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Managing a Livestock Operation to Minimize Odor

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Public concern over air and water quality has grown as the number of confined animal feeding operations increases and the rural areas of Arkansas become more populated. Some among this growing population are unaccustomed to the odors associated with livestock and poultry production. Odors from livestock production systems are generally regarded as nuisance pollutants. However, they are not regulated under the Federal Clean Air Act. Nor are there any Arkansas air quality regulations that specifically address livestock production. The Arkansas Department of Environmental Quality administers Regulation No. 5, which regulates only liquid manure management systems, and does require "control to the degree practicable the generation of offensive odors." Aside from minimal distances between animal housing, manure storages, land application sites and neighbors, the specification of odor control practices is the responsibility of the professionals writing the ADEQ-approved waste management plans.

There is little information about the impact of odors on human health, although adverse health effects have been related to individual gases, e.g., ammonia, or dust. Societal factors, such as familiarity with the rural environment, livestock production and the physical appearance of animal operations, can contribute to the level of tolerance or intolerance associated with odors. Management techniques can help minimize the generation and movement of odors off farm. Adopting a "good neighbor policy" is recommended to increase the tolerance when odors do reach downwind neighbors.

Facility Considerations

When siting and designing a new livestock operation or expanding an existing operation, consider the following items:

1. **Distance to the neighbors.** As a rule, odor concentrations decrease with distance from the source. Therefore, greater buffering distances are desirable. Arkansas does not have required minimal distances for animal housing or manure application sites for dry manure. ADEQ Regulation No. 5 for liquid manure is often suggested as a guide for minimal distances. This regulation specifies that for small farms the minimum distance between animal barns or manure storages and neighbors is 500 feet. For farms with more than 600 beef cows, 430 dairy cows, 1,500 finishing hogs, 600 sows, 6,000 nursery pigs, 33,000 turkeys or 130,000 chickens, the minimum distance is 1,320 feet. The regulation also specifies that liquid manure is not to be applied within 50 feet of property lines or 500 feet of neighboring occupied dwellings. For more details and information on exemptions to these requirements, refer to UA fact sheet *Regulation No. 5: Liquid Animal Waste Management Systems*, FSA3004.

2. **Prevailing winds.** Since odors and dust are carried by air movement, attempts should be made to maximize the distance to neighbors in the prevailing downwind direction.

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3. **Terrain and land cover.** Under cool, humid conditions, cool air will tend to flow down along slopes and valleys, carrying odors with it. On the other hand, terrain and land cover features such as trees can serve to shelter potential odor sources from the wind so that less odor is transported downwind. These same types of features can help to disperse odors, thereby reducing their strength.

4. **Vegetative shelter belts and windbreak walls.** They help to trap dust, disperse odors and minimize adverse impacts on downwind neighbors. They can also serve as visual barriers.

5. **Visual isolation.** It is often the case of "out-of-sight, out-of-mind." Therefore, it is desirable for the facilities not to be readily visible to the public. If they can't be completely hidden, consider what steps can be taken so they are less visually noticeable.

Integrated Odor Management

Considerable progress has been made in the past decade in understanding livestock odor and developing odor control technology. However, many aspects of the relevant processes are not completely understood, and new techniques are under continuing investigation. Approaches to mitigate livestock odor and odorants are presented below. A particular operation may desire to implement one, two or more approaches. While not listed below, a major factor in successfully minimizing odors is good facility management. Clean and well-run facilities tend to generate less odor than dirty, poorly-run facilities. Combined with the advantages of the positive perceptions associated with a neat, attractive farm, this should help to minimize odor concerns.

- **Diet manipulation to minimize odor production**

Progress has been made in managing manure odors by altering animal diet or by the addition of specific odor-reducing agents (such as peppermint and others) to the diet. Lowering the protein content of the diet while maintaining the balance of amino acid composition to the animal's needs will reduce the potential for ammonia and odor generation. While ammonia is not the only odorous compound in manure, practices that reduce ammonia generation tend to reduce overall perception of odor.

- **Manure treatments**

A variety of manure amendments have been effective in reducing odor and ammonia volatilization from dry manure/litter in poultry houses, including PLT (sodium bisulfate), Ferix-3 (ferric sulfate granular) and liquid or dry forms of alum (aluminum sulfate). These amendments usually are most effective in the first one to two weeks after application. Minerals, such as zeolite, have also shown effectiveness in reducing ammonia volatilization during poultry manure composting.

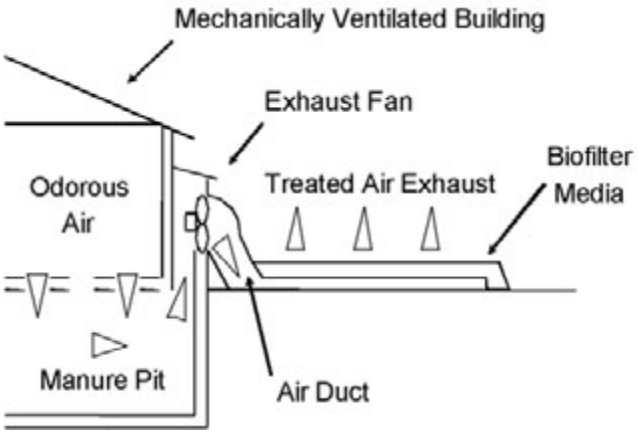
Bottom-loading manure storage tanks or pits generate fewer odors than top-loading systems, because in top-loading tanks or pits, part of the surface crust that was formed over time is disrupted. Solid separation from liquid manure by screening, filtration or centrifugation allows for the removal of larger-size materials and may reduce the odor generation potential. Separated manure solids need to be dried, composted or otherwise processed to manage odor generation and fly propagation. Use of in-house manure conveyor belts allowing separate collection of swine feces and urine has demonstrated a promising way to maximize the value of manure and minimize ammonia emissions from swine housing.

Aerobic treatment lagoons are very effective in reducing odors. These lagoons are fairly shallow and have large surface areas to allow oxygen to be diffused into all the liquid manure. This large size makes them expensive to build and maintain. When liquid manure is sufficiently aerated, organic compounds are degraded to water, carbon dioxide and other simple compounds, and many compounds linked to offensive odors are removed (or less likely to be generated). Associated with this decomposition is ammonia volatilization, which decreases the nitrogen fertilizer value of the manure. In principle, any liquid manure storage or lagoon can provide aerobic treatment by including a mechanical aeration system. However, due to energy cost, mechanical aeration tends to be expensive.

- **Capture/treatment of discharged air and gases**

Biofilters are living organic filters that trap particulates and attached odorous compounds and provide an environment for biological degradation of the trapped compounds. They are potentially suitable to reduce odorous emissions from mechanically ventilated buildings. Biofilters are usually made up of wood chips and/or compost. Odor reductions of 90 percent from swine and dairy facilities with biofiltration systems have been reported. To function properly, they must be properly sized. The size of a biofilter is proportional to the amount of air being filtered. To date, treating large volumes of air, such as all the air discharged from a tunnel-ventilated

poultry house, has not been viewed as practical. However, some consideration has been given to the concept of filtering the air discharges when minimal ventilation of the house occurs.



The use of anaerobic digestion has proven to be very effective in reducing manure odors both during manure storage and during land application. Anaerobic digestion, such as that which occurs in a properly functioning lagoon, provides conditions suitable for complete decomposition of organic matter to lower-odor end products. The release of odors is further reduced if the manure is covered during storage. Although perceived as a capital-intensive system, impermeable covers have recently been used to capture methane to be flared or utilized. Not only does this have the potential for energy conversion, it can also help to address greenhouse gas emissions and generate carbon offsets or credits for farmers.

As indicated above, manure storage units and lagoons can be covered to decrease odor and gas emissions, using either permeable (i.e., biocover) or synthetic impermeable materials (Nicolai et al., 2005). Covers act as barriers to the solar radiation onto the storage surface and the wind force over the surface area. The permeable covers include a closed-cell polyurethane foam with and without topical natural zeolite, chopped straw or cornstalks and geotextile covers. Costs for biocovers vary widely depending on materials used and methods of application. Some permeable materials such as straw and cornstalks are effective for only short periods of time and increase pumping and agitation problems. The impermeable covers include an inflatable plastic, floating plastic, etc. Unless vented, methane production will cause the covers to inflate, which has been known to cause the material to tear. Also, unless precipitation is removed from the top of the cover, it will accumulate and lead to submerging the cover. With proper installation, management and prior regulatory approval, this accumulated precipitation may be excluded from the manure, thus reducing pumping costs. Another consideration is access to the manure during pumping if agitation is necessary to remove accumulated manure solids.

- **Enhanced dispersion of odors**

Structural windbreak and vegetative shelterbelts represent impermeable and permeable barriers, respectively, to reduce downwind dust particles and odor concentrations. Structural windbreaks resist the force of the wind flow, deflecting the wind upward and increasing turbulence in the area downwind of the windbreak. Shelterbelts, a vegetation system that uses trees and shrubs to filter dust particles, also have the potential to decrease odor and dust leaving production sites. When combined with separation distances, they have been reported to effectively reduce the odor

perception levels reaching populated areas, reduce the number of people affected by odor and reduce the time duration of exposure to odors.

Best Management Practices for Manure Spreading

1. When feasible, **injecting** and incorporating manure into soil shortly after application can best prevent odorous emissions that occur as a result of land application.

2. Follow the liquid animal waste management plan's pumping schedule. Remove waste from the storage facility as often as the management plan requires and more **frequently** if possible. Odors increase over the storage period, and delaying cleaning the storage facility only increases the potential odor.

3. Spread **early in the day** when air is warming, rising and more turbulent, rather than late in the day when the air is cooling and settling. This also allows the applied waste to dry, which reduces odors.

4. Be aware of **wind** condition so that neighbors will be in the downwind direction as little as possible.

5. Avoid weekends or holidays when spreading. When possible, don't spread immediately before and during **times** when it would be most objectionable to your neighbors.

6. Avoid spreading waste near heavily traveled roads. Keep equipment as clean as possible, and minimize leaks and spills. **Appearance** goes a long way in public perception.

7. Properly dispose of livestock mortality. **Composting** is accepted and approved as an environmentally sound method of mortality disposal. On-site **incineration** provides a clean and efficient way of mortality disposal for poultry operations. When available, **pickup for rendering** can be a viable option. Finally, when properly implemented, **burial** can be environmentally safe.

References

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