Managing Ammonia Emissions

ARE WE THERE YET?
Past Roads, Future Paths
An Update
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Where the Farms Are

“If you build it, they will come”

*The Voice, Field of Dreams*
NC As An Agricultural State

- Long, established farm history
- Crops
  - Tobacco
  - Corn and Cotton
  - Soybeans
  - Peanuts
- Hogs
- Poultry (broilers and turkeys)
NC As An Agriculture State (cont’d)

- Large human population growth in the 1980’s, 1990’s, and in this most recent decade
- Three large population centers
  - RTP
  - Triad
  - Charlotte
- Much of the state is rural though major transportation corridors are urban/suburban.
Regulated Poultry Farms in NC

Division of Air Quality
Regulated Cattle Farms in NC

Division of Air Quality
Regulated Hog Farms in NC
All Farms Regulated in NC by NC DENR
Applicability of NC DENR Regulations

- Liquid animal waste systems
  - >250 swine
  - >100 confined cattle
  - >75 horses
  - >1,000 sheep
  - >30,000 confined poultry
- Operating Certificate (requires training and passing test)
Applicability of NC DENR Regulations (cont’d)

- Certified animal waste management plan from Technical Specialists (NC DSWC or NRCS)
- General permit from NC DWQ
- Odor Management Plan for largest swine farms (>1,000,000 lbs SSLW)
- NC’s animal industry generates approximately 30 million tons of manure/yr
Number of Hog Farms Decline

Hog Farms in NC

Division of Air Quality
Historical Trends in NC (Hog Farms & Inventory, 1970-2007)
Distribution of Farms by Size
NC Trends

- First major decrease in number of farms between 1970 and 1975 (~21,000 farms)
- Number of small farms (<1000 swine) now account for less than half of all farms raising hogs
- In 2007, there was a significant resurgence in the small farms (<100 swine) and in the 1000-1999 swine category
NC Trends (cont’d)

- Increase in “large farms” from 1990 to present day
- ~610 farms (out of 2800) with more than 5000 animals account for 75% of production
- ~1140 (out of 2800) with more than 2000 animals account for 92% of production
- Small farms account (<100 animals) for 0.1% of total production
- ~2150 farms are regulated by DENR
NC Hog Growth by Region & Co
This map represents the number of swine in each county, as defined by G.S. 143-215.10B, by county. This information was derived from the US Department of Agriculture database.
Swine in North Carolina in 1980

This map represents the number of swine in each county, as defined by G.S. 143-215.10B, by county. This information was derived from the US Department of Agriculture database.

Legend
- >250,000 Animals
- 100,000 - 250,000 Animals
- 50,000 - 100,000 Animals
- 25,000 - 50,000 Animals
- 5000 - 25,000 Animals
- <5000 Animals

Division of Air Quality
Swine in North Carolina in 1985

This map represents the number of swine in each county, as defined by G.S. 143-215.10B, by county. This information was derived from the US Department of Agriculture animal operations database.
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Legend
- >500,000 Animals
- 250,000 - 500,000 Animals
- 100,000 - 250,000 Animals
- 50,000 - 100,000 Animals
- 25,000 - 50,000 Animals
- 5000 - 25,000 Animals
- <5000 Animals
This map represents the number of swine in each county, as defined by G.S. 143-215.10B, by county. This information was derived from the US Department of Agriculture animal operations database.
Swine in North Carolina in 2000

This map represents the number of swine in each county, as defined by G.S. 143-215.10B, by county. This information was derived from the US Department of Agriculture animal operations database.
Swine in North Carolina in 2005

This map represents the number of swine in each county, as defined by G.S. 143-215.10B, by county. This information was derived from the US Department of Agriculture animal operations database.

Legend
- >500,000 Animals
- 250,000 - 500,000 Animals
- 100,000 - 250,000 Animals
- 50,000 - 100,000 Animals
- 25,000 - 50,000 Animals
- 5000 - 25,000 Animals
- <5000 Animals

Division of Air Quality
Animal Operations in North Carolina

This map represents the number of animal operations, as defined by G.S. 143-215.10B, by county. This information was derived from the Department of Water Quality animal operations database.

Legend
- > 100 Animal Operations (annotated with actual value)
- 50 - 100 Animal Operations
- 10 - 50 Animal Operations
- 1 - 9 Animal Operations
- 0 Animal Operations
Controlling Ammonia Emissions

- Not directly regulated except for new and modified farms.
- New and Modified Farms: EST or equivalent to farm-wide emissions of 1.0 lb/week/1000 lb SSLW (75% control) and specific odor limits
- Existing Farms: Indirectly “controlled” through odor management and regulations
- Management techniques may increase ammonia emissions
- Emissions of other odorous compounds may be reduced
Odor Complaints in NC
Sources of Ammonia/Odors

- Confinement Buildings
- Lagoons
- Spray Fields
  (spraying to fields a significant ammonia source)
Sources of Odors

- Undersized lagoons
- Poor balance between nutrient requirements and supply
- Poor water balance
- Trade-off between NH₃ and VOCs?
Sources of Odors

- Lagoons
- New design standards
- Larger capacity = stability
- Anoxic, photopic (purple) algal blooms
- Ammonia, phenols, aldehydes, amines
What’s Happening Now?

- Moratorium (1997) on swine lagoon systems remains in effect and is now permanent
- NCSU studies (Phase 3 Report) completed
- All operators certified under NC DWQ
- Dramatic decrease in swine farm complaints after 3rd qtr. 1999 has remained stable in last 10 years
- Odor investigations
- Swine farms inspected twice/yr by DWQ and NC DSWC
- Issues: Ammonia, other organics, \( \text{H}_2\text{S} \)
What’s Happening Now?

- EST’s for new and modified farms (18 technologies)
- Environmentally Superior Technologies
  - Testing completed
  - Focused on ammonia emissions and control
- New rules promulgated by DAQ and DWQ to require EST’s
- Lagoon conversion projects
- Methane capture projects (GHG/RPS implications)
- “Safe Harbor” Agreement / National Emissions Study—waiting for results (may affect recent NH₃ emission limits)
Future Regulations?

- Response to PM 2.5 NAAQS
- Response to current/future CAFO rules
- Individual BMP plan implementation
- Implementation of Environmentally Superior Technologies
- Use of one or more of the 18 technologies under consideration
North Carolina
PM2.5 Design Values, 2002 - 2004

Summary of 31 Counties
- 11 well below annual standard
- 15 moderately below annual standard
- 3 slightly below annual standard
- 2 above annual standard

Note: Not to Scale
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NC DENR
PM2.5 Value
Broader Considerations

- Minimize or eliminate the formation of ammonia (~130,000 MT/yr released by existing swine farms)
- Technologies to control ammonia emissions
- Maximizing ammonia formation for capture and use of feedstock
- Deal with GHG formation and replacement of NH₃ both directly and indirectly
- Swine aren’t the only farm sources of ammonia
Growth of the Turkey & Hog Production in NC
Questions?
Further Information

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