

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

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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

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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.

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Emission Sources

- Building Ventilation Air
- Outside Manure Storage
- Land Application

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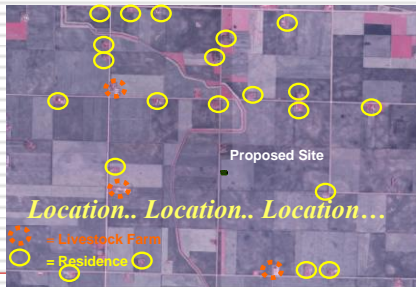
Classification of Effective AQ Mitigation Techniques

- Principles
 - Effective
 - Economical
 - Practical
 - Have limited management demands
 - Limitations are known
 - Not universally applied

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Effective Odor Mitigation Techniques: Siting



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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)

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Effective Odor Mitigation Techniques: Siting

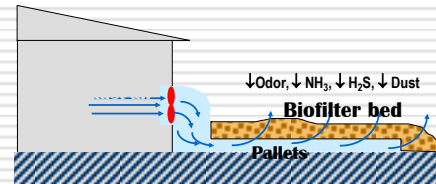
- Limitations of Models
 - Models do not account for the impact of terrain
 - Should be coupled with:
 - Producer education
 - Communication with neighbors
 - Common Sense

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Effective Odor Mitigation Techniques: Biofiltration

- Biomaterial filters and acts as a bio-treatment substrate



LPES Curriculum

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Effective AQ Mitigation Techniques: Biofiltration



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



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Effective AQ Mitigation Techniques: Biofiltration

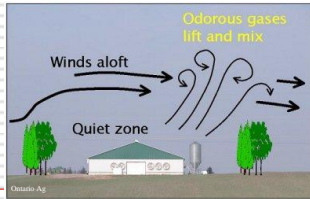
- Limitations
 - Curtain Buildings – partial filtration
 - Proper design to minimize ventilation impact
 - Moisture maintenance critical
 - Large footprint

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Effective AQ Mitigation Techniques: Vegetative Environmental Buffers

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



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Effective AQ Mitigation Techniques: Vegetative Environmental Buffers



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Effective AQ Mitigation Techniques: Vegetative Environmental Buffers



- ❑ Up to 15% odor reduction
- ❑ 6 to 10 cents/pig over 20 years
- ❑ Years to establish
- ❑ Beware natural ventilation applications

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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

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Effective AQ Mitigation Techniques: Permeable Covers

- ❑ Cover breathes
 - Prevents wind from blowing over surface
 - Material forms a biological substrate
 - Ammonia Reduction 40 to 90%



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Effective AQ Mitigation Techniques: Permeable Covers

Material	Odor Reduction	Cost per square foot	Life
4" Straw	40%	\$0.10	< 1 yr
6" Straw	60%	\$0.13	< 1 yr
LECA Rock	90%	\$1.50	10+ yrs
Geotextile	50%	\$0.25	3-5 yrs

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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

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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



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Effective AQ Mitigation Techniques: Manure Injection

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



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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"

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Research Gaps in AQ Mitigation Techniques

- Barriers (windwall)
 - Remove dust, force air up
 - Low cost
 - Impact downwind?
- Biocurtain w/ ESP
 - Removes dust
 - Quantification/cost?



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Research Gaps in AQ Mitigation Techniques

- V Manure Scraper
 - Ammonia reduction
 - Costs/Odor?
 - Availability?
- UV Degradation
 - Strong odor reduction in lab scale
 - Implementation/costs?



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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?



AQ Mitigation Techniques

- Must be:
 - Effective
 - Economical
 - Practical
 - Have limited management demands
 - Limitations are known
 - Not universally applied

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.

Air Quality Tools

- National Air Quality Site Assessment Tool (NAQSAT) - CIG Grant
- Air Management Practices Assessment Tool – NPB Grant

National Air Quality Site Assessment Tool Overview | Disclaimer | Sponsors | Resources

Purpose: The National Air Quality Site Assessment Tool (NAQSAT) has been developed for the voluntary use of livestock producers and their advisors or consultants. It is intended to provide assistance to livestock and poultry producers in determining the areas in their operations where there are opportunities to make changes that result in reduced air emissions. Air emissions research from livestock production systems is increasing every year. NAQSAT is based on the most accurate, credible data currently available regarding mitigation strategies for air emissions of ammonia, methane, volatile organic compounds, hydrogen sulfide, particulates, and odor.

NAQSAT was designed to provide information and education, only. It is not intended to provide emissions data and/or regulatory guidance. All users receive a report of priority areas where improvements can be made, regardless of the amount of emissions produced by the facility. These priorities are not a reflection of risk, but rather a relative evaluation of current production systems based on the most accurate data and understanding of management systems currently available. The report generated cannot be used to compare one livestock facility to another because the evaluation is of a facility relative to its potential given current understanding of management practices and mitigation options.

Scores for each emission are generated upon online completion of NAQSAT. Scores reflect the degree to which an operation has incorporated all of the possible practices needed that would effectively minimize air emissions from the facility. Trade-offs may exist within a housing type that all categories of emissions cannot effectively be minimized. The tool considers the impact of diet, housing management, manure handling, management, and transport, land application of manure, neighbor relations, and internal and nearby road management practices. Check areas where changes could be made are identified, resources to help implement changes are identified by the user. A user can run NAQSAT a second time with a proposed change included to determine the impact a change would have on emissions.

Select a species to begin:

- Swine
- Dairy
- Beef
- Broiler Chickens
- Laying Hens
- Turkeys

naqsat.tamu.edu

Swine National Air Quality Site Assessment Tool Overview | Disclaimer | Sponsors | Resources

Note: Do not use your browser's back button to navigate this form. Save often using the **Save Progress** buttons at the end of each section.

Animals and Housing

Note to User: Many farms may use more than one of the listed choices below. In order to allow the use of NAQSAT as a "What If" tool only one of the choices can be selected at a time. The user can click on "Get Results" for that selection and see how changing the answer will affect their results. If only a general overview is desired, identifying the predominant practice will accomplish that result.

Housing type:

Confined total stall

Ventilation:

Natural

Mechanical

Combination (Natural ventilation with tunnel ventilation available in warm weather or natural ventilation with pit fans)

Animal cleanliness - which best depicts typical animal appearance? (Click on an image below; your selection will highlight in green.)

Confined partial stall

Open front

Hoop or deep bedded

