

## AN INVESTIGATIVE STUDY OF 2 PIG ABATTOIRS IN SWEDEN WITH REGARD TO CO<sub>2</sub> CONCENTRATION, CO<sub>2</sub> EXPOSURE TIME, STUN GROUP SIZE, STUN TO STICK INTERVAL, AND STUN EFFECT.

**Bo Algers & Sophie Atkinson**

*Department of Animal Environment and Health, Swedish University of Agricultural Sciences, P.O.Box 234, 532 23 Skara, Sweden*

### Introduction

Preslaughter stunning has the prime aim to ensure the animal is insensible to exsanguination and post slaughter procedures. The stun itself should be painless, close to instantaneous in its effect, and should provide a duration of insensibility which ensures that death from subsequent slaughter intervenes before recovery of sensibility (Cook et al., 1999).

The Swedish Board of Agriculture have set down regulations for CO<sub>2</sub> stunning of pigs in abattoirs, and stipulate that the time interval between the last CO<sub>2</sub> exposure and exsanguination (stun to stick interval) should be within 60 seconds. These regulations are based on EU guidelines made in 1991 for CO<sub>2</sub> stunning in abattoirs.

In recent years group CO<sub>2</sub> stunning procedures have been implemented in Sweden based on Danish designs. The concept is comprised of three main elements:

- an area where groups of approximately 20 pigs are divided into smaller groups
- automatic transfer of these smaller groups to and through the stunning equipment utilizing their flock behaviour
- a system for presenting the stunned pigs for shackling and sticking.

After the end of CO<sub>2</sub> exposure under some conditions pigs can begin to regain consciousness and can recover completely (Forslid, 1987; Holst, 1998). Also, due to biological variations, some pigs will never recover from the stunning conditions while others will be reversibly stunned and show indications of regaining consciousness within a given time after the end of the CO<sub>2</sub> exposure. Therefore to ensure good animal welfare during post stun handling of pigs, CO<sub>2</sub> stunning should always induce unconsciousness of a sufficient duration which should include not only the stun-stun-stick interval but also the time taken for the animal to become insensible due to debleeding (Holst, 1999). According to EU regulations (Council Directive 93/119/EC) pigs must be exposed to CO<sub>2</sub> for long enough to ensure they remain unconscious until they have been killed. Furthermore, bleeding (sticking) must be started as soon as possible after stunning, and in any event carried out before the animal regains consciousness.

To ensure good stunning practice under CO<sub>2</sub> stunning i.e. no pigs regain consciousness during post-stun handling and bleeding, the safe depth of anaesthesia at the time of sticking can be evaluated by the following criteria:

No pigs shall show deep or regular respiration except for irregular abdominal gasping

No pigs shall show signs of excitation or kicking apart from for slow movements of legs

No pigs shall have spontaneous blinking of the eye

Maximum of 5% pigs can have corneal reflex

Corneal reflex is a good criterion for assessing consciousness because when there is no corneal reflex, it indicates deep anaesthesia or death of the animal (Holst, 1999).

### Aim

This study aimed to investigate in 2 different CO<sub>2</sub> group-stunning abattoirs (A and B):

Actual group size in the stun boxes in abattoirs A and B

Actual stun to stick time intervals for each pig in the stun groups

Stun effect when stun boxes are in CO<sub>2</sub> concentrations not less than 70% in the first stop and not less than 90% in the bottom stop at exposure duration of 210 seconds in abattoir A and 150 seconds in abattoir B.

### Material and Method

Observational studies and data recordings were made at 2 abattoirs A and B for stun group size, stun to stick interval and stun effect. These parameters were recorded for 502 stun groups (3444 pigs) over a 2 day period for abattoir A, and 553 stun groups (2325 pigs) over a 3 day period for abattoir B. The results for each abattoir were analysed separately.

The stun effect was assessed for every stun group during the study period starting after the 2nd pig of each group. This was done by a person trained and experienced in assessing pigs for consciousness. Any information indicating poor stunning was recorded. When there were stops in the slaughter line and the last pigs in a stun group had extended stun to stick intervals, extra care was taken to check for signs on these pigs for regaining consciousness. The same person conducted all consciousness assessments throughout the study.

### Results

Abattoir A: In abattoir A the stun group sizes varied between 3 and 10 pigs, with majority between 6 and 8. The most common stun group size however was 7. The rotation times for the boxes to pass through the stunning system varied. Thus the CO<sub>2</sub> gas exposure times for each group of pigs in the stunning system varied. The CO<sub>2</sub> exposure times for stun groups were estimated from 46 box rotation times and making a calculation to estimate the CO<sub>2</sub> gas exposure times when pigs were in CO<sub>2</sub> gas concentrations above 70%. The average CO<sub>2</sub> exposure was estimated at 282 seconds. There were no pigs out of a total of 3444 that showed signs of regaining consciousness.

Abattoir B: In abattoir – B the stun group sizes varied between 2 and 6 pigs with the majority between 4 and 5. The most common stun group size however was 4. 79% of all pigs in the study were stuck after 60 seconds, i.e. 21% with a stun to stick interval within 60 seconds. The fastest stun to stick interval was 41 seconds and the longest 145 seconds. The CO<sub>2</sub> exposure times for stun groups were estimated from 28 box rotation times and making a calculation to estimate the CO<sub>2</sub> gas exposure times when pigs were in CO<sub>2</sub> gas concentrations above 70%. The average CO<sub>2</sub> exposure was estimated at 238 seconds. There was one pig out of a total of 2325 pigs that showed spontaneous blinking of the eye and corneal reflex.

## Discussion

This study investigated stunning procedures in 2 different abattoirs with similar CO<sub>2</sub> pig group stunning practices. In total, 5769 pigs and 1055 stun groups were observed for the purposes of assessing animal welfare after stunning. The stunning procedure was observed to assess how good the stunning practice was overall. The stunning systems varied in that abattoir A operated with 7 boxes rotating through a CO<sub>2</sub> chamber 10 meters deep. Abattoir B operated with 6 stunning boxes rotating through a CO<sub>2</sub> chamber 9 meters deep. The maximum slaughter capacity for abattoir A is 720 pigs per hour, and in abattoir B, the slaughter line has the capacity for 300 pigs per hour.

In both abattoirs the CO<sub>2</sub> gas concentrations exceeded the minimum recommended by the manufacturer of the system i.e. 70% at the upper level, and 90% at the lower level. In both abattoirs the CO<sub>2</sub> gas concentrations exceeded the minimum recommended by the manufacturer of the system (EU legislation requires a minimum of 70 %). In abattoir A the average CO<sub>2</sub> exposure time was 286 seconds, and the minimum time 218 seconds. In abattoir B the average CO<sub>2</sub> exposure time was 238 seconds, and the minimum time was 193 seconds. There is variation in stun exposure times and box rotation times due to factors that occur during the division of the immediate preslaughter groups.

The stun to stick intervals for each pig in a stun group varied by 20 to 30 seconds for both abattoirs. Stun to stick intervals varied due to many factors other than group size. Stops occurring in the systems caused most of the delays in sticking time. In abattoir A stops occurred due to the derailment of shackles holding pigs as they were conveyed around a hook bend just before being stuck. Occasionally shackled pigs were derailed completely and fell off the line onto the abattoir floor before sticking. There were also quite a few stops just after sticking where shackled pigs passed through a narrow gap between 2 walls. However most causes of the stops could not be seen, as they occurred far down the slaughter line past sticking.

The stun effect in this study was considered to be 100% effective in abattoir A and B. One pig (abattoir B) of a total of 5769 pigs (0.043%) stunned showed corneal reflex and spontaneous blinking of the eye. It was the 3rd pig in a group of 4. The stun to stick interval was 80 seconds, which was the average interval for every 3rd pig of a group for this abattoir and it showed no other symptoms.

## Conclusions

The results of this study have shown that the minimum to maximum stun to stick intervals are 46 to 160 seconds for abattoir A, and 41 to 129 seconds for abattoir B and that these intervals allow for an acceptable stunning. Therefore the recommended stun to stick interval can be reviewed.

## References

- Cook, C.J. (1999) Neurological Measures to Qualify Welfare Aspects of Stunning. In : Proceedings of an International Workshop on Stunning Systems for Pigs and Animal Welfare, Danish Meat Research Institute.
- Forslid, A. (1987) Transient neocortical, hippocampal and amygdaloid EEG silence induced by one minute inhalation of high concentration CO<sub>2</sub> in swine. *Acta Physiol Scand* 130, 1-10.
- Holst, S. (1998) Praktisk overvågning af slagtesvin efter CO<sub>2</sub> - bedövelse. Slagteriernes Forskningsinstitut. Rapport nr. 0057. 8 Januar 1998.
- Holst, S. (1999) Assessment of stun-stick interval in relation to time of exposure in CO<sub>2</sub> stunning of pigs. Animal Welfare implications. In : Proceedings of an International Workshop on Stunning Systems for Pigs and Animal Welfare, Danish Meat Research Institute.