

## ANIMAL WELFARE

**Title:** The use of different gases and gas combinations to humanely euthanize young suckling pigs - #NPB #09-199 **Revised**

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**Date Submitted:** 2/14/2011

### Scientific Abstract:

When euthanasia of sick or injured animals is required on animal welfare grounds, a method that induces minimal welfare compromise should be chosen. Blunt force trauma to the head is currently the most commonly employed means for on-farm euthanasia of pre-weaned piglets. When performed correctly, loss of consciousness is immediate, but the potential for delivery of sub-lethal blows, along with aesthetic unacceptability to many operators, has led to the need for alternative methods to be developed. The objective of this study was to evaluate different gases and gas mixtures (CO<sub>2</sub>, argon and nitrogen) as a humane method for euthanasia of young suckling pigs. In experiment 1, piglets received one of five gas treatments: 100% carbon dioxide (CO<sub>2</sub>), 90% argon in air (Ar), 90% nitrogen in air (N<sub>2</sub>), a mixture of 30% carbon dioxide/60% argon in air (Ar/CO<sub>2</sub>) or a mixture of 40% carbon dioxide/50% nitrogen in air (N<sub>2</sub>/CO<sub>2</sub>). In experiment 2 and 3, piglets received one of three gas treatments: 100% carbon dioxide (CO<sub>2</sub>), 100% argon (Ar), or a mixture of 40% carbon dioxide/60% argon (Ar/CO<sub>2</sub>). On each occasion a chamber was filled with the test gas and a piglet was placed inside. Throughout the experimental period, behavioral (escape attempts, vocalization, loss of coordination, respiratory effort, convulsions) and physiological (electroencephalogram (EEG), electrocardiogram (ECG), respiratory rate) data were continuously recorded until death. In addition, plasma cortisol and adrenaline levels were determined before treatment and immediately following death. A welfare index was established to assess the relative welfare compromise induced by each gas treatment. The index included five behavioral measures observed in the period prior to apparent loss of consciousness, beyond which there was no further potential for welfare compromise. These measures were: latency to onset of convulsions, duration of escape behavior, duration of increased respiratory effort, respiratory effort grade and duration of squealing. In experiment 1, four of the five gas treatments evaluated (Ar, CO<sub>2</sub>/Ar, N<sub>2</sub> and CO<sub>2</sub>/N<sub>2</sub>) contained 10% air and therefore 2.1% residual oxygen. The duration of labored breathing, indicative of respiratory distress, was greater in those treatments containing residual oxygen. Additionally, animals in three of the residual oxygen treatments exhibited conscious behavior after the initial onset of convulsions, representing potentially serious welfare compromise due to distress or injury sustained during convulsions. Based upon the latency to respiratory arrest in each treatment, it appears that the inclusion of residual oxygen may prolong the survival time of piglets when exposed to lethal hypoxia or hypercapnic hypoxia, without any apparent welfare benefit. It was thus decided to exclude residual oxygen from the gas treatments evaluated in the subsequent experiments the following three gas treatments were selected for further evaluation: 100% carbon dioxide, 100% argon and 40% carbon dioxide/60% argon. In experiment 1 and 2, the sum of ranks for each animal across the 5 measures yielded a single score indicative of welfare compromise, with a lower score equating to less

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These research results were submitted in fulfillment of checkoff-funded research projects. This report is published directly as submitted by the project's principal investigator. This report has not been peer-reviewed.

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compromise. According to this index, CO<sub>2</sub> induced significantly greater welfare compromise ( $49.8 \pm 2.77$ , mean  $\pm$  SEM) than either Ar ( $35.2 \pm 3.56$ ), or Ar/ CO<sub>2</sub> ( $37.0 \pm 0.89$ ). These results suggest that 100% CO<sub>2</sub> may cause piglets' distress prior to loss of consciousness. Although argon and the mixture did not significantly differ in terms of welfare impact, times to loss of consciousness, isoelectric EEG and respiratory arrest were significantly shorter with Ar/ CO<sub>2</sub> than Ar ( $P < 0.05$ ), making this potentially more useful from a practical standpoint. However, the degree of welfare compromise observed in all treatments suggests that other alternatives to manually applied blunt trauma should be investigated.