

Odour environmental risk assessment for Victorian broiler farms



Environment
Protection
Authority Victoria

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Guideline

1. Introduction

1.1. Purpose of this guideline

This guideline provides information on odour environmental risk assessments (Odour ERAs) that are part of planning permit applications for new and expanded Special Class Broiler Farms and Farm Clusters, as defined in section 5 of the *Victorian Code for Broiler Farms 2009* (the Code).

The guideline:

1. advises odour modellers on how to conduct an Odour ERA in accordance with the *State Environment Protection Policy (Air Quality Management)* (SEPP (AQM))
2. encourages odour modellers to adopt a clear and consistent approach to presenting Odour ERAs to enable responsible authorities to understand the level of risk of offsite odour impacts
3. advises responsible authorities on how to interpret Odour ERAs and determine the acceptability of the risk of offsite odour impacts.

1.2. Legal status of this guideline

This guideline provides information and guidance for meeting the legal requirements in the Code and SEPP (AQM). The guideline itself is advisory and not legally binding.

1.3. How to use this guideline

If you are an odour modeller:

- **section 2** explains how to conduct an Odour ERA in accordance with SEPP (AQM)
- **section 3** recommends an approach to presenting Odour ERAs for consideration by responsible authorities.

If you are a responsible authority:

- **section 4** provides guidance on how to assess an Odour ERA.

This guideline may also be used by planning authorities, the Environment Protection Authority Victoria (EPA), the broiler farm industry, the community, residential developers and others.

1.4. Background and policy context

Broiler farms

Broiler farms are where chickens are reared for meat production, typically on behalf of processing companies. Broiler farm operators receive one-day old chicks and grow them to an age of five to eight weeks, depending on the requirements of the processor. Broiler farms grow an average of five and a half batches each year, with the litter bedding removed and sheds cleaned between each batch.

Broiler farms can impact on the amenity of nearby residents, including by odour emissions, dust, noise emissions, light spill and visual appearance. The majority of community concerns and complaints relate to odour impacts.

Odour is emitted primarily by the ventilation of the sheds in which the chickens are reared, but also through the composting of dead birds and spent litter onsite and the opening of shed doors during litter removal at the end of each growing cycle.

The Code

The Code sets out the requirements for the planning, design, assessment, approval, construction, operation and management of broiler farms in Victoria.

Planning permit applications to establish a new broiler farm or to increase the capacity of an existing broiler farm are required to comply with the Code by clause 52.31-2 of the Victoria Planning Provisions.



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Section 5 of the Code classifies broiler farms as Class A, Class B, Special Class or Farm Cluster. The classification depends on the number of birds on the farm, proximity to nearby sensitive uses (such as houses, schools, hospitals and nursing homes) and proximity to other broiler farms. The Code applies different information and assessment requirements to each farm classification.

For Class A and Class B farms, the Code provides a formula to calculate the minimum separation distance required between the nearest external edge of a broiler farm shed and the nearest external edge of a sensitive use not associated with the broiler farm.

For Special Class and Farm Clusters, the Code requires the completion of an Odour ERA in accordance with section 6 of the Code.

Odour ERAs

An Odour ERA involves modelling and analysing odour predictions for a proposed broiler farm to enable the responsible authority to assess the acceptability of the risk of odour impacts beyond the broiler farm boundary.

An Odour ERA does not determine a separation distance or describe an acceptable level of risk. The responsible authority needs to decide on the acceptability of the risk. The Odour ERA helps the responsible authority to understand the level of risk in relation to the particular proposal and the characteristics of the site.

Section 6 of the Code sets out the mandatory requirements for Odour ERAs. One of those requirements is that Odour ERAs must be conducted in accordance with SEPP (AQM). The Code prohibits responsible authorities from accepting Odour ERAs not conducted in accordance with SEPP (AQM). The Code refers to this guideline as providing more information on how to meet that requirement.

SEPP (AQM)

SEPP (AQM) establishes the statutory framework for managing emissions into the air environment in Victoria.

Schedule A to SEPP (AQM) sets out the 'design criteria' for the purpose of assessing proposals that will produce air emissions.

Odour from broiler farms falls under the 'general odour' classification in Schedule A to SEPP (AQM). The design criterion for general odour is 1 odour unit, which is the odour detection threshold in laboratory conditions. That means proposals for premises that will emit odour are generally required to show that odour will not be detectable at and beyond the property boundary.

However, Schedule A includes an exception for intensive animal industry proposals in certain circumstances. That exception relaxes the design criterion to 5 odour units at and beyond the property boundary (that is, five times the odour detection threshold).

Schedule C to SEPP (AQM) sets out how to model emissions to air to estimate the impact of a proposal.

According to section 6 of the Code, odour modelling results that exceed the SEPP (AQM) design criterion at and beyond the broiler farm boundary do not necessarily make an application unacceptable. Instead, the Code requires risk assessment of the modelling results to consider the frequency, duration and intensity of estimated odour impacts on surrounding sensitive uses.

2. Conducting an Odour ERA

Conducting an Odour ERA involves:

1. selecting an appropriate air dispersion model
2. constructing a meteorological data file (or files) that represents the geographic area of the proposed broiler farm
3. characterising the source(s) of odour emissions, such as broiler farm sheds and composting areas
4. estimating the time-varying odour emission rates from each of the odour sources
5. simulating the dispersion of odour emissions from the broiler farm
6. assessing the risk of offsite odour impacts identified through the modelling using the SEPP (AQM) design criterion
7. in cases where the criterion is not met, determining the risk of odour impact on the basis of predicted peak odour concentrations and the likelihood of their occurrence.

Information on each of these steps is set out below.

Odour modellers are strongly encouraged to engage with EPA before conducting an Odour ERA to ensure modelling is completed in accordance with SEPP (AQM) and as efficiently as possible.

2.1. Air dispersion model selection

SEPP (AQM) requires the currently approved regulatory air dispersion model to be used, unless it can be demonstrated to EPA's satisfaction that an alternative model is appropriate. The currently approved regulatory model is AERMOD.

EPA is satisfied that currently CALPUFF is the most appropriate model for modelling air dispersion from broiler farms and recommends its use when conducting an Odour ERA. This guideline constitutes written approval from EPA to use CALPUFF for broiler farm odour modelling for the purposes of Schedule C to SEPP (AQM).

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2.2. Meteorological data

SEPP (AQM) requires the use of meteorological data that is representative of meteorological conditions near the site.

For some locations, site-specific meteorological data may be available from EPA.

Where site-specific data is not available, observational data should be obtained from Bureau of Meteorology (BoM) stations. This data should be selected on the basis of:

- proximity to the site
- similarity of meteorological patterns to the site and surrounds
- similarity of terrain to the site and surrounds.

If there are no BoM stations within a 5 kilometre radius of the application site, then prognostic models such as TAPM or MM5 may be used as the basis for developing site-specific data.

SEPP (AQM) further requires the meteorological data file to contain hourly data. It should be noted that meteorological observations from BoM stations described as 'hourly averages' are in fact the values from the last 10 minutes of each hour. Where one minute or 30 minute BoM data is available, this should be used to calculate hourly averages.

2.3. Odour source characterisation

For non-tunnel broiler farm sheds, the most appropriate description of the odour emission is as a volume source based on the broiler shed dimensions.

For tunnel sheds, there are two alternative description options:

1. as a volume source treating the plume as a jet
2. as a point source accounting for plume buoyancy.

Volume source treating the plume as a jet

This option describes the emissions from a broiler shed as a jet source propelled by the forward momentum of the ventilation fans. The volume source is established following the centre axis of the shed, at a distance of 5 to 10 metres from the end of the shed containing the fan bank. The release height is set at half the height of the broiler farm shed, with the initial horizontal and vertical plume spreads (σ_{y0} and σ_{z0}) being set at the shed width and height respectively, each divided by four.

Point source accounting for plume buoyancy

This option takes into account plume thermal buoyancy when the emission temperature exceeds ambient temperature. It characterises the source as a stack, even though the exhaust air is almost always directed horizontally rather than vertically.

For AERMOD, the source parameters should be adjusted so that the mass flow is conserved but the maximum exit velocity is reduced to a very low value (such as below 0.1 metres per second). This means expanding the source diameter until the necessary reduction in velocity is achieved.

2.4. Odour emission rate

All sources of odour should be identified and modelled, and then clearly described and justified in the modelling report.

Odour sources other than broiler farm sheds may include nearby broiler farms and composting of spent litter or dead birds onsite. These should be included in the modelling in order to estimate the cumulative odour impacts.

Shed cleanouts can also result in significant odour impacts and need to be considered as part of dispersion modelling. Analysis of data in *Dust and Odour Emissions from Meat Chicken Sheds* (Australian Poultry Cooperative Research Centre Project 04-45) establishes an average factor for post-shed cleaning and fumigation of 352,140 OU/min.

Where an existing broiler farm operation is in place and the proposal is for expansion, direct odour emission rate measurements can be used instead of estimations. The odour emission rate from broiler farm sheds may be affected by a number of factors that vary over time, including:

- the number of birds in a batch
- the weight of the birds over the batch cycle (which is a function of the birds' age)
- the length of the batch cycle (including thinning and time between batches)
- shed cleanouts
- ambient temperature and humidity
- internal shed temperature
- shed ventilation rates.

Various methods are used to estimate odour emission rates over a batch based on the above variables.

EPA can review and provide advice on these methods.

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2.5. Odour dispersion modelling

The selected model is used to simulate dispersion of identified odour emissions throughout each hour of the modelling period. The predicted peak concentrations are determined for each sensitive receptor location and compared against the SEPP (AQM) design criterion.

2.6. Odour impact assessment

If the modelling results show that the proposal will meet the SEPP (AQM) design criterion of 5 odour units or less at and beyond the farm boundary, then the Odour ERA process is concluded and it is not necessary to prepare a risk assessment.

If the modelling results show that the SEPP (AQM) design criterion will not be met at and beyond the farm boundary, then risk assessment is required to determine the frequency of predicted odour events exceeding defined odour concentrations for the nearby sensitive receptors. Both day and night events should be included.

This information should be set out using the risk matrix in table 1 of this guideline below.

3. Presenting an Odour ERA

Section 6 of the Code requires Odour ERAs to be presented in a manner that enables responsible authorities to determine the acceptability of the risk of offensive odour impacts.

The Odour ERA report should specify and attach any relevant EPA approvals.

EPA recommends that, in addition to presenting the body of an Odour ERA report as clearly as possible, each report should include a one to two page summary setting out:

1. a description or map of the location of the nearby sensitive receptors in relation to the broiler farm premises
2. the estimated frequency and intensity of all odour impacts (including those during the night hours) on the nearby sensitive receptors using the risk matrix below
3. advice on and a clear recommendation as to the acceptability of the estimated odour impact.

The following risk matrix is recommended for inclusion in all Odour ERA summaries.

Table 1 – broiler farm odour risk assessment matrix

Frequency	Odour concentration		
Odour events per year	10+ OU	6–9 OU	1–5 OU
0–9	see note below		
10-44	H	M	L
45-175	H	H	M
>175	H	H	M

Key:

L = low risk
(compliant with SEPP (AQM))

M = medium risk

H = high risk

Note: The highest 9 events per year are deemed statistical outliers. EPA has low confidence in these as estimates and recommends that they be disregarded for the purposes of risk assessment under SEPP (AQM).

4. Assessing an Odour ERA

When a responsible authority receives an Odour ERA as part of a Special Class Broiler Farm or Farm Cluster planning permit application, section 6 of the Code requires the responsible authority to:

1. reject the Odour ERA if it has not been conducted in accordance with SEPP (AQM)
2. decide on the acceptability of the risk of odour adversely impacting on:
 - the amenity of existing sensitive uses beyond the broiler farm boundary
 - the orderly and sustainable development of land beyond the broiler farm boundary.

EPA can advise responsible authorities on whether an Odour ERA has been conducted in accordance with SEPP (AQM).

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4.1. How to read an Odour ERA

The Odour ERA should provide advice on the proposal's level of odour impact risk. This advice is typically presented by describing the 'FIDOL' factors: the frequency, intensity, duration and offensiveness of the estimated odour impacts in relation to the location of the sensitive uses.

Frequency

Frequency refers to how often a sensitive receptor (usually a house) will be exposed to odour over a given time period. Frequency should be expressed in terms of the number of odour events estimated to occur per year.

An 'odour event' represents the peak odour concentration over a one hour period (assessed by considering three-minute averaging intervals).

Frequency may alternatively be expressed in terms of a percentile peak, based on the number of hours in the year where modelled concentrations exceed a particular criterion:

Table 2 – events per year to percentile conversion

Events per year	Percentile
0 to 9	100 th to 99.9 th
10 to 44	99.9 th to 99.5 th
45 to 175	99.5 th to 98 th
More than 175	Less than 98 th

Intensity

Intensity refers to the perceived strength of the odour, and can be related to odour concentration expressed in odour units.

Odour intensity is a subjective measure. Odour units are based on the levels at which the human nose typically detects odour at various concentrations. Generally:

- 1 odour unit is able to be detected by half the population in a laboratory environment with no background odour
- 5-9 odour units means the odour will be detectable and recognisable in the ambient environment. At the recognition level, odour is likely to be offensive.

Duration

Duration refers to how long an odour event will last within the one hour period and the number of events that occur over consecutive hours.

Offensiveness

Offensiveness refers to the offensiveness of the character of odour from broiler farms.

Offensiveness can be highly subjective. However, odour from broiler farms (like odour from all faecal matter) is generally offensive to most people.

Location

Location refers to where the broiler farm and nearby sensitive receptors are located.

When considering the risk of offence from odour, the important locations in a risk assessment are the closest identified sensitive receptors, which may include houses, schools, hospitals and nursing homes.

4.2. How to decide on the acceptability of the risk of odour impacts

If the odour modelling conducted as part of the Odour ERA shows that the broiler farm proposal will meet the design criterion in SEPP (AQM), then a risk assessment is unnecessary. In that situation, the risk of adverse odour impacts from the proposed farm is deemed to be low and EPA recommends that the responsible authority consider the risk to be acceptable.

If the odour modelling shows that the SEPP (AQM) design criterion will not be met, the Odour ERA is required to include a risk assessment. The risk assessment should include a risk matrix showing the frequency and intensity of odour impacts at the sensitive receptors near to the proposed broiler farm. That risk matrix should include impacts occurring during both the day and night.

EPA recommends the use of the risk matrix above in table 1 of this guideline.

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When presented with the matrix in table 1:

- **Low risk** means the proposed development is unlikely to create adverse odour amenity problems.
- **Medium risk** means the proposed development may create some adverse odour amenity problems.

When considering a medium risk proposal, EPA recommends that responsible authorities take into account:

1. the level of engagement with the local community undertaken by the applicant prior to and as part of the application process
2. how well the environmental management plan (EMP) submitted as part of the planning permit application meets the objective, standard and approved measures in section 7, element 6 of the Code
3. whether the EMP has been developed under the Victorian Farmers Federation Chicken Care program
4. whether the EMP includes a contingency plan to address odour events and complaints, including (but not limited to) active management options such as reducing the number of birds on the farm and ceasing ancillary odour producing activities such as onsite composting
5. whether the EMP includes a plan for regular communication with neighbours to proactively manage the risk of odour impact and respond to odour complaints
6. whether the proposal includes the use of any odour reduction technology proven to reduce odour emissions.

These factors are recognised as reducing the risk of odour impact from broiler farms. With good environmental management planning, contingency planning and engagement with neighbours, a responsible authority may support proposals assessed as medium risk on the basis that actual odour impacts will be quickly dealt with.

- **High risk** means the proposed development is likely to create adverse odour amenity problems.

The responsible authority must decide on the acceptability of the risk of adverse odour impacts. A responsible authority may decide that a high risk is acceptable for a particular application, for example, on the basis that the proposed site is within an area specifically designated for intensive agriculture.

Responsible authorities may contact EPA to request further advice.