Swine odor and manure management are important for the long term vitality of the swine industry in Illinois. Odor complaints for existing facilities can be quite difficult for a producer to know what to do in attempting to decrease odor emitted from the farm. Odor is related to many different factors, some of which can be controlled by producers and some which cannot be controlled by producers. This project investigated the controllable and uncontrollable factors that were related to the amount of odor emitted from swine finishing buildings.

We monitored 26 buildings on 10 different farms, with buildings from a farm monitored on four different days over the course of a 15 month period. Each farm visit was separated by 3-4 months. During our farm visits, we collected data and samples for measuring air quality and odor. Barn inspections were conducted to determine barn cleanliness, surface dustiness, air cleanliness, type of feed (pelleted or ground), problems with dunging, depth of manure in the pit, and type of pit (either shallow (<4 f; manure stored < 2 wks) or deep ( >4 f; manure stored >6 mo)). Other data recorded and observations made were inventory of pigs in the barn, barn dimensions and layout in order to estimate floor space/pig, pig size, and a general impression of pig health. Several measures relating to air quality and air characteristics were recorded. We measured air temperature, relative humidity, carbon dioxide, ammonia, and hydrogen sulfide concentrations. We collected bagged air samples from barn inlets and exhausts, and recorded information on the number and size of fans that were running at the time of sample collection, and from which of the fans samples were collected.

The bagged air samples were analyzed for odor by an eight-person odor sensory panel. Each person was presented an air sample from the farm which had been diluted by a controlled amount. Each person is simultaneously presented with room air samples. The dilutions are changed after each round of sniffing three samples (two with only room air and one diluted with the farm air), so that the sample becomes less dilute (has more air from the farm in the air that is sniffed). Each person is then asked when they believe that they can just distinguish the room air samples from those samples that are mixed with air from the farm. The machine used for this process is called a dynamic olfactometer, and has become a standard method for evaluation of odor detection. Recordings of the
amount of sample when accurate detection occurs are an indication of the "amount" of odorous compounds in the sample.

One goal of our overall project was to be able to look at correlations and statistical relationships to see what we could learn about the factors on the farm that are most closely linked to odor emission rates from these 26 mechanically ventilated swine buildings. What we learned was interesting. Of the variables studied, there are some which are outside of the control of the producer that are statistically associated with odor. These factors included season, ambient temperature, and relative humidity. Thus, it is clear that producers have times when odor is more likely to be higher because of these uncontrollable factors. The spring season had the lowest odor emission rates of any season. As temperature and relative humidity increased, odor emissions decreased. We are uncertain as to why this occurred but believe it may be because of the complex relationships between humidity and dustiness, the water carrying capacity of air as temperature increases, and the affinity of water molecules to odorous compounds. There are other factors which are at least somewhat controlled or completely controllable by the producer that influence odor. These factors included manure depth, floor-space per pig, barn cleanliness, air cleanliness, pit type (deep or shallow), and pig health. As manure depth increased, so did odor emissions. While building type cannot be changed in the short run, the choice of pit depth is within the control of the producer at the time of construction. Barns with deep pits were found to emit less odor than a comparable building with a shallow pit. This relationship held as long as the manure depth in the deep pit was less than approximately 3 feet. Other management variables studied had predictable associations with odor emissions. For example, barns with more space per pig emitted less odor. Barns with cleaner air emitted less odor. However, some of the barn management observations were not related to odor in the way we would have anticipated. For barn cleanliness, and pig health, these factors had opposite effects than we predicted. As barn cleanliness improved, odor emitted increased. Also when pig health was good, odor emitted increased. Panelist was also an important variable in explaining ability to detect odor in air samples. The statistics associated with known factors (those mentioned above) could explain only about half of what causes barn-to-barn variability in odor emissions. The other half of the variability in odor emissions is occurring for reasons that we could not explain based on our observational study. Thus, not only are there uncontrollable factors that influence odor emissions, there are a lot of other unobserved (at least in this study) factors which influence odor. The variables from our study which did not appear to be associated with odor emissions included feed type (pelleted or ground), surface dustiness, and dunging.

The full report of this study is currently under consideration for publication in a refereed journal. A copy of our preprint manuscript is available upon request.

Another goal of this project was to use the results from this study where we were able to find relationships between management factors and odor emissions in combination with costs to be able to estimate the cost-effectiveness of different control strategies a producer might use when attempting to decrease odor emissions. This cost-effectiveness analysis is reported on separately (summary of this study is included in this Proceedings).