RESEARCH ABSTRACT

pork checkoff

SWINE HEALTH

Title: Low Cost Mobile CO_2 Vaporizer System Prototype - 2020 – **NPB #20-146**

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Date Submitted: 06/23/2021

Scientific Abstract: CO_2 based depopulation of swine has been considered a viable approach for small animals, however the process is typically not used for large animals due to the availability of large volumes of gaseous CO_2 required for use in large depopulation chambers. The best option for CO_2 supply to these large chambers is on site liquid CO_2 vaporization, which is not a feasible expectation for swine operations. To overcome the drawbacks of fixed equipment on every swine farm, a trailer mounted CO_2 vaporizer system was proposed. This trailer mounted CO_2 vaporizer system was designed for low cost, to be easily transported between farms and easily setup and operated. To achieve all of these goals the system has limited electrical components with only one electronic flow and temperature meter that is connected to a digital readout and is powered internally off of the trailers battery (which is recharged during towing). The system is short (18 foot) lightweight (4550 lbs.) and can be towed easily with a 3/4 ton truck. The system is designed to be connected to a bulk delivery vehicle meaning that there is no need for any external infrastructure on the site. The system can be operated by two people with minimal training, during testing operators that had not operated the system before were capable of controlling the system within a few minutes of starting.

The system was designed and tested in Alberta, Canada with typical prototyping processes. There was design and construction, follow by testing and identification of system flaws. After a quick redesign the system operated as expected on the testing day. The testing demonstrated that the trailer mounted CO_2 vaporizer system was capable of providing the AVMA required flow of CO_2 for the proposed depopulation chambers:

- Dump truck (11.5'X7.2'X4') 67 CFM
- Dump Trailer (7.6'X18'X4') 110 CFM
- Roll off (20 yd -21.5'X7'X4') 121 CFM
- Semi (48 ft) (47.6'X8.2'X4') 313 CFM
- Semi (53 ft) (52.5'X8.2'X4') 345 CFM
- Custom (16'X48'X4') 615 CFM

Testing occurred on a warm day (approx. 80°F), and it will therefore require further testing and verification when the ambient temperatures are closer to the lower design temperature of -30°F. Modelling by both the vaporizer manufacturer and the design team indicates that the temperature will not be a concern, but this needs to be fully verified with testing.

Testing also demonstrated that the pressure in the vaporizer was able to be reduced from the supply pressure of 300 PSI to 80PSI in the vaporizer meaning that ambient air vaporization can be achieved at low ambient temperatures without dry ice formation.

Based on the testing conducted, the trailer mounted CO_2 vaporizer system prototype was considered a success meeting all design goals: it is easily transported, setup, and operated; it is capable of providing gaseous CO_2 for all proposed depopulation chamber sizes, it can be cleaned using most conventional cleaning solutions available at swine operations; and it can be constructed for $75 000 USD.

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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