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pork industry handbook

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Controlling Odors from Swine Buildings

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Odor control is a significant problem for swine producers throughout the country. The problem most often consists of neighbors' complaints and occasional legal actions seeking either monetary damages or court-imposed injunctions. To operate compatibly within the community and to provide maximum self-protection, the swine producer must be aware of some basics concerning odor control and be prepared to practice those techniques appropriate to his location.

Odors are primarily a subjective response—there are few universally good or bad odors. People react to odors according to their attitudes and previous experience. This factor is usable by swine producers as they maintain a public image of responsibility and productivity. Operators of well-maintained and attractive facilities who have maintained a cooperative public attitude are seldom subjected to odor complaints.

Compounds evolving from swine buildings have never been measured in excess of safe air standards and are not hazardous to human health. Under certain situations, such as manure pit agitation, however, dangerous gas concentrations can develop. Odors, therefore, are nuisance pollutants and, like other non-hazardous assaults to the environment, must be regarded accordingly. Of principal importance are intensity, duration, and frequency of perception. Within an agricultural community, it seems appropriate that livestock odors be occasionally detectable, but nuisance complaints result when intensity or frequency exceeds reasonable limits.

Sources of Odors

Odors from swine production facilities arise predominantly from manure decomposition. Odor from freshly excreted manure is generally regarded as less offensive than odor released when manure is allowed to undergo anaerobic or septic decomposition. The exact nature of this odor is a function of the ration fed to the animals, the animal's metabolism, and the environmental conditions under which decomposition occurs. Therefore, individual facilities may have differing odors, with anaerobic lagoons having odors easily distinguishable from deep pit or scraped buildings.

Manure decomposition is not the only potential odor source. Decomposed feed materials may also contribute an objectionable odor. Some food processing wastes fed to livestock are particularly notorious in this respect. Ensiled cannery wastes, wet whey, cooked garbage and other biologically decomposable materials deserve particular consideration. It is also appropriate to recognize, however, that feeding of these waste materials to livestock is frequently the highest use to which they can be put—thereby converting a waste material to a valuable feed ingredient. Thus, solving odor problems must be weighed against the benefit of utilizing a waste material.

Other odor sources include dead animals not quickly buried or removed from the site, pesticide sprays, and manure handling facilities. Each of these odor sources can be handled by appropriately selected control procedures.

Odor Measurement and Analysis

Considerable effort has been devoted to identifying compounds resulting from manure decomposition. These gases, when released into the air, provide the odorous constituents. Ammonia, hydrogen sulfide, skatole, indole, and the amines and mercaptans are the most commonly mentioned. Although there is merit in identifying these compounds as released, this provides only limited assistance in the design of an odor control program.

More usable odor measurements include *odor intensity* —more often measured in the field with a Scentometer. This device consists of a plexiglass box that is held in front of the nostrils in such a way that only air which has passed through an activated carbon filter is breathed. By standing on the site to be evaluated and breathing through this device, it is possible to keep odorous compounds from entering the nostrils. By selectively opening unfiltered air ports, one can determine the ratio of odor-free air required to dilute a volume of odorous air to the barely detectable concentration. By use of this technique, it is possible to estimate the odor intensity. Since quantitative measures are helpful in discussing and describing odor problems and in documenting improvement in odor control, this has proved to be useful.

The measurement and estimation of odor detection frequency has received widespread use as a means for evaluating odor problems. This approach attempts to determine the percentage of time that an odor can be detected at the site where the receiver is located. For example, if a home is located near a pork producer's operation, it might well be important to be able to estimate the percentage of time, i.e., 5, 10, 20%, that odor would be detectable at that site. Frequently, by consulting published data on wind direction, velocity, temperature and relative humidity, it is possible to calculate an estimated odor distribution or frequency. This calculation is helpful in assessing the severity of an odor problem.

Principles of Odor Control

Although odors frequently seem mysterious and difficult to manage, the principles of odor formation and potential means of control are relatively few and straightforward. For an odor to be detected downwind, odorous compounds must be (a) formed, (b) released to the atmosphere, and (c) transported to the receptor site. These three essential steps provide the basis for most odor control technologies. If any one of the steps is inhibited, the odor will be diminished.

Since odorous compound formation is generally the product of biological decomposition, steps to stop odor formation generally inhibit biological activity. Moisture reduction is the most commonly used technique. By maintaining a manure-covered surface in a dry condition (less than 40% moisture), anaerobic biological decomposition is generally halted. This is substantiated by the frequent observation that odors are most prevalent immediately following rainfall and when manure surfaces are allowed to remain moist over an extended period. Other techniques for inhibiting biological activity of animal manures include chlorination, pH adjustment and, in nature, temperature control.

Although odorous compounds may have formed in manure or manure storage systems, few complaints will be registered unless these compounds are allowed to escape to the atmosphere. The most common means of inhibiting the escape of odorous compounds is the use of covered manure storage tanks. Covering inhibits the interchange of odorous compounds between the liquid surface and overlying atmosphere. This interchange may also be reduced by altering the chemical state of the compound of greatest concern. For example, in regions where hydrogen sulfide is a major problem, the addition of lime or other alkaline material will reduce hydrogen sulfide volatility. This procedure should be tried on a small scale, however, to make certain the chemical adjustment will improve rather than worsen the odor problem.

The third means of preventing odor complaints is inhibiting transport of manure odor from the production and release site to the area where odor control is necessary. Odor transport has been inhibited in certain locations by the installation of sprays which scrub the odorous materials from the air, and of barriers which cause more complete mixing of the odorous materials with odor-free air to achieve sufficient dilution. This approach has received only limited application with livestock production odors but is widely used in industry.

Odor Control Techniques

Application of odor control techniques requires specific attention to the operation under discussion. Perhaps the most critical and effective means of reducing odor complaints occurs in the initial site selection. Although it is difficult to establish definitive perimeters beyond which odor complaints will not be problems, a swine producer must seriously consider odor control as he selects a development site. Sites near residential developments, commercial enterprises and recreational areas are particularly prone to problems. A site may be ideally suited for livestock production in terms of transportation, feed supply and zoning regulations, but may be inappropriate because of existing or proposed development in the area.

Although wind direction is important in evaluating an odor control site, most locations have winds from several directions during the year. The simple location "downwind" of development is not sufficient to assure acceptability. By referring to published data, one can estimate the percentage of time the wind will blow from the odor source to the point in question and thereby make a more rational decision concerning the site suitability. Where distance alone is used as the criterion, it must be expected that under appropriate climatic conditions, odors can be transported in excess of a mile downwind. If these conditions are sufficiently rare and the damage is slight, this may not be an inhibiting factor toward development.

The second opportunity for reducing odor problems occurs during the design and construction of a facility. By application of odor control principles, the probability of odor production can be minimized. Designing outdoor lots that are well drained, watering systems that do not flow onto the lot surface, and runoff control facilities that are remotely located from areas of odor sensitivity will achieve some odor reduction. In confinement facilities, the methods of manure removal from the pens, manure transport and the handling approach are most important for odor control. Also, the animals must be kept clean and dry. Among approaches used for accomplishing this are slotted floors, flushing gutters and frequent pen scraping. Covered manure storage tanks control odor release from stored manure. Where treatment is required and odor control is important, aerobic systems such as oxidation ditches and floating surface aerators, although more expensive, can be effectively used to maintain low odor intensities.

The operation and management of a livestock production facility also offer considerable opportunity for exercising odor control. Maintaining the operating system in functional order is probably most important. Overflowing manure storage tanks, broken scrapers, leaking waterers and ruptured retention ponds and dikes are among the most common causes of odor complaints.

Anaerobic swine waste treatment lagoons are of special concern in odor control. Properly designed and managed lagoons are not free of odors but are seldom the cause of an odor problem. However, overloaded or shock-loaded lagoons are more likely to have objectionable odors. Where multiple-celled lagoons are used, it is important that the cell or cells receiving fresh manure not be loaded in excess of the recommendations for your particular area. Anaerobic lagoon odors are most common in the late spring and early summer when the water temperature warms and manure accumulated during the winter undergoes rapid decomposition. Where odor control is critical, it has been found helpful to remove and refill to the normal operating level with clean water. Another alternative is to add a surface aerator.

Where practical, it is desirable to locate lagoons as far as possible from neighboring residences, roads and other odor-sensitive areas. Shielding lagoons from view is also helpful.

Manure dispoal techniques and timing are also very important for odor control. When manure is to be applied to cropland, selection of a field downwind of neighboring residences on the particular day is important. Morning application of manure is more desirable than late afternoon application, which limits potential drying time. Neighbors are generally most sensitive to odor problems in early evening when utilizing outdoor recreational facilities. When manure disposal is necessary and odor control is critical, immediate covering of the manure can effectively minimize odor complaints. Where soil is suitable and neighbors are particularly close, direct soil injection is a valuable technique.

The "Extra Mile"

The above approaches generally provide great assistance to the livestock producer in meeting the complaints of neighbors. When these techniques are not suitable, further steps may be taken. Although some are experimental and have not received widespread acceptance, they are worthy of consideration.

Odor control chemicals are widely available. Little data exist concerning the effectiveness of most of these materials. Some have been proved effective under specialized conditions—others have been disappointing. The cost of using odor control chemicals is highly variable, but generally they are considered an expensive alternative. Liquid products are quoted at $10-20 per gallon and solid forms at $1-15 per pound. It is important that a trial be conducted with the control chemical being considered to make certain it operates to your satisfaction before purchasing large quantities.

Odor control chemicals are generally one of four particular types. *Masking agents* have an odor stronger and, it is hoped, more pleasant than the odor being masked. These chemicals may be applied by aerial spray or directly to the odor source. They are best used on an intermittent basis and only when anticipating severe problems. After prolonged use, neighbors may find the masking agents more offensive than the original odorous compounds. Odor-masking agents are perhaps the most predictable and generally the most effective of the odor control compounds.

Another group, *odor counteractants,* are materials designed to interact with odors and result in a lessened odor intensity. Owing to the great variability in odorous gases, these compounds have had limited success.

Laboratory and limited field trials with *odor absorption chemicals* have provided some degree of encouragement. Although not widely marketed at present, this area of technology is worth watching for potential breakthroughs.

Enzymatic products designed to alter the biological pathways involved in manure decomposition are available for odor control. Again, only limited data are available for the justification of these materials, and their success has been erratic. Considerable research is currently underway in this field.

Other techniques which involve "extra mile" efforts by swine producers include perimeter spray systems and windbreaks to disperse the odors and shield the livestock enterprise from direct sight. These and other approaches may be tried where odor control is especially critical and the additional cost can be justified.

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