AIR EMISSIONS AND OCCUPATIONAL AND PUBLIC HEALTH

The 2010 Poultry and Animal Waste Management Symposium,
Kelley J. Donham MS, DVM, DACVPM
Patrick O’Shaughnessy PhD, CIH
Tara Smith PhD

Objectives

Review:
• 25 years of Research on Occupational and Community health Associations to Air Contamination from Livestock Operations

New Research:
• Task-based dust exposures in Swine Production
• Methicillin Resistant Staphylococcus aureus (MRSA)

Worker (Human) Capital

Andrew Savitz – Sustainable businesses
Profit – People-Planet
The Triple Bottom Line

• http://getsustainable.net/triple-bottom-line.html
• What are the Drivers?? Health a Value added farm product

Reduce:
• Health insurance cost
• Workers’ comp cost
• Disability cost
• Sick leave
• OSHA Concerns
• Liability risks

Maintain:
• Employee retention
• Worker moral
Respiratory Illnesses in Pork Producers vs. Other Farmers

Data from Donham et. al. 2010
Certified Safe Farm Study

Occupational Health
(Research from 1975 – 2000)

Air Exposures = Respiratory risk
- Bronchitis (25%)
- Non-allergic Asthma (25%)
- Mucous Membrane Irritation (25%)
- Organic Dust Toxic Syndrome (30%)

Dose Response
- Dust (>2.5 mg/m3)
- Endotoxin (> 100 EU)
- Ammonia (7 > ppm)
- Combined health effects of dust + ammonia = 2-4 x (Cumro and Donham 2001)
- H2S (> 10 ppm)

Community Health Issues
Some recent conferences on Pork Production and Environment

- 2002 - Iowa Concentrated Animal Feeding Operations Air Quality
  www.public-health.uiowa.edu
- 2006 - Environmental Health Impacts of CAFO's: Anticipated Problems, Searching for Solutions
- 2008 - Pew Commission on Industrial Farm Animal Production 2008
  http://www.ncifap.org

Community Health Issues

- Depression, anxiety (Shiffman, 1995 - North Carolina)
- Respiratory symptoms similar to workers (Thu, Donham, 1997 - Iowa)
- Respiratory symptoms similar to workers (Wing et al., 1999 - North Carolina)
- Utah Community Health Study (increased respiratory and GI illnesses)
- Antibiotic resistant organisms (Zahn, 01)
- Environmental injustice (Wing 2002)
- Protection against Asthma
- Increase Asthma in children (Merchant et. al. 2005, Sigudarsson et.al. 2006)

GIS and Modeling in Environmental Research in Progress
Lots of self reported Symptoms, little Objective Findings. Possible “Extra Toxic Mechanisms” ??

Dennis Sushterman, U. California

Bottom Line of Community Health & CAFO’s?

- Lots of Symptoms and Subjective findings in rural residents
- Little Objective exposure - response Health findings
- Lower property Values
- “____ inconsistent evidence of a weak association between self-reported disease in people with allergies or familial history of allergies. No consistent dose response relationship between exposure and disease was observable” (O’Conner et. al., PLoS One, 2010)

EFFECTIVE CONTROL MEASURES AVAILABLE FOR OCCUPATION AND COMMUNITY

Little implementation at Present

Make Environment and Worker Health a value added product on the farm
New Research at U. Iowa
Task Based Dust Exposures in Swine Production

What Tasks are most hazardous?
Monitoring Worker Exposures

Gestation/Breeding/Farrowing/Processing
Feeder/Grower/Finishing/Sorting/ Load Out

Dust Measures by Season

Site 1

Personal Real-time Measurements
Dust Concentrations - Winter

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Concentration, mg/m³</th>
<th>Ranking (most to least dusty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorting and Loading</td>
<td>15.0</td>
<td>1</td>
</tr>
<tr>
<td>Finishing Hogs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weaning</td>
<td>8.5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drop Feed</td>
<td>7.7</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set up and Break Down</td>
<td>5.0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat check</td>
<td>4.7</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treat Pigs</td>
<td>4.0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breeding</td>
<td>3.9</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fill out breed sheet/card</td>
<td>3.5</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sow/gilt handling</td>
<td>3.5</td>
<td>8</td>
</tr>
</tbody>
</table>

Risks from Power Washing?
High Endotoxin levels

- Average Endotoxin levels
  - Ambient = 1,342 EU
  - During Pressure Washing = 42,711

Conclusions

- When hogs are moved – its dusty
- Targets for Control Measures
  - Load out
  - Farrowing- weaning facilities
  - Feeding
  - Power Washing
- Control Measures
  - Oil in feed
  - Oil sprinkling
  - Power Washing
  - Respirator use
- Power Washing a Special Case
Methicillin Resistant *Staphylococcus aureus* (MRSA)

Why should we be concerned about MRSA?

**Antibiotic Resistant bacteria**

1. Human Disease that is difficult to treat
2. Hospital Acquired (HA MRSA)
   a. 94,000 (US)
   b. 18,000 deaths (US)
3. Community (CA MRSA)
   a. 1% of US population colonized
4. A window/reservoir to the larger picture of antibiotic resistance

History and Epidemiology

1970’s – Mastitis in Dairy Cow (DeVriese, 1975)

1980’s – Hospital acquired infections (HA MRSA)

1990’s – Community Acquired infections (CA MRSA)
   • Athletics and facilities
   • Nursing homes
   • Child care facilities

2000’s – Livestock Associated MRSA (LA MRSA)
   • Dutch Child and Veterinarian infected (Huizsdens 2006)
   • Pigs, Cattle, Poultry,
**MRSA in animal populations**  
(this is an *Amphizooonosis*)

- Cattle, Pigs, poultry, Dogs, Cats, Horses,
- Livestock = ST 398
- Most ST 398 strains do not have serious toxins
- But, they can become toxic by genetic transfer

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**Significance for Livestock Health**

- Animal Health Problem?
  - Mastitis in cattle – 1970’s
  - Carriers in pigs (40%), Dairy calves, Poultry, in N America, Europe and Asia
- Not a large obvious clinical veterinary Problem at present
- An occupational health problem?
  - High 40% of livestock farmers and veterinarians are carriers
  
  (Smith, 2009)
- Public Relations Problem – YES!
  - e.g. H1N1, Salmonella, E coli H157, bird flu etc

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**Significance for Producer/Worker Health?**

- Occupational and Public infections more common in Europe (LA MRSA = 20% of human cases) VanLoon 2007
- 3% reported but no clinical confirmed human livestock MRSA in US at Present
- Mainly skin infections, but septicemia, pneumonia, head and neck abscesses, also
- Not a huge occupational problem generally at present
**LA MRSA a Public Health Risk?**

- Person to person spread – yes
- Worker to family - yes
- Spread to the general community – Yes
- 20% of MRSA in Netherlands is ST 398
- Sources include Meat and Poultry
- Air from Animal facilities

**U. IA. Research on MRSA**

Tara Smith PhD, Mike Male DVM, Dwight Ferguson, Kerry Leedom DVM, MPH, Kelley Donham DVM

- With funding from IPPA and The Great Plains Center for Agricultural Health, U. IA.
- How common is it?
- What is its ecology?
- Is it an important occupational or public health concern?
- Biosecurity Issues?
  - Were does it live in swine buildings?
  - How do we prevent its spread?

**Research ongoing at Iowa**

- Prevalence in livestock populations (smith, 2009)
  - Pigs (40% of pigs sampled) & People in contact
  - Poultry
- Prevalence of human cases of LA MRSA
  - Questionnaire data = 3% of workers self-report infections (Leedom-Larson, 2010)
  - Case finding mechanisms from Physicians
- Mechanisms of transmission
  - Air – inside and outside of swine barns
  - Shower facilities (Leedom-Larson 2010)
- Prevention of transmission
  - Dust Masks
  - Biolilers
Worker (Human) Capital

Andrew Savitz – Sustainable businesses

Profit – People-Planet

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Summary and Questions for the future

- Dust exposures in Swine and Poultry = respiratory health hazards.
- Community Health air Exposures are a concern, but objective indicators wanting.
- Winter, load out, feeding, Processing pigs, Power washing
- Enough known to prevent the problem – need broader implementation
- Ecology of MRSA (an emerging issue)
  - Are animals or people long term carriers?
  - Disease burden in Animal and human hosts?
  - Relationship to antibiotic use in Livestock production?
  - Toxic producing genes in LA MRSA?

MRSA, MRSA, MRSA !!!

- The nose knows all
- Stay tuned
- Stay informed

Thanks for all you do!

Kelley Donham MS, DVM, DACVPM

Intervention Theory and Practice  
**Effective for Agriculture**

Keystones in Successful Interventions

- Making Environmental Health and Safety a value added product of the business

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