



AUSTRALIAN PORK LIMITED
Minimising Odour from Piggeries

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INTRODUCTION

All piggeries produce some odour. This becomes an issue if it causes nuisance for neighbours. People vary in their tolerance of odour. The factors contributing determining whether odour becomes a nuisance include:

- » **F**requency of occurrence
- » **I**ntensity or strength
- » **D**uration of exposure
- » **O**ffensiveness, or character, of odour
- » **L**ocation of potential receptors (e.g. houses, towns) in relation to the piggery.

Understanding and managing odour sources and taking these FIDOL factors into account, is crucial in preventing odour nuisance. This booklet provides practical guidance on preventing odour nuisance from conventional, deep litter and outdoor piggeries.

Odour Creation

Breakdown of manure, waste feed, mortalities and other organic matter produces odour. The strength and offensiveness of the odour generated depends on the quantity and composition of the material being digested, and whether breakdown occurs in the presence (aerobic) or absence (anaerobic) of oxygen.

Aerobic digestion is a simple process that yields low odour products like carbon dioxide, water and cell biomass.

Anaerobic digestion, which occurs when the decomposing material is moist or wet; is often associated with strong, offensive odours. The anaerobic digestion process involves four stages:

1. Breakdown of organic matter into soluble forms
2. Fermentation to yield volatile fatty acids (VFAs)
3. Creation of acetic acid, ammonia, hydrogen and carbon dioxide
4. Formation of low odour methane and carbon dioxide.

It is difficult to provide conditions that suit all the microorganisms involved, so maintaining a stable anaerobic digestion process is challenging. The bacteria involved initially are robust and react quickly to increased food availability. However, the methane-forming bacteria are very pH sensitive. Spikes in VFA production that reduce pH disrupt the process, releasing VFAs and other compounds with a strong and offensive odour. Hence, maintaining regular inflow to effluent ponds is important.

Management that promotes aerobic breakdown or complete anaerobic breakdown of manure results in less odour.



Odour Dispersion

The strength of an odour declines with distance from the source as the smell mixes into the surrounding air. For this reason, providing generous separation distances around a piggery reduces the likelihood of odour nuisance complaints. Other factors also influence odour dispersion. A basic understanding of these can be used to select better sites, manage odour sources and minimise the risk of nuisance.

The topography and vegetation surrounding a piggery play an important role in odour dispersion. Significant hills and valleys, and heavy timber help to mix the air. Flat land with limited ground cover does little to promote air mixing. A distinct valley below a piggery will confine the air and inhibit mixing, keeping the odour concentrated. While little can be done about topography once a site is selected, vegetation can be modified. Well-designed, suitably-located tree buffers promote air mixing and filter odour and dust. When placed upwind of effluent treatment ponds or manure storages they can reduce emissions by decreasing the wind speed over these sources. Growing tall fodder crops on reuse areas, rather than short plants also enhances surface roughness. Vegetative buffers may also screen a piggery from public view.

Using vegetative buffers to screen a piggery from public view can effectively reduce complaints. “Out of sight, out of mind.”

Weather and atmospheric conditions are also important. On cool, still mornings, air from a piggery may be trapped under an inversion layer that restricts dispersion. Similarly, odour lingers on still, humid days when the atmosphere is heavy. Sensitive neighbours at a similar altitude, or downwind of an odour source, will be more affected under these conditions than under hot, dry, windy conditions when dispersion is enhanced. Also consider wind conditions. Gusty winds disperse odour, but may carry more dust, while a gentle breeze will carry odour. Wind directions vary seasonally so different neighbours might be impacted at different times of the year. Consider weather and atmospheric conditions, and the location of neighbours, when scheduling activities where the timing can be controlled (e.g. spreading manure or irrigating effluent).

Odour Sources

Odour sources vary with the type of piggery, standard of cleanliness and manure management.

Indoor Piggeries

In conventional piggeries, most odour tends to come from uncovered effluent treatment ponds. However, a range of odour sources contribute to overall emissions from conventional and deep litter piggeries. They may include:

Sheds

Clean, hygienic conditions are vital in minimising shed emissions (Photograph 1).

It is important to:

- » Keep the pigs clean and dry. Use suitable stocking densities, maintain animal health to minimise loose stools and provide a good shed environment. Dirty pigs smell as their body warmth encourages anaerobic breakdown of the manure on their skins (Photograph 2)



- » Use water with a low sulfate and nitrate content
- » Formulate diets to meet animal needs. Use split-sex and phase feeding to reduce excretions
- » Minimise feed wastage and dust. Use suitable feed milling, pellets, liquid feeding or oils in diets. Replace floor feeding and high-wastage feeders; the expense is offset through reduced feed costs
- » Promptly sweep up and remove spilt or wasted feed
- » Frequently and regularly clean flooring and other dirty and dusty surfaces in conventional sheds. Slatted floors generally stay drier than solid floors
- » Provide good shed ventilation to reduce dust
- » Flush effluent channels at least once a day. Use sufficient water volume to remove manure solids
- » Empty pull plug pits and static pits at least weekly, more frequently if biogas is being collected from a covered pond. Add 5 cm of water to the bottom of the clean pit to prevent manure sticking. Empty different pits on different days to promote even flow of effluent to the treatment pond/s
- » Avoid using bacteriacides for shed cleaning as these may adversely affect pond function
- » Provide concrete flooring in deep litter piggeries
- » Use plenty of bedding in deep litter piggeries (0.5–1 kg straw/pig/d) (Photographs 3 and 4)) Change bedding at least once every seven weeks. Promptly repair any water leaks that may wet the bedding
- » Collect mortalities, afterbirth and foreign materials promptly, before they enter flushing channels or pits.



Photograph 1 Clean sheds produce little odour



Photograph 2 Dirty sheds generate more odour



Photograph 3 Dry bedding minimises odour



Photograph 4 Insufficient bedding and poor design and management creates wet, odorous conditions

“Good shed hygiene is important
in minimising odour.”

Producer QLD



Regular and frequent removal of manure from sheds maintains hygienic, low odour conditions that are conducive to good pig performance and worker comfort.

Channels, Drains and Pipes

Wet manure in channels, drains and pipes is an odour source. To avoid this, these should:

- » Have a smooth, even surface (e.g. concrete or fibreglass) and sufficient slope to self-clean (minimum slope of 1–2%) (Photographs 5 and 6)
- » Be cleaned with a sufficient water volume to remove all solids
- » Be inspected daily (or after each use) with any remaining solids promptly removed.



Photograph 5 Well-designed channels are self-cleaning



Photograph 6 Manure in flat channels is odorous

Sumps

Where practical:

- » Cover sumps
- » Avoid sump agitation under still conditions or when the wind will carry odour towards neighbours.

Solids Separators

Separating solids from the effluent stream reduces the organic matter load to the pond.

To minimise odour:

- » Maintain the solids separator to ensure it is effective
- » Capture separated solids within a control drainage area with an impermeable base (Photograph 7)
- » Regularly transfer wet solids to the manure storage area or reuse area.



Photograph 7 Screening the effluent stream reduces the load to the effluent pond

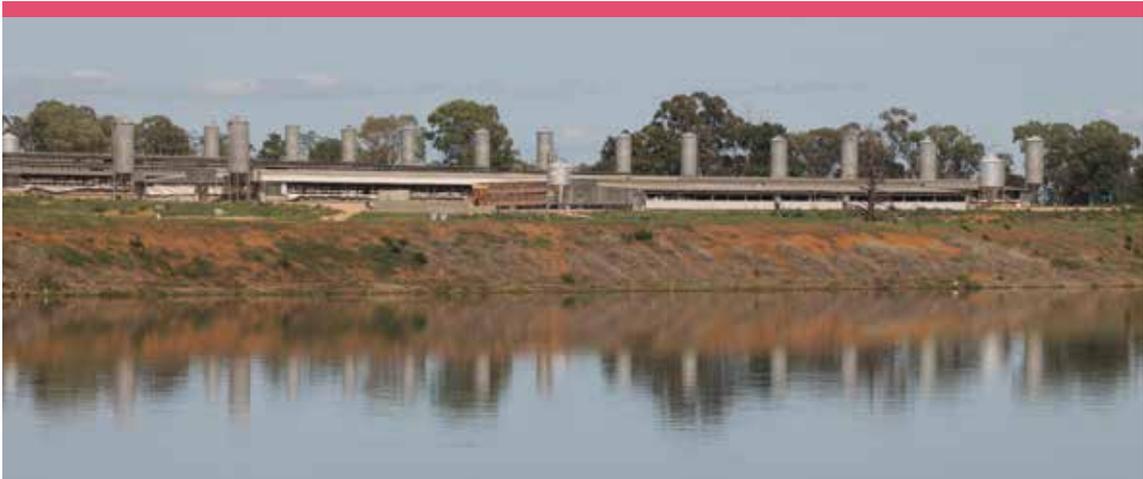
Effluent Treatment Ponds

Since uncovered primary effluent treatment ponds are a major odour source at a conventional piggery, good management is critical in reducing overall emissions. Ensure:

- » A consistent effluent flow to the ponds through regular and frequent effluent channel flushing or pit emptying. Providing multiple inlets to the pond helps to spread the load
- » Active treatment volume is adequate (Photographs 8 and 9). The pond outlet should be well separated from the inlet/s to ensure all active volume is utilised. Desludge ponds when solids start to impinge on the active volume
- » Pond chemistry is suitable for treatment microorganisms. Aim for a pH of 6.8–8.0. Monitor salinity, particularly if effluent is recycled as flushing water and dilute with fresh water if necessary
- » Afterbirth and rubbish does not enter the pond
- » Potential impacts to neighbours are considered when planning pond desludging. Choose a time when the prevailing wind direction is likely to be away from sensitive neighbours. Avoid stirring up the pond during holiday periods, weekends or other times when neighbours are likely to be home. Consider which method to use. A vacuum tanker causes minimal pond disturbance and odour, while agitating the pond contents before pumping increases odour. Dewatering the pond and excavating the sludge may prolong odour release.

Covering the pond (Photograph 10) significantly reduces overall emissions but may not always be practical or cost-effective. Permeable covers made from supported straw, shadecloth or geofabric can reduce pond odours by up to 90%, while impermeable covers completely eliminate odour from the covered pond.

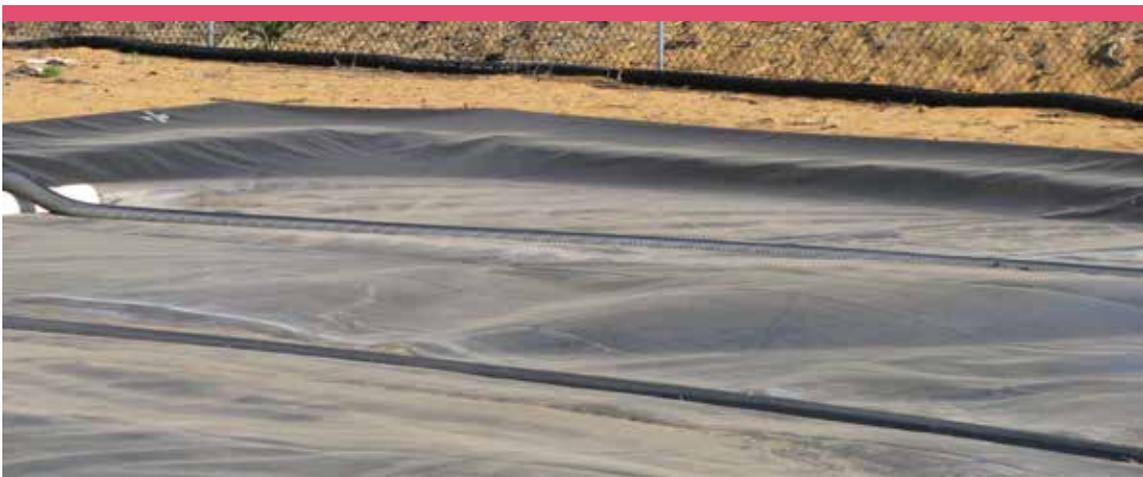
Regular inflows are important in maintaining stable, low odour conditions within anaerobic effluent treatment ponds. Shock loadings disrupt the process, resulting in odorous releases.



Photograph 8 Effluent treatment ponds must provide adequate active volume



Photograph 9 Overloaded effluent treatment ponds are likely to release strong odours



Photograph 10 Covering ponds eliminates a major odour source

Rotational Outdoor Piggeries

On-farm research undertaken by Banhazi (2013) demonstrated very low odour and dust emission rates at two rotational outdoor piggeries located in southern NSW and western Victoria. Nevertheless, it is important to be aware of factors that contribute to odour and dust and mitigate the nuisance risk where practical.

Choosing a suitable site reduces the likelihood of odour and dust nuisance. Consider:

- » Climate – temperate climates with lower rainfalls are generally preferred
- » Topography – gently sloping or undulating sites promote good drainage while generally posing a lower erosion risk than steeper sites
- » Soil type – soils must provide acceptable paddock conditions in wet weather, be capable of growing crops or pastures for harvest, and have low erosivity. Heavy clays, very sandy soils or soils with structural concerns are generally unsuitable. Parts of the paddock where manure concentrates may also become odorous if the soils remain wet for prolonged periods
- » Land area needed – large areas are needed to effectively manage rotations and soil nutrient levels.

Good management is also essential. To minimise dust, robust ground cover must be established, and soil structural concerns addressed, before pigs come onto an area (Photograph 11). It is very important to allow land to rejuvenate between pig phases. Wallows can become odorous during the pig phase and these should be backfilled and replaced as necessary.

The latest version of the “National Environmental Guidelines for Rotational Outdoor Piggeries” provide detailed information on the siting, design and management of rotational outdoor units.



Photograph 11 Under good management, rotational outdoor piggeries produce very little odour or dust



All Piggeries

Manure Storage Areas

To minimise odours from manure storage areas:

- » Limit the mass of manure kept on-hand, although it may be necessary to provide capacity for 6–12 months manure to fit in with cropping cycles
- » Promote good drainage so water doesn't pool around manure piles. Provide an impermeable base and a gradient of 2–3% on storage areas. Orient the long sides of manure piles down the slope
- » Consider blending very wet manure solids with drier material and / or regularly turning the manure to promote drying. (Do not form wet manure into tall piles (>2–2.5 m) as these are likely to heat excessively and may catch on fire)
- » Avoid turning or handling very dry manure, particularly under windy conditions. The dust produced can transport odour. Ideally wet the manure before handling using high pressure jets along the sides or micro-sprinklers along the window apex. Take care not to over-wet the manure or create runoff
- » Consider composting manure (aerobic process) (Photograph 12).

Control moisture in stored or composting manure to maintain aerobic conditions.



Photograph 12 Composting is a low-odour, aerobic process

“Meteorological conditions really drive odour complaints- monitor and interpret weather conditions.”

Producer NSW

Reuse

Reuse of effluent and manure offers many benefits to farming systems. To prevent it from creating a nuisance:

- » Schedule reuse to occur from mid-morning to mid-afternoon when dispersion is likely to be better and neighbours may be at work. Avoid reuse on weekends or public holidays when people are more likely to be home and notice odour
- » Consider the weather conditions: avoid effluent irrigation under still or very windy conditions and avoid spreading solids under windy conditions. Don't irrigate effluent or spread manure near a neighbouring house if the wind is blowing towards it
- » Avoid effluent irrigation onto wet soil. It may stay on the surface where it remains an odour source and promotes nutrient losses
- » Choose an irrigation method that suits the site and management, while also minimising aerosol production. Aerosols are fine liquid droplets, or solids, suspended in air; they can carry odour for long distances. Low pressure spray irrigators (Photograph 13) produce less aerosols than high pressure systems, which should be avoided
- » Tankers and travelling drip irrigators (Photograph 14) can be suitable options. Surface irrigation systems minimise aerosols but need to be well designed and managed to ensure effluent is spread evenly with no surface pooling. Direct injection minimises odour and nitrogen losses. Irrigating directly from an open pipe is a poor option; while it produces few aerosols it spreads effluent very unevenly which can result in pooling (Photograph 15)
- » Spread moist solids under warm conditions, and not too thick, to encourage drying
- » Avoid spreading very dry solids, particularly under windy conditions. The dust produced can transport odour (Photograph 16)
- » Promptly incorporate manure into the soil if practical.

Manage the timing of reuse to optimise odour dispersion and prevent strong odours from being carried towards sensitive neighbours.



Photograph 13 Low pressure spray irrigators produce less aerosols than high pressure systems



Photograph 14 Travelling drip irrigators distribute effluent evenly and produce few aerosols



Photograph 15 Open pipes spread effluent unevenly and can pool effluent which is an odour source



Photograph 16 Spreading dry manure can create a dust and odour problem

Further information on managing effluent and manure reuse, storage, composting and mortalities management is provided in the Piggery Manure and Effluent Management and Reuse Guidelines (2015).

Mortalities and Afterbirth

Mortalities and afterbirth should immediately be removed from the sheds or paddocks for prompt disposal. Rendering and composting are preferred disposal options. Burial and proper incineration may be suitable in some cases, although this should be confirmed through consultation with the state environment protection agency. Burning will create odour.

To minimise odour, ensure:

- » Mortalities for rendering are collected within 24 hours of discovery
- » Extraneous stormwater is excluded from burial pits and composting areas
- » Composting mortalities are continually kept surrounded by at least 300 mm of bulky, high carbon material like sawdust (Photograph 17). This material absorbs moisture released from the body, adds carbon, promotes oxygen entry and filters odours
- » Buried mortalities are well covered with soil immediately after placement
- » Incineration is done using equipment that also burns the odorous gases produced by carcass destruction.

Maintain continuous cover over composting or buried mortalities.



Photograph 17 Composting mortalities need to be kept well covered to provide aerobic conditions and filter odours



Visual Screening

Visually appealing farms tend to attract fewer complaints. Vegetative screening can play an important role in masking the visual reminder of odour (the piggery) from a neighbour's view. Tree buffers also enhance odour dispersion and filter odour and dust from the air.

Consider the summer and winter wind directions, the location of neighbours and roads, and shed ventilation requirements when planning vegetative screenings. Screens need to be downwind of the piggery to aid odour dispersion, and between the piggery and the neighbouring house/s or roads to provide a visual screen. It is important not to compromise airflow to naturally ventilated sheds in summer; provide sufficient space on the upwind side of the sheds. To protect the trees, avoid plantings within 12 m of fans for mechanically-ventilated sheds.

Vegetative buffers are more effective if they provide coverage from the ground up. Select different species of mixed height to promote air mixing. Select plants that need minimal upkeep and will thrive under site conditions, for example plants indigenous to your location.

Managing the Timing of Odour Releases

People vary in their sensitivity to odour. However, odour is more likely to create a nuisance if it occurs at times when neighbours want to relax or socialise at home. There are opportunities to control the timing of some odorous activities to reduce overall impact. There may also be scope to minimise nuisance by planning which reuse areas to use at different times of the year depending on the prevailing wind direction.

To best manage the timing of controllable odour releases, build and maintain a relationship with neighbours, encourage two-way dialogue and understand the times when odour is likely to create most nuisance. If your neighbours work in town on weekdays, schedule regular activities like pit emptying or flushing to occur while they are at work. If they always host a celebration at a particular time of the year, avoid extra odour generation at that time. Let them know if you need to undertake an activity that will result in short-term increased odour. This is particularly important for activities that occur very infrequently, like pond desludging. People are likely to be more tolerant if they understand that the increased odour is a one in five or ten year event or will only last for a short time.

To minimise nuisance:

- » Schedule short-duration, regular activities like pit flushing or emptying to occur at times of the day when neighbours are less likely to be home and good odour dispersion is expected, mid-morning to mid-afternoon is usually the best time
- » Undertake time-flexible activities, like effluent irrigation, manure spreading, manure turning or manure transport when conditions are conducive to dispersion. Avoid early morning, evening and overcast days
- » Use a wind vane or weather station so you know the wind direction, and how it might affect a particular neighbour, before commencing an activity that will generate odour. Activities that are time flexible can be rescheduled
- » Avoid scheduling odorous activities for weekends or public holidays when neighbours are more likely to be home and may be less tolerant

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- » Consider the seasonal wind direction when developing an annual reuse plan. Take into account the location of different reuse areas in relation to sensitive neighbours. Plan to use different areas when the wind is least likely to carry odour to sensitive houses or communities
 - » Try to condense manure spreading, which often has to fit in with cropping cycles, into a short time frame to limit the length of exposure time for neighbours
 - » Contact neighbours before scheduling odorous activities that may affect them so they know what to expect.

A map showing the location of neighbours, reuse areas and summer and winter wind directions can be useful for selecting which reuse areas to use at different times of the year.

Managing Complaints

Aim to maintain a good, open relationship with neighbours so issues can be identified and resolved before they become a serious problem. Manage complaints by:

- » Encouraging neighbours to contact the piggery if odour is a nuisance and making a commitment to look into the possible cause/s. Acknowledge the concerns of your neighbours
- » Investigating odour sources. Consider what activities were being undertaken, where, and the weather and wind conditions at the time the nuisance occurred
- » Taking corrective and/or preventative action (if appropriate)
- » Telling the neighbours about what has been found and actions taken and asking if the issue has been resolved
- » Recording all details of the complaint, the investigation, actions taken and communications with neighbours (see example Complaints Register).

Maintaining communications with neighbours helps to minimise odour complaints.



Example Complaints Register

The rate of complaints received cannot be used as a sustainability indicator, as it is an imprecise measure of community amenity impact. However, any complaint should be taken seriously by the piggery operator, and should be recorded and properly investigated. Full details of complaints received, results of investigations into complaints, and corrective actions should be recorded in a 'complaints register'. An example of a complaints register form is below.

Complaint Register

Complaint Details	
Date of complaint:	Time of complaint:
Nature of complaint: <input type="checkbox"/> odour <input type="checkbox"/> noise <input type="checkbox"/> water <input type="checkbox"/> dust <input type="checkbox"/> other:	
Name of person advising of complaint:	
Method of complaint: <input type="checkbox"/> phone <input type="checkbox"/> fax <input type="checkbox"/> email <input type="checkbox"/> in-person <input type="checkbox"/> other:	
Complainant name (if known):	
Complainant contact details (if known):	
Investigation Details	
Temperature at time of complaint: <input type="checkbox"/> Cold <input type="checkbox"/> Cool <input type="checkbox"/> Mild <input type="checkbox"/> Warm <input type="checkbox"/> Hot <input type="checkbox"/> Very hot	
Wind strength at time of complaint: <input type="checkbox"/> Calm <input type="checkbox"/> Light <input type="checkbox"/> Moderate <input type="checkbox"/> Fresh <input type="checkbox"/> Strong <input type="checkbox"/> Gale	
Wind direction at time of complaint: <input type="checkbox"/> N <input type="checkbox"/> NE <input type="checkbox"/> E <input type="checkbox"/> SE <input type="checkbox"/> S <input type="checkbox"/> SW <input type="checkbox"/> W <input type="checkbox"/> NW	
Direction from piggery (or reuse area) to complainant (if known):	
Distance to complainant (if known):	
Person responsible for investigating complaint:	
Investigating method:	
Significant activities at the time of the complaint:	
Findings of investigation:	
Action Taken	
Corrective actions:	
Communications with complainant:	



Notes

References

Banhazi, T, 2013, *Data Collection to Underpin the Quantitative Assessment of Odour, Dust and Noise Emission from Free Range Piggeries*, Final Report of Australian Pork Ltd Project 2011/1015.417, Australian Pork Ltd, Barton.

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“Mowing lawns and keeping
the piggery surrounds tidy affects
perceptions.”

Producer NSW

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