

LIVESTOCK PRODUCTION SITE EVALUATION PROCEDURES

**John A. Hoehne, P.E. and
Joseph M. Zulovich, Ph.D., P.E.**
Extension Agricultural Engineers
Commercial Agriculture Program
University of Missouri
Columbia, MO 65211

Abstract

Site selection and evaluation has been one of the best methods in avoiding odor problems and litigation with livestock production facilities. These evaluations have become more important as production facilities get larger. This paper describes a practical approach to site evaluation that can be used by producers, engineers, agricultural credit personnel and others for evaluating new or expanding livestock production units. These principles are applicable to other agricultural production and processing facilities that are concerned with emissions and odors.

Introduction

Livestock and other agricultural production facilities have increased in size. Problems with emissions and odors have resulted. A site evaluation method for new or expanding confined animal production facilities could aid in avoiding potential odor problems and possible nuisance litigation. These procedures would assist producers, engineers and agricultural credit personnel in evaluating a site prior to construction of facilities.

Initial Site Feasibility

Potential sites for new or expanding livestock facilities must be thoroughly and accurately evaluated to insure that:

1. Adequate land area is available to spread the manure nutrients produced by the animals in a manner that is environmentally acceptable.
2. A water supply of sufficient quantity and quality can be developed to serve the production needs of the facility.

Lack of land area for manure spreading or an inadequate water supply renders a site unsuitable for large confined livestock production units (Bailey, et.al., 1993 and Bates, et. al., 1994). Answers to the previous two questions may vary between specific sites and locales. Their purpose; however, is to require whoever makes a site evaluation to obtain

answers or at least information to answer the requirements suggested by the questions. More detailed site evaluation questions are presented in the following sections of this paper.

Other Site Evaluation Criteria

Additional investigation is required in the site evaluation process if the initial site feasibility study provides positive answers for available land to spread manure nutrients and if a water supply can be developed. Evaluation of the following subject areas would be required to complete an investigation.

Accessibility

A site that is considered for a large animal confinement operation must be accessible to a highway network that will allow large trucks access during construction and that also provides adequate access for marketing products and purchased production inputs. An all-weather route between the highway network and the site will be required to transport the produced agricultural commodity to market as well as to transport necessary production inputs into the operation. Electrical service and other necessary utilities must also be available to the site. Utilities and all-weather access can be developed for a site if not available.

Isolation

The site needs to be isolated so that prevailing winds and air drainage patterns do not create nuisances for neighbors or local public use areas. It is desirable for prevailing winds from an operation to blow away from neighbors instead of blowing toward the neighbors. When wind velocity is low, air will drain following the same general paths as water. It is desirable to have air drainage follow paths that are not toward a close neighbor. Each potential animal production site must be thoroughly evaluated in order to minimize the chance of future nuisance complaints. Separation distances that regulate buffer zones from animal production facilities are found to be successful in controlling odor nuisances in the Netherlands (Klarenbeek and van Harreveld, 1995).

Biosecurity

Separation of animal production units is desired and sometimes required to prevent the spread of disease organisms into the units from neighboring units. Biosecurity is more important for production units that produce breeding animals for sale to commercial

producers (Bailey, et.al., 1993 and Bates, et. al., 1994).

Topography

The topography at a building site needs to be level or gently sloping so that buildings can be properly located and constructed to the desired slopes without excessive cuts and fills. Gentle slopes are usually desired to transport manure effluent from the livestock buildings to manure treatment and/or storage facilities. Steep slopes make movement of wheel traffic, animals, and workers difficult. Planning is needed to insure drainage of rainfall runoff from the site is accomplished without affecting the operational routines of the production units.

Space

The space available to develop a site may dictate the potential size of an operation that a given site can support. Space will be required for the building site as well as land space requirements for spreading manure nutrients or for developing a fresh water supply. Adequate space between buildings needs to be provided for proper operation of the building. Space is also required for the manure management facilities, feed storage and other required facilities. Planned traffic lanes for efficient movement of wheel traffic, animals and workers must be incorporated into the overall facility layout. Significant amounts of open space inside the site will be required if road tractors and semitrailers are to be used for either transporting commodities or supplying inputs for the operation. Detailed site development plans are required to insure that air movement to the naturally ventilated animal housing buildings is not restricted. The detailed site plans should also include provisions for expansion and/or implementation of new technologies. If expansion plans are not known at the initial planning stage, plans that allow the proposed operation to either double in size or maximize the site capabilities should be initiated.

Zone Planning

The concept of zone planning has been used for years as a method for developing farmstead site plans (MWPS-2, 1974). The zone planning concept provides a procedure for arranging components of a farmstead with respect to the family home or residence. Modern livestock production operations may not have a residence as part of the farmstead. This same zone planning concept can be used if a sensitive location is substituted for the residence. A sensitive location should receive minimal impact from farmstead activities. The focus of zone planning could be a residence, an office/visitor center on the

farmstead, or a neighboring area for which additional isolation from the livestock production or manure storage facility is required (Zulovich, et.al., 1994).

Zone planning is useful during site evaluation to determine if a production unit can be developed to operate efficiently while minimizing the impact on adjacent properties. For example, if a surface water supply needs to be developed, the fresh water impoundment could possibly be located between the animal facilities and a sensitive location. Similarly, locating manure management facilities on the opposite side of an operation will further isolate a sensitive location. Air drainage, prevailing winds and other factors must also be included in the overall planning process. Sometimes a site for animal production is not acceptable because an efficient layout to adequately support the operation would cause a negative impact to a sensitive location.

Livestock Production Site Evaluation Procedure

An audit comprised of a series of questions has been developed to assist in evaluating the potential of a specific site to support a confined livestock production facility (Hoehne, 1994). Those questions are presented in the following sections.

Initial Engineering Feasibility Analyses:

Water Supply

KEY QUESTION: Can an adequate water supply be developed to supply the anticipated needs of this facility?

1. Have water requirements to include both quantity and quality been evaluated for the production unit?
2. Can a water supply be developed that will provide the required quantity and quality of water?
3. Will the primary water source be from a well, surface impoundment or other source?
4. What are the plans for a "back-up" water supply?

DISCUSSION: Water supply is critical to animal production operations. Anticipated water quality and quantity must be matched to those production needs.

Water supply can render a site unsatisfactory for animal production or be the factor that determines the maximum stocking rate of the production system.

½-mile?

1-mile?

Land Area for Manure Spreading. (Nutrient Management)

KEY QUESTION: Can the manure nutrients be adequately managed from this animal production site?

1. Is there a preliminary nutrient management plan that estimates the number of acres required to spread the manure produced in the planned facility?
2. Is the spreading area land available for use by the production unit for a known number of years?
3. Is the spreading area land owned by the production unit?
4. Does the proposed spreading area contain the required spreadable acres after necessary buffer acres and acres not suitable for spreading manure are subtracted?
5. Does the spreading land area requirement correspond with the manure removal and treatment systems planned in the production unit?

DISCUSSION: Every site that is considered for animal production has some inherent "natural resource base" or land area that will limit the number of animals that can be produced on the site. In many cases, the ability of that site to utilize manure nutrients in an environmentally acceptable manner will determine the maximum animal stocking rate.

Site Planning and Evaluation:

KEY QUESTION: Will the site provide long-term acceptance by local residents?

1. How far in miles to the nearest animal production unit?
2. Are there any non-owned dwellings closer than ¼-mile to the buildings, manure storage structures or manure spreading area?
3. With respect to the production buildings, manure storage structures and manure spreading areas, how many non-owned dwellings are within:

4. How far in miles are the following sensitive areas from the production unit, manure storage facilities and the manure spreading area:

"built-up" areas or clusters of homes?

public use areas to include churches?

private and public water supplies (include known aquifers)?

5. How many of the above listed non-owned dwellings and other sensitive areas are located in a direction opposite of the summer prevailing wind from the production and manure storage facilities? (i.e. north or northeast of the production facility if the prevailing summer wind is from the south or southwest)
6. Topography and air drainage: How many of the above listed non-owned dwellings and other sensitive areas are located at lower elevations in the same drainage area as the production unit and manure storage facilities?
7. Do site development plans include methods for limiting visibility and for "landscaping" so that final grades around buildings and manure storage facilities can be safely mowed and maintained to present a "business-like appearance"?
8. Do roads and bridges to the site provide adequate access for hauling feed and materials in and produced agricultural production out?
9. Will daily traffic to and from the production site be required to pass neighboring dwellings or sensitive areas?

DISCUSSION: Sites need to be evaluated for suitability and acceptance in the community. Evaluation and public relations are important aspects of the long-term viability of an animal production facility. The availability of financial credit to construct and operate the facility are usually very dependent on whether the proposed animal production facility is accepted in the local community.

Site Qualification and Permitting Requirements:

KEY QUESTION: Can the site be permitted on a long-term basis?

1. Are there local zoning ordinances that would govern the construction and operation of the production facility?
2. Have local and/or state operational permits for the animal production facility been obtained or can these permits be obtained?
3. What is the frequency of permitting for the facility?
4. Are there minimum required separation distances and are these distances observed and reasonable?
5. Are geologic investigations required and have these requirements been met?
6. Are there specific sealing requirements for earthen manure storage basins or lagoons and have these requirements been met?
7. Do plans for concrete or steel manure storage tanks meet the required specifications?
8. Are there required soils investigations for either the manure storage site or the manure spreading area and have these requirements been met?
9. Are there any land slope limitations or other spreading restrictions in the manure spreading area and have these been addressed?
10. Does the manure storage period meet permit requirements and is the storage period long enough to insure implementation of a spreading program that can be fit into the restricted "spreading windows" allowed by climate and crop production?
11. Are manure spreading records maintained in the operation?
12. Are the required spreadable acres determined on the application of nitrogen, phosphorus or other nutrient and is the land area sufficient to meet present environmental requirements?
13. Does the long-range operational plan contain provisions to address reduced application rates of specific manure nutrients?
14. Are there any water table separation regulations

and have these been met?

15. Is any part of the production facility, manure storage facility or manure spreading area located in a flood plain and, if so, are environmental requirements met?
16. How will dead animals be disposed of, and is this an environmentally acceptable method?
17. Has the site and facility been evaluated by an engineer familiar with the local and state environmental regulations for confined animal production, and is regular environmental compliance monitoring a planned management practice?
18. Will the facility be monitored on a regular basis by a qualified environmental engineering consultant?

DISCUSSION: Any potential animal production site must meet permitting standards of the specific site. Documentation of these technically measurable requirements is the next developmental step following a favorable initial engineering feasibility study.

Existing Operations

Expansion of animal production operations usually includes additional facilities. A thorough site evaluation of an existing livestock operation including proposed expansion plans should be conducted using the same evaluation criteria as a new operation. If no problems are identified during the site evaluation, the proposed expansion can proceed.

Problems identified during a site evaluation of an operating animal production unit may require alternative approaches to insure continued operation or possible expansion of animal production at the existing site. Alternative approaches for reducing problems might include:

- 1) Separating production phases and moving one or more phases to a new site.
- 2) Adopting new technologies to solve identified problems.
- 3) Re-evaluating production plans.

Adopting an alternative approach may provide a viable method for a production unit to remain in operation.

Summary

Environmental compliance requirements will vary at different locations throughout the United States and other countries. There will also be differences between specific sites in many states and countries due to the sociological, geological and other variables that exist.

Agricultural production and processing must continue to develop scientific methods to control and minimize the effects of emissions and odors. A systematic approach to site selection and evaluation is the initial step in planning a new or expanded production unit.

References

- Bailey, K., M. Bennett, J. Garrett, D. Hardin, J. Hoehne, R. Randle, J. Spain, B. Steevens, and J. Zulovich. 1993. Missouri dairy plan-The Missouri system of dairy production 500, 300, 150-cow model. Extension Manual 155. Dairy Focus Team, Commercial Agriculture Program, University Extension. Columbia, MO.
- Bates, R., D. DiPietre, J. Hoehne, M. Newcomb, R. Tubbs, and J. Zulovich. 1994. The Missouri system of swine production. Extension Manual 144, Swine Focus Team, Commercial Agriculture Program, University Extension. Columbia, MO.
- Hoehne, J. 1994. Site selection and evaluation. *Swine Production-"Taking Advantage of Your Opportunities" Proceedings of the 1994 Commercial Agriculture Swine Institute*. University of Missouri, Columbia, MO.
- Klarenbeek, J. and A. van Harreveld. 1995. On the regulations, measurement, and abatement of odours emanating from livestock housing in the Neitherlands. *International Livestock Odor Conference '95, Proceedings '95-New Knowledge in Livestock Odor*. pp. 16-21. Iowa State University, Ames, IA.
- MWPS-2. 1974. Farmstead planning handbook. MidWest Plan Service, Iowa State University, Ames, IA.
- Zulovich, J., J. Hoehne, and C. Fulhage. 1994. Arranging dairy operations for the 21st century. *Dairy Systems for the 21st Century, Proceedings of the Third International Dairy Housing Conference*. pp. 515-523. American Society of Agricultural Engineers, St. Joseph, MI.