Controlling Ammonia Emissions at Poultry Facilities

Livestock and Poultry Environmental Learning Center Webcast

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Air Quality Focus from Indoor to Outdoor

- Decades of attention to indoor air quality for animal health
- Attention has shifted to include outdoor environment impacts on air quality

Air Quality Regulated

- U.S. Environmental Protection Agency (EPA) is asking agriculture to "take its turn" in improving national air quality
  - manufacturing, transportation, energy, etc. have taken their "turns"

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The archived presentation can be found at:
http://www.extension.org/pages/Controlling_Ammonia_and_Air_Emissions_in_Poultry_Facilities

Agriculture Air Emissions appear to be more subtle

-- But what about haze?

-- Global warming?

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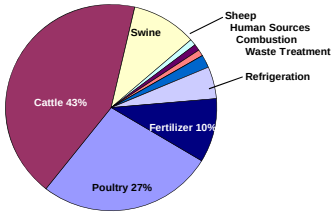
Gases from Poultry Agriculture

- Ammonia
- Hydrogen sulfide
- Greenhouse gases
  - Methane
  - Nitrous Oxide
  - Carbon Dioxide

Ammonia NH_3 Source

- Manure in housing and storage
- Poultry is a major source

Source: Battye, R., W. Battye, C. Overcash, and S. Fudge. 1994. Development and Selection of Ammonia Emission Factors. Final report prepared for U.S. EPA



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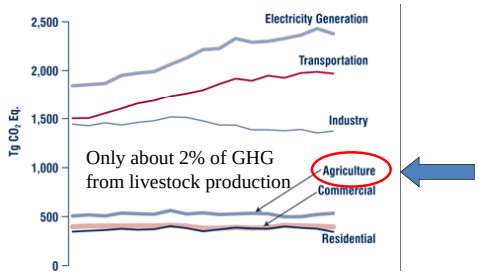
Hydrogen Sulfide H_2S Source

- Manure in storage - anaerobic conditions
- Very low H_2S from poultry manures

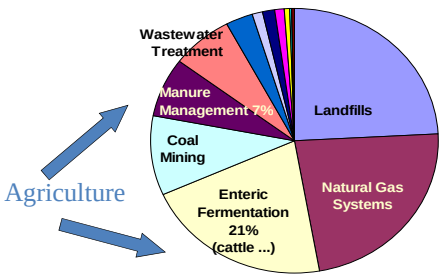
Emission from housing typically is small

USA Greenhouse Gas Sources Allocated to Economic Sectors



Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, USEPA #430-R-08-005

Anthropogenic Methane Sources



Source: US Emissions Inventory 2005. EPA 430-R-05-003

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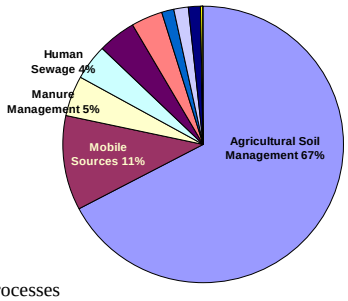
Nitrous Oxide (N_20) Inventory USA



Nitrification and denitrification processes in soil produce N_2O

Source: US Emissions Inventory 2005. EPA 430-R-05-003

Gases from Animal Agriculture Review the Importance

- Ammonia- a major source & regulated gas
- Hydrogen sulfide – minor but regulated gas
- Greenhouse gases – Anthropogenic sources
  - Carbon dioxide – not a major source

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  - Nitrous oxide > 50% all Ag: land application primarily

Estimates from: Climate Change 2001: The Scientific Background
Cambridge University Press

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Significant Gases from Poultry Agriculture

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Ammonia and the Environment

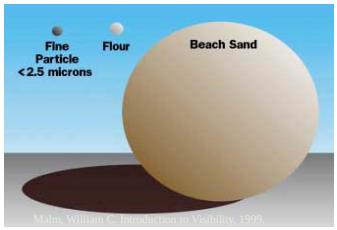
"Local" deposition of Nitrogen (fertilizer) in sensitive areas

Source: aginfo.psu.edu

Ammonia and the Environment

"Global" combination with atmospheric trace gases to form small particles ($PM_{2.5}$)

- Respiratory problems in sensitive individuals
- Haze



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Ammonia and Health

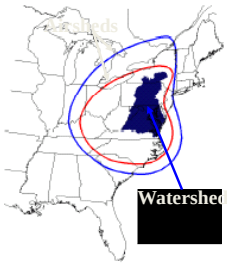
- OSHA guidelines 8 hour exposure 50 ppm; this is an indoor air quality issue
- Exhaust air from poultry houses may be higher than 50 ppm NH_3 but is quickly dissipated. Although not a health risk, this ammonia is still regional pollution
- Property line concentration usually less than human detection level for ammonia

OSHA = Occupational Safety and Health Administration

Air Quality Impact

- Concept of the "air-shed"
  - Part of the atmosphere that behaves in a coherent way with respect to the dispersion of emissions.

"water flows downhill" like…
"air pollutants flow downwind"



Chesapeake Air- & Water-sheds

Clear some Confusion: Emission vs. Concentration

- Gases are measured as a concentration
  - ppm (part per million)
  - mg/m^3 (milligram per cubic meter)

Electrochemical
3% accuracy $900

Photoacoustic Infrared
ppb accuracy $42,000

Colormetric tube with Pump
15% accuracy $400

Source: Manufacturers
Accuracy for ammonia

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Clear some Confusion: Emission vs. Concentration

- Emission = concentration x ventilation rate
- Emissions are a mass per unit time- often with reference to an agriculture unit
  - g/d (gram per day)
  - g/d/b (gram per day per bird)

Ventilation rate is difficult to determine accurately on farm

Clear some Confusion: Emission vs. Concentration

- Most useful emissions are expressed in terms of a common unit
  - g/d/AU (per Animal Unit)
  - g/d/kg (per kilogram body weight)

AU = Animal Unit = 500 kg or 1000 pounds

Ammonia Emission

- Evolves from the manure
- Chemical, biological and physical processes of release are established
- Magnitude being determined in studies

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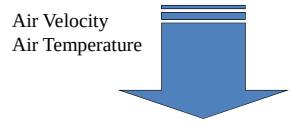
Mechanisms of Ammonia Emission: Lower these to reduce emissions



Manure Temperature
pH
Moisture Content (dry litter)
Surface Area of storage
Nitrogen nutrients

MANURE STORAGE

Emissions Poultry Agriculture

Emission Compound	Global Effect	Local Effect	Concern
Ammonia	Major	Minor	Deposition & Haze
Hydrogen Sulfide	Insignificant	Significant	Quality of human life
Greenhouse Gases	Significant	Insignificant	Climate change

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Adapted from: Air Emissions from Animal Feeding Operations. 2003. NRC

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