing

The killing of poultry with gas mixtures does not result in an immediate loss of consciousness, therefore it is important to ensure that the induction of unconsciousness does not cause distress to the birds. In addition to this, the type of gas used must be suitable for a commercial environment. The characteristics of an ideal humane and efficient gas mixture include that it must:

- be non-aversive (causes no detectable signs of distress)
- induce loss of consciousness in birds as rapidly as possible
- be capable of killing birds within the system (in the UK)
- be reasonably cheap and safe to use in commercial conditions
- be relatively easy to contain within an open container
- have no side effects on meat quality

Gas mixtures

From these specifications and further research, potentially suitable gases have so far been narrowed down to carbon dioxide, argon and nitrogen.

Carbon dioxide is heavier than air (therefore easy to control), relatively cheap and an anaesthetic gas which produces rapid unconsciousness when inhaled at high concentrations. However, it is acidic, induces a sense of breathlessness, and is thought to be highly aversive to birds at concentrations above 30%. **Argon** is an inert gas (colourless, odourless and tasteless) that is heavier than air, kills birds by anoxia and is non-aversive. Argon is more expensive than both carbon dioxide and nitrogen. **Nitrogen** has the same welfare advantages and properties as argon except it is slightly lighter than atmospheric air, so may be more difficult to contain in high concentrations.

Research into the behaviour of chickens, during exposure to a number of different gas mixtures, looked at the time to loss of posture (an indicator of unconsciousness) and the number of gasping and head shaking episodes (an indicator of discomfort) occurring during this time. The two mixtures which resulted in rapid induction of unconsciousness and produced the least number of gasps and head shakes were:

- (i) any mixture of argon, nitrogen or other inert gases with a maximum of 2% total oxygen by volume or
- (ii) carbon dioxide with any mixture of argon, nitrogen or other inert gases with a maximum of 2% oxygen by volume, provided that the carbon dioxide does not exceed 30%

Signs of effective and ineffective killing processes

Once birds have left the CAS system, they must be checked to ensure they have been killed before they are shackled. If any indicators of consciousness are seen, the bird(s) must be killed immediately using a back-up system, eg electrical stunning or captive-bolt equipment, and the loading of new birds into the system stopped until the problem has been rectified. Any birds still within the system should be removed immediately and killed using a back-up method.

The signs that a bird has been killed are:

- no rhythmic breathing
- wings drooping
- the absence of a third eyelid (nictitating membrane) reflex when the surface of the eye is touched
- dilated pupils

The signs that a bird has not been killed are:

- rhythmic breathing (look for movements in the vent area)
- tension in the neck (ability to control the movement of the head)
- signs of co-ordinated movement

IMPORTANT

If any of these indicators are seen, the bird(s) should be killed immediately and effectively, before the neck is cut.

Bleeding

Although CAS systems used in the UK must kill the birds within the system, for meat quality purposes their necks will still have to be cut to drain as much blood as possible from the carcass before any further processing. Blood loss can be achieved by a ventral neck cut across both carotid arteries and both jugular veins.

A sharp, clean blade must be used to cut across the front of the neck just below the head (see Figure 1).

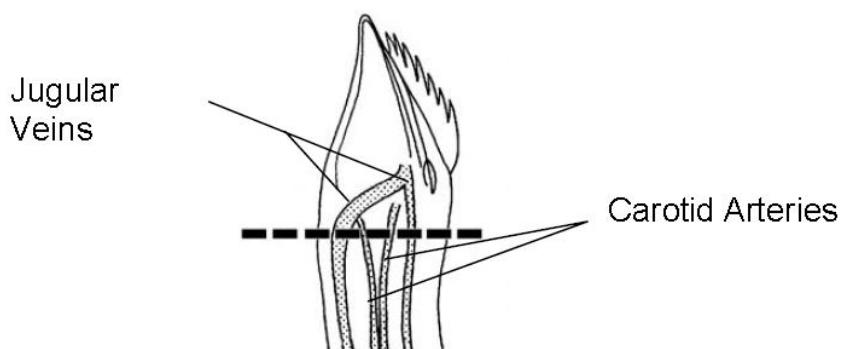


Figure 1: Diagram of ventral neck cut across carotid arteries and jugular veins

Advantages of gas killing

The use of CAS systems for poultry killing has a number of welfare and commercial advantages in comparison to conventional electrical waterbath stunning. These include:

- birds are not inverted and shackled live, thus reducing handling stresses and the risk of injury to both the bird and the hanger-on
- birds are killed within their crates, therefore there should not be a risk of recovery before slaughter if the system is functioning correctly
- the possibility of pre-stun shocks is eliminated
- the possibility of birds receiving inadequate current levels is eliminated
- the killing of birds using gas mixtures is associated with a lower incidence of broken bones compared to electrical waterbath stunning, which can improve carcass quality

Disadvantages of gas killing

Some disadvantages of gas killing also need to be taken into account when considering fitting this system. These include:

- more moving parts in the system compared to electrical waterbath stunners, therefore there may be an increased chance of a system breakdown
- the initial cost of fitting the equipment is high
- although argon is an excellent gas to use for these systems, it is more expensive than other gases available

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Further Reading

Council Regulation (EC) No. 1009/2009
OJ of the EU 2009

The Welfare of Animals at the Time of Killing (England) Regulations 2015
Defra 2015

Practical Slaughter of Poultry - A Guide for the Small Producer (2nd Edition)
HSA 2001

Full details of all UK legislation can be found on www.tso.co.uk

Technical Note No 10 Electrical Waterbaths
HSA 2005

Electrical Waterbath Stunning of Poultry (HSA Online Guide)
HSA 2016

www.hsa.org.uk/downloads/publications/hsaonlineguidewaterbathpoultryapril2016.pdf