Air Quality: Reducing Feedlot Emissions

Federal Initiatives Accomplishments

2007

Lead Agency:
Texas AgriLife Research

Partners:
Texas AgriLife Extension Service,
West Texas A&M University,
Kansas State University,
U.S. Department of Agriculture–
Agricultural Research Service

Federal Funding:
U.S. Department of Agriculture–Cooperative State Research, Education, and Extension Service (CSREES)

AgriLIFE RESEARCH
Texas A&M System

AgriLIFE EXTENSION
Texas A&M System

Purpose/Objectives

To conduct field and laboratory research to develop science-based emission factors and cost-effective abatement technologies for dust, particulate matter, ammonia, hydrogen sulfide, odor, and volatile compounds from cattle feedlots and dairies in Texas and Kansas. This will improve sustainability of cattle and dairy operations as vital economic sectors of rural communities in the Southern Great Plains, while addressing environmental air quality issues through control and mitigation strategies based on sound science.

Accomplishments/Impacts

- Determined that the primary odorants several miles downwind of cattle feedyards are phenolic compounds and that a genetically modified yeast resulted in a 70%–90% reduction in airborne odorous phenolic compounds.
- Showed that, in laboratory conditions, zeolite added to feedlot surface manure decreased ammonia emissions by 25%–50%; zeolite plus alum reduced ammonia emissions by 70%; and cornstarch reduced ammonia emissions by approximately 85%.
- Demonstrated that supplementing cattle diets with 3% added fat decreased laboratory ammonia losses by more than 30%.
- Showed that phase feeding (reducing dietary crude protein) decreased nitrogen volatilization losses by 16%. Varying protein at 48-hour intervals decreased apparent nitrogen volatilization losses by 10%–20%, when compared to steers fed a constant 11.5% crude protein diet.
- Completed field evaluations of a prototype water curtain system, which yielded 20%–40% near-field particulate matter reduction.
- Project results from dairy particulate matter monitoring has led the California Air Resources Board to reduce its adopted emission factor.
- In laboratory tests, Kansas State University researchers determined that 6%–10% of feedyard dust could be deposited in the deep lung, with potential to cause inflammation.
- Continuous feedyard monitoring indicated three factors responsible for particulate matter peaks in early evening in warm, dry weather: daytime moisture evaporation, increased cattle hoof activity, and reduced mixing height. Abatement strategies such as water sprinkling can mitigate the onset of three-hour peak dust concentrations.
- Documented large errors when EPA samplers were the only means available for monitoring feedyard particulate matter; correcting federal measurements to account for oversampling of larger particles can yield more accurate results.
- A new ammonia wet- and dry-deposition monitoring site at Palo Duro Canyon, Texas, was approved, serving both USDA National Atmospheric Deposition Program and EPA Clean Air Status and Trends Network national monitoring systems. When instrumented using project funds, the new site will fill a geographic data gap overlying a major livestock-feeding region.
- Construction began on a 70-ton/day feedlot manure-fired steam-generating plant supplying renewable energy for a co-located ethanol plant in the Texas Panhandle. The manure-fired system, which drew from AgriLife Research project expertise, is expected to provide economic incentives for collecting surface manure to maximize heating value and will likely reduce ammonia emissions as well.