National Air Emissions Monitoring Study
Emerging Trends and Environmental Challenges Facing Livestock Production
U.S. Environmental Protection Agency
Clean Air Act Advisory Committee
January 8, 2009

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The New York Times

If all you ever do is all you've ever done, then all you'll ever get is all you ever got.

- Thomas Friedman
September 13, 2008
Background and Overview

• National Pork Board
  - Research, Education, Promotion
  - The Other White Meat
  - Mandatory Check-off
  - Reports to USDA-AMS

• National Pork Producers Council
  - Des Moines & Washington, D.C.
  - Membership
    • Voluntary Producer Membership
    • 43 State Pork Councils
    • Allied Industry Membership
  - Public Policy / Advocacy Arm
    • Lobbying, Litigation & Trade Negotiations

Background and Overview

US Pork Industry Today

• 67,000 Pork Producers Nationwide
  - 116.2 million hogs marketed
  - Total gross receipts ~$15 billion
  - Supporting > 550,000 rural jobs
    • 34,720 full time equivalent jobs
    • 127,492 agricultural jobs
    • 110,665 manufacturing jobs (packing)
    • 65,224 professional jobs (vet/finance)
    • $20.7 billion personal income
    • $34.5 billion gnp
Background and Overview

• 100 million gallon ethanol plant
  - 37 million bushels of corn
  - 80 Iowans directly employed

• 37 million bu corn \[\text{Direct jobs}\]
  Farrow-finish 800
  Or Wean-finish 242
  Or Beef feedlot 278

• Further processing of livestock to meat?

![Graph showing U.S. Pork Exports](image)
Background and Overview

Top Global Exporter of Pork

Top 10 Countries Receiving U.S. Pork Exports:
January - April 2008

<table>
<thead>
<tr>
<th>Country</th>
<th>Amount exported (in million tons)</th>
<th>Value of pork exports (in million U.S. Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>144.950</td>
<td>482.0</td>
</tr>
<tr>
<td>China/Hong Kong</td>
<td>144.800</td>
<td>243.5</td>
</tr>
<tr>
<td>Mexico</td>
<td>109,882</td>
<td>163.4</td>
</tr>
<tr>
<td>Russia</td>
<td>68,334</td>
<td>119.0</td>
</tr>
<tr>
<td>Canada</td>
<td>63,348</td>
<td>165.4</td>
</tr>
<tr>
<td>South Korea</td>
<td>46,550</td>
<td>98.9</td>
</tr>
<tr>
<td>Australia</td>
<td>12,216</td>
<td>29.3</td>
</tr>
<tr>
<td>Philippines</td>
<td>8,963</td>
<td>16.2</td>
</tr>
<tr>
<td>Taiwan</td>
<td>5,754</td>
<td>9.2</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>4,312</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Background and Overview

Production Evolution

- Economic Cycles Drive Efficiency Gains
- Indoor Production
  - Food Safety, Disease, Predation, Environmental
- Feed Mills and Integration
  - Food Safety, Quality Control, Consistency
Background and Overview

Production Evolution

CATTLE, BROILERS, HOGS, TURKEYS
POUNDS PRODUCED, 1960-2007

Number of Hog Operations
United States, 2007

Background and Overview

Pig and Hog Inventory X 1000
(Sum of Inventory per class)

>0 to 40 (5,765,453)
41 to 149 (16,741,393)
150 to 404 (14,007,309)
405 to 1,072 (8,616,427)
1,073 to 2,186 (6,187,916)

Data Source: USDA NASS, 2002 Census of the Agriculture
Volume 1 Geographic Area Series. Online at www.nass.usda.gov
Production

• Corn & Soybean Meal
• Specialization
• Manure Management & Environmental Concerns
• Deep Pits vs Lagoons

Lagoon Management

© Pork Checkoff
Lagoon Management

Methane Capture Project
Animal manure storage is a widespread source of methane emissions. Anaerobic decomposition produces VOC, NH₃, H₂S, H₂O, CO₂, CH₄. These gases contribute to odor and greenhouse gas emissions. Open-air manure lagoons can emit significant amounts of methane and ammonia. Covered manure lagoons with biogas collection systems can capture methane, reduce greenhouse gas emissions, and improve stormwater management. Biogas can be used for renewable electricity and heat. Simple covers can capture methane from lagoons and reduce greenhouse gas emissions.
Deep Pits
Environmental Challenges

- Pork Industry Response
  - Settlement of lawsuits
  - Engaged in National Dialogue
    - Regulators, Environmentalists
  - CAFO Rules and Permits
  - Improved Manure Management
    - Deep Pits, Setbacks, Application Improvements
    - Nutrient Management Plans
    - Goal: Zero Discharges

### Environmental Challenges

**History of manure release incidents involving swine operations during 2000 to 2005**

<table>
<thead>
<tr>
<th>State</th>
<th>Rank in Production</th>
<th># Regulated Sites (Estimated)</th>
<th># Years Reported</th>
<th># Incidents Reported, Total</th>
<th>Average # Incidents Per Year</th>
<th>Average Rate of Incidents Per Facility Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA</td>
<td>1</td>
<td>5,250</td>
<td>4</td>
<td>30</td>
<td>7.5</td>
<td>0.001</td>
</tr>
<tr>
<td>NC</td>
<td>2</td>
<td>2,300</td>
<td>2.5</td>
<td>64</td>
<td>25.6</td>
<td>0.011</td>
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<tr>
<td>MN</td>
<td>3</td>
<td>2,300</td>
<td>6</td>
<td>2</td>
<td>0.3</td>
<td>0.000</td>
</tr>
<tr>
<td>IL</td>
<td>4</td>
<td>3,400</td>
<td>4</td>
<td>6</td>
<td>1.5</td>
<td>0.000</td>
</tr>
<tr>
<td>NE</td>
<td>6</td>
<td>950</td>
<td>6</td>
<td>10</td>
<td>1.7</td>
<td>0.002</td>
</tr>
<tr>
<td>MO</td>
<td>7</td>
<td>570</td>
<td>6</td>
<td>5</td>
<td>0.8</td>
<td>0.001</td>
</tr>
<tr>
<td>CK</td>
<td>8</td>
<td>220</td>
<td>5</td>
<td>40</td>
<td>8</td>
<td>0.036</td>
</tr>
<tr>
<td>OH</td>
<td>10</td>
<td>690</td>
<td>6</td>
<td>23</td>
<td>3.8</td>
<td>0.006</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15,460</td>
<td>140</td>
<td>590</td>
<td>5.9</td>
<td>0.007</td>
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</tbody>
</table>
Environmental Challenges

Air Emissions

CERCLA/EPCRA Reporting Rule

National Air Emissions Monitoring Study

Neighbor Relations

- Odor - housing
- Odor - land applying
- Nitrogen in water
- Phosphorus in water
- Antibiotics in water
- Pathogens in water

<table>
<thead>
<tr>
<th></th>
<th>Neighbor Complaints</th>
<th>Public</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odor - housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odor - land applying</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen in water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphorus in water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antibiotics in water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pathogens in water</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Less serious | Very serious
Manure application and odor control

Environmental Challenges

Timeline

- 1998-1999
  - EPA OECA investigations into CAFO air emissions
  - EPA/DOJ determination that insufficient data exists to support enforcement action
  - First suggestion of settlement agreements as method to develop data
- 2000 - 2002
  - Referral to National Academy of Science
  - Report found EPA lacked scientifically credible methodologies for estimating emissions from AFOs
- 2002 - 2004
  - EPA commences settlement negotiations with livestock producers
Environmental Challenges

CERCLA / EPCRA Reporting

- Proposal
  - Exemption from reporting requirement related to releases of hazardous substances to the air where the source of those hazardous substances is animal waste at farms.
  - EPA proposed finding that reports are unnecessary because there is no reasonable expectation that Federal, state or local emergency responders would respond to such report
- NPPC Compromise
  - Develop threshold based on facility size
  - Large CAFO’s - file periodic report
- Final Rule
  - Preserved CERCLA Reporting Exemption
  - EPCRA Report Based on size (Large CAFOs - 1000 Animal Units)

AFO Consent Agreements

- EPA announced Air Compliance Agreement Jan. 21, 2005.
- Organized agreements by animal type, evaluating each separately and sending them to the Environmental Appeals Board (EAB) for signature and approval.
- Sign-up period for the Environmental Protection Agency (EPA) Air Quality Compliance Agreement (the Agreement) ended on Aug.12, 2005.
- Environmental Appeals Board ratified all agreements by mid August 2006.
- 2,568 agreements representing 6,267 farms
  - 1,856 swine,
  - 468 dairy,
  - 204 layers,
AFO Consent Agreements

- Producer Agreed To
  - Pay a civil penalty, ranging from $200 to $100,000, depending on the size and number of AFOs.
  - Pay up to $2,500 into a fund for a nationwide emissions monitoring program.
  - Make facilities available for monitoring.
  - Apply for all applicable air permits and comply with permit conditions.
  - Report any qualifying releases of ammonia (NH₃) and hydrogen sulfide (H₂S) as required by section 103 of CERCLA and section 304 of EPCRA.

- Producers Received A Covenant Not To Sue For Past and Current Violation During Course of Study

- Legal Challenge
  - USDA-AMS (In re: Mark McDowell, Jim Joens, et al., AMA PPRCIA Docket No. 05-001, Dec 18, 2008)

General Timeline of the NAEMS

- 2004  Protocol Development
- 2005  PI Selection, Staffing, Budgeting at Purdue
- 2006  Site Selection, Quality Assurance Project Plan
- 2007  Setup of Barn and Open Source Emission Monitoring
- 2008  Data Collection, Analysis and Reporting
- 2009  Data Collection, Analysis and Reporting
- 2010  Prepare Final Report for EPA
- 2011  EPA Develops Emissions Estimating Methodologies
NAEMS

- **Objective:**
  - Collect quality-assured emission measurements from representative farms across America to generate a database from which emission estimation methodologies can be developed
    - Particulate Matter (PM$_{10}$, PM$_{2.5}$ and TSP)
    - Ammonia
    - Hydrogen Sulfide
    - VOCs
  - Quality Assurance Project Plan and Standard Operating Procedures
**Uniqueness of the NAEMS**

- Pollutants ($PM_{2.5}$, $PM_{10}$, TSP, NH$_3$, H$_2$S, CO$_2$, CH$_4$, VOC)
  - Add-on studies measure N$_2$O, odor and airborne pathogens.
- 24-months of continuous monitoring at each farm
- 38 livestock & poultry barns tested with same protocols
- Quality assurance/quality control (raising the bar)
  - Oversight by the U.S. EPA OAQPS in Raleigh, NC
  - Quality Assurance Project Plan (Category 1)
    - 57 standard operating procedures (SOPs)
    - 15 site monitoring plans (SMPs)
  - On-site audits
- Novel methods
  - NV barn airflows measured with 3-D sonic anemometers.
  - Fan operation measured with vibration sensors.
  - Custom designed data acquisition & processing systems
Summary of NAEMS Sites

<table>
<thead>
<tr>
<th>Species</th>
<th>Barns per Site</th>
<th>Total number</th>
<th>Number of Area Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-b</td>
<td>3-b</td>
<td>4-b</td>
</tr>
<tr>
<td>Swine</td>
<td>0</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Dairy</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Layers</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Broilers</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

Legend
1 – Broilers
2 – Layers
3 – Swine finishers
4 – Sows (swine)
5 – Dairies
A – Open source
B – Barn source
NAEMS Swine Barn Sites

Finish: Deep Pit

Legend
1 – Broilers
2 – Layers
3 – Swine finishers
4 – Sows (swine)
5 – Dairies
A – Open source
B – Barn source

Open Source Measurement Sites

<table>
<thead>
<tr>
<th>Type</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>Southwest- TX</td>
</tr>
<tr>
<td>Dairy</td>
<td>East- IN</td>
</tr>
<tr>
<td>Dairy</td>
<td>Midwest- WI</td>
</tr>
<tr>
<td>Dairy</td>
<td>Northwest- WA</td>
</tr>
<tr>
<td>Pork-sow</td>
<td>Southeast- NC</td>
</tr>
<tr>
<td>Pork-finisher</td>
<td>Southeast- NC</td>
</tr>
<tr>
<td>Pork-sow</td>
<td>Midwest- IN</td>
</tr>
<tr>
<td>Pork-finisher</td>
<td>Midwest- IA</td>
</tr>
<tr>
<td>Pork-sow</td>
<td>West- OK</td>
</tr>
<tr>
<td>Pork-finisher</td>
<td>West- OK</td>
</tr>
</tbody>
</table>
Criticisms

- Inadequate Number of Facilities Monitored
- Not fully responsive to NAS demands
- No study of mitigation technologies
- Industry Funded / Lack of Environmentalist Participation
- No Adequate Oversight

Independent Review and Oversight

- Independent Review Committee
  - Dr. Robert Burns and Dr. Hongwei Xin
    - Iowa State University
    - Conducted Kentucky Broiler Study (Tysons v. Sierra Club) on Behalf of Sierra Club
    - “We were impressed with the ammonia emissions study which scientists at Iowa State did for Tyson as part of the fulfillment of the settlement from the Sierra Club v. Tyson lawsuit. This report is definitely the most comprehensive ever done on the issue of chicken house emissions and we are pleased that it has been completed and can be viewed by the public.”
  - Aloma Dew
    Sierra Club Midwest Representative
    September 7, 2007 Statement/Press Release

- SAC, PASPAC
Questions?

"That's all folks!"

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