Air Quality Component

Bioaerosols, list compounds, emission factors move to processed based models
Recognize that system studies need to be conducted…

Problem Areas

1. **Measure concentrations and quantify emissions**

Objectives

a. Develop appropriate methods and protocols to measure concentrations and emissions from animal agriculture

Todd, Cole—Bushland—NH3, GHG—Beef cattle, Dairy
Dungan, Leytem—Kimberly—endotoxins, bioaerosols, NH3, GHG, VOC—dairy
Trabue—Ames—VOC, Reduced S, PM—swine, poultry
Spies—Clay Center—GHG, NH3, H2S—beef cattle
Moore—Fayetteville—NH3—poultry
Ro—Florence—NH3, GHG—poultry, swine
Miles—Mississippi State—NH3, GHG—poultry

b. Determine emission factors from various production practices
Animal units, field application, etc

Todd, Cole—Bushland—NH3, GHG—Beef cattle, Dairy
Dungan, Leytem—Kimberly—endotoxins, NH3, GHG, VOC—dairy
Trabue—Ames—VOC, Reduced S, PM—swine, poultry
Spies, Varel—Clay Center—GHG, NH3, H2S—beef cattle
Moore—Fayetteville—NH3—poultry
Ro—Florence—NH3, GHG—poultry, swine
Miles—Mississippi State—NH3, GHG—poultry

2. **Develop and test abatement technologies and improved management practices**

a. Evaluate impact of diet modification on emissions

Miller—Lincoln—H2S, VOC—beef
Todd, Cole—Bushland—NH3, GHG—Beef cattle
Moore—Fayetteville—NH3—poultry
Spies, Woodbury—Clay Center—GHG, NH3, H2S—beef cattle
Kerr, Trabue—Ames—NH3, VOC, Reduced S—swine

b. Evaluate impact of animal/facilities management on emissions

Kerr, Trabue—Ames—NH3, VOC, Reduced S—swine
Miles, Brooks—Mississippi State—NH3, GHG, bioaerosols—poultry
Moore—Fayetteville—PM, endotoxin, NH3—poultry, swine
Woodbury—Clay Center—NH3, GHG—beef
Vanotti, Szogi—Florence—NH3—swine, poultry

c. Evaluate impact of manure handling, storage, & treatment on emissions
Vanotti, Szogi—Florence—NH3—swine, poultry
Todd, Cole—Bushland—NH3, GHG—Beef cattle
Miller—Lincoln—GHG—Beef cattle
Moore—Fayetteville—NH3—poultry, swine
Whitehead, Cotta—Peoria—microbes, H2S, GHG—swine
Miles—Mississippi State—NH3, GHG—poultry
Dungan, Leytem—Kimberly—bioaerosols, NH3, GHG, VOC—dairy
Varel—Clay Center—VOC, NH3, microbes, GHG—beef, swine
Loughrin, Lovan—Bowling Green—VOC, GHG, NH3—swine, poultry

d. Evaluate impact of land application on emissions
Watts—Auburn--GHG, NH3—poultry
Miles—Mississippi State—NH3, GHG—poultry
Sistani, Lovan—Bowling Green—GHG, NH3—swine
Pote, Moore—Fayetteville & Booneville—NH3—poultry
Moorman—Ames—microbes—swine
Dungan, Leytem—Kimberly—bioaerosols—dairy

3. Model emissions based upon physical, chemical, and biological processes

a. Identify and verify existing process-based models
Todd, Cole—Bushland—NH3—beef
Ro—Florence—NH3, GHG—swine, poultry

b. Identify critical physical, chemical, and biological processes contributing to emissions
Todd, Cole—Bushland—NH3, GHG—Beef cattle, Dairy
Dungan, Leytem—Kimberly—endotoxins, NH3, GHG, VOC—dairy
Trabue—Ames—VOC, Reduced S, PM—swine, poultry
Spiehs, Varel, Woodbury, Eigenberg—Clay Center—GHG, NH3, H2S—beef cattle
Moore—Fayetteville—NH3—poultry, swine
Ro, Szogi, Vanotti—Florence—NH3, GHG—poultry, swine
Miles—Mississippi State—NH3, GHG—poultry
Loughrin, Lovan—Bowling Green—VOC, GHG, NH3—swine, poultry
Whitehead, Cotta—Peoria—microbes, H2S, GHG—swine
Miller—Lincoln—VOC, microbes, NH3, GHG—Beef cattle

4**. Identify and address emerging issues**

Research Products

Breakout Session 4- Andy Cole/Karamat Sistani

Component: Nutrient Management

- **Problem Area 1: Animal Feeding and Management**
  - **Balanced diets for nutrient management**

- **Problem Area 2: ~~Innovative Technologies for collection, storage, and treatment~~ Collection, Storage, Treatment, and Utilization**
  - **Separation/Extraction of nutrients**
  - **Volume reduction & storage**
  - **Microbial mechanisms from excretion to application**

- **Problem Area 3: ~~Management tools for indexing and evaluating nutrient fate and transport~~ – Nutrient Fate and Transport**
  - **Nutrient management for water quality**
  - **Better methods for nutrient measurements**

- **Problem Area 4: ~~Farming systems and practices for efficient and balanced manure nutrient management~~ Farming Systems and practices for efficient and balanced nutrient management**
  - **Application technologies**

Component: Nutrient Management, Preservation, and Enhancement of Manure Resources

- **Problem Area 1: Animal Feeding and Management**

- **Problem Area 2: Collection, Storage, Treatment, and Utilization**

  Develop protocols to quantify for environmental credits

- **Problem Area 3: Nutrient Fate and Transport**

  Biological, chemical, and physical mechanisms affecting nutrient availability and loss

- **Problem Area 4. Farming Systems and practices for efficient and balanced nutrient management**

- **Problem Area 5. Develop technologies to recover and conserve energy from animal production**

Component: Management, Enhancement, and Utilization of Manure Resources

Problem Area 1. Animal Nutrition, and Management

Problem Area 2. Collection, Storage, Treatment, and Utilization of manure

Problem Area 3. Utilization of manure in an integrated farming system to improve soil, water, and air quality.

Problem Area 4. Manure as a renewable energy resource.

Component: Manure Pathogens and PACs

1) Kimberly Cook – Co-Chair (KY – MSA)
   a) Fate Transport Pathogens
   b) Odors
   c) Swine/Chicken
2) Cliff Rice – Co-Chair (Beltsville)
   a) PACs
3) Rob Dungan (ID – NW)
   a) Bioaerosols
   b) Dairy/Cattle
4) Michael Jenkins (GA – S)
   a) Fate Transport Pathogens
   b) Chickens/Dairy
5) Mark Ibekewe (CA – W)
   a) Fate Transport Pathogens
   b) MST
   c) Dairy
6) John Brooks (MS – MSA)
   a) Fate Transport Pathogens
   b) Chickens/Swine
7) Tom Moorman (IA)
   a) Fate Transport Pathogens
   b) Swine

Research Problem Area & Subsets

1) Microbial Pathogens
   a) Fate and Transport (Manure, Air, Soil, & Water)
      i) Microbial Ecology
   b) Microbial Source Tracking

2) PACs (Veterinary Pharmaceuticals & Natural Hormones)
   a) Fate and Transport (Manure, Air, Soil, & Water)
   b) Environmental Frequency
   c) Source

3) Antibiotic Resistant Bacteria (Pathogenic & Commensals)
   a) Fate and Transport (Manure, Air, Soil, & Water)
   b) Environmental Frequency
   c) Source

4) Best Management Plan(s) for Mitigation and Risk Management

Co-Products/By-Products

In General:

1) In the past, energy was a sub-component, but it has recently been elevated to a higher priority level.

2) What do we people mean by bio-energy? Need clarification of/establish a definition of bioenergy. (e.g. Energy from biomass)

3) Should have integrated systems that reflect synergistic ecosystem services
4) On site utilization of power is important
5) Manure=energy
    - Anaerobic digesters—what is the next step?
        - Viewed as mature, but design options may evolve
    - Generate hydrogen for microbes and microbial fuel cells energy.
    - Ethanol production by-products
    - Hybrid, wind, solar, control systems
    - Bio energy from manure waste: Hydrogen and electricity
        - Energy recovery from biofuels

Problem Statement:

1) Energy: Develop technologies to recover energy from manure and to conserve energy.
2) Develop beneficial uses from bioenergy residue.
3) Develop protocols to quantify environmental credits.
4) Risk assessment: Establishing risk based limits on by-products on beneficial use of MIA byproducts.
5) By product utilization technologies: What are the rates that we need? Where, when, what, how? Establishing beneficial uses of municipal/industrial/agricultural by-products.

Objective Statements, Organized by Problem Statement:

1) *Energy*, identify:
    - A. Microbial sources
    - B. Thermochemical systems
    - C. Integrated systems
    - D. System energy conservation and transfer systems