

Air quality guidance note

Piggeries

This guideline deals with air pollution issues. It does not deal with water pollution or noise.

1 Industry description

Piggeries that are intended to accommodate more than 2,000 pigs or 200 breeding sows are scheduled under the POEO Act. They need to hold an Environment Protection Licence and DECC is the Appropriate Regulatory Authority. Local government is responsible for environment protection for piggeries with capacity smaller than 2,000 pigs or 200 breeding sows.

Councils can influence the initial siting of all intensive agricultural industries through the development approval process. This is usually the most important decision on air quality management for these premises.

The environmental management and resolution of any air pollution-based nuisance or off-site impacts caused by odour and dust from such premises are the direct responsibility of the site operator.

This guidance note provides general information on good design and management practices to reduce air emissions from piggeries. It does not deal with nutrient management, pig health, occupational health and safety, piggery productivity or greenhouse gas emissions.

General guidance on good piggery design and management can also be obtained from the *National Environmental Guidelines for Piggeries* (Tucker *et al.*, 2004), available from Australian Pork Limited (APL): www.australianpork.com.au or phone 02 6285 2200.

1.1 Industry structure

Pig production is now a major agricultural industry in Australia. The trend has been towards fewer farms with large numbers of animals housed in sheds holding up to 100,000 pigs. Pig diets consist mainly of grains (wheat, sorghum and barley) with supplements rich in protein and minerals. Pig production tends to be located in grain-growing areas in Southern Queensland, NSW and Western Australia.

Pig production phases

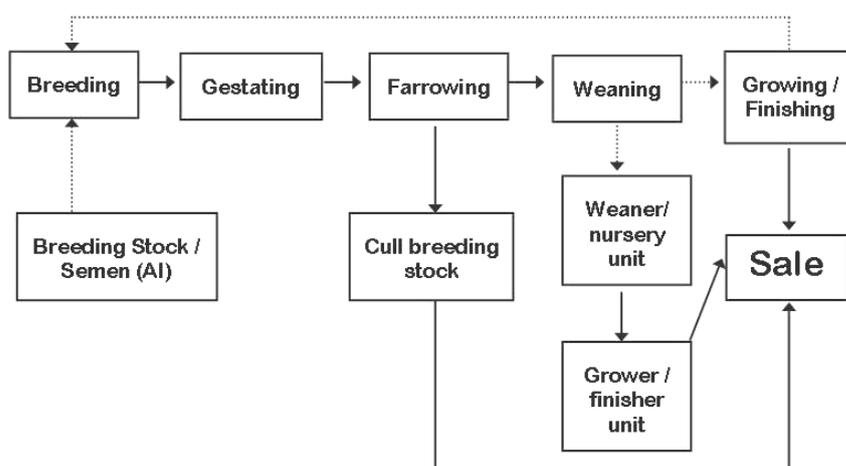
Pig production involves five main phases:

- **breeding**—housing the boars, gilts and dry sows awaiting mating
- **gestating or dry sows**—housing sows that have been mated
- **farrowing**—housing sows giving birth and young piglets
- **weaning**—housing piglets after weaning from the sow, and
- **growing or finishing**—housing pigs before their sale or induction to the breeding herd.

Types of pig production units

Pig production units take many different forms. Options include:

- **Farrow to finish:** includes the breeding, weaning and growing or finishing stages. The pigs born at the site are reared until they are old enough to be sold or inducted to the breeding herd (usually 21–26 weeks of age).
- **Breeder:** includes breeding stock and the breeding process. The pigs born at the site are reared until either the start or finish of the weaning phase (usually 3–10 weeks of age).
- **Weaner:** includes only weaner pigs. All pigs at the site are transferred in from a breeder unit and are generally kept at the site from approximately 3–10 weeks of age.
- **Grower or finisher:** includes grower (approximately 10–16 weeks of age) and finisher pigs (approximately 16 weeks and up to 21–26 weeks of age). All pigs at the site are transferred in from a breeder or weaner unit.



1.2 Pig housing and piggery types

Extensive piggeries

In an extensive piggery, the animals rely primarily on foraging and grazing rather than on supplementary feed to meet most (greater than 50%) of their nutritional requirements.

Intensive piggeries

An intensive piggery is a facility with watering and feeding infrastructure where pigs are confined and fed for the purpose of production. The pigs are maintained within a structure designed to modify the environment for all or part of the breeding and growing cycles. They rely primarily on supplementary feed to meet their nutritional requirements.

In the case of an **intensive indoor piggery** the ‘structure’ may include a slatted or concrete floor or deep litter housing.

For an **intensive outdoor piggery**, the ‘structure’ is usually a small paddock or pen, sometimes with huts or other basic accommodation. There are two types of intensive outdoor piggeries: **rotational** and **feedlot**.

In a **rotational outdoor piggery** the pigs are kept in small paddocks that are used in rotation with a pasture or cropping phase. During the stocked phase, the pigs are supplied with prepared feed, but can also forage. During the non-pig phase, the area is used to grow pastures or crops that are harvested to remove nutrients deposited in pig manure during the stocked phase.

Feedlot outdoor piggeries continuously accommodate pigs in permanent outdoor enclosures. These enclosures must be located within a controlled drainage area and the base of the enclosure must be sealed to prevent nutrients and salts from leaching to ground water.

Conventional housing accommodates pigs in concrete-floored pens within sheds. The flooring is usually partly or fully slatted or includes open channel dunging areas. For sheds with slatted flooring, spilt feed and water, urine and faeces fall through the slats into under-floor channels or pits. These are either flushed or drained regularly to remove effluent from the sheds.

Deep litter housing typically accommodates pigs in a series of hooped metal frames covered in a waterproof fabric, similar to the plastic greenhouses used in horticulture. Variations include converted conventional sheds or skillion-roof sheds with bedding over the flooring. Pigs are bedded on straw, sawdust, rice hulls or similar loose material. This absorbs manure, eliminating the need for water cleaning. The spent bedding is removed and replaced as each batch of pigs is finished.



Outdoor piggery pen



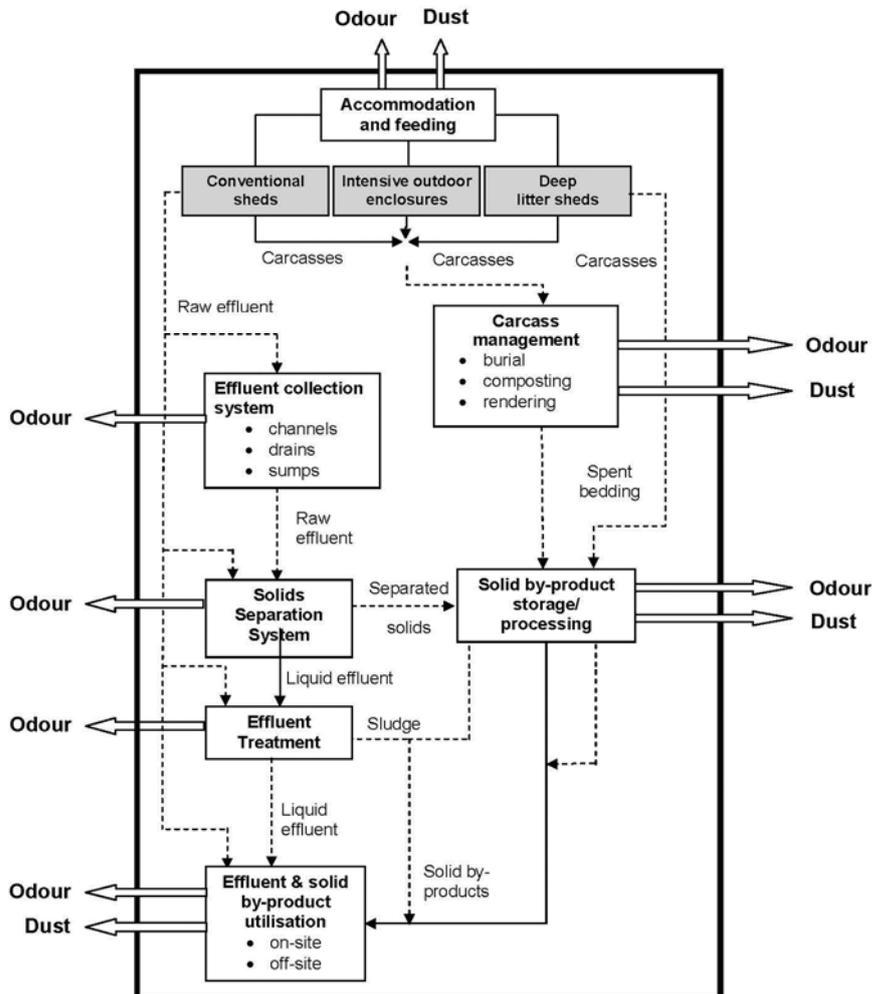
Slatted piggery pens with automatic feeding and watering



Deep litter piggery sheds

1.3 Production cycle

The following diagram shows the flow of by-products through different piggery designs and the relevant air quality issues at each stage of the production system.



2 Potential emissions to air

The main air pollution problems from piggeries are odour and dust.

2.1 Odour

Odour has become a significant problem for piggeries, even for some operated with a view to minimising odour generation. Australian Pork Limited has funded a range of studies on odour relating to the Australian pig production industry, and these can be found on their website: www.australianpork.com.au/.

Odours in pig production arise from:

- production sheds housing pigs
- collecting and storing liquid effluent
- treating effluent

- storing and processing solids
- applying effluent and solids to land, and
- disposing of carcasses.

Studies show that the biggest source of odour from piggeries is the treatment of liquid effluent. However, since all sources contribute to off-site odour impacts, emissions and mitigation measures related to the other sources cannot be ignored.

2.2 Dust

Dust in pig production arises from:

- production sheds housing pigs
- storing and processing solids
- applying effluent and solids to land, and
- disposing of carcasses.

Before going on site for an inspection or assessment the following should be checked:

- the consent conditions for the premises or the activity, and
- any previous reports on file including diagrams, photographs, maps, etc.

3 Managing air pollution

There are limitations to the control mechanisms that pig producers can use to deal with air pollution because:

- anaerobic processes are necessarily involved
- large odorous surface areas are exposed, and
- large ventilation air flows through sheds are required to maintain suitable production conditions.

Nevertheless, on-site measures can be highly effective in mitigating off-site odours from piggeries.

3.1 Location of establishments

Initial location of establishments and their relationships to sensitive neighbours is critical, since dispersion is the main method of ameliorating both odours and dust. This is discussed in Module 3 Part 1, 'Air pollution control techniques' sections 3 and 5.3.

The odour criteria recommended in Appendix A of the *National Environmental Guidelines for Piggeries* (Tucker *et al.*, 2004) are not identical to those recommended by DECC in its draft policy *Assessment and Management of Odour from Stationary Sources in NSW* (2001). Any dispersion studies should be carefully examined to make sure they will meet NSW government criteria.

Stacks are not feasible for the large air volumes or large areas involved, so distance separation is the only practical means of dispersion. Correct assessment at the approval stage is paramount.

The newer, larger intensive pig production facilities have mainly been established in areas relatively remote from rural towns and urban settlement. Some smaller-size piggeries, which are likely to be administered by local government, are located where they have potential to give rise to unsatisfactory air quality for neighbours and subsequent complaints.

3.2 Odours

Piggery sheds and pens

Measures which can be adopted to minimise emission of odours from piggery sheds and pens include:

- shed cleanliness
- in-shed temperature—lower temperatures reduce odours
- in **flushing sheds**, any measures to improve the regular removal of liquid and manure from the pens will contribute to reduced shed-odour generation, for example:
 - increasing frequency of flushing in drain-type sheds
 - making sure there is adequate slope on pen floors to influence drainage of liquids.

Where flush pits are used, the proportion of pen floor area provided as slats influences the ability of manure to pass into the flushing pit and hence affects the accumulation of manure in the pens and the odour emissions.

The slope on manure pit floors and the sizing of the flushing pits and the pit outlets influences the ability of the flushing water to adequately clean the pit.

- in **pull-plug type systems**, improving the frequency of pit emptying and recharge
- in **conventional sheds**, improving the pen cleaning interval
- in **deep litter housing**, improving the amount of bedding supplied, shed design and pig water supply
- in **outdoor systems**, improving bedding supply and hut movement
- in all systems, removing wet, spilt feed, which quickly becomes odorous.

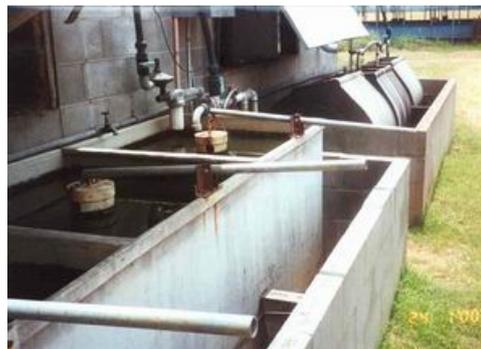


Litter in this shed has not been replaced regularly enough, allowing manure to build up and creating potential for odour

Wastewater treatment and handling

The effluent storage, treatment and handling system is a major source of odour in a piggery. Measures for managing odours from treatment and handling include the following:

- In conventional piggery sheds, effluent is collected through a network of pipes or drains. Effluent flushed from the sheds runs through these pipes or drains to effluent ponds.
- The flushing system's ability to clean all manure out of all drains after each flush influences odour emissions. For efficient cleaning the flush volume needs to match the drain type.
- Treatment ponds need to be managed to maintain the bacterial balance, maximising pond efficiency.
 - To make sure ponds function effectively, and to minimise their odour emissions, sudden, large changes to pond inflow volume or total pond volume should be avoided and sufficient pond treatment volume should be maintained.
 - *National Environmental Guidelines for Piggeries* provides guidance regarding sizing and design of effluent ponds.
 - Excessive sludge build-up in the treatment pond should be avoided because it reduces the pond's effective treatment volume and results in overloading and odours.
 - Pond treatment capability is related to the number of pigs producing effluent. If this increases, pond capacity should also increase.
 - It is unlikely that any uncovered anaerobic treatment process will be completely odour-free, but biological activity at the surface of an anaerobic pond can reduce odour levels.



Piggery flushing tanks



Drainage channels



An overloaded effluent pond

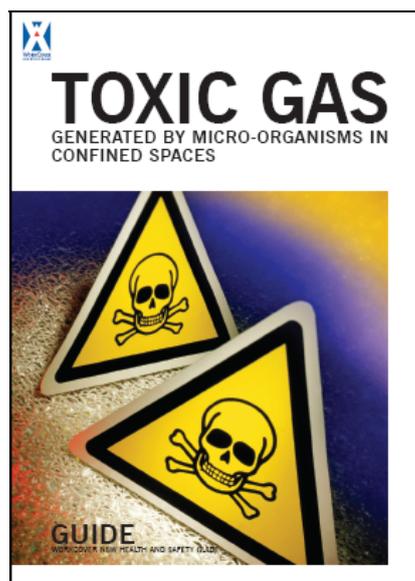


An effective effluent pond—the pink colour indicates bacterial activity

Sludge removal by vacuum tanker

Using a vacuum tanker to remove sludge:

- causes minimal disturbance of the pond
- requires sufficient land close to the pond for immediate spreading
- involves safety hazards for workers due to the extreme toxicity of the hydrogen sulfide gas which can be released when handling sludge; appropriate health and safety precautions must be followed. (Refer to the WorkCover NSW publication *Toxic gas generated by micro-organisms in confined spaces*.)



Sludge removal using an excavator

- Using an excavator to remove sludge completely empties the pond and may disturb its lining.
- The sludge is likely to be an odour source while it's wet and may take time to dry.
- The de-sludging can take place in dry weather only.

Sludge removal using agitation and pumping

- Agitating the sludge and pumping it out also causes a large disturbance to the pond volume.
- Sufficient land must be available close to the pond for applying the sludge mix.

Use of piggery by-products

Piggery by-products are generally reused through application to land as a fertiliser. In most instances the material is applied to each area in small quantities.

The **key design factors** influencing odour emissions from land application are:

- the level of treatment achieved—effluent should be aerobic if applied by spray
- the quantity of aerosols formed during application.

The **key management factors** in land application are:

- application rate
- quantity of material remaining on the soil surface after application, and
- odour potential of the material being applied.

Use of piggery effluent

The potential for aerosols to impact on receptors depends largely on the proximity of receptors to the application area and the dispersion conditions at the time of application.

Potential effluent application methods include:

- spray irrigation
- surface irrigation
 - surface, drip or trickle (surface or subsurface) irrigation produces less aerosols than spray irrigation, but is often not a viable alternative for effluent application.
- irrigation with droppers
- drip irrigation, tanker spreading
- deep injection.

Odour emissions are influenced by the method of effluent use and the management of its application.

Managing solid wastes

Solid wastes include spent bedding, manure, sludge from treatment ponds and carcasses.

- Spent bedding and manure are generally formed into trapezoidal piles (wider at the base than the top). The ability of water to drain from the base of the piles will help reduce odour emissions.
- Spent bedding and manure that is stockpiled without turning will develop odorous material inside the pile. Operations that disturb stockpiled materials (e.g. shifting piles or spreading material) should be timed to minimise potential off-site odour impacts.



Traveling effluent irrigator with droppers



Tanker spreading effluent



Effluent spray irrigator

Anaerobic activity in solid wastes can be avoided by composting the material, but this requires extra management and access to appropriate equipment.

- The moisture level, degree of aeration and other factors influence the odour emissions. (See Module 3 Part 1, section 5.6.)
- For effective results composting requires expert design and close management.

The delay between collection and treatment of solid by-products influences odour emissions.

Treatment of carcasses

Common treatments for carcasses at piggeries include composting, burial and rendering.

Composting carcasses

Carcasses are readily composted, but **the volume of material used to cover the carcass is important for controlling odour emissions.**



Pig carcasses composting;
carcasses have not yet been covered



Properly covered carcasses
composting with a plentiful supply of sawdust

Composting and the POEO Act Schedule

Composting which:

- receives over 200 tonnes per year of animal waste, food waste, sludge or bio-solids, or
- receives over 5,000 tonnes per year of wood waste, garden waste, or natural fibrous material, or
- receives any organic waste and is located within 500 metres of any residentially zoned land, or within 250 metres of a school, hospital or a dwelling not associated with the facility

renders the operation scheduled under the POEO Act and the premises becomes the administrative responsibility of DECC.

Rendering carcasses

Rendering carcasses is an excellent disposal method for producers located near a rendering plant.

Rendering and the POEO Act Schedule

Rendering plants with an intended production capacity of more than 200 tonnes per year of tallow, fat or their derivatives or proteinaceous matter, are scheduled under the POEO Act and the premises become the administrative responsibility of DECC.

Burying carcasses

For carcasses that are buried, the amount of soil cover over the carcasses influences odour emissions.

3.3 Dust

Dust emissions from pig accommodation are unlikely to cause impacts unless receptors are located close to the accommodation.

- **Dispersion conditions** (separation from sensitive sources) adequate to manage off-site odour impacts will usually also be adequate to manage off-site dust impacts.
- Dust generation can be influenced by the **nature of the feedstuffs** used.
- Farms that have **on-farm milling facilities** may generate some dust during feed mixing.
- In outdoor piggeries dust can be generated from **pigs' movement over extremely dry ground**. Over time the ground may become dusty and cause a problem.
- Dust emissions from **solids storage and processing** are unlikely to cause impacts unless receptors are located close to the area. The moisture content and particle size of these materials influence dust emissions.
- Water sprays can be used to settle dust and consolidate dusty surfaces.

4 Considerations for consent conditions

Other conditions may be necessary to control environmental impacts other than air pollution.

4.1 Standards to be met

- In cases where odour modelling and testing is to be undertaken, odours from the premises to comply with the requirements of DEC draft policy *Assessment and management of odour from stationary sources in NSW* (2001).
- Solid particle emissions to comply with POEO (Clean Air) Regulation 2002 for any stack discharges on the site:
 - 400 mg/m³ for plant installed before 1 Aug 1997 (not for a new development consent)
 - 250 mg/m³ for plant installed between 1 Aug 1997 and 1 Sept 2005 (not for a new development consent)
 - 100 mg/m³ for plant installed after 1 Sept 2005.
- Smoke emissions to comply with Ringelmann 1 or 20% opacity.
- Plant to be operated and maintained in a proper and efficient manner which does not cause air pollution, in accordance with s. 124 and 125 of the POEO Act.
- Materials to be handled in a proper and efficient manner which does not cause air pollution, in accordance with s. 126 of the POEO Act.

4.2 Operational and control requirements

- Odours from the premises not to be detectable at the nearest sensitive land use.
- Pig sheds to be flushed regularly and cleaned regularly.
- Litter used in deep litter pig sheds to be maintained in a dry condition.
- Litter to be removed only in weather conditions which minimise impact on sensitive receptors.
- The effluent flushing system to have adequate storage volume, discharge capacity and drain slope to enable adequate cleaning of drains.
- Storage volume within effluent treatment ponds to meet required treatment volume plus sludge storage volume.
- Holding ponds to be maintained so that sedimentation does not reduce their capacity by more than the designed sludge capacity.
- Solids to be stored as far away from sensitive receptors as practicable.
- Solids storage areas to be provided with an impervious, free-draining surface.
- Wherever possible, movement of solids to be carried out in weather conditions which minimise odour emissions.
- All solid by-products (e.g. spent bedding, sludge, screened solids) to be stored in an impervious, free-draining, bunded area.
- All operations and activities occurring at the piggery to be carried out in a manner that will minimise dust at the boundary of the premises.

- Land application of effluent to be carried out in a manner which minimises odour emissions.
- Spray from effluent application not to drift beyond the boundary of the premises.
- Carcasses to be disposed of in a manner which minimises odour and dust emissions.
- Carcasses which are buried to be covered with sufficient soil to prevent odour emissions.

Piggeries: air quality management checklist

This checklist has been designed for:

- local government officers—to help identify potential air emission problems and provide advice to operators.
- operators—to help identify and manage potential air emission problems.

Company

Address

Site location

Contact	Permit assessment
	Complaint response
Phone	Compliance inspection
Fax	Time & date of inspection
Email	Inspector's name

A Site location and context

What are nearby sensitive land uses? (e.g. schools, hospitals, car detailers, etc.)

	Land use	Distance	Comments
North			
South			
East			
West			

What are the prevailing winds at the site? (morning/afternoon/night)

Summer		Autumn	
Winter		Spring	

How will the surrounding topography and nearby buildings affect dispersion of any air pollution that is emitted from the site?

B Sketch plan of the site

Draw a sketch plan of the site showing the surrounding land uses, nearby buildings and local topography.



Note particularly:

- nearby sensitive land uses (schools, homes, other affected premises.)
- locations of any complainants
- locations and heights of nearby buildings or trees
- locations and heights of stacks on premises
- wind directions during times of complaint (night and day)
- any other relevant features.

Comments:

D Core business and activities

Tick if yes and add comments as appropriate.

Types of operation

Operation: indoor	No.	Size (pigs, sows)	Comments
Concrete or slatted			
Flushed or drained			
Operation: outdoor	No.	Size	Comments
Intensive			
Rotational			
Feedlot			
Extensive			

Treatment of wastes

Method	Wastes treated	Comments
Anaerobic		
Aerobic		
Solids or sludge		
Carcasses		

Location and numbers of ventilation discharge points

Location	Forced or natural	No.	Comments

Operational conditions

Aspect	Condition/activity	Yes/no/NA
Accommodation	Sheds and pigs clean?	
	Well-ventilated?	
	Odour in sheds not strong?	
	Effluent drains clean after flushing?	
	Bedding plentiful and mostly dry?	
	Laneways clear of manure and spilt feed?	
Effluent storage and treatment	Pond not odorous?	
	No solids visible on or through pond surface?	
	Ponds pink/purple in colour?	
	No bubbles visible breaking the pond surface?	
	No artificial crust or cover on pond?	
Solids treatment and storage	Solids stored in well-defined piles?	
	Area dry and well drained?	
	Carcasses well covered?	
	Stormwater excluded?	
	Operations during day only?	
Land application	No by-products visible on soil surface?	
	Vegetation on soil surface?	
	Spreading operations done during day?	

Comments and recommendations on operations:

E Management of odorous materials

How are odorous materials stored?

	Open storage	Covered storage	Bin or hopper storage	Comments
Manure				
Shed bedding				
Compost				

How are odorous materials moved?

Operation	Weather considered?	Comment
Bedding from sheds		
Pond de-sludging		
Land application		

Comments on the general standard of housekeeping:

F Complaints from nearby premises

Odours

Date	Complainant	Distance and direction from piggery	Time of day	Comments

Dust

Date	Complainant	Distance and direction from piggery	Time of day	Comments

