S-1025 (2006-2012)

Emissions from Dairy, Swine & Poultry Facilities

This project has provided extensive, high-quality emissions data and robust, low-cost strategies for mitigating particulate matter, gas, and odor emissions from animal housing, thus reducing indoor and downwind concentrations and protecting animal and human health, producer profits, and a stable, safe food supply.

Photo by Ken Casey, Texas A&M AgriLife Research

Who cares and why?

Dairy, swine, and poultry production are major industries in the U.S. Total production has continued to increase over the past two decades; however, the number of production operations has rapidly decreased. Although there are fewer facilities, they are larger and more productive and have concentrated air pollution in both the indoor environments and their surroundings. These operations emit odorous and hazardous dusts, gases (like methane and nitrous oxide), and microbiological pollutants (such as bacteria and viruses). Airborne pollutants affect the productivity and well-being of the animals, comfort and health of workers, quality of life for neighboring communities, and energy and resource use on the farm. Although some promising technologies for controlling emissions have been developed, cost and practicality are still concerns for producers. Technologies must be tailored for use in indoor facilities and engineered to deal with the targeted pollutant. A multidisciplinary approach involving scientists and engineers is needed in order to design feasible solutions that help producers meet demands for improved air quality, reduced emissions, improved animal welfare, and safe, low-cost food.

What has the project done so far?

Over the past six years, S-1025 scientists, engineers, and extension professionals from 20 universities across the U.S., USDA-ARS stations, and foreign universities have worked with producers, agricultural equipment suppliers, regulators, public health workers, veterinary experts, and other groups to solve air quality issues associated with poultry and livestock production. Researchers have completed comprehensive measurements of gas, particulate matter, and odor concentrations and emissions from swine, poultry, and dairy buildings and manure storages. As part of the National Air Emissions Monitoring Study (NAEMS), S-1025 scientists have provided benchmark emissions rates, which the U.S. EPA is using to develop "Emissions Estimating Methodologies." S-1025 scientists have also refined sensor systems and air sampling tools for monitoring air pollutant concentrations and airflow rates. S-1025 scientists and engineers have conducted many studies and side-by-side comparisons to determine the effectiveness of various emissions mitigation strategies, including dietary changes, manure treatments, filters, sprinkler systems, shelterbelts, vegetative buffers, and new facility designs and bedding types. Moreover, project members have played a key role in training students and researchers and have shared information through workshops, outreach programs, peer-reviewed journals, popular press articles, an online decision aid, and a video series. To address barriers to adopting mitigation technologies, S-1025 extension professionals have engaged with stakeholders to assess perceptions, concerns, and knowledge about agricultural air quality and emissions.

Impact Statements

Fostered collaboration that resulted in robust, practical, well-tested solutions.

Offered solutions that help livestock producers maintain profits and provide a safe, affordable food supply. For example, shelterbelts and diet changes have been readily adopted by producers because they are relatively low-cost, easy-to-implement solutions with immediate mitigation effects.

Reduced threats to public health and improved neighbor relations by mitigating emissions from livestock facilities. For example, better manure management (such as covering manure lagoons, injecting manure below the soil surface, and treating manure with chemicals) have reduced odor complaints in many areas.

Improved the well-being, performance, and economic value of livestock by informing producers about equipment, management practices, and facility designs that provide healthier indoor environments for animals.

Created better models that track the dispersal of emissions and identify sources of pollutants—information needed to optimize the design and siting of indoor livestock facilities.

Developed monitoring and measurement tools that have been used in 13 states for more than 30 laboratory and long-term field studies in the U.S. and China.

Helped farmers target problems and adjust strategies to seasonal climatic changes and animal growth cycles by providing precise emissions measurements.

Helped regulators set new regulations and make sure that producers meet environmental protection requirements with detailed emissions data from the NAEMS.

Developed and tested various bedding materials that reduce ammonia emissions from poultry facilities—a major concern for producers. These are timely findings since traditionally-used materials are in short supply.

Researchers at the University of Minnesota have tested a vertical biofilter that treats exhaust air from a commercial-type pig nursery barn. Exhaust air flows from the barn through ducts and then into a tall, packed bed of living material that biologically degrades the pollutants in the exhaust air. Photo by Larry Jacobson, University of Minnesota.

Researchers have positioned a sampling port and instruments in front of the primary exhaust fan in this building to measure exhaust gases, particulates, temperature, and relative humidity. Photo by Ken Casey.

What research is needed?

More research and testing are needed to develop technologies for improving the air quality of and reducing emissions from animal production facilities. Increased focus should be given to environmental design standards for reducing the water footprint and fossil fuel and feed energy use in indoor livestock facilities. Animal wellbeing and animal care should also be incorporated into livestock facility design standards. In particular, more work is needed to develop non-evaporative cooling options for lowering heat stress and improving animal performance in response to higher nighttime temperatures and humidity levels. Due to shortages of pine shavings and sawdust, evaluating bedding material alternatives is also a high priority.

Want to know more?

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