

ARGON RETROFIT SYSTEM



Introduction

In 2004, the European Food Safety Authority (EFSA) identified the induction phase of carbon dioxide (CO₂) controlled atmosphere stunning (CAS) stunning as incompatible with animal welfare due to the aversive reactions that pigs show when exposed to the gas. The aim of the PigStun project is to encourage EU pig slaughterhouses using high concentrations of CO₂ for stunning pigs to convert to more animal welfare friendly systems, by testing technical specifications and feasibility for four promising alternatives that have been developed in other initiatives. These alternatives are the Argon Retrofit system, Helium system, Optimised CAS process, and Improved Electrical Stunning system.



Description of the system



How it works

The **Argon Retrofit system** is an alternative that uses argon (Ar) instead of CO₂, which is an inert gas that previous studies have shown to be less aversive when used as a stunning method, improving the welfare of animals. The Argon Retrofit system can be used following conversion of an existing commercial Dip-Lift or Paternoster high CO₂ stunning system. As such, this system was successfully tested in a low(er) throughput commercial Dip-lift setting¹.

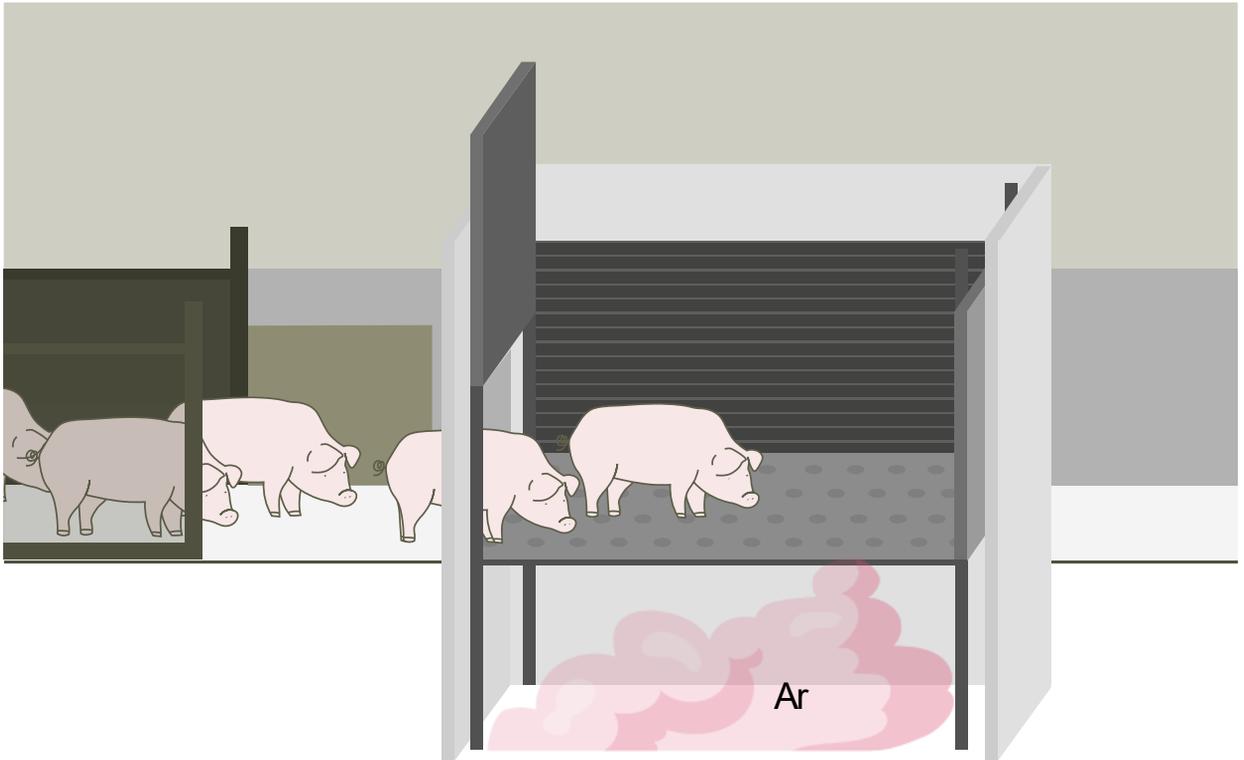
The Argon Retrofit system allows stable atmospheres of inert gases such as argon or argon-nitrogen mixtures at very low oxygen levels (<1%). This type of gassing system can be installed on the walls of the pit of an existing stunner. The Argon Retrofit system was tested in a Dip-Lift System and comparisons with regular CO₂ stunning were conducted inside the same stunner. Technical tests were also carried out in a Paternoster stunner to show that the required low residual oxygen levels can be reached.



Outcomes

The control unit (regulation of gas flow and alarms for inadequate gas atmospheres) for the stunner has to be adjusted for the use of argon and is controlled based on residual oxygen content. The Argon Retrofit system was tested in a Dip-Lift System, where gas atmospheres with residual oxygen contents well below 1% (<0.8%, mean <0.6%) were established. At a dwell time of 250s, no animals had to be re-stunned during the tests and the rate of insufficient stuns is expected to be low (<0.5%). During technical tests in a paternoster system without animals, residual oxygen levels of less than 1% were reached at the first and last stop, with oxygen levels at the bottom position being lower than those at the other positions. These technical tests indicate that the new gassing system can be used to stun pigs with argon in a commercial Paternoster system.

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Implementation of the system

For the implementation of the Argon Retrofit system, an existing CO₂ Dip-Lift or Paternoster stunner can be modified to use argon instead of CO₂. If the gas is replaced one to one in the system, there will be no need to alter the lairage or the driveway towards the stunner or the sticking area. For slaughterhouses with a Dip-Lift or Paternoster system to switch to this method, the Argon Retrofit system must be installed inside the pit of the stunner. Additionally, the control unit for the CO₂ system needs to be adjusted for the use of argon and residual oxygen content. Furthermore, the CO₂ tank needs to be replaced or supplemented by an argon tank. The installation can be completed within a few days. After these changes, the stunner is ready to be used with argon or other inert gas mixtures.

Conversion to the Argon Retrofit system will result in a loss in capacity due to the increased exposure time (up to 250s) that is needed to stun pigs properly, as compared to CO₂. The capacity can be maintained by either adding an additional retrofitted CO₂ stunner or by replacing the entire stunner with a larger model.

Strengths and weaknesses



Strengths

The strengths of the Argon Retrofit system are:

- 1) Existing infrastructure can be retrofitted with relative ease and modifications can be completed within a few days, if there is compatibility between the old and new system.
- 2) Low installation cost for conversion from an existing stunner.
- 3) Reduced aversion to argon during the induction phase compared to CO₂ (fewer pigs showing agitation or respiratory distress).
- 4) Reduced pre-handling stress because pigs are less reluctant to enter the stunner.
- 5) Argon is easily available, as it is extracted/produced from air.
- 6) The system can also be used with other inert gasses if the mixture remains heavier than air.



Weaknesses

The weaknesses of the Argon Retrofit system are:

- 1) An increase in exposure duration of approximately 40% is needed for a proper stun, reducing the throughput per stunner.
- 2) Argon is 4-5 times more expensive than CO₂.

Impact on key points



Animal welfare

The Argon Retrofit system significantly reduced aversion during the induction phase compared to CO₂, with fewer pigs showing strong agitation (2.3% vs 60.0%) and none showing abnormal breathing (vs 59.0% for CO₂). Pre-stunning stress was also reduced in this system compared to high CO₂, as pigs were less reluctant to enter the Argon stunner (5.7% vs 11.3%).



Economy

Adapting the stunner takes approximately 1-2 days, thus the conversion can be implemented relatively quickly in a working slaughterhouse. However, due to the 40% lower throughput rate, more lines should be implemented, if this cannot be compensated by longer working hours. For this reason, the estimated cost per pig is about 2 to 3 times higher than selected high CO₂ stunners used as reference in the PigStun project.



Environment

Argon is a good alternative to CO₂ as it can be reproduced in practically unlimited quantities.



Labour

The risk of inhalation by humans of toxic levels of argon was estimated to be lower compared with CO₂. According to the European Agency for Safety and Health at Work, inert gasses such as helium and argon will only pose a risk when present in high concentrations and O₂ is lower than 19.5%. CO₂ poses health risks already at much lower concentrations.



Meat quality

No differences in meat quality were found between the Argon Retrofit system and the local CO₂ control inside the same stunner, but the level of blood spots in the comparative trials was relatively high for both Argon and the CO₂ control condition (approx. 25% of samples had at least one blood spot).