

Title: Validating water-based foam for the depopulation of swine – NPB #21-070

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Scientific Abstract:

Swine populations are susceptible to infectious diseases, and those instances urgent responses including large-scale depopulation may be required to control and prevent farm-to-farm transmission during outbreaks. The American Veterinary Medical Association (AVMA) recommends a number of methods for swine depopulation, but their efficiency for large populations is debatable. In this study, water-based foam (WBF), an AVMA-approved method in poultry, was adapted to swine. The objectives of the study were to describe “time to animal unconsciousness” and “time to non-recoverability” using WBF; and to provide a recommendation on the duration of WBF foaming under field conditions. Additionally, the perceptions of people observing application of WBF to pigs was also assessed.

Two trials (Trial 1 and 2) were conducted for a stepwise evaluation on the use of WBF in swine. Trial 1 assessed time to unconsciousness by immersing 72 feeder pigs (6 pigs for 12 replicates) in WBF for 6 time periods (2.5, 5, 7.5, 10, 12.5, and 15 minutes post-fill (MPF); 2 replicates per time period). The recoverability of foamed pigs was assessed via different levels of vital signs, and the time period for which no “Level 2” were present was selected for Trial 2. In Trial 2, 135 cull sows (3 replicates of 45 sows) were loaded into an adapted rendering dump trailer (40 × 8.5 × 6 in) and immersed in WBF for the period suggested in Trial 1. Activity bio-loggers (Star-Oddi©) were implanted in 6 sows in each replicate to measure animal movements. The last movement was determined by the last external acceleration measurement beyond the third quartiles + 1.5 times the interquartile range. For both trials, pigs with any signs of consciousness were immediately euthanized by captive bolt.

In Trial 1, kicking, respiratory rhythm, and convulsions were absent while regular gasping and corneal reflex were observed respectively in 3 and 12 pigs at 2.5 minutes MPF. Consciousness signs > “Level 1” were absent at ≥ 5 MPF; thus, sows were immersed for 5 MPF in Trial 2. In Trial 2, the mean durations between end of trailer WBF fill and last animal movement (min:sec) as per bio-loggers were 1:332:40 (SD=1:31), 1:102:26 (SD=1:11), and 0:221:58 (SD=0:47) for replicates 1, 2, and 3 respectively. All sows were deemed unconscious after unloaded from the trailer.

In a third trial, EEGs were performed on 12 feeder pigs as they were depopulated with WBF. The average time to onset of transitional period (i.e. unconciseness) was approximately 2 minutes; and the average time to onset of isoelectric period was 3 minutes and 10 seconds

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Invited stakeholders (n=33) completed pre- and post- surveys on perceptions regarding animal behavior, methodology, and likelihood of field success. The WBF depopulation process was applied in cull sows. Comparing pre- to post- survey responses, the actual time (in minutes) to fill the trailer with foam (5.0 ± 12.0 vs. 1.0 ± 0.7), stop hearing animal vocalizations (5.0 ± 6.5 vs. 0 ± 1.0), and stop hearing animal movements (7.0 ± 6.0 vs. 2.0 ± 0.25) were all shorter than anticipated ($P < 0.001$). Additionally, the majority of participants indicated WBF was a better method than currently approved depopulation methods (e.g. captive bolt, electrocution, CO_2), which was significantly higher than before they observed the process (86.7% vs. 56.3%; $P = 0.008$) Additionally, observers reported few to no negative long-term mental health impacts after observing depopulation of swine with water-based foam.

Based on our studies, WBF could be an attractive method for emergency depopulation in swine. Given our assessment of time to unconsciousness in feeder pigs and our field validation in sows, we recommend that 7.5 minutes of submersion should be used to ensure unconsciousness and subsequent death. Our findings support efforts to seek conditional AVMA approval of water-based foam as an emergency depopulation option for all ages of swine.