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Project No. 167

Odour Modelling Assessment - Green Farm, Ingbirchworth.

1. Introduction

Michael Bull and Associates Ltd has been commissioned by Mr James Stafford to carry out odour modelling using the SCAIL Agriculture model in connection with a proposal for a new pig building at Green Farm, Ingbirchworth.

Rearing of pigs in housing can be a source of odours and this can result in possible nuisance at nearby sensitive receptors. This note therefore provides a summary of an odour assessment carried out to determine the likelihood of unacceptable odour conditions at nearby sensitive receptors. This provides background details regarding odours and the standards applied to determine acceptable conditions, the methodology applied, the input data and the outcome of the assessment.

The author of this report is Dr Michael Bull who was the chair of group that produced the Institute of Air Quality Management (IAQM) guidance on the assessment of odours for planning. He is an air quality and odour consultant with over 37 years of experience, has published and spoken widely on air quality and odour matters and was a contributing author to the book, *Designing with Smells*, published by Routledge in 2017.

2. Odours – background and relevant guidance

The human nose is very sensitive to odour and can detect the presence of some chemicals at very low concentrations that would be difficult for instruments to measure. The environment is rarely “odour free”, even in places that are perceived to be clean such as rural areas or by the sea. Our response to odours depends on four interlinked (sensory) characteristics:

- Hedonic tone: this is a judgement of the relative pleasantness or unpleasantness of an odour made by assessors in an odour panel;
- Quality/Characteristics: this is a qualitative attribute which is expressed in terms of “descriptors”, e.g. “fruity”, “almond”, “fishy”. This can be of use when establishing an odour source from complainants’ descriptions;



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- **Concentration:** is the “amount” of odour present in a sample of air. It can be expressed in terms of parts per million, parts per billion or in mg/m³ of air for a single odorous compound. More usually a mixture of compounds is present, and the concentration of the mixture can be expressed in odour units per cubic metre (ouE/m³) (see definition below); and
- **Intensity:** is the magnitude (strength) of perception of an odour (from faint to strong). Intensity increases as concentration increases but the relationship is logarithmic. Increases or decreases in concentration of an odour do not always produce a corresponding proportional change in the odour strength as perceived by the human nose.

The most commonly used attribute is the concentration of odours; this is measured in European odour units (ouE/m³) using a device known as an olfactometer which presents a sample of odour at different dilutions to a trained panel. The panel is asked whether they are able to detect odour at various concentrations. Once only 50% of the panel can detect the odour it is considered to be at its “Detection Threshold”. The odour concentration at the Detection Threshold is defined to be 1 ouE/m³. For instance, if an odour sample has been diluted in an olfactometer by a factor of 10,000 to reach the detection threshold, then the concentration of the original sample is 10,000 ouE/m³.

Where the source does not yet exist, dispersion modelling is usually the main tool for assessment. The results from the odour model are then compared with established standards to determine whether unacceptable odour conditions exist.

The Environment Agency H4 odour guidance is the main source of the odour standards generally applied to assess the significance of dispersion modelling results. The odour benchmarks in H4 were derived from studies that examined the relationship between the percentage of the population reported to be “annoyed” by odours from pig farming with predicted odour concentrations from odour modelling. The percentage of the population reported to be annoyed was derived from community surveys.

The H4 document provides the following odour benchmarks:

- 1.5 ouE/m³ for most offensive odours;
- 3 ouE/m³ for moderately offensive odours; and
- 6 ouE/m³ for less offensive odours.

The guidance states that exposures above these benchmark levels indicates the likelihood of unacceptable odour pollution. H4 provides some guidance on the classification of the offensiveness of odours as shown in Table 4. Odours from intensive animal rearing clearly are defined as moderately offensive and therefore the standard applied for this study is 3.0 ouE/m³.

3. Modelling Assessment

Odour modelling has been carried out using the SCAIL Agriculture model. This model was developed on behalf of a number of government bodies including the Environment Agency. SCAIL Agriculture is a simple screening tool that can be used to estimate the effect of an

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agricultural emission on odour levels. The model is an online tool based on the AERMOD dispersion model and includes a database of odour emission rates that have been used for this assessment. The model includes inbuilt meteorological data files and the most appropriate information is selected by the model based on the source location. The model is intended to be a screening model and consequently makes relatively pessimistic assumptions and the results would be expected to overestimate odour concentrations. However, it is a useful tool to establish the likely scale of odour risk and if a more detailed assessment is needed.

1 Environment Agency H4 Odour Management, How to comply with your environmental permit, March 2011

Level of offensiveness	Activities
Most offensive	Processes involving decaying animal or fish remains Processes involving septic effluent or sludge biological landfill odours
Moderately offensive	Intensive livestock rearing Fat frying (food processing) Sugar beet processing Well aerated green waste composting
Less offensive	Brewery Confectionery Coffee roasting Bakery

Table 1 H4 Classification of different odours

The model has been set up to examine the potential odour impacts from the pig housing and associated manure storage. It is recommended that the model is run for a single source and therefore the housing and manure have been assessed separately.

MBAL has been advised by Mr James Stafford that the housing will be for 900 pigs, the housing is naturally ventilated with a solid flooring with straw used for bedding. There are also up to four proposed manure heaps, each of approximately 5 square metres holding 6 tonnes of manure. The source and receptor locations used in the modelling are shown in Figure 1 and an example of the set up input screen shown in Figure 2.

The SCAIL Agriculture model has been run separately for the housing and the three manure piles and the odour concentrations calculated, the results are shown in Table 2. Note that the model calculates the 98th percentile of hourly means to allow direct comparison with the Environment Agency H4 odour benchmarks.



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Receptor	Housing	Manure heap 1	Manure heap 2	Manure heap 3	Manure heap 4
Campsite	1.35	0.02	0.02	0.02	0.07
Ingfield Barn	0.53	0.01	0.01	0.02	0.03
Old Farmhouse	0.56	0.01	0.01	0.02	0.03

Table 2 Results of SCAIL Odour Modelling (ouE/m³ as a 98th percentile)

The results show that the predicted odour concentrations are well below the H4 standard of 3 ouE/m³ as a 98th percentile of hourly means. A worst case assessment of the total odour levels from all five sources can be made by adding together the results. In practice, the overall odour concentrations will be lower as the 98th percentile figures should not be directly added together. The maximum odour concentration would therefore be 1.48 ouE/m³ at the camp site.

Note that the SCAIL Agriculture model is a screening model and consequently will be expected to overestimate the actual odour impacts but as the predicted levels are well below standards, a more detailed modelling approach is not required.

4. Summary

The odour concentrations arising from a proposed pig housing facility at Ingbirchworth have been calculated using the SCAIL Agriculture model. This is a screening model developed on behalf of a number of government bodies including the Environment Agency.

The results from the modelling show that the predicted concentrations are well below the appropriate odour standard of 3.0 ouE/m³ with a maximum level of 1.48 ouE/m³ being predicted. In practice, the odour levels would be expected to be lower as a screening model is designed to overestimate odour concentrations.



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Figures

Figure 1 Location of sources and receptors (Source Apple Maps)





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Figure 2 Example SCAIL Agriculture input screen

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Project Run Mode ⓘ ☒ Conservative Met ☐ Realistic Met

Location Details

Select Country ⓘ

Installation Details

Installation ⓘ

Installation Name ⓘ

Installation Location ⓘ ☐ Landranger ☒ x,y

Source Details

Source ⓘ

Source ⓘ ☒ Pig ☐ Poultry ☐ Cattle ☐ User defined emissions

New or Existing Source ⓘ

Source Name ⓘ

Source Location ⓘ Provides a link to GoogleMaps to check the location.
 ☐ Landranger ☒ x,y

Source Type ⓘ

Details ⓘ

Livestock Number ⓘ

Housing Floor Area ⓘ m²

Naturally Vented ☒

Building Height ⓘ m

Fan Location ⓘ

No. of Fans (optional) ⓘ

Fan Diameter ⓘ metres

Fan Flowrate ⓘ m³/s

Total emissions ⓘ

Pollutant	Source Emissions	Running total of all emission sources	Units
NH ₃ :	189	189	(kg)
PM ₁₀ :	19	19	(kg)
Odour:	113529600	113529600	(kOu)