Design and development of an industrial equipment farm slaughter of animals with controlled atmosphere considering the OIE’s Standards.

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ABSTRACT
Controlled atmosphere killing is performed by exposing animals to a predetermined gas mixture, by different methods. Inhalation of carbon dioxide (CO₂) induces respiratory and metabolic acidosis and hence reduces the pH of cerebrospinal fluid (CSF) and neurones thereby causing unconsciousness and, after prolonged exposure, death. Exposure to carbon dioxide does not induce immediate loss of consciousness, therefore the aversive nature of gas mixtures containing high concentrations of CO₂ and the respiratory distress occurring during the induction phase are important considerations for animal welfare. (OIE - Terrestrial animal health code. Chapter 7.6. Killing of animals for disease control purposes)

MATERIALS
The gas valve includes a pressure regulator to provide the gas concentration needed for optimal sacrifice with a clear reading. It also includes a heater, which allows the gas to reach room temperature, so as to avoid causing pain or cold discomfort. The “S” tube shape allows homogenous dispersion of gas. The window and light allow the observation of animals in order to confirm death without opening the lid, which also prevents the loss of gas concentration; the basket allows animals to be transported without improper handling. The case materials are intended to prevent deterioration as a result of weather conditions and they are cheap and easy to clean. The wheels allow easy transportation to bring the whole equipment closer to the animals. The chronometer allow to measure the time of exposure and the CO₂ meter allow to monitor and alert about the correct CO₂ concentration.

INTRODUCTION
One of the main problems concerning emergency slaughter is having the right equipment to properly implement the OIE animal welfare recommendations. There are countries and situations where, although the intention is good, the poorly-designed available equipment and incorrect use of equipment cause even greater suffering. Furthermore, graphic media images of the farm slaughter process using poor equipment and methods results in heavy criticism by the general public.

These factors and the variability in conditions between farms to deliver good animal welfare outcomes makes enforcement of animal welfare laws very challenging. For this reason a need arose to develop portable well-designed industrial equipment. This has been designed with the necessary expertise and scientific and technical input to be able to monitor the whole animal management process from handling and moving animals through yards to the point of humane slaughter and confirmation of death.

Another very important issue is the requirement for the staff to have the necessary skills, experience, attitude and training to use the specially designed equipment to achieve good animal welfare. Therefore, equipment should be of efficient and simple design so that people can be easily trained to use it properly.

OIE—Animal Welfare Recomendation for CO₂ / air mixture
Requirements for effective use in a container or apparatus:
1 Containers or apparatus should allow the required gas concentration to be maintained and accurately measured.
2 When animals are exposed to the gas individually or in small groups in a container or apparatus, the equipment used should be designed, constructed, and maintained in such a way as to avoid injury to the animals and allow them to be observed.
3 Animals can also be introduced to low concentrations (as low concentrations are not aversive) and the concentration could be increased afterwards and the animals then held in the higher concentration until death is confirmed.
4 Team members should ensure that there is sufficient time allowed for each batch of animals to die before subsequent ones are introduced into the container or apparatus.
5 Containers or apparatus should not be overcrowded and measures are needed to avoid animals suffocating by climbing on top of each other.

Advantages: CO₂ is readily available. Application methods are simple. The volume of gas required can be readily calculated. As the units are operated outdoor, the gas is dispersed quickly at the end of each cycle by opening the door, improving operator’s health and safety. The system uses skilled catching teams and equipment in daily use by the industry. Metal containers can be readily cleansed and disinfected.

Disadvantages: The need for properly designed container or apparatus. The aversive nature of high CO₂ concentrations. No immediate loss of consciousness. The risk of suffocation due to overcrowding. Difficulty in verifying death while the animals are in the container or apparatus.

Conclusion: Method 1 is suitable for use in poultry, and neonatal sheep, goats and pigs.

CONCLUSION
The prototype created was designed by veterinarians with extensive experience in animal welfare, taking into account the industry’s needs. Specifically, it can be used for farm slaughter of poultry, sheep, goats, newborn animals and pigs up to the age of weaning. If used properly, it will deliver the necessary animal welfare standards for humane slaughter. It will address ethical concerns by the public, is cost effective, safe for operators and supports biosecurity, environmental and aesthetic requirements.