

STUNNING/KILLING OF PIGS WITH HIGH CONCENTRATIONS OF CO₂

Summary

The position of Eurogroup for Animals is that – in the spirit of Recital 6 of the Slaughter Regulation (1099/2009/EC) – **the stunning of pigs with high concentrations of CO₂ should be phased out as quickly as possible**. Therefore, research and development resources should be urgently devoted to finding a painless and non-aversive alternative to stunning with high concentrations of CO₂.

The European Commission, the EU Member States and the pig industry must invest the necessary funding, energy and commitment to developing one or more alternative stunning methods that either induce instantaneous unconsciousness or that, if the process is gradual, are non-aversive.

In order to stimulate focus on this matter, **Annex I of Council Regulation 1099/2009 should be amended (under Articles 4(2) and 25(2) of the Regulation) to prohibit the use of high concentrations of CO₂ from 1 January 2025 with a review in 2023 to verify the availability of commercially viable non-aversive alternatives.**

1. Regulatory context

The EU Slaughter Regulation (1099/2009) allows gas stunning of adult pigs for slaughter with the following methods:

- CO₂ at high concentrations (min. 80%)
- CO₂ associated with inert gases
- Inert gases

Recital 6 of the Regulation states:

*“The European Food Safety Authority (EFSA), established by Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety (1), has adopted two opinions on the welfare aspects of the main systems of stunning and killing of certain species of animals, namely on the welfare aspects of the main systems of stunning and killing the main commercial species of animals, in 2004, and on the welfare aspects of the main systems of stunning and killing applied to commercially farmed deer, goats, rabbits, ostriches, ducks, geese and quail, in 2006. Community law in this area should be updated to take into account those scientific opinions. **Recommendations to phase out the use of carbon dioxide for pigs and the use of waterbath stunners for poultry are not included in this Regulation because the impact assessment revealed that such recommendations were not economically viable at present in the EU. However, it is important to continue this discussion in the future.**”*

In 2004 the European Food Safety Authority (EFSA) concluded that at concentrations above 30%, CO₂ “is known to be aversive and cause hyperventilation and irritation of the mucous membranes that can be painful, and elicits hyperventilation and gasping before loss of consciousness”. [1] 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. However, in spite of this clear recommendation, research on humane alternative methods has lagged behind and therefore pigs are still being stunned or killed inhumanely across the EU.

2. State of play

2.1. Use of CO₂

Some of the biggest European pig slaughterhouses use CO₂ at high concentrations as preferred stunning method. Others are still using electrical stunning.

Data on the percentage of the total pig production that is stunned/killed with CO₂ is available from the countries below:

France: 6/157 abattoirs (15-18% of the total national production) [2]

Spain: 85% [2]

Germany: 85% [2]

UK: 86% [3]

Denmark: 95% [2]

Sweden: nearly 100% (source: Djurens Rätt), 2.5 million/pigs/year

The Netherlands: 43% (total annual 15.7 million pigs, of which stunned with CO₂ 6,7 million pigs; source: Dierenbescherming)

2.2. Physiological mechanism of CO₂ stunning

CO₂ stunning works by producing acidosis in the blood and cerebrospinal fluid. The consequence is the acidification of brain cells, with progressive loss of consciousness. At concentrations of CO₂ of 80% and higher, loss of consciousness occurs within 30 to 60s after the start of inhalation [4,5]. Most pigs exposed for a sufficient length of time to high-concentration CO₂ will actually be dead when they are released from the stunning box [4,6].

2.3. Commercial considerations

The use of CO₂ stunning has commercial advantages: meat quality is better than with electrical stunning (although problems with lumbar muscle haemorrhages persist and are a potential animal welfare concern; [7]); CO₂ is cheap and normally more readily available than other gases that could potentially be used instead or mixed with it; the use of CO₂ is compatible with speed of operations in large abattoirs (e.g., 800+ pigs/hour) as the pigs are moved and stunned in groups. Due to the initial investment, CO₂ stunning is more readily adopted by large abattoirs [2] than smaller abattoirs.

2.4. Animal welfare considerations

The main reason why we consider the use of CO₂ at high concentrations unacceptable for the stunning of pigs is **because it is highly aversive for the animals and causes acute pain and severe distress from first exposure to the gas to loss of consciousness.**

Atkinson et al. [8] report that:

“CO₂ gas at high concentration is acidic when inhaled causing severe irritation of the eyes, nasal mucosa, lungs, and an overall painful experience due to the presence of chemoreceptors in the throat (Raj and Gregory 1995). The lack of oxygen (O₂) also causes a severe sense of breathlessness which may cause severe distress. For these reasons EFSA (2004) concluded that CO₂ stunning is not optimal from an animal welfare perspective.”

Aversive behaviours (conscious phase) that have been reported in the literature include lateral head movements, sneezing, gasping, vocalisations, muscular excitation, aggression, neck extension, eye rotation, violent bulking [6,9]. Modifying the highest concentration of the gas in the chamber does not

influence the duration of the suffering: there are no detectable differences in time to loss of consciousness as recorded by posture and EEG between final concentrations of 80% vs. 95% CO₂ [9].

2.5. Alternatives to CO₂ stunning

Currently, there is no commercially available alternative to CO₂ at high concentrations for gas stunning of pigs. Several combinations of different gases have been studied in research settings, also in collaboration with slaughterhouses.

Based on a literature review carried out by Eurogroup for Animals' member organisations, the tested gas mixtures (argon and/or nitrogen associated with various concentrations of CO₂) generally result in less suffering than exposure only to high concentrations of CO₂ but often:

- They produce a less reliable stun (animal welfare problem)
- They take considerably longer to induce unconsciousness (5-6 min exposure required; commercial problem)
- They produce a shorter period of unconsciousness (animal welfare problem)
- The longer induction to unconsciousness may negatively affect meat and carcass quality (commercial problem)

3. Research into alternatives

Various solutions could be envisaged, in collaboration with the industry and with the support of European and/or national funding. Eurogroup for Animals considers it promising to invest further into methodologies such as:

- **Two-phase systems**
 - Non-aversive gas mixtures (for pigs in groups) to induce unconsciousness followed immediately by individual electrical killing
 - Exposure to a non-aversive gas such as argon + a maximum of 15% CO₂ to induce unconsciousness followed, once the pigs are unconscious, by high concentrations of CO₂ to kill the pigs
- **Non-aversive gas mixtures** (for the moment no "ideal" combination has been found according to the available scientific evidence)

Any alternative solution (apart from being *non-aversive*) should be not only fit for purpose, but also fit for the future, i.e., it should take into account important factors such as the time to unconsciousness/death, the depth and duration of unconsciousness if reversible, and the viability, cost, and safety of the method used.

Slaughterhouses that presently stun pigs electrically should not change to high concentrations of CO₂ but should instead improve their electrical system, for example by using a corral system for moving pigs, also taking into account measures to reduce stress in pigs when they are being separated from their group. More information is available on the [website of Eyes of Animals](#). In the future, these slaughterhouses should change to new methodologies if available and if acceptable from an animal welfare point of view.

The UK government and the Humane Slaughter Association are funding research into the feasibility of using Low Atmospheric Pressure Stunning (**LAPS**) to stun pigs. Eurogroup for Animals is aware of such research and will follow the relevant results.

4. References

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