Managing Ammonia Emissions

ARE WE THERE YET?
Past Roads, Future Paths
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NC DENR, DAQ
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)
• Large human population growth in the 1980’s and 1990’s
• 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
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 27 million tons of manure/yr
Distribution of Farms by Size

The chart above shows the distribution of farms by size from 1988 to 2002. The x-axis represents the years from 1988 to 2002, while the y-axis represents the number of swine farms and the percentage of farms in each size category.

- Farms with 1-99 Animals
- Farms with 100-499 Animals
- Farms with 500-999 Animals
- Farms with 1000+ Animals

The data indicates a decrease in the number of farms in each size category over the years, with a slight increase in farms with 1000+ Animals as a percentage of the total.
NC Trends

- First major decrease in number of farms between 1970 and 1975 (~21,000 farms)
- Number of small farms (<100 swine) now account for less than half of all farms raising hogs
NC Trends (cont’d)

- Increase in “large farms” from 1990 to present day
- ~640 farms (out of 3200) with more than 5000 animals account for 75% of production
- ~1340 (out of 3200) with more than 2000 animals account for 97% of production
- ~2700 farms are regulated by DENR
Growth of the Hog Industry in NC from 1980 to present

Hog Inventory

Year

Number of Pigs and Hogs


Total Hog and Pig Production
South Coastal Region
North Coastal Region
Central Coastal Region
Southern Piedmont Region
Central Piedmont Region
NC Hog Growth by Region & Co

Pigs and Hogs in Southern Coastal Region

Number of Pigs and Hogs

Year

Southern Coastal Total
Bladen County
Brunswick Co.
Columbus Co.
Cumberland Co.
Duplin County
Harnett Co.
Hoke Co.
Onslow Co.
Pender Co.
Robeson Co.
Sampson County
Scotland County
Other Co.
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.
Swine in North Carolina in 1990

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 1995

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.
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.
Controlling Ammonia Emissions

- Not directly regulated
- Indirectly “controlled” through odor management and regulations
- Management techniques may increase ammonia emissions
- Emissions of other odorous compounds may be reduced
Sources of Ammonia/Odors

- Confinement Buildings
- Lagoons
Sources of Odors

- Spraying to fields (a significant ammonia source)
- 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) remains in effect
- NCSU studies (settlement agreements)
- All operators certified under NC DWQ
- Dramatic decrease in new complaints after 3rd qtr. 1999
- Odor investigations
- Inspected twice/yr by DWQ and NC DSWC
- Issues: Ammonia, other organics, H₂S
What’s Happening Now?

- Smithfield Foods and Premium Standards settlement agreements
- Settlement agreement with Frontline
- Environmentally Superior Technologies
  - Testing being completed
  - Focus on ammonia emissions and control
- Technology recommendations in 2004
- “Safe Harbor” Agreement - no effect on NC
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
- Safe Harbor?
Estimated Annual Mean PM 2.5 - 24 Hour Concentrations for January 1999 through December 2001

From each county's one-day or three-day monitoring site with the highest mean. Documented forest fire samples are excluded.

<table>
<thead>
<tr>
<th>Color</th>
<th>Mean Concentration</th>
<th>Comparison to Annual Standard</th>
<th>Counties Counted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>12.1 - 13.0</td>
<td>Moderately Below</td>
<td>4</td>
</tr>
<tr>
<td>Green</td>
<td>13.1 - 15.0</td>
<td>Below</td>
<td>7</td>
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<tr>
<td>Yellow</td>
<td>15.1 - 16.0</td>
<td>Above</td>
<td>9</td>
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<tr>
<td>Orange</td>
<td>16.1 - 16.8</td>
<td>Moderately Above</td>
<td>3</td>
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<tr>
<td>Red</td>
<td>16.9 - 17.3</td>
<td>Well Above</td>
<td>2</td>
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<tr>
<td>(NA)</td>
<td></td>
<td>Not Available</td>
<td>6</td>
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</table>

* In one or more of 12 calendar quarters, less than 75% of expected valid sampling occurred.
© In one or more of 12 calendar quarters, 0% valid sampling occurred.
Broader Considerations

- Minimize or eliminate the formation of ammonia
- Technologies to control ammonia emissions
- Maximizing ammonia formation for capture and use of feedstock
- GHG formation and replacement of NH3
Further Information

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