**Poultry House of the Future Concept**

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**HEALTH EFFECTS**

Bird health

- 10 ppm: Trachea irritation (turkeys)
- 20 ppm: Increased rate of Newcastle disease virus infection
- 25 ppm: Impaired growth rate & feed conversion. Reduced final body weight
- 50 ppm: Increased levels of keratoconjunctivitis
- 100 ppm: Increased chick mortality

Adapted from: Inma Estevez, Poultry Perspectives, v. 4

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**Introduction**

- Nitrogen in the form of NH₃ is of particular concern because of its potential to negatively affect
  - Bird health and performance (Anderson et al., 1964a, Caveny et al., 1981)
  - Environment (Moore, 1998, Pain et al., 1998)
  - Human health
    - Particulate matter PM₂.₅ (EPA 1997, Schiffman, 1998)

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**PM₂.₅ Formation**

\[ \text{NH}_3 + \text{SO}_x + \text{NO}_x \rightarrow (\text{NH}_4)_2\text{SO}_4 + \text{NH}_4\text{NO}_3 \]

- Haze
- Human health

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**PM₂.₅ LINK**

Image credit: U.S. EPA

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**Introduction**

- Revisions to the Clean Air Act will set a fine particulate matter (PM₂.₅) standard.
- EPA has reported that 47% of the PM₂.₅ in the eastern US is ammonium sulfate.
- Therefore management and dietary strategies need to be implemented to control ammonia emissions from poultry houses.
Estimated Ammonia Emission Sources for Chesapeake Bay Watershed
(Battye et al, 2000 – NH₃ in Airsheds & Watersheds Workshop)

Where does ammonia come from?
- Nitrogen
  - Component of amino acids (AA) that are the building blocks of proteins
  - N from feed in the form of protein is utilized by birds for growth and development
- N absorbed but not used for body functions is excreted as uric acid in poultry feces
- Decomposition of uric acid results in large losses of N in the form of ammonia NH₃

What conditions are needed to produce ammonia?
- N source
  - Uric acid in feces
- pH levels of ~ 7-8 or above
- Heat
- Moisture (drinkers and manure)

If we can remove (or change) any one of these then we can reduce ammonia emissions

New Housing Concept Will reduce moisture by rapidly drying the excreted fecal material
- Reduced moisture will prevent uric acid from being converted into ammonia
  - Improved bird health
  - Improved worker health
  - Reduced carcass contamination
  - Improved environmental health (less particulate matter)

Project Sponsors

Flooring
Flooring in Experimental Chamber

Exhaust
RH
Exhaust
Fresh
RH
Fresh
Recirculation
Fan
Ventilation
Heater

Heat loss evaluation with ventilation

Winter setup

• Air-to-air Heat Exchanger

Materials and Methods

- 12 environmentally controlled chambers
  Five hundred commercial one-day old birds per chamber (density of 0.8 ft²/bird)
- 6 chambers will be set up using the new flooring system and 6 with conventional litter
- Bird performance, health and environmental quality will be evaluated
Partitioning of Feed N in Commercial Broiler Production

Non-linear Breakpoint Analysis of Net Ammonia Production from Commercial Straight Run Broilers
Dietary deposition N (%) - studies comparison

- Patterson 2002
- Cougal et al. 2006
- UMES Study

Dietary N deposition (%)

- Carcass
- Litter
- NH3

Old Shed House

New vs. Old Housing

The Future?

Research Plan

- Laboratory Research
- Exploratory setup in Experimental Chambers
- Retrofit older broiler houses on the UMES Hawk Farm
- Explore the concept of a nursery unit in combination with grower-out facilities to increase production potential

Nursery: 0-18 days with 7 day layout
Grow-out: 18 days to market ~ 21-26 day layout
14 flocks/year vs. 8 with conventional houses
Summary

- New system could improve
  - Bird health
  - Human health
  - Environmental health
  - Food Safety
- Improve economic return by increasing production potential

Thanks!