Air Quality: Reducing Feedlot Emissions

Federal Initiative Accomplishments

2010

Lead Agency
Texas AgriLife Research
Partners
Kansas State University; West Texas A&M University; Texas AgriLife Extension Service; USDA Agricultural Research Service
Federal Funding
USDA National Institute of Food and Agriculture
Jobs Generated
15 FTEs
Nonfederal Funds Leveraged
$781,500

AgriLIFE RESEARCH
Texas A&M System

AgriLIFE EXTENSION
Texas A&M System

Purpose/Objectives

To develop a sound scientific basis for generating cost-effective air quality emissions abatement measures; process-based emission models; science-based dispersion models, and accurate emission factors for open-lot cattle feedlots and dairies in the Southern Great Plains states of Texas and Kansas. Air quality constituents included particulate matter (PM), or "dust," ammonia, hydrogen sulfide, odor, volatile organic compounds (VOCs), and greenhouse gases (GHGs).

Accomplishments/Impacts

- Helped refine management practices for feedlot PM control through research at cooperating feedlots and field laboratories. PM_{10} reductions using a sprinkler system for dust control were 50%–55% average, compared with 70% reductions from rainfall at Kansas feedlots.
- Determined the critical threshold for reducing PM_{10} emissions to be 20% pen surface moisture content; sprinkler applications were more efficient when applied in late afternoon. Recurrent evening peak concentrations at cattle feedyards were greater for PM_{10} (larger particulates) than for $PM_{2.5}$ (fine dust) and were less pronounced at an open-lot dairy than in cattle feedyards.
- Determined nitrous oxide emissions to be much higher on freshly scraped (moist) dairy manure surfaces compared with dry manure surfaces at a New Mexico dairy.
- Determined that cattle fed steam-flaked corn diets used in Texas and Kansas gave off significantly lower enteric methane emissions than steers fed dry-rolled corn diets used in the Midwest, with similar carbon dioxide production.
- Determined that replacing corn and protein supplement with 30% dry-base wet distillers grain did not affect enteric methane production when the diets were balanced for fat concentration.
- Identified 13 volatile fatty acids with acetic acid concentrations five times higher from the free-stall barn than from the primary lagoon.
- Determined that feedlot surfaces contributed 96% of phenol and p-cresol summertime emissions as odorous VOCs, which is much greater than compost windrows and runoff retention structures.
- Determined that emission rates from the feedlot surface, compost windrows, and runoff retention structures were much lower for methane than for carbon dioxide.
- Conducted three seminars for beef feedlot and dairy producers in Texas and Kansas.
- Ammonia and hydrogen sulfide emissions results from this project were adopted by the National Cattlemen's Beef Association and the Environmental Protection Agency to satisfy the feedyards' reporting requirements under the Emergency Preparedness and Community Right-to-Know Act.
- Presented the first estimates of cost-per-unit emissions reduction for sprinkler dust control on cattle feedyards, based on results of economic surveys, abatement-measure evaluations, and emissions measurements.
- Conducted training courses for the Texas Commission on Environmental Quality and regulators from nine central states on PM emissions, dispersion modeling, emission rate calculations, abatement measures, and permit requirements.