# Stunning of Pigs with Carbon Dioxide

## SUBMISSION TO THE OIE BY THE INTERNATIONAL COALITION FOR ANIMAL WELFARE

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ICFAW welcomes the recognition in the OIE *Terrestrial Animal Health Code* (Article 7.5.7.4) that "Inhalation of high concentration of carbon dioxide is aversive and can be distressing to animals. Therefore, the use of non-aversive gas mixtures is being developed." We also note that the section on gas stunning is stated to be "under study". We believe that this is an appropriate time for the OIE to review the use of different gas mixtures in the stunning of pigs.

ICFAW members are deeply concerned about the welfare of pigs at slaughter when high concentrations of $CO_2$ are used to induce unconsciousness. The welfare disadvantages of the use of $CO_2$ for stunning pigs are widely acknowledged.[1,2,3,4] Pigs are not rendered unconscious immediately following exposure to $CO_2$.[5] When they are lowered into a well containing 80-90% $CO_2$, as occurs commercially, it may take 30-60 seconds after the start of inhalation for them to lose consciousness.[6]

$CO_2$ is known to be highly aversive to pigs.[7,8,9,10] Inhalation of $CO_2$ causes acute respiratory distress through irritation of the mucus membranes.[11,12] Respiratory distress causes hyperventilation, a sense of breathlessness, gasping,[13] and suffocation.[14] Pigs also display muscular excitation and vocalization when exposed to $CO_2$, and all of this occurs prior to the loss of consciousness.[15,16] Collaborating researchers in Denmark and Spain concluded that "[t]he fact that these behaviours occur when the animal is conscious is evidence that induction to $CO_2$ anaesthesia is not immediate and pigs suffer from fear, pain and/or stress during immersion into gas." [17]

Behavioural studies have shown that the majority of pigs avoid or quickly withdraw from high atmospheric concentrations of $CO_2$[18] and that almost 90% of pigs preferred to go without water for 72 hours rather than experience exposure to $CO_2$.[19] Further, a German study found that a concentration of 80% $CO_2$ over 70 seconds is not sufficient to stun pigs properly.[20]

Genetic variation appears to have an effect on how pigs react to $CO_2$. Pigs possessing the 'halothane' gene can have stronger reactions to $CO_2$[21] and may therefore be even more sensitive to changes in $CO_2$ concentration.[22] If $CO_2$ mixtures are used, the potential to use selective breeding to eliminate the halothane gene should be investigated. Regardless of the presence of the halothane gene, there can be variation in responses between pigs to stunning with $CO_2$,[23] which presents a further issue regarding consistency in the procedure. Variation in loss of consciousness during stunning can have major animal welfare implications.[24]

A European Food Safety Authority (EFSA) report (2004) [25] explained that stunning is intended to induce insensibility and unconsciousness in animals so that slaughter may occur without avoidable fear, anxiety, pain, suffering, and distress. Gas stunning has a high potential to be more humane, but

only if non-aversive gases are used.[26] However, there is overwhelming scientific evidence demonstrating that $CO_2$ stunning does not guarantee an absence of avoidable pain, suffering, and distress in pigs.[27,28] EFSA has concluded that at concentrations above 30%, $CO_2$ "is known to be aversive and cause[s] hyperventilation and irritation of the mucous membranes that can be painful, and elicits hyperventilation and gasping before loss of consciousness". EFSA recommended that "the gas used to induce unconsciousness should be non-aversive" and stressed that the development of alternative humane gas mixtures was a high research priority.[29] The UK Farm Animal Welfare Council (2003)[30] concluded that the use of high concentrations of $CO_2$ to stun pigs is not acceptable, and should be phased out.

Evidence suggests that anoxia induced with inert gas mixtures of argon and nitrogen may offer a higher welfare option for stunning pigs.[31] Behavioural evidence suggests that pigs do not find argon aversive, even at a concentration of 90%,[32] and physiological evidence indicates that exposure to 90% argon results in minimal respiratory distress.[33] Inert gases are used commercially in poultry abattoirs in the United Kingdom, and it has been estimated that more than 75% of turkeys and 25% of broiler chickens slaughtered for human consumption are killed using inert mixtures.[34] Studies have examined the commercial feasibility of using inert gas mixtures to stun pigs. Dalmau et al. (2010) found that gas uniformity was higher in 90% argon, argon and $CO_2$ mixtures, and nitrogen and $CO_2$ mixtures than in 90% $CO_2$. This finding suggests that these mixtures may have a higher stability and uniformity than $CO_2$.[35] The AVMA (2013) approves the use of argon and nitrogen gases, and states that the advantages of these gases include being non-aversive, nonflammable, nonexplosive, readily available as compressed gases, that hazards to personnel are minimal when used with appropriate equipment, and that they are heavier than air and can be contained within equipment in which animals can be lowered.[36]

While nitrogen, argon, or mixtures of the two, have welfare advantages over the use of $CO_2$,[37,38,39,40] the stun-to-stick interval needs to be carefully monitored following the use of these hypoxic gas mixtures. Combinations of argon with $CO_2$ have been proposed, with the various concentrations and exposure times requiring different stun-to-stick intervals.[41,42] Important considerations when using hypoxic gas mixtures include not only the short stun-to-stick interval, but also longer exposure times to cause death. Research has examined the possibility of using a combination of hypoxic gas mixtures to induce unconsciousness in a humane manner, followed by electrical cardiac fibrillation.[43] Another potential method to improve welfare involves a two-step procedure, by which pigs are initially anaesthetised using an anoxic gas mixture such as nitrous oxide, followed by death from immersion in $CO_2$.[44]

Mixtures of low concentrations of $CO_2$ with argon or nitrogen (e.g. 30 and 60% $CO_2$ and argon, respectively) have been suggested.[45] However, this is very much the least preferred option compared to using inert gases alone. EFSA opinion has stated that "Hypoxic stunning induced with 90% argon in air is less aversive than hypercapnic hypoxia induced with 30% $CO_2$ in argon or nitrogen or stunning with 80-90% $CO_2$ in air."[46]

The science is very clear that $CO_2$ gassing does not meet an acceptable standard of animal welfare. ICFAW recommends that stunning/killing pigs with high concentrations of $CO_2$ should be phased out, quickly. The development of more humane gas mixtures and suitable equipment should be urgently prioritized, and this can be facilitated by a strongly worded recommendation in the *Terrestrial Animal Health Code*, chapter 7.5 on slaughter of animals.

## ICFAW Members:

Animal Welfare Institute
Compassion in World Farming
Eurogroup for Animals
Humane Society International
International Fund for Animal Welfare
National Council of SPCAs
Japanese Farm Animal Welfare Initiative
Pan African Animal Welfare Alliance
Royal Society for the Prevention of Cruelty to Animals
RSPCA Australia
World Animal Net
World Animal Protection
World Horse Welfare

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