Livestock, the Environment and Purdue

Don Jones
Agricultural & Biological Engineering
December, 2007

12 Room Environmental Bldg - ASREC

- Allows evaluation of air environmental abatement strategies with better experimental control and replication than is possible in field studies
- Clean instrumentation room plus twelve 60-pig rooms with independent ventilation, feeding, watering, and waste collection
12 Room Environmental Bldg - ASREC

- Air temperatures and relative humidity, static pressure, heater, fogger and fan operation, and wind speed and direction
- Real-time measurements of feed consumption and pig weights accurately document animal performance

Water Quality

- Applied Research
  - 12 Room at ASREC, 720 swine
    - Effect of more balanced ration of excreted nutrients
    - Impacts of DDGS on carcass quality
    - Facility enables very large scale metabolism studies
  - Water use and effects on dairy manure handling (T. Nennich)
Proposed Research – Water Quality

• Impact of Paylean™ on carbon sequestration
• Impact of nutrient dense corn on air and water quality
• Impact of soybean hulls and other fiber on ammonia emissions
  (B. Richert, S. Radcliffe, A. Schinckel, A. Sutton & others)

Air Quality

• Measurement & control of emissions from swine houses
• Effect of biocurtains on emissions from a Swine Building
• Effect of misting of essential oils and water on air emissions
Ammonia, Particulate, Pathogen & Odor Emissions from Egg Production Facilities

• Determine if belt battery barns emit less air emissions than conventional deep pit barns
• Quantify effects of litter composting, and wet scrubbers on air emissions from egg production facilities

Air Emissions from High Rise and Belt Battery Layer Barns

• Determine (PM) and ammonia emissions
• Efficiency of a PM impaction system in a high-rise layer barn
• Impact of diet on PM and ammonia emissions
• Evaluate enzyme-based manure additive to reduce ammonia
• Layer Feed Additive in Laying House
• Effect of Biocurtains on a Poultry Building
USDA-NRI grant – done in 12-room

- Establish baseline gas, dust and odor emissions from group-fed pigs at different stages of growth and different seasons
- Determine impact of diets on emissions and dust
- Determine effect of manure storage time on gas, odor and dust emissions

USDA-NRI grant – done in 12-room

- Develop prediction models and determine economic impacts of diet manipulation and manure storage times on nutrient excretion, air quality, lean growth, and pork production economic stability and profitability
National Air Emission Monitoring Study (NAEMS)

• Voluntary Consent Agreement between the U.S. EPA and participating livestock industries

• Objectives:
  – Determine if individual farms are likely to emit particulate matter and volatile organic compounds in excess of Clean Air Act thresholds.
  – Determine if individual farms are likely to emit ammonia and hydrogen sulfide in excess of applicable CERCLA and EPCRA requirements
  – Continuous monitoring at 5 dairies, 5 swine, 3 layer and 1 broiler (total of 22, some part-time monitoring)

National Air Emission Monitoring Study (NAEMS)

• Mobile laboratories allow continuous monitoring at farm site. One lab can collect quality data from up to three barns, and monitored from off-site via an internet connection

• Buoyant and convective flux chamber (BCFC) for estimating lagoon emissions.

• Intensive monitoring of ventilation systems

• Extensive campus lab air analysis equipment
Air Quality

• **Interactive Setback Model** [National Pork Producer Council (NPPC) Project]
  — Intended for swine facilities
  — Considers
    • facility size and building design
    • orientation and shape
    • wind frequency, land use, topography, and management
    • manure handling characteristics, and
    • odor abatement effectiveness.
  — Working on version with better output

Land Application

• Manure Management Planner – B. Joern
• Effect on DDGS manure on P content
• ASREC – recently removed solids from dairy lagoons (4-6 feet of sludge land-applied)
Land Application Certification

• Fertilizer regulated by Office of Indiana State Chemist (OISC)
• OISC developing certification for those who transport and land apply nutrients
  – Developed in stages – custom haulers and applicators, farmers who apply manure, farmers who apply fertilizer
  – Apply to farms with > 100 acres
  – Authority to charge training & certification must come from legislature - may or may not happen in 2008

CAFO Rule

• EPA CAFO rule will be finalized in Dec 07 or Jan 08
• IDEM must modify their existing CAFO rule to agree with the federal rule (Goal = April 2008)
• CAFO compliance date February 09 – IN & EPA
• IDEM plans to revise existing CFO rule to make it closer to CAFO rule (Goal = 2008)
Process Wastewater

Purdue CAFO websites

- Purdue Animal Manure Solutions (PAMS)  
- Purdue Extension Water Quality Program,  
  [http://www.ces.purdue.edu/waterquality/](http://www.ces.purdue.edu/waterquality/)
- Purdue Land Use Team  
  [http://www.ces.purdue.edu/anr/landuse/](http://www.ces.purdue.edu/anr/landuse/)
- CAFO siting  
- Purdue Manure Management Planner (MMP)  
  [http://www.agry.purdue.edu/mmp/](http://www.agry.purdue.edu/mmp/)
- Purdue Manure Locator  
  [www.anse.purdue.edu/ManureLocator](http://www.anse.purdue.edu/ManureLocator)
- Purdue Agriculture Air Quality Laboratory  
  [http://cobweb.ecn.purdue.edu/~odor/index.htm](http://cobweb.ecn.purdue.edu/~odor/index.htm)