

Farm Structures

FACTSHEET



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ODOR CONTROL ON SWINE FARMS

The swine industry in British Columbia has come under pressure recently to do a better job of controlling odors and nuisance conditions. This is particularly true in the more intensely populated areas of the province including the Fraser Valley and Okanagan Valley, but pressure is mounting in other areas as well. Swine farmers must accept responsibility for managing their farms in accordance with currently best practical technology or face the inevitable consequences of more and stricter regulations by non-sympathetic authorities.

Pollution of the air, soil and water all can result from improperly managed swine operations. However, complaints about intensive swine farms have, in the past, most often involved odors and aesthetics or nuisance conditions. This report, therefore, is primarily a review of measures to control odors and nuisance rather than control of pollution in its wider sense.

The odor nuisance potential of any swine farm has three dimensions, odors from the barns, odors at the manure storage and processing facilities and odors at the field spreading site. Although it is helpful to consider each dimension separately, it must be recognized that all three are interrelated.

ODORS AT THE BARN

Odors within the pig barn, and hence odors detected in ventilation exhaust air, are a combination of pig body odors, manure odors and odor associated with feed handling (e.g. dust). With good management, odors from dead animals and afterbirth should not be a factor.

As a general rule, most pigs today in the intensely populated areas of the province will be reared in total confinement. Open yards generally should not be considered for new operations. In areas such as the Fraser Valley, seasonally heavy precipitation causes yards to become mud wallows and a source of odors and fly breeding, not to mention the aesthetic problems and the potential for water pollution. Even in areas of lesser precipitation, confinement of pigs pays dividends in terms of improved pig performance and reduced labour requirements. Where open yards are used occasionally for breeding stock, a good grass cover should be maintained at all times.

To minimize the negative effects on neighbors of the confinement swine facility, the best practical technology should be applied at the planning, construction and management stages. The following recommendations are a guide to the establishment of a successful swine operation.

Distance Separation

Locate barns and related facilities as far away from neighboring non-agricultural land uses as practically possible. Keep in mind that zoning regulations must be met in any case.

Although building design and management ultimately become of greater significance in determining the nuisance potential of the pig farm, proper attention to sites can solve a lot of problems before they get started. The negative effects that pig facilities will have on neighbors are reduced as the distance between the farm and the neighbor increases. Distance dilutes the odor and, by exploiting man's limited vision, helps to focus less of the neighbor's attention on day-to-day activities at the farm. Because of small property size and previous pockets of urban developments in

agricultural areas, it is not possible anymore to get far enough away from urban areas but the livestock farmer should try to get as far away as possible. Consider increased separation distances as a trade-off between more expensive manure handling and ventilation systems. The less separation you are able to provide, the more elaborate your buildings will need to be, the more careful your management must be and the less flexibility you will have in the future.

As a guide to the least separation distance that should be considered, the Ministry of Agriculture Green Zone Committee has developed a set of building siting formulas. These formulas have been enacted into legislation in the Township of Chilliwack to control the location of piggeries in that municipality and already a number of other municipalities are getting very interested in the formula concept. This system of controlling building siting is based on minimum distance separation formulas first developed in Ontario some three or four years ago. These formulas have since then been modified to suit British Columbia's conditions. The first formula regulates the distance between new livestock buildings and existing non-farm uses. This formula incorporates such measures as distance to closest residential area, industrial or commercial area, distance to road, distance to first and second neighbors, distance to Agricultural Land Reserve boundary, etc. The basic formula is adjusted by factors which are related to the number and types of animals, the type of manure handling and the existing commitment to the site. Thus, the farm operator has the option to reduce the required distance separation by, for example, going to a less offensive method of waste handling. The second formula handles the reverse situation, i.e. the distances between any new dwelling or non-farm use and an existing building housing livestock. Information which is used in the formula includes the number of animals in the operation, the type of animal and the method of manure handling as in the previous formula. This formula is then used to compute the allowable distance that the non-farm use can be located from the livestock buildings. Use of the second formula, therefore, provides a measure of protection for the farmer against encroaching urban uses.

Exhaust Fan Orientation

If there is more than one option for pig building orientation, consider that orientation which will have the fans exhausting away from the nearest neighbor's residence.

Pen and Building Design

Design the building to promote clean pens and clean pigs. Accepted practice is to use rectangular pens for feeder pigs. Experience has indicated that the 5 ft x 16 ft pen is optimum for promotion of good dunging habits in pigs and hence clean pens. Smaller 4 ft x 13 ft weaner pens are equally satisfactory. Evaporative spray coolers or equivalent are recommended for use during hot weather to maintain clean pens. Within practical limits and notwithstanding the need for adequate space per pig, building designs involving denser housing and less cubic air capacity per pig are recommended where barns are mechanically ventilated. Use partially slotted floors rather than fully slotted floors, as experiments have consistently shown this arrangement to result in better pig performance and less feed wastage.

Dust Control

Keep dust levels to a minimum. Odors are carried around on dust particles. A build-up of dust will spread and cling to pens, equipment and clothing creating lingering odors in the barn. Dust particles also can be carried considerable distances from the barn in air currents.

Frequent Manure Removal

Choose a manure collection option involving frequent removal of manure from the barn. Traditionally where bedding was used in large quantities, this could be achieved through the use of gutter cleaners. Scraper systems may still have application in modern swine barn, particularly in smaller farrowing and weaner operations. Some interest is being shown in the use of scrapers in channels beneath partially slotted floors. If minimization odor levels within the barn is your objective, not just manure removal, do not be too optimistic about the success of these scraper systems unless you are prepared to use a lot of bedding, at least enough bedding to wipe the channel completely clean during each clean out. Any standing pools of liquid manure left in the trench will create typical swine barn odors.

An option widely used in recent years, often termed a stop-and-flow gravity system, may be as successful in minimizing barn odors as a scraper system. With this system, manure accumulates in trenches up to 1 ½ to 2 feet deep and then is released to an outside storage. Where the stop-and-flow gravity system is used, the

gutter width must be carefully chosen in order to achieve at least weekly removal of manure from the barn. Generally narrower gutters will be required in the farrowing and breeding gestation barns.

Much interest is now developing in the use of flushing gutters. Theoretically, odors within the barn would be minimized by the daily or more frequent removal of manure from the barn. However, a few words of caution may be in order. Firstly, odors will not be reduced if anaerobic manure or manure effluent is used in the flushing process; fresh or aerated effluent, on the other hand, should achieve the desired results. On the basis of past experience with aeration of pig manure, be especially wary of systems involving continuous aeration of the entire manure volume as opposed to aerating only the effluent. One other consideration with regard to flushing systems, in theory, odors within the barn should be eliminated. However, achievement of this ideal is foiled by the fact that urine and manure falling directly on the slats will still be a source of odor. Open flushing gutters would be better in this respect but are not acceptable from an animal health standpoint.

A fourth system for frequent removal of manure from the barn utilizes the continuous gravity flow concept, sometimes known as the lip system. With this system, manure flows under its own weight out of the gutter on a continuous basis. A flat-bottomed channel lubricated by a layer of water are the essential features of the system. Although the system has some very attractive features, do ensure that a backup system is installed in the event the gutter doesn't work as expected. Experience from Ontario is indicating that solids buildup can be a problem with certain types of pigs on certain types of rations.

To summarize this section, get manure out of the barn regularly and at least once a week. The tried and true stop-and-flow gravity system still may be the best, although with proper design and management, scrapers, flushing gutters and the lip-system may achieve the same objectives.

Managing In-House Storage

Storage of manure for extended periods of time beneath slotted floors in a pig building is not recommended. A report recently published in the *Journal of Occupational Medicine* stated very conclusively that occupational health problems exist in

confinement swine buildings where manure is stored in pits beneath slotted floors. The authors measured levels of carbon monoxide, carbon dioxide, ammonia and hydrogen sulfide in 13 barns in Iowa and reported levels of these gases in excess of safe standards in most of the barns. A survey of swine confinement workers indicated that a majority of those workers suffered adverse upper respiratory symptoms and chronic health problems. Furthermore, there are a number of references suggesting that pig performance also is adversely affected by the high levels of gases released into the barn from manure stored in pits beneath the slotted floor.

Where underfloor storage already exists in a pig barn, consider the possibilities of converting to one of the systems previously mentioned. At the very least, ensure that the ventilation system is adequate. A pressurized system is recommended, involving high level inlets and below slat outlets which help to reduce gas accumulation above the slats. Even so, this merely transfers the problem from inside to outside the barn if you happen to live close to an urban area. Farmers in such a situation will, in all likelihood in the near future, have to consider some form of air scrubber for removing dust, gases and odors from the ventilation exhaust air. While scrubber systems that can do the job are available, they are costly, for example, reports from Holland quote operating costs in excess of £2 per animal marketed. Clearly the alternative of regular manure removal will be less costly for new operations.

Ventilation

Ventilation of swine buildings is necessary for temperature and moisture control and for maintaining an even distribution of fresh air in the building. Poor ventilation of a barn can result in the buildup of odors which when released by the exhaust fans, will be offensive to neighbors and to farm workers alike.

In general, mechanical ventilation systems required, although naturally ventilated barns can be equally acceptable. In either case, ensure the system is properly designed and installed. Inlets are of utmost importance for proper air distribution in the barn. Automatic fan controls are preferred, as the operator usually is not available to adjust fans when necessary. Ensure that a small amount of air is being moved through the barn continuously, even if this means adding supplemental heat to maintain desired room temperature.

Farmstead Appearance

Keep the farm neat and tidy and access roads in good condition. This will create a good visual impression on neighbors and may make them more tolerant of occasional unavoidable odors.

Chemical Odor Control

Chemicals or proprietary compounds for odor control within the barn should never be necessary. Redesign of the manure handling system, proper ventilation and good management will always suffice. Biological and enzyme preparations may have some beneficial effects in terms of solids breakdown, but will not be necessary if all of the preceding recommendations are followed.

ODORS AT THE MANURE STORAGE

Long-term storage of manure is becoming a necessity on pig farms wherever they are located in the province. In colder regions, storage is required to avoid spreading manure on snow covered or frozen fields. For operators on small properties, storage is necessary to facilitate timely sale or delivery of manure to crop producers. The storage and handling of manure must be carefully planned and managed to avoid the creation of nuisance conditions.

Storage Location

Locate the storage away from and out of sight of neighboring residences. Consider using trees to screen the storage and to hasten dilution of odors before reaching neighbors.

Covered Storage

Covers are strongly recommended on all ground-level storages to reduce odors during storage. These covers will be of less benefit as the depth of the storage increases, for example, in 30-foot high silos. A secondary but major benefit of covered storages is the exclusion of snow and rain, thereby reducing manure handling costs. Remember that typical costs for handling liquid manure from storage to field can be as high as \$3.00 per ton.

Agitation

Be considerate of neighbors when planning to agitate manure prior to spreading. Odors released during the first few hours of agitation can be very oppressive and will draw unnecessary neighbor attention to subsequent spreading activities.

Aeration

Where a farm is located very close to an urban area, and, where odors during land spreading also are a problem, consider aerated storage. Commercially available aeration equipment appropriate for continuous aeration of swine manure includes float-mounted surface aerators and pneumatic aerators. Design of the aeration system is critical, as experience indicates that the machines perform much differently in pig manure than in domestic sewage effluent. Foaming and cold weather operation continues to be largely unsolved problems.

ODORS FROM FIELD SPREADING

Odors from land spreading of manure have been the most complained about nuisance associated with intensive swine farms. To minimize these nuisance conditions, consider the following:

Time of Spreading

Choose manure-spreading times carefully. As general guidelines, spread manure:

- When prevailing wind is away from the closest urban area or neighboring residences.
- On cool days rather than hot days.
- On windy days rather than calm days.
- Early in the day rather than late in the day.
- On midweek days rather than on weekends or holidays.

Avoid Irrigation Systems

If you live in close proximity to an urban area, consider all other alternatives before choosing an irrigation system for spreading manure. Odors will be

worse the higher manure is sprayed into the air. High aerial sprays also have a visual impact which can create a bad impression and draw attention to the manure spreading activities.

Spreader Alternatives

On grassland, consider spreader adaptations that permit the placement of manure directly on the ground without any aerial spray. Variations include a boom attached to the spreader outlet with either dragging curtains or flexible down tubes.

Rapid Cover Systems

Rapid-cover manure application techniques ultimately may be the best solution. Alternatives for rapid-cover in plowed land are varied, but to date, no entirely satisfactory equipment seemingly is available for incorporation of manure into sod. In plowed land, either follow the spreader closely with a disc or plow, or directly inject the manure with commercially available injection equipment. Rapid cover methods are more costly but you won't be offending your

neighbors and you will be maximizing returns from the manure as a fertilizer.

Manure Treatment

If spreading on grassland in very close proximity to urban areas, consider treatment of manure with chemicals or by aeration. Hydrogen peroxide and potassium permanganate both are quite effective but also quite expensive. Get advice from the Ministry of Agriculture Food and Fisheries before proceeding with these treatments and follow safety precautions carefully.

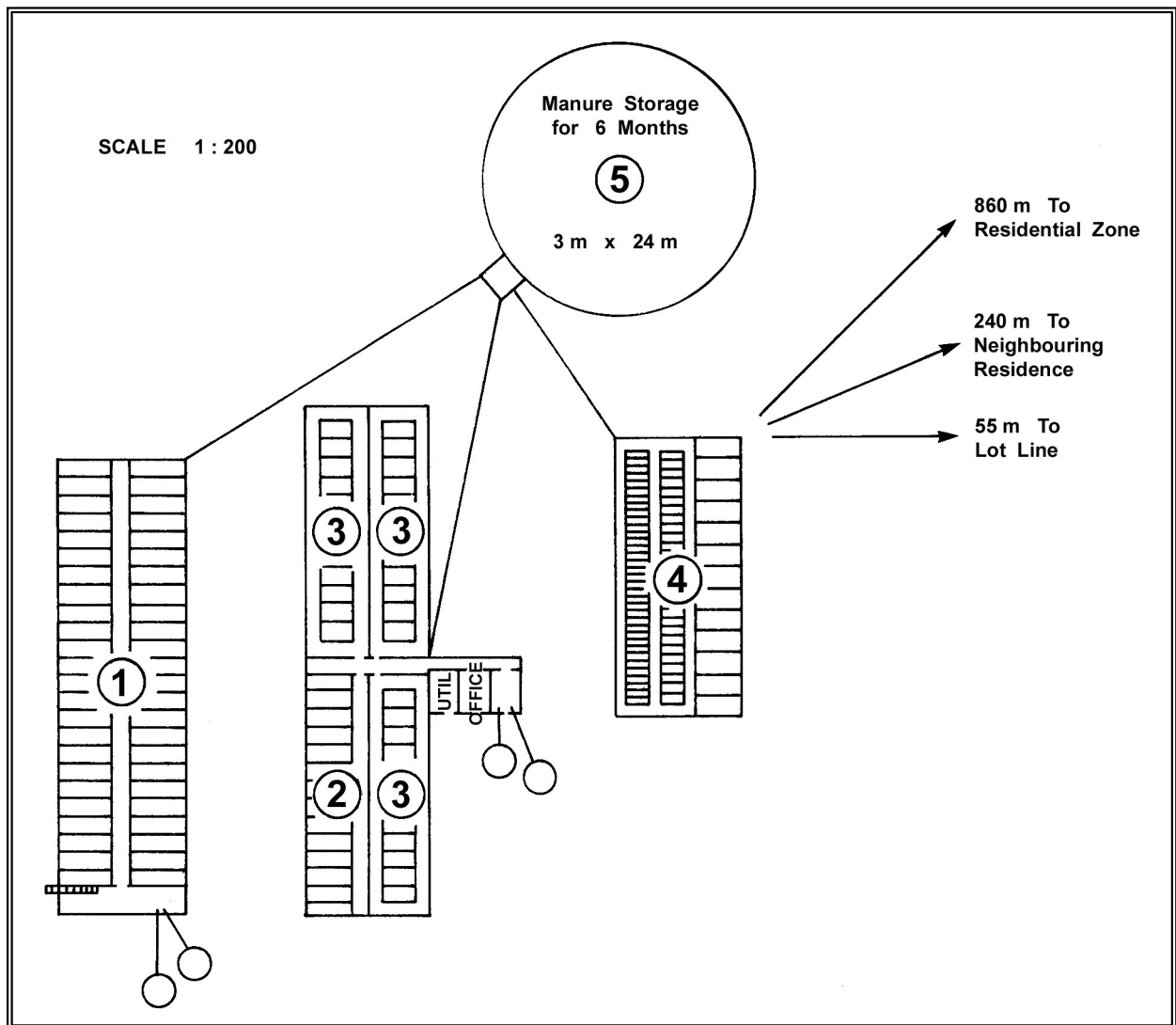
Aeration can provide satisfactory odor control at costs well below chemical treatment. The most economical system involves aeration for a short period, say 24 hours prior to spreading. Recent trials in British Columbia have shown quite good success with aeration in this manner for a cost of perhaps 50 cents per hog marketed. This method of treatment does create very odorous conditions at the manure storage site during the startup of aeration. If these odors cannot be tolerated, continuous aeration during storage should be considered instead.

SUMMARY

In summary, all swine producers particularly those who are just beginning or planning large expansions are encouraged to give adequate attention to the nuisance and pollution potential of their operation and provide the greatest separation possible from urban areas, nearest neighbors, etc. The BC Ministry of Agriculture, Food and Fisheries can help you by working out the Green Zone Formula recommendations for your particular property. Plan the buildings on paper before you build, considering the alternatives regarding pen layout, ventilation systems and manure systems. The alternative which you choose will depend to a large extent on factors such as ration, production cycle, past experience and your own personal preferences. Hopefully, your decision will be based to at least some extent on the potential for nuisance or pollution problems in your particular locality. Recognize that pig production is not what it used to be and can be a source of nuisance and pollution problems. If you have recognized this, chances are very good that you and your neighbors will get along.

FEATURES OF A WELL PLANNED LAYOUT

- Shallow gutters with frequent manure removal into outside storages.
- Separate barns and multiple farrowing rooms for disease control.
- All barns expandable in at least one direction, for example, expand to 200 sow farrow-to-finish by adding onto the top end of finisher barn, both ends of farrowing barn and bottom end of breeding-gestation barn.



BUILDING LEGEND

- 1 Grower-finisher barn as shown in [CPS Plan 3428](#), 11 m x 39 m.
- 2 Weaner pens in one quadrant of farrowing barn.
- 3 Farrowing barn, 3 room continuous farrowing, similar to [CPS Plan 3303](#).
- 4 Breeding-gestation barn, similar to [CPS Plan 3236](#).
- 5 Manure storage, circular as shown in [CPS Plan 10730](#) or [CPS Plan 10733](#), or rectangular as [Plan 383.100-2](#).

FOR FURTHER INFORMATION CONTACT

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