RESEARCH ABSTRACT

ANIMAL WELFARE

Title: Development of improved trailer designs and transport management practices that create the optimum environment for market weight pigs during transport and minimize transport losses – **NPB #05-192**

Investigator: Mike Ellis

Co-Investigators: Xinlei Wang, Ted Funk, Bradley Wolter, Christina Murphy, Andrew Lenkaitis, Yigang Sun, Chad Pilcher

Institution: University of Illinois
The Maschhoff's Inc.

Date Submitted: October 9th, 2008

Scientific Abstract:
The objective of this project was to develop a computer simulation model to predict micro-environmental conditions on a swine transport trailer during transportation from the time of loading the pigs at the farm, during the journey, to the time of unloading pigs at the plant under the range of typical external ambient conditions. A trailer of typical current design was equipped with instrumentation in all 11 compartments to measure internal temperature, relative humidity, air velocity, surface temperature of the inside surfaces of the trailer and of the pigs, and carbon dioxide concentration. Measurements were taken every 6 sec during the journey on a total of 20 loads of pigs (156 pigs/load; average live weight 132 kg; floor space on the trailer 0.48 m^2/pig) under standard transportation conditions (total time from start of loading to end of unloading 5.5 hours; distance from farm to plant 220 km) in journeys in all four seasons. These data were used to construct a three-dimensional Computational Fluid Dynamic model, the results of which were used to develop recommendations for improvements of current trailer designs and transport management practices.

There was considerable variation in all environmental parameters measured on the trailer between seasons and, also, within season, between decks and compartments of the trailer, and between stages of transportation. For example, average compartment temperature during the journey were considerably lower in winter than in summer [6°C (42°F) vs. 29°C (85°F), respectively], with temperatures in the spring (17°C; 63°F) and Fall (19°C; 67°F) being intermediate and similar. The greatest variation in temperature between compartments within the trailer was observed in the winter. The compartments in the front of the trailer generally had higher temperatures than those in the rear, particularly in the winter, which reflects the likely direction of air flow from the rear to the front of the trailer. Increases in internal trailer temperature were generally greater at times when the trailer was stationary and air movement was limited, particularly during the period at the farm.

Major recommendations for improvements of trailer design based on model simulations included varying the size, shape, and/or position of the ventilation openings along the trailer side to provide the variable ventilation rates required to maintain conditions in all locations on the trailer within comfortable ranges for the pigs. Ideally, the opening and closing of the side wall openings to change air flow should be automated so that adjustments can be made more quickly in response to the rapidly changing conditions that can occur during the journey due, particularly, to changes in vehicle speed.

Further research is needed to validate the current model, to obtain more detailed measurements of the direction as well as the speed of air movement within the trailer, and to make measurements at more locations within each trailer compartment.