ENVIRONMENTAL ISSUES IN LIVESTOCK PRODUCTION HOME STUDY COURSE

Livestock Industry Facilities & Environment

The *Environmental Issues in Livestock Production* home study series was developed for livestock producers, educators, students, and others seeking to better understand potential air and water quality impacts of animal agriculture, and to learn more about management practices that can minimize these impacts.

Modules in this series include:

- *Open Feedlot Runoff;*
- *Odor Assessment and Control;*
- *Manure Application;*
- *Livestock Environmental Regulations; and*
- *Manure Treatment*

For information concerning home study course completion certificates, and supplemental teaching materials (Power Point presentations) for use in the classroom, contact Agricultural & Biosystems Engineering Extension, 207 Davidson Hall, Iowa State University, Ames, IA 50011-3080 (phone 515-294-6360), email tglanvil@iastate.edu, or visit our World Wide Web site at http://www.ae.iastate.edu.

Environmental Issues in Livestock Production was developed through an Iowa State University Extension grant, and is part of the Livestock Industry Facilities & Environment (LIFE) project of the Department of Agricultural & Biosystems Engineering. Project team members included the module authors: Dr. Mark Hanna, Dr. Jay Harmon, Dr. Jeffery Lorimor; and project coordinator Dr. Tom Glanville.

IOWA STATE UNIVERSITY
University Extension

Ames, Iowa

Odor Assessment and Control Home Study Lesson 2

This lesson discusses odor assessment and control. It was developed through an Iowa State University Extension project by the Agricultural & Biosystems Engineering Department. This module was developed by Jay D. Harmon, Extension Ag Engineer and Assistant Professor, Agricultural and Biosystems Engineering, and Gene Tinker, Extension Swine Field Specialist, Iowa State University, Ames, IA.

Livestock Industry Facilities & Environment

Objectives:

Upon successful completion of this unit, agricultural producers and support personnel will be able to:

- Determine how the frequency, duration and intensity of odor influence public perception.
- Choose management to minimize odor from livestock manure.
- Use management practices which affect the frequency, duration and intensity of odor.
- Properly select sites for livestock and manure storage facilities to minimize manure odor nuisances.

Introduction

A person's perceptions are based on experiences that they have had throughout their life. For some, this experience includes agricultural production that makes them realize that some odors naturally occur with livestock production, and therefore some level of odor is acceptable to them. Other people may not have been exposed to such situations and may perceive any livestock odors as being much more offensive. To these people livestock odor is a nuisance. In many cases odors can not be eliminated, only minimized through proper management and good neighbor relations.

Livestock production generates numerous odors. Those odors vary greatly, and the offensiveness of each odor is dependent upon the person smelling the odor. Some odors are generated by the animals and the dander from their bodies; some odors are from the animals' feed; and some odors, usually the strongest, are from the livestock manure and decomposition of that manure. So when do odors go from being acceptable to unacceptable? Much of that determination depends on when the odor is considered to be a nuisance. How frequent an odor occurs and the intensity of the odor often are factors considered in whether or not an odor is a nuisance. Since the tolerance of these factors differs for individual people, there is no clear cut answer for what does constitute a nuisance. Many times other things affect how people respond to detected odors, such as the size or ownership of a livestock unit. Some people are not happy with the construction of larger livestock units in their neighborhood, so they have an immediate bias on how much of an odor problem is generated by such an operation. Larger operations do have the potential for more odor because of more animals, however it may actually be the dislike of the production unit that causes more of a problem than the actual odor produced by the unit.

The odors released from livestock production may affect numerous people. In addition to the livestock producers and their families, others exposed to odors include neighbors, people that pass by on roadways and anyone who uses nearby public areas. The number of people affected by any one livestock operation can vary greatly due to the proximity of housing developments or location along major roadways or recreational areas. The more people affected, the greater the chance that some will find the odors offensive. People all have personal differences on how sensitive they are to odors and on what is considered acceptable. These differences in acceptability are very subjective, and are often based on attitudes or previous experiences. A person's memory of an unpleasant prior experience often influences their attitude toward an enterprise. Objections also arise from people feeling they have no power over their own situation and are forced to be exposed to odors.

When assessing an odor situation and evaluating possible methods of reducing odor, if necessary, it is important to consider what is a realistic expectation. Elimination of odor from livestock and associated facilities is not realistic. Odors of some sort will always be produced and are usually released to the environment. What can be evaluated and possibly changed is the frequency of odor occurrence, the duration of the odor, the intensity of the odor and the negative perceptions by some neighbors. This unit will discuss management techniques that can be used to affect these odor characteristics and additional control methods that are being evaluated for effectiveness of reducing odor problems.

Causes of odor

There are three primary sources of odor: livestock facilities and the animals contained within, manure storage structures, and application of livestock manure to agricultural land. The odor itself is a combination of many different compounds and gases. Many of the compounds that combine to produce odors are the result of anaerobic bacterial decomposition of manure during storage. Decomposition rate is affected by temperature, pH and moisture. Warm, moist conditions favor bacterial action, and therefore increase decomposition and odor generation. Some odorous compounds produced are: sulfides, organic acids, carbonyls, indoles, skatoles, and phenols. A number of factors, including which compounds are present and in what combinations, affect the odor emitted and the intensity of that odor.

There are primarily three gases produced by manure decomposition that are major components. Those gases are hydrogen sulfide, amines and methyl mercaptans. All of these are present in the atmosphere in dilute concentrations but may be present in higher concentrations near livestock buildings. Hydrogen sulfide (H_2S) has a rotten egg smell at low concentrations. At greater concentrations, which may occur in a deep pit building during manure agitation, the gas cannot be smelled due to paralysis of the olfactory senses, and can actually cause death due to respiratory arrest. H_2S is heavier than air so it accumulates in pits and other low lying, unventilated areas. Hydrogen sulfide concentrations should not be high enough to cause concern as you move away from the manure storage structure.

Dust is also a component of odor and may be the most detrimental because it can be transported long distances along air currents. Dust particles act as a transport mechanism for odor. Gases and compounds disperse but dust will carry compounds farther. Dust particles

may also deposit next to olfactory cells where the odor can continue to affect a person. The dust can come from many sources, including dried manure, feed and animal hair or skin.

Odor measurement

Odor measurement is difficult because no instrument has been found to successfully measure odor and all its components. The human nose is the only thing that can really measure odor, and then personal preference affects what is considered acceptable or offensive. Modern instruments can measure some compounds that make up odor, but odor is a combination of many compounds. A high or low concentration of just one compound is not a good indicator of whether or not offensive odor is present.

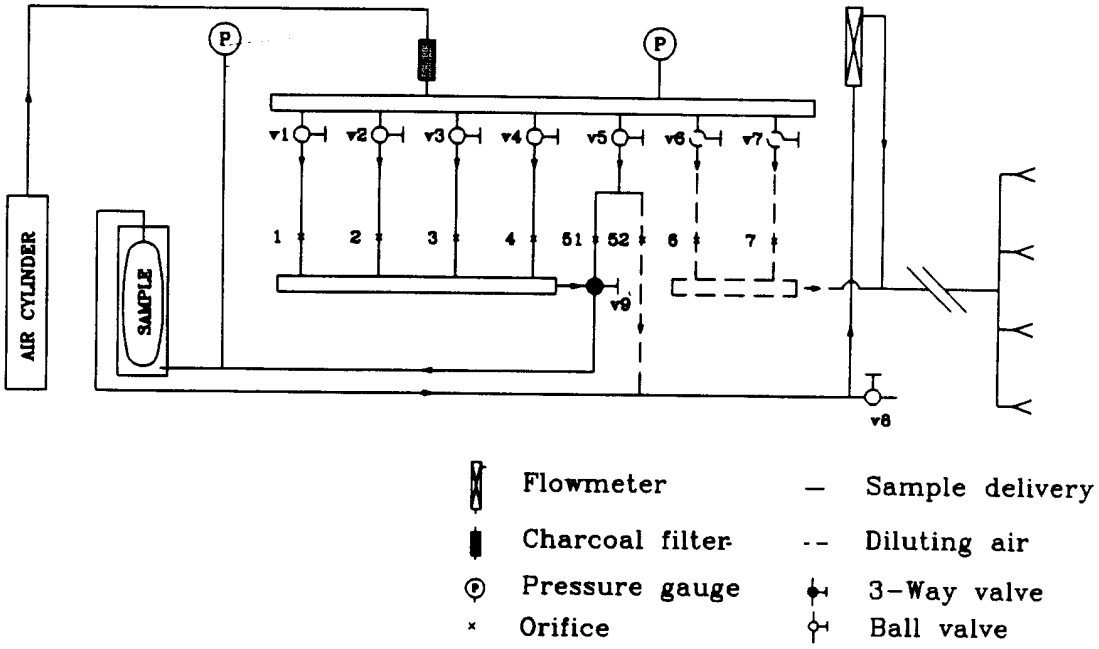

Figure 1. Olfactometer layout (Bundy, et al, 1993) .

One primary measurement method uses human noses to detect odors. A panel of people is exposed to air samples with different amounts of fresh air added to a set amount of odorous air. The panel's task is to determine the threshold level, which is the amount of fresh air that needs to be added for panelists to just be able to detect the odor. This technique is called olfactometry. An examp le of an olfactometer layout is shown in Figure 1. The ports on the right are where the odor panel would be seated. The sample is combined with fresh air through a series of valves that dilute the sample. The panel then determines at what dilution they can begin to detect the odor. This dilution level is referred to as the odor threshold.

A second method used is the Electronic Nose, which is an instrument that detects a specific element. This method is not accurate for all odor detection, because odor is often composed of many different components in various concentrations.

Siting livestock buildings

A good philosophy when siting livestock buildings is to always prevent odor problems rather than cover them up. Selecting appropriate building sites can go a long way toward minimizing odor problems. Some people may consider this to only be important when purchasing land or building a farmstead from scratch. But in reality, it is important to evaluate a building site before investing much in improvements or expansion. Such an investment in a site that may have potential odor problems probably would not be wise.

Topography

Topography around a building site is very important since it affects air movement. Relatively flat sites that have good air movement and mixing are good places to build livestock facilities. It is best to avoid hilltops above residences in a valley, as odors may travel down hills. On calm nights cool air drains from higher to lower elevations. Any odors from livestock facilities will travel with the cooler air, thus creating potential odor problems. If there are no residences at lower elevations, hilltops are a good location for livestock buildings, especially naturally ventilated ones.

Wind

Wind direction has a major impact on how odors travel. Check the direction of prevailing winds and compare them with the direction toward neighboring residences, public use areas, highways, population centers and also any areas to be developed in the future. If the summer prevailing wind is toward any such places, it would probably be best to choose another site. In Iowa, winds typically come from the northwest in winter and south to southwest in summer. Therefore, preferred locations for facilities are straight north or straight east of housing to minimize potential problems.

Distance

In addition to wind direction, distance is important. Odor intensity decreases as distance from the source increases. Distance allows fresh air to mix with the odors, resulting in decreased odor intensity. Regulations for separation distances were set by House File 519 in Iowa. Separation distances are based on the odor source type and the size of the operation. Required distances range from 750 to 2,500 feet. More detailed information on separation distances may be found in the **Livestock Environmental Regulations**, Lesson 4 of this series.

Building orientation

Building orientation also has an impact on the odor emitted. Buildings or outdoor manure storages that are exposed broad side to neighbors are more likely to cause odor problems a greater percentage of the time due to the fact that there is a much larger building surface area exposed toward the direction of the neighbors. Therefore, it is advisable to orient buildings with the narrow side toward neighbors. An exception to this is naturally ventilated buildings, in which the wind direction needed for proper ventilation is of more concern than exposure to

neighbors. However, if neighbors or a public use area is not far away, it may be best to consider relocation of a naturally ventilated building. If potential odor problems are a concern, it may be better to construct a mechanically ventilated building and orient it to reduce exposure or find a different site.

Appearance

The importance a person's perception has on their judgment has already been discussed. This is also true with regard to the appearance of livestock facilities. Well-maintained production units usually are not perceived to smell as bad as units that look run-down. Nice landscaping and a regularly mowed lawn will also encourage workers to do a better job of cleaning up spilled feed and disposing of livestock carcasses. A production site that is overgrown with weeds and has junk accumulated throughout the site certainly wouldn't encourage workers to keep everything tidy. Properly planted and maintained windbreaks can serve a number of functions. Windbreaks that shield the production site from the view of passers-by may decrease the chance of odor complaints. When people cannot see the source of an odor, they are less likely to notice an odor or complain about it. Windbreaks also cause air to be lifted up, which causes more mixing of fresh air with the odorous air, thus diluting the odor effect. However, wind breaks need to be used with caution around naturally ventilated buildings because they can reduce the air flow through buildings and create ventilation problems.

Odor from buildings and lots

Some odors are generated by livestock buildings and lots. Much of the problem can be attributed to dust production and release. Excessive dust particles are an air pollution problem and can transport odors some distance. There are a number of methods to reduce the dust generated and released into the air. One control option is to clean the building frequently and remove dust that has accumulated on gates, feeders and walls. This decreases the amount of dust that can be stirred up and released into the air. Dust released from feed can be reduced by using feed drops that extend down into the feeders and lids to close the feeders. Adding a small amount of fat to the feed or pelleting the feed are other methods of reducing feed dust. Air stirring fans can dramatically increase airborne dust concentrations.

Proper humidity levels (50 to 70 percent) will reduce dust build up and proper ventilation will help livestock develop good dunging patterns, which in conjunction with good flooring, allows manure to drop through the flooring quickly. Diluted manure is less likely to volatilize gases. Outside livestock lots should be well- drained and kept as dry as possible. If water is not given a chance to accumulate, less bacterial decomposition will occur ; and therefore , less odor is produced. Accumulated manure should be scraped and hauled as frequently as possible.

Biofilters

Filters can be used to reduce the dust particles in the air. Biological filters, or " biofilters" are used to cleanse the air of odor and dust. These filters consist of biological matter, such as peat moss or wet wood blocks which, when kept moist, fosters bacterial growth. The odorous air is passed through this filter where microorganisms break down the odorous compounds to simple substances like carbon dioxide and water. Biofilters generally are used to cleanse the air exiting the building through exhaust fans. Biofilters have only been efficient at treating low

concentrations of odorants from building fans. Most biofilters require fans that are capable of providing a good flow of air at a high static pressure. As the filter bed ages , the peat or other filter material will become more compact and will need to be stirred. It is a difficult task to design a system in which the biofilter is "transparent" to the building 's operation. Figure 2 shows an example of a biofilter.

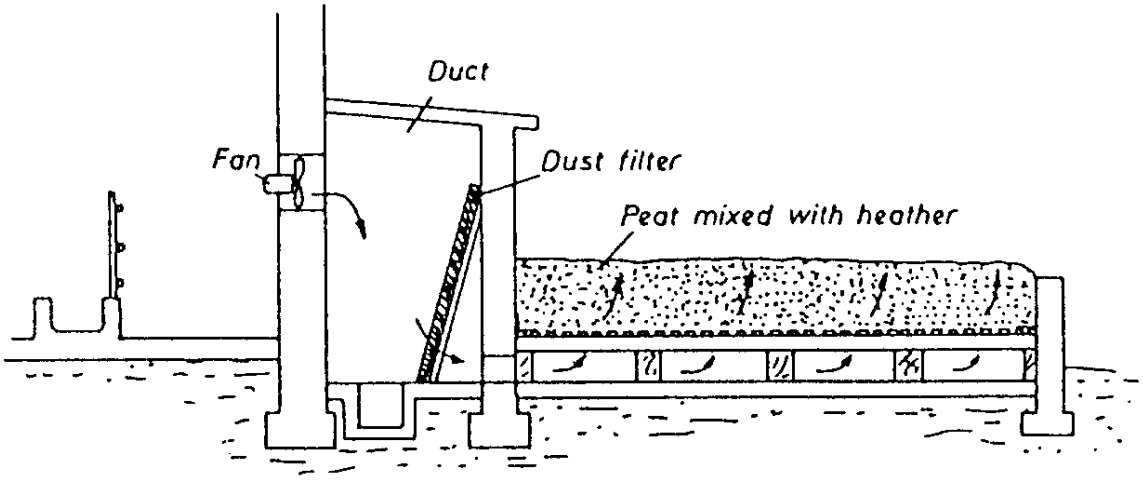

Figure 2 An example of a biofilter for ventilation air.

Another variation of the biofilter is a biomass filtration system. This system draws air through crop residue to remove some of the dust, thereby removing some of the odor. This is a new approach that has only begun to be tested but is showing promise.

Chimneys

Dilution of odorous air with fresh air has been shown to be one method of reducing odor intensity. One way to increase the mixing effect is to use exhaust chimneys on livestock buildings. Chimneys elevate the point at which the ventilated air is released into the atmosphere. Raising the point of odor release stimulates additional mixing, thus reducing the odor intensity. The velocity at which the ventilation air is released also affects odor annoyance. I ncreased velocity also causes increased mixing. Since chimneys are mounted on exhaust fans, care should be taken to not constrict the flow. This is done by providing 1 square foot of chimney cross-sectional area per 800 cubic feet of ventilation air per minute (cfm). For example, if a chimney was mounted on a fan that was rated at 8000 cfm, a chimney of 10 square feet would be needed. The inside of this chimney should be smooth to reduce air friction.

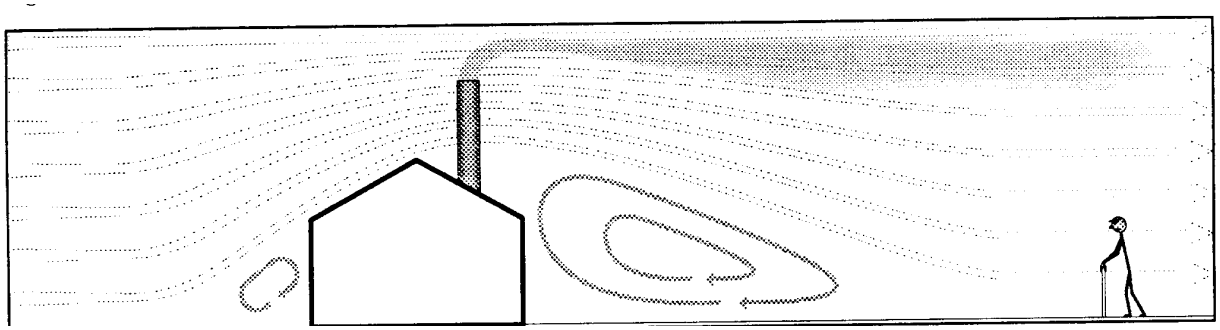

Figure 3 A ventilation chimney to disperse odors (Mortensen and Kai, 1995).

Odor from manure storage

A second source of odor from livestock production is manure storage. Bacterial action causes manure decomposition, which generates odors. These odors are then released to the atmosphere if nothing is done to contain them. A number of factors impact the bacterial action that breaks down manure. Moisture is needed for bacteria to function; so dry manure (under 40 % moisture) is usually less odorous than liquid manure. Temperature also has an impact on manure odors. H igher temperatures speed microbial action, resulting in faster decomposition of the manure . Also important is the type of bacteria present that is primarily dependent on the presence or absence of oxygen in the manure. Aerobic bacteria live when oxygen is present. Water and carbon dioxide are the products of manure degradation by aerobic bacteria. Anaerobic bacteria work in the absence of oxygen, which is the status of most manure storage structures. The products of anaerobic bacteria degradation of manure are much more odiferous than the products from aerobic bacteria. Many of those compounds and gases are listed in the **Causes of odor** section of this home study lesson . Unfortunately, aerobic treatment is not considered practical at this time because it is an energy-intensive process. However, surface aeration techniques are under development in which much less energy is required to reduce odor from slurry basins.

Manure in buildings

Deep manure storage pits under livestock buildings are another source of odors. These odors are primarily generated by bacterial decomposition of accumulated manure. There are two basic methods of reducing odors in buildings from such storage pits. The first is a good pit ventilation system that removes the gases and odors generated from manure in the pit. Such a ventilation system can also pull dust particles from the building down into the pit where those particles may become trapped in the pit liquids. This method may reduce odor within the building but may cause odor problems in surrounding areas. The second method is to use shallow pits that are cleaned at least every 2 to 3 weeks. This removes the manure from the building so that when degradation occurs , the odors and gases generated are released into the atmosphere rather than accumulated within the building. After the manure is removed, 2 to 3 inches of water should be added back into the pit to decrease ammonia production..

Size

Size obviously has an impact on odor. L arger operations generate more manure, which may generate more odor. This has been a concern about larger pork production units that have been built. However, there are management techniques that may help reduce some of the odor generated. One technique is to remove manure as frequently as possible, thus decreasing the opportunity for decomposition. Fresh manure is less of fensive than decomposing manure; so decreasing storage time of the manure lessens odors. Frequent removal also usually removes more solids, the portion of manure generally responsible for odor production. However, it is a problem to have land available for continuous spreading of manure. If such land is available, this technique is a good option. But in areas where crops are growing on the land for a considerable part of the year, frequent spreading is not possible.

Lagoons

A manure storage method gaining popularity in the Midwest is anaerobic treatment lagoons. Lagoons are much different than "true" storage facilities. In addition to storage, treatment also takes place in a lagoon . Lagoons are much larger than traditional storage structures because the manure must be diluted with 6 to 10 times as much water as manure added. This dilution is necessary for proper bacterial decomposition of the manure. Odor intensity from lagoons is usually less than from typical slurry storage facilities. Although lagoons are not free of odor, odor is seldom a problem if the lagoon is managed properly. An exception is late spring and early summer, when warmer weather causes increased decomposition. During the cooler weather of fall and winter, bacterial activity decreases and less manure solids are broken down. Since the amount of manure added to the lagoon generally remains the same throughout the year, the amount of undigested manure accumulates during the cooler weather. When the weather warms and bacterial activity increases, there is a large amount of manure solids to be broken down. The rapid breakdown of this large amount of accumulated manure generates more intense odors than normal, which can be offensive.

Management effects

Mismanagement of lagoons can cause increased odors throughout the year. In addition to having enough dilution water, it is also important to release consistent amounts of manure frequently into the lagoon. This allows the bacterial population to stabilize and break down the manure as it is added. Adding too much manure at one time, or at infrequent intervals, causes a situation similar to the spring warm-up, when too much manure is available for decomposition at one time. This procedure really starts with proper sizing of the lagoon. If the lagoon is too small, a similar effect is seen as adding too much manure at one time or not having enough dilution water. The lagoon must be large enough for adequate dilution of the manure added to have proper decomposition without excessive odor production. Operations that add production facilities that release manure into a previously constructed lagoon may be asking for trouble if the lagoon is not large enough to properly break down the additional manure. An important aspect of proper lagoon start-up is that adequate water be in the lagoon before any manure is added. The lagoon should have 1/3 to 1/2 of the minimum design level to ensure adequate manure dilution to properly start the manure degradation process. Lagoons should also be started during warm weather when bacteria are more active.

The solids' component of livestock manure is of primary interest in lagoon function because the solids' component contains the organic matter that is broken down by bacteria. Therefore, the solids are ultimately the source of odors. If the amount of solids released into a lagoon is reduced, odor production should also lessen. One method of reducing the solids in a lagoon is to separate the solids from liquids before the liquids are released into the lagoon. There are a number of processes by which this can be done, including mechanical processes or simply gravity in a settling basin or tank. Separation works well for bovine manure but is more difficult with swine. Some chemicals may work well in separating solids from liquid in swine manure.

There are a number of products that have been proposed as solutions for reducing odors from manure storage structures. There has been little research to support the odor reduction claims of these products, with most information being testimonials from individuals. The processes these products use are discussed in the next section .

Possible solutions

Odors from storage structures can become a problem when wind blows across the liquid surface and odors are allowed to escape from the storage structure. This is especially a concern with lagoons, which have large surface areas exposed to the atmosphere, thus allowing plenty of opportunity for odor release. One method of reducing the odor escape is to cover the storage structure. This is easier done with some structures than others. Concrete structures may actually be capped, so the structure is totally enclosed. Other structures may be covered with materials such as large tarps. Another product is an oil based film that spreads over the entire surface. The key to success of this process is to decrease the interaction of the liquid surface with the atmosphere. To be effective the cover must maintain coverage of the liquid surface in order to decrease the chance of the atmosphere picking up odors and spreading them.

A similar concept is a floating biological cover. A simple example of such a cover is the crust that forms on the surface of dairy manure in storage. Such a crust was found to decrease the odors emitted from the storage structure. Covers similar to the dairy crust are made of biological materials that will decompose over time and can be mixed with the manure and applied to land. One example of such a material is a layer of straw. The bio-cover reduces interaction between the liquid surface and the atmosphere. One problem with floating bio-covers is that they will sink after a while and therefore must be replaced. One possible solution that has been suggested is to add mineral oil to the biological material as it is blown out on the surface.

Some products are designed to cover up or offset the odors that have been released into the atmosphere. **Masking agents** are one class of products that have an odor that is stronger than the odor from manure. The object is to cover the manure odor with a stronger, hopefully less offensive, odor. Another class of products is **counteractants**, which work by offsetting manure odor with another odor so that the two odors basically cancel out one another, thereby reducing odor intensity. One difficulty experienced with counteractants is knowing what odor

to offset. With the great variation of odors possible, it is difficult to know which odor to prepare for and thus what product to use. Because of this, success has been variable and somewhat limited. A third class of additives is **deodorants**. These products are to eliminate odor from manure, either by preventing the escape of specific gases or by killing the organisms that cause the odor. Enzymatic products are a fourth class of additives. These products are supposed to alter the biological pathways involved in manure decomposition. As with many of the other classes of additives, success has been erratic and there is limited data. Much work is currently being conducted at a number of universities to evaluate many different products and the effectiveness of each at reducing odors, and under which conditions the products work best.

One treatment method that does reduce odor if conducted appropriately is aerobic treatment. This process involves adding enough oxygen to the manure so that the aerobic bacteria can live and break down the manure. As stated previously, the products of aerobic digestion are generally carbon dioxide and water, two compounds without much odor. One major concern with this method is the need to be sure adequate oxygen is added. There are several procedures available or being developed to accomplish this. One method is to install a surface aerator that incorporates air into the manure, either with windmills or electric motor driven aerators. A second method is to release oxygen into the manure. There are a number of ways being developed to do this, including bubbling oxygen below the manure surface. A second major concern with aerobic treatment is the cost required to apply the treatment. The process does work if conducted properly, but it is an expensive alternative. Another speculation is to combine both surface aeration and bacterial additives to control odor.

Odor from land application

Many nuisance complaints due to odor occur just after manure has been applied to agricultural land. Such spreading creates a large surface area of applied manure to interact with the atmosphere. Fortunately, there are a number of management practices that will reduce odor intensity and duration if conducted timely and properly.

Use of tillage equipment to incorporate manure that has been surface applied is one way to reduce the interaction of manure with the atmosphere, and thus reduce odor. The sooner manure can be incorporated after spreading, the less time there is for odor release. A similar technique possible with liquid manure is to inject the manure below the soil surface with a knife or sweep assembly , or incorporate it with a series of disks as the manure is applied on the soil surface. This will be effective in reducing odor but may not be acceptable in a conservation tillage program. When surface applying by irrigation or broadcasting from a spreader, use of a low trajectory spread pattern decreases mixing with the atmosphere and thus reduces odor release. Irrigation of stored manure may cause more odor release than any other application technique. Irrigation of liquid from the second stage of a lagoon is a more acceptable alternative. See also **Manure Application** home study, Lesson 3 of this series.

Another odor control method is to carefully select the time when manure will be land applied. Careful timing can decrease the opportunity for neighbors to experience the odor released. Avoid spreading just prior to weekends or holidays when people are involved in outdoor

activities. Give special consideration to events planned at recreation areas near the land receiving the manure. Also pay attention to the wind direction and avoid spreading on days the wind is blowing toward neighbors or recreational areas. Time of day also has an effect. Morning spreading is preferred because as the air warms it rises, promoting manure drying and lifting the odor upwards for mixing and dilution in the atmosphere. Avoid high humidity days or just before a rain because the humidity causes odors to linger. If possible, it is best to conduct all land application of manure within a short time period rather than to extend the task. This will decrease the duration of odors.

Neighbor relations

Personal interaction with neighbors has very little to do with odor control, but may be the most important part of avoiding complaints. Producers who have a cooperative public attitude receive few odor complaints. Open communication is important; hiding something generally arouses suspicion. Always be courteous when dealing with neighbors, even if their requests are unrealistic. Alert neighbors to plans for spreading manure and discuss any plans they have for outside activities. One farmer uses post cards to notify neighbors of proposed spreading. If they are planning an activity they are asked to call the farmer. This gives the neighbors a feeling that they have some control over the situation and it is not imposed without their consent. Another suggestion has been to even offer a motel room to neighbors during times when odors will be intense. The offer itself may be the difference between happy or unhappy neighbors. All spreading activities should be documented so a record is available in case a problem should develop. Determine the cause of any complaint and work to correct it. Good public relations go a long way toward improving acceptance of odors generated by livestock production.

Conclusion

Livestock production does produce odors, and there is no way to eliminate those odors entirely. The severity of those odors is dependent on the frequency and duration of occurrence and the intensity of the odor, in addition to the perception of the people experiencing the odor. Everyone's perception is different, as what may be a nuisance to one person may be pleasant to another. Fortunately, there are a number of management practices that can be implemented to reduce odor problems. The most important of these is general cleanliness of animals and buildings. Frequent manure removal also decreases odors, as some odors are generated while manure decomposes. Proper site selection for production facilities is also important, with distance from neighbors one of the most important factors. Increased distance from neighbors may be the easiest and most appropriate method to minimize odor complaints. Many products are being developed and promoted to reduce odors released from production facilities and manure storage units. However there has been little research to support the use of such products. Careful selection of when to apply manure to agricultural land and use of practices such as injection or incorporation of manure goes a long way toward reducing odor complaints. Open communication and cooperation with neighbors develops good relationships, decreasing complaints and promoting acceptance of livestock production.

Test Questions

Lesson 2, Odor Assessment and Control

1. Discuss three characteristics of livestock odor which influence public perception and why those characteristics are important.

2. Explain why it is difficult to actually measure odor.

3. When is it important to avoid hilltops when siting production units?

4. How do windbreaks around production facilities decrease odor complaints?

5. List three things that can be done to reduce the amount of dust in livestock buildings.

6. Explain why excessive odors are released from lagoons during spring warm-up?

7. What are some lagoon management activities that can decrease odor generation and release?

8. Why is morning the best time of day to apply manure to agricultural land?

9. What are some available products that claim to counter act odors?

Answers for Test Questions
Lesson 2, Odor Assessment and Control

1. Discuss three characteristics of livestock odor which influence public perception and why those characteristics are important.
Frequency, intensity and duration are characteristics that influence public perception. Persons generally will tolerate infrequent odors, low intensity odors or short duration odors. Odor annoyance is much like temperament. Some people will not lose their temper easily while others will have a "short fuse". The less the frequency, intensity and duration of odors, the less likely that any person will be annoyed. The point at which a person becomes annoyed will depend on their background and other factors that influence personal perceptions.

2. Explain why it is difficult to actually measure odor.
Odors are composed of a combination of many compounds. No one compound is a good indicator of how offensive odors will be to people. There also is no one right answer because odor interpretation is subjective. The use of olfactometry is believed to be the most effective means of measuring the level of odor.

3. When is it important to avoid hilltops when siting production units?
Odor will travel downhill with air currents and humidity. When residences are in valleys below a livestock production site they receive more odor emissions. However, hilltops are a good site for naturally ventilated buildings. These factors should be balanced.

4. How do windbreaks around production facilities decrease odor complaints?
Windbreaks shield the site from public view. It is believed that there is an "out of sight, out of mind" factor that affects the level of complaints. Windbreaks also lift air currents. This has two potential impacts. 1) If the windbreak is upwind from the livestock site, air currents are lifted prior to picking up odorous compounds and dust so the odor potential is diminished. 2) If the windbreak is between the livestock site and neighboring residences, air currents are lifted and stirred, making the odor plume to dissipate more rapidly.

5. List three things that can be done to reduce the amount of dust in livestock buildings.
Potential improvements come from:
- *cleaning frequently*
- *using feed drops to minimize dust*
- *adding fat to the diet or pelleting feed*
- *avoiding using stirring fans when unnecessary for animal comfort*
- *maintaining proper humidity*

6. Explain why excessive odors are released from lagoons during spring warm-up?
Biological activity is low all winter in lagoons during cold temperatures. When temperatures increase, the activity increases. Because the lagoon has been biologically overloaded all winter

it takes the microbes time to catch up to the loading rate and regain equillibrium. Therefore, the lagoon will stink during this process.

7. What are some lagoon management activities that can decrease odor generation and release?

This guidelines will help to keep lagoons from producing many odors:

- *maintain consistent and frequent loading of the lagoon*
- *add the proper amount of dilution water*
- *start the lagoon during warm weather*
- *initially fill the lagoon ½ to 1/3 with water.*

8. Why is morning the best time of day to apply manure to agricultural land?

Air will generally be warming in the morning and thereby lifting odors for better dispersion. This will also promote drying of the manure. In the evening, humidity will make odors settle into low places and cause the odors to "hang" in the air longer.

9. What are some available products that claim to counter act odors?

Several categories of products are available. These categories are:

- *Masking agents - to cover odors*
- *Counteractants to "cancel out" odors*
- *Deodorants to eliminate certain gaseous products*
- *Enzymatic products alter the biological activity.*

Make sure products have been tested by a reliable laboratory before accepting odor-reducing claims.

Home Study Module Evaluation

Environmental Issues in Livestock Production - Odor Assessment and Control

Thank you for participating in the Iowa State University *Environmental Issues in Livestock Production* home study series. Please take a few minutes to give us your suggestions for improving these materials, and to guide our development of new home study materials. If you wish to obtain a certificate of completion for this module, mark the certificate request line at the bottom of this form, fill in your name and address, and attach your answers to the homework problems for this module. (Note: your answer sheet will NOT be returned)

Describe your objective(s) for completing this module:

___Personal interest in environmental issues ___Background for other class work
___To evaluate and/or modify your livestock enterprise ___Background for your profession
___Other (please specify)_____

Do you feel that you met your objectives? ___Yes ___No

The content of this module was:

___too easy ___somewhat easy ___about right ___somewhat difficult ___too difficult

It took me about _____ hours to complete this module.

What did you learn from this module that was of greatest value to you?

Your suggestions for improving this module.

Please suggest other subject(s) you would like to have home study materials on.

___I would like a certificate of completion from Iowa State University for the *Odor Assessment and Control* module. **My answers sheet for the homework problems in this module are enclosed as proof of completion**, and my name and mailing address are as follows:

Your name: _____ Address:_____

Return this form to: Livestock & Environment Home Study Project, Department of Agricultural & Biosystems Engineering, 207 Davidson Hall, Iowa State University, Ames, Iowa 50011-3080, OR FAX to L&E Home Study Project at 515-294-9973, OR email your responses to tglanvil@iastate.edu.