Air Quality and Livestock: An Iowa Perspective

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In Iowa:
- Odor has been the biggest concern
- State Regulations govern siting
  - Utilizes a "master matrix" point system for permitting
- No current emission criteria

Philosophy: Odor Control Impacts
To Be Effective.....
An odor control technology needs to result in at least a 70% reduction of source odor when needed
This does not mean 70% reduction, 100% of the time

Philosophy: Gas Control Impacts
- The receptor becomes the atmosphere rather than a neighbor, so overall reduction is the goal.
- There isn’t really an “off” time.

Emission Sources
- Building Ventilation Air
- Outside Manure Storage
- Land Application

Classification of Effective AQ Mitigation Techniques
- Principles
  - Effective
  - Economical
  - Practical
  - Have limited management demands
  - Limitations are known
  - Not universally applied
Effective Odor Mitigation Techniques: Siting

- No strategy is more effective than proper pre-construction site selection
- Scientific Approach – Site dependent
  - All directions are not equal
  - Receptor based
  - Windroses for odor season
  - Atmospheric Stability consideration
  - Determination of Number of Hours of
    - Very Weak Odors (2:1)
    - Identifiable Odors (7:1)

Effective Odor Mitigation Techniques: Biofiltration

- Biomaterial filters and acts as a biotreatment substrate

- Limitations
  - Curtain Buildings – partial filtration
  - Proper design to minimize ventilation impact
  - Moisture maintenance critical
  - Large footprint

Effective AQ Mitigation Techniques: Biofiltration

- 60% odor reduction
- Installation $22/pig space
- Energy cost 45 cents/pig finished
- NH3 (up to 65%)
- H2S (up to 95%)
- PM

Location.. Location.. Location...

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Effective AQ Mitigation Techniques: Vegetative Environmental Buffers

- Vegetative filter
- Promotes mixing and uplift
- Visual Screen
- Difficult to quantify impact

Effective AQ Mitigation Techniques: Vegetative Environmental Buffers

1) Outside row – Austree Willow
   Middle – Red Cedar
   Inside – Red Osier dogwood
2) Outside – Austree Willow
   Inside – Red Cedar
3) Red Osier Dogwood

Effective AQ Mitigation Techniques: Dietary Manipulation

- Examples:
  - Crude protein reduced, added crystalline amino acids
  - Limited use of bloodmeal, fishmeal
- Up to 30% reduction
- May improve hedonic tone
- Easy Implementation
  - Stay tuned for developments

Effective AQ Mitigation Techniques: Permeable Covers

- Cover breathes
  - Prevents wind from blowing over surface
  - Material forms a biological substrate
  - Ammonia Reduction 40 to 99%

Effective AQ Mitigation Techniques: Permeable Covers

<table>
<thead>
<tr>
<th>Material</th>
<th>Odor Reduction</th>
<th>Cost per square foot</th>
<th>Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>4” Straw</td>
<td>40%</td>
<td>$0.10</td>
<td>&lt; 1 yr</td>
</tr>
<tr>
<td>6” Straw</td>
<td>60%</td>
<td>$0.13</td>
<td>&lt; 1 yr</td>
</tr>
<tr>
<td>LECA Rock</td>
<td>90%</td>
<td>$1.50</td>
<td>10+ yrs</td>
</tr>
<tr>
<td>Geotextile</td>
<td>50%</td>
<td>$0.25</td>
<td>3-5 yrs</td>
</tr>
</tbody>
</table>
Effective AQ Mitigation Techniques: Permeable Covers

- Limitations
  - Biological materials sink
  - Possible pumping problems
  - Distribution can be a challenge on large storage and impractical > 5 acres

Effective AQ Mitigation Techniques: Impermeable Covers

- High-density polyethylene (HDPE) cover
- 90%+ odor reduction
- $2.50/ft²
- Traps gas, rain, snow that must be handled
- More difficult to remove manure

Effective AQ Mitigation Techniques: Manure Injection

- Odor/Ammonia Reduction > 90%
- Injection toolbars may be retrofit
- Custom cost similar
- Operational additional <0.6 cents/gal
- May be a challenge with no-till

Research Gaps in AQ Mitigation Techniques

- Principles
  - Shows some promise
  - Practical
  - Cost may not be known
  - Some effectiveness may be unknown
  - More work needs to happen before deeming as “effective”

Research Gaps in AQ Mitigation Techniques

- Barriers (windwall)
  - Remove dust, force air up
  - Low cost
  - Impact downwind?
- Biocurtain w/ ESP
  - Removes dust
  - Quantification/cost?
- V Manure Scraper
  - Ammonia reduction
  - Costs/Odor?
  - Availability?
- UV Degradation
  - Strong odor reduction in lab scale
  - Implementation/costs?
**Research Gaps in AQ Mitigation Techniques**

- **Bioscrubber**
  - Strong odor reduction in Europe
  - Impact on ventilation?
  - Costs? Winter practicality?

- **Topical applications**
  - Example: zeolite (poultry)
  - Lab trials show odor reductions
  - Implementation/costs?

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**Final Thoughts**

- **First Off…:** There is absolutely no substitute for proper site selection. This is the number one odor control technology we know of. Good siting choices do not need mitigation.

- **Second…:** Effective odor control will be a suite of options. Example is “as-needed” partial biofiltration + diet modification + VEBs + ……. = 70% or more odor reduction

- **Third…:** Any mitigation strategy adopted MUST have a proven economic assessment associated with it.

- **Finally…:** Incorporating a mitigation strategy should be associated with a distance credit proportional to the level of odor control, as proven with research.

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**Air Quality Tools**

- **National Air Quality Site Assessment Tool (NAQSAT) – CIG Grant**

- **Air Management Practices Assessment Tool – NPB Grant**

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Department of Agricultural and Biosystems Engineering
Choosing Odor

http://www.extension.iastate.edu/airquality/practices/homepage.html

Thank You