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Agricultural and Biological Engineering

Odor Control for Animal Production Operations

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As more non-farm residents move into rural areas, complaints about odors from animal production operations are increasing. The trend toward animal facility expansion can only intensify the problem. Without zoning to keep residential and agricultural areas separate, odor problems will not go away. This fact sheet outlines practical and technology-based methods to help control odor generation and minimize odor complaints about your operation.

Some odor control techniques—such as good housekeeping—cost nothing but time and can be extremely effective in preventing odor production. Sound management practices, careful site selection, and communication with your neighbors may be your best and least expensive prevention for odor complaints. If prevention measures fail to solve disputes over farm odors, technology-based approaches to odor control may be necessary. However, technological measures can be expensive and their effectiveness can vary widely. Current odor control methods include preventing the production, release, and transport of odors, or altering or reducing them.

Source of Odors

Most offensive odors are created by the anaerobic (oxygen-free) decay of wet organic matter such as manure, feed, or silage. Warm temperatures enhance anaerobic decay and foul odor production (Figure 1). Wet manure in a warm poultry house, spilled feed moistened by rain on a warm day, liquid manure storages during the warm months, and manure caked on a warm animal are just a few potential odor sources. Odors can originate from the animal housing facility, manure handling, improperly handled carcasses and decaying organic matter.

Spread of Odors

Odors can be broadcast through air as a gas, or can be absorbed and transported by dust particles. Odors will tend to linger in the area on humid, windless days and will dissipate on dry, windy days.

Unacceptable Odors

Frequency, intensity, duration, and offensiveness are the main factors affecting the acceptability of farm odors. Any combination of frequent, intense, long-lasting, or offensive odors probably will be unacceptable to your non-farm neighbors. Your neighbors may tolerate frequent or intense odors that do not linger in the air or are not offensive, although sensitivity to odors varies from one person to the next.

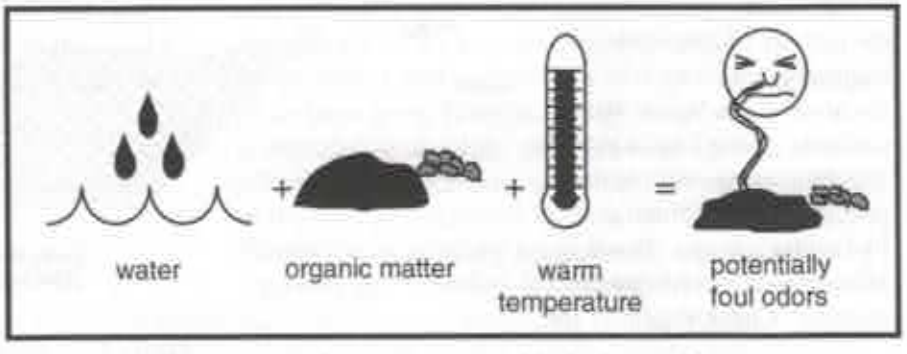

Figure 1. Conditions for potential foul odor production.

Practical Ways to Help Minimize Odor Complaints

Whenever possible, use practices that aim to prevent odors from reaching and bothering your neighbors. Sometimes it is easier to prevent odor complaints than it is to stop odor production. Consider the prevailing winds in the area when choosing a site for an animal facility or manure storage. Try to locate a new facility downwind and as far from residential areas as possible (one-half to one mile is recommended). Agitate and spread manure in the morning or early afternoon on dry, windy days, when there will be sufficient time for odors to dissipate and ample wind to dilute odors before your neighbors arrive home in the evening. Visual buffers such as a row of trees around manure ponds and spreading areas may help reduce the number of complaints. Most importantly, open lines of communication with the community. Let your non-farm neighbors know that you are concerned about odors and would like to work with them to understand and solve the problem. A little community outreach can go a long way, but neighborly strategies are not always sufficient. Preventing the production of odors may be the solution if being courteous fails.

Preventing the Production of Odors

Several steps can help reduce odor production on the farm. Good housekeeping is your best defense against odor generation. Clean up spilled feed, silage, and manure trapped in hard-to-reach areas. Even small leaks in feed augers can result in large spills over time. Wash manure-caked spreading equipment shortly after use. Keep animals clean—their warm bodies speed up anaerobic decay. Dispose of carcasses promptly and properly. Clean bedded pens daily if possible. Minimize dust levels to prevent odors from escaping through the ventilation system.

Keep organic matter dry to reduce odor production—the activity of anaerobic bacteria is inhibited when moisture drops below 40 percent. Grade lots to avoid standing water—a potential problem even in small areas like under a fence. Don't allow water to infiltrate dry manure. Check regularly for leaks in the drinking water supply in high-rise poultry houses and watch for leaks into the manure area from outside. Good ventilation in poultry manure areas will help keep manure dry, but manure that becomes too dry will create dust problems. Always cover dry manure storages with a roof or tarp to keep rain out.

Composting manure, bedding material, and poultry and swine carcasses also can inhibit odor production. Air is brought into the compost pile by frequent turning or by forced aeration. Putrid odors are not formed because the presence of air kills anaerobic bacteria. Fully composted material smells earthy and will not be offensive when spread. Be aware, however, that improperly composting material can become anaerobic and be a source of odors.

Mechanical aeration can suppress odor generation in very dilute liquid manure systems containing approximately 1 to 3 percent solids. However, the amount of energy required to aerate a manure storage tank or earthen basin can be prohibitively expensive. Sufficient aeration should permit storage for up to one month before odors return.

If odors are still a problem after trying all measures to prevent odor production, try to prevent these odors from escaping the boundaries of your farm.

Preventing the Release and Transport of Odors

Some odor control methods are designed to keep the odors within the farm boundary, thus minimizing odor complaints from surrounding neighbors.

To control odor dissipation from enclosed housing facilities, consider adding a biofilter to your ventilation system (Figure 2). Air from the ventilation system is passed through a bed of organic matter, such as compost, peat, or wood chips. Microbial action within the bed aerates and "scrubs" the odors out of

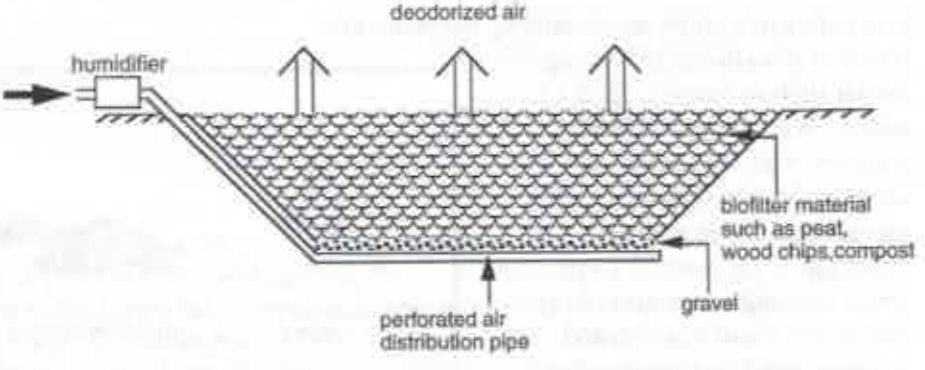

Figure 2. A typical biofilter system.

the air. Drawbacks to biofilter systems include additional static pressure on fans, potentially reduced air flow in the animal facility, acidification of the filter material, and high cost. A biofilter system requires maintenance, management, and monitoring.

A floating, permeable cover that functions as a biofilter for manure storages is under development at Oregon State University. It resembles a burlap quilt filled with straw, zeolite, and floatation material such as polyethylene foam and is placed over a storage tank and kept moist (Figure 3). As odorous air from the manure storage passes through the cover, the moist, aerobic environment helps to break down odors.

Natural permeable covers, such as a floating crust of manure or a layer of straw or hay, will tend to filter odors from liquid manure storages.

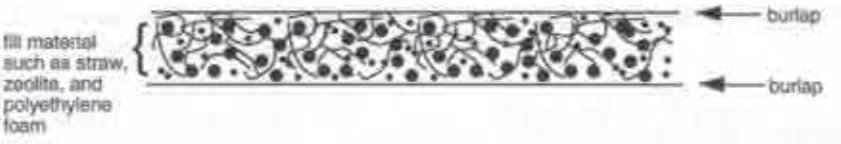

Figure 3. Permeable cover for manure storages.

Loading storages from the bottom and minimizing agitation will help maintain a solid crust. Permeable covers will not prevent odor release during agitation or spreading—common causes of odor complaints. Be aware that crusts of manure and wet straw create ideal breeding sites for flies.

Discharging air through water scrubbers is another method to prevent the release of odors, but currently is prohibitively expensive.

Manure storages can be covered or sealed to prevent the transport of odors by wind. A pipe will be necessary to vent gases, but a small pipe emits less odorous gas than the surface of a large storage tank.

Spread manure thinly and incorporate it into the soil within hours of spreading to minimize the diffusion of odors. Inject manure to achieve the best odor control when field-applying.

When disposing of mortalities off the farm, arrange for daily pick-up and use suitable storage methods to contain odor when necessary. When composting carcasses, add enough sawdust or other carbon material to minimize ammonia loss and odor.

If methods for containing odors within the boundary of the farm are insufficient, odor treatment methods may need to be employed.

Treating Odors

Manure and other organic matter can be treated biologically or chemically to reduce odor potential. Biological treatment includes aerobic systems like composting and anaerobic systems like treatment lagoons or anaerobic digesters. Other methods include using additives designed to chemically or biologically alter odors.

Anaerobic digestion is a way to speed up a natural biological decay process to create biogas and a low-odor, biologically stable manure (effluent). Instead of trying to stop anaerobic decomposition, this process actually encourages it. However, under controlled conditions at elevated temperatures, anaerobic decomposition is more complete. In the process, odorous compounds are created and then converted into odorless biogas. Effluent from an anaerobic digester can be stored in a liquid manure storage for several months without the return of odors. An exact storage time has not been documented and will vary with climate and degree of anaerobic digestion, but very few odor problems have been reported even after effluent has been stored for six months. Although digested manure is not odor-free, the odor is less intense than stored liquid manure and tends to dissipate quickly when field-applied. The biogas can be used to generate electricity or heat, offsetting the initial cost of the system.

Anaerobic treatment lagoons are often used to break down solids in manure in the same manner as an anaerobic digester. Because lagoons operate at ambient temperature rather than at an elevated temperature, lagoons break down solids more slowly than anaerobic digesters. Hence, lagoons require a very dilute manure, about 1 to 2 percent solids. When lagoon temperature is high enough, the proper mix of bacteria will break down solids and produce methane and carbon dioxide—both odorless gases. However, the bacteria won't function properly at low temperatures, and neither does the lagoon. The result of an improperly functioning lagoon is an accumulation of solids, an overloaded lagoon, and potential odor problems when lagoon temperatures rise in the spring. Treatment lagoons are not popular in Pennsylvania, partially because they require a large land area and treatment is seasonal.

Odor control additives have been designed to mask, neutralize, or chemically or biologically alter odors. Many of these storage or feed additive products are expensive and require frequent doses with variable effectiveness. With the exception of a yucca-plant extract, sarsaponin, that has been proven to reduce ammonia emissions, no odor additives have been scientifically proven to reduce manure odors. Be wary of manufacturers' claims and buy products in small quantities at first. Current research at the North Carolina Animal and Poultry Waste Management Center is evaluating the effectiveness of various odor control additives.

Further Reading

Several related Fact Sheets are available from Penn State's Department of Agricultural and Biological Engineering. "On-Farm Composting—RCL-3", "Farm Composting: Plan Now to Avoid Problems Later—C-4" and "Farm Composting for Profit—C-5" offer more detailed information about composting. "Anaerobic Digestion: Biogas Production and Odor Reduction from Manure—G-77" discusses anaerobic digestion.

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