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14th August 2012

Dear Sue

Advice on LINCO Gas Stunning System

Introduction

1. There is growing scientific evidence that electrical waterbath stunning in processing plants presents a number of significant welfare disadvantages for the birds. Four particular areas of concern have been identified: the stress, pain and discomfort of inversion on a shackle line; leg compression in the shackle, pre-stun shocks due to poor bath entry; and inadequate stunning due to low stunning currents. Live shackling can cause considerable pain and distress leading FAWC (2009)¹ to call for the end of pre-slaughter inversion and live shackling in the long term.

“Both practical experience and scientific evidence show that current systems of inversion and live shackling raise significant welfare concerns. Inversion is unnatural and stressful and may elicit fear and an escape response, such as wing flapping” (FAWC, 2009, para 107)

“Shackling is likely to be very painful. Pain is caused by the compression of the periosteum by the shackle and the variations in leg size that are not compensated for by shackle design, both of which are compounded by any bone fractures or joint dislocation” (FAWC, 2009, para 109)

2. The use of electrical stun-to-kill in general is also a known source of welfare concerns including the incidence of pre-stun shocks, the impact of missed stunning, variation in resistance of different birds leading to insufficient current to stun.

3. Although a number of specific solutions to these issues exist in practice (e.g. compliant shackling, breast support systems, more effective water-bath design,

¹ Farm Animal Welfare Council. Report on the Welfare of Farmed Animals at Slaughter or Killing – Part Two: White Meat Animals (2009) <http://www.fawc.org.uk/pdf/report-090528.pdf>

head-only water-bath stunning, head-cloaca stunning, more robust operating parameters), FAWC, in its 2009 Report concluded that “current systems of pre-slaughter inversion and shackling for poultry should be phased out”. It might be noted that at least one EU Member State has stated that they will progressively move to only gas stunning techniques.

4. Nevertheless, inversion and water bath stun-to-stun and stun-to-kill systems remain the dominant form of poultry slaughter in the UK at the present time. According to the FSA Report (FSA 2012²), 62% of poultry slaughtered in the UK were restrained on a shackle line and electrically stunned (at 52 establishments) against 37%, where a gas mixture system was used (present at 10 establishments).

5. Recent years have seen growing attention paid to gas stunning systems as an alternative to shackling and water-bath stunning for poultry. Gas stunning or controlled atmosphere systems minimize pre-slaughter handling, remove the need for inversion and live shackling and avoid the problems associated with pre-stun shocks, missed stuns and inadequate stuns. In the 2009 White Meat Report, FAWC identified a number of welfare criteria against which controlled atmosphere systems might be judged:

- pre-slaughter handling;
- aversiveness of the gas (mixtures);
- disruption of respiration;
- anaesthesia;
- the period to insensibility to pain and distress;
- the mental state at the onset of muscular contractions;
- injuries sustained; and
- whether all birds are killed within the system.

6. Additional criteria for assessment (particularly in terms of compliance with EU Regulation 1099/2009 on the protection of animals at the time of killing³) might include:

- effective monitoring and control of gas concentration throughout the gas enclosure; and
- visual monitoring where the Official Veterinarian (OV) and slaughterman can observe birds.

The LINCO system

7. Representatives from LINCO presented information and video footage to the FAWC Welfare at Killing Standing Committee. LINCO have installed 17 gas systems (Controlled Atmosphere Killing) worldwide, with 10 systems installed in 5 EU countries. Five more systems have been ordered for delivery in May/June 2013 and a further 10-12 in 2013. EU Member States already using the LINCO systems

² <http://www.food.gov.uk/multimedia/pdfs/board/fsa120508.pdf>
<http://www.food.gov.uk/multimedia/pdfs/board/fsa120508annexes.pdf>

³ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:303:0001:0030:EN:PDF>

expect it to be compliant with EU Regulation 1099/2009, with the inclusion of upgraded control and monitoring systems. Competent authorities in France and Italy are due to confirm compliance in the near future.

8. Birds in drawers (85kg per drawer) are de-stacked from the transport modules and lowered stepwise into a pit where they are exposed gradually to a controlled increasing concentration of carbon dioxide. Minimum pit depth is two metres, but most are much deeper to enable increased throughput. Speed of movement of the drawers through the system and dwell time is calculated for the weight and size of birds. Maximum throughput is 15,300 2.5kg birds per hour or 3,600 slaughter weight turkeys per hour.

9. Gas temperature is regulated. Carbon dioxide is endothermic and when evaporated from the liquid form absorbs energy, which lowers the temperature. The gas control system heats the gas to 30°C prior to delivery with the aim of maintaining 20°C within the pit. There are seasonal and geographical effects on ambient temperature and the warmer the temperature carbon dioxide achieves the less stable it is. Carbon dioxide is injected at the base of the pit and compressed air is used to regulate the concentration of carbon dioxide in different parts of the pit. Movement of crates also helps to regulate the gas concentration.

10. Drawers are moved down into the pit gradually in two stacks and up out of the pit in one stack. A conveyer between the downward and upward movement can be moved vertically to increase the number of drawers in the system and therefore to increase throughput.

11. Dwell time in the system is 6 minutes plus or minus 30 seconds for different sizes of birds. Free-range birds are more active so the procedure adopted is to use lower carbon dioxide concentrations with a longer dwell time to reduce wing flapping and subsequent damage in high value birds. Maximum carbon dioxide concentration in the bottom of the pit was set by the distance from the exit of the gas system to the hanging and cutting area. The heart-beat can continue for 4 minutes but a maximum stun to cutting time of 1½ minutes is reported to be preferable.

12. Free-range birds have forced LINCO to make engineering changes to the equipment to increase dwell time in the system. Two elevators lower drawers to the base of the pit over a 5 minute period and the exit conveyor raises them out in 1 minute. This is achieved by setting smaller steps as the drawers are lowered into the gas and larger steps as they are raised up.

13. Maintaining acceptable bird welfare requires that when birds are lowered into the system they must lose consciousness before being exposed to greater than 40% carbon dioxide. Signs of calm induction to unconsciousness that could be used in the system through the internal cameras include: loss of posture; the bird is not visibly awake; the bird does not show signs of negative emotions such as fear or excitement.

14. Birds in drawers within the gas system can be observed through all phases in the system through video cameras that follow birds down the pit. There is also a carbon dioxide concentration monitor visible with the images and an indication of the

step at which the drawers were positioned down the pit. Control panels on all new builds will incorporate the camera and monitoring systems with capacity to store images for 1 year, in line with the new regulation. Observations shown to FAWC on video were recorded in commercial conditions rather than having EEG or other measures made in experimental conditions, so needed to be interpreted.

15. The Welfare at Slaughter Standing Committee was shown a video of birds entering the different stages down into the pit with both the gas concentration and the reactions of the birds readily visible. The time of exposure to the increasing concentration of carbon dioxide was recorded as follows:

- Level 2 – 2.5% carbon dioxide – 54 seconds
- Level 3 – 16% carbon dioxide – 83 seconds
- Level 4 – 26% carbon dioxide – 108 seconds
- Level 5 – 35% carbon dioxide – 125 seconds
- Level 6 - 40% carbon dioxide – 132 seconds

16. There are a maximum of 16 stages down into the pit and the stage at which a gas concentration of 40-50% carbon dioxide was reached would depend on the size of birds. The system automatically monitored gas concentrations.

17. The camera and gas monitoring unit is currently a recording system only and not relaying information back to the gas control system. The operator manually applies fine control. It is probably possible in future for the camera/gas monitor to supply feedback to the control system.

18. The speed of realigning the carbon dioxide concentration in older systems is 4-5 minutes but in present systems it takes about 1 minute to stabilise. Gas levels are usually realigned when there is a natural break in supply, i.e. different flocks coming through. Gas analysers are spread throughout the pit and are cleaned with air to maintain their effective operation.

19. To get access to the birds in the event of a breakdown the pit has to be flushed of gas. For the health and safety of the operators access to the pit is not permitted while the gas mixture is present. The observation camera could be useful in identifying the cause of any stoppage. The LINCO system does not move as quickly as other drawer operating gas systems so breakdowns might be expected to have less impact. Other systems can move 12-14 drawers a minute giving a throughput of 10,000-11,000 birds an hour, whereas the LINCO system moves 7 drawers a minute at maximum throughput which, due to the system's larger capacity, gave a throughput of 15,300 2.5kg birds an hour.

Responses, issues and concerns

20. The LINCO system, as presented to the FAWC Welfare at Killing Standing Committee, did appear to offer a number of welfare advantages over more conventional shackling and electrical water-bath stunning systems. These advantages might be summarised as:

- The birds were not inverted or shackled until post-mortem, but remained in the drawers in which they were transported from the farm thereby minimising welfare disadvantage at primary processing.
- Improved drawer design reduced the risk of head or wing crushing during loading.
- Progressive exposure to carbon dioxide concentrations observed in the LINCO system did appear to reduce aversive responses amongst poultry. The birds were not reacting vigorously to the lower concentrations of gas through wing flapping and there was little evidence of fighting or other excessive activity in the drawers with progressive exposure.
- Effective monitoring of the birds with progressive gas exposure at different levels. The camera with in-picture carbon dioxide monitoring gave good real time observations.
- All the birds appeared to be unconscious before exposure to the more aversive 40% carbon dioxide concentrations.
- The system as a whole was slower than other systems, which offered welfare benefits to the birds in the drawers.

21. A number of concerns or points for further research and investigation were identified:

- It was not clear how much an analgesic effect of carbon dioxide exposure was reducing bird reactions in addition to reduced consciousness.
- It was felt there was a lack of scientific data on the point at which analgesia begins to take effect.
- The progression of the drawer down into the gas system might displace the gas. To what extent this would result in a mixing of the concentrations at different levels was not clear.
- At a broader level, over what time did the various layers of carbon dioxide concentration become less distinguishable through mixing by the passage of birds?
- If it becomes apparent to the operator that the concentrations are wrong, prompting more violent aversive reactions amongst the birds, how quickly can the system respond and rebalance the gas concentrations?
- What back up stunning mechanisms were available in the case of system failure?
- The passage of free-range birds through the system appeared to generate additional welfare issues and necessitate longer exposure times.

- There was potential for birds placed in the drawers to be subject to catching and crushing of head and wings.

Conclusion

22. FAWC feels that the system observed represents a set of genuine improvements to the welfare of poultry at slaughter and marks a potentially significant advance over more traditional shackle and water-bath systems. Purely from a welfare point of view, this constitutes a preferred and acceptable alternative.

23. FAWC is aware, however, of the substantial costs involved in establishing such a system and thus its inapplicability to smaller poultry slaughterhouses.

24. FAWC would like to see approval of the system linked to:

- The inclusion of a full real-time monitoring system, as demonstrated in the video;
- Effective visual or other means to ensure and verify that birds are fully unconscious before they enter concentrations of 40% and above; and
- The provision of full and detailed Standard Operating Procedures identifying the critical control points within the system (including the adjustment and monitoring of gas concentrations, conveyer and drawer operation, adaptations for different species and birds from different production systems).

25. In future, the Committee would like to see progression towards a system employing anoxia in a first stage followed by a high concentration of carbon dioxide.

26. In terms of criteria for assessment of gas systems for the stunning and killing of poultry (referred to above) FAWC has made an initial assessment of the LINCO gas system as set out below:

FAWC (2009) Criteria for assessment of gas systems	LINCO system
pre-slaughter handling,	Good – birds remain in drawers
aversiveness of the gas (mixtures),	No real aversion at low concentrations
disruption of respiration,	Progressive unconsciousness
anesthesia,	Acceptable
the period to insensibility to pain and distress,	Acceptable
the mental state at the onset of muscular contractions,	Unknown
injuries sustained	Seemingly minimal
whether all birds are killed within the system.	Apparently
Effective monitoring and control of	Yes

gas concentration throughout the gas enclosure	
Visual monitoring where the OV and slaughterman can observe birds	Yes

With best wishes,

Yours sincerely



Professor Christopher Wathes
Chairman, Farm Animal Welfare Committee