Air Quality Note:
Ermine Poultry Farm

July 2020

Experts in air quality
management & assessment

SUPERSEDED

Document Control

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1 Introduction

1.1 Air Quality Consultants Ltd (AQC) carried out an odour assessment for the proposed Ermine Poultry Farm in Scunthorpe, North Lincolnshire, in February 2020[1]. The assessment demonstrated that the proposed development would lead to 'not significant' odour effects at nearby sensitive receptor locations.

1.2 North Lincolnshire Council (NLC) has reviewed the assessment report and has raised several queries relating to the assessment and the overall conclusions of the study. This note addresses the comments made by NLC.

1.3 Any reference to 'IAQM guidance' in this note refers to the IAQM's *Guidance on the assessment of odour for planning* v1.1 (2018).

2 Responses to Comments

Odour

2.1 The comments made by NLC in relation to the odour assessment are set below:

1. Dispersion Modelling Uncertainty: It is required that a section on uncertainty assessment is included that considers the factors shown in Table 13 of Environmental Protections response.

2. Dispersion Modelling Sensitivity Analysis: In order to be able to account for the uncertainties a sensitivity analysis needs to be carried out for the modelling.

3. Model input parameters. The full details of the model input parameters have not been provided in the written report. This Council would expect to receive the modelled input files as an Appendix along with these figures fully tabulated and justified whist giving consideration to uncertainty and the parameters changed in a sensitivity analysis.

4. EIA Regulations: The qualitative risk based assessment concludes that the proposed poultry farm will have a moderate adverse effect at the two sensitive receptors (Receptors 7 and 8), a slight adverse effect at Receptor 1 and negligible effects at all other receptors. The dispersion modelling has predicted that the proposed poultry farm will result in a moderate adverse odour effect at Receptor 8, a slight adverse odour effect at Receptor 7 and negligible odour effects at all other receptors.

[1] AQC. *Odour Assessment: Ermine Poultry Farm, North Lincolnshire.* February 2020.

The IAQM Guidance states that "The EIA regulations require an assessment to reach a conclusion on the likely significance of the predicted effect. Where the overall effect is greater than "slight adverse", the effect is likely to be considered significant." Can this be clarified please.

Comment 1 – Model Uncertainty

2.2 The responses to NLC's table of comments are set out below. These responses address NLC's comments concerning the uncertainty associated with the odour assessment.

Row	Parameter	NLC Comments	AQC Comments
1	**Type of Units**	It is assumed that this facility is not a free range unit. Submit Permit so clear whether or not a planning condition is required for these aspects.	N/A – erroneous comment relating to incorrect permit.
2	**Max Number of Units**	Odour Modelling report states 5 sheds Environmental Permit allows 4 sheds. A change to the Permit would be required to operate 5 units or the number of sheds reduced to 4.	N/A – erroneous comment relating to incorrect permit. Four poultry sheds are proposed.
3	**Max Number of Birds**	Modelled for 300,000 but Environmental Permit allows 500,000 birds. Would therefore require a planning condition to restrict the number of birds if this could not be controlled via a Permit Variation/Condition	N/A – erroneous comment relating to incorrect permit. 300,000 bird capacity is proposed.
4	**Main Sources of Odour on Site**	Dirty water impact has not been considered. The ES states "Dirty water from the clean out process will be collected through a dedicated sealed drainage system to an underground storage tanks. The dirty water will be removed from the tank and either spread in appropriate locations and conditions on the applicants holding or taken to third party lands." Clarification around this aspect and the 2.5 million litre holding lagoon is advised. Fugitive emissions have not been considered (cleaning out of sheds/dead carcasses etc.) as IAQM guidance states that these should be represented as an area source with no or low efflux velocity	The dirty water is transferred via a sealed drainage system and stored in sealed, underground tanks; the odours generated by the water will thus be well contained, and odour emissions will be negligible. These sources were thus discounted from the assessment due to the effective containment of odours within the sealed system. The fugitive emissions associated with the cleaning of sheds and the storage of carcasses have been included within the qualitative risk assessment. The IAQM guidance makes it clear that the main applications for a qualitative odour assessment are: *"c. Situations where there is insufficient information to carry out detailed predictive dispersion modelling;* *d. Situations where the information has wide uncertainties and its use as input to a detailed predictive dispersion model would be at best a waste of time, money and effort or, worse, would lead to an illusory and*

Row	Parameter	NLC Comments	AQC Comments
			false impression of accuracy and precision in the numbers generated; *e. When the model is not able to properly represent the reality of the situation being assessed, e.g. if the odour effects are likely to be significantly influenced by accidental, unexpected, or unknown releases. In such instances a qualitative estimate may be more appropriate, on the basis that it is better to be broadly correct than precisely wrong.* *Many (though not all) fugitive/diffuse sources fall into the last three categories and it may not be practicable to model these because reliable quantitative emissions data are often not available".* The guidance also goes on to state that *"there are some types of odour source that may exist that are not easily modelled (e.g. diffuse sources, fugitive emissions or intermittent sources) and so model results may not give a complete picture of the odour risk on site. Current odour assessment cannot be applied to short-term events."* Odour emissions from shed clean out are infrequent and fugitive events for which reliably estimating odour emissions for use in the model is not possible. The assessment of the potential for odour impacts from these events has therefore been adequately assessed in the risk assessment, in accordance with the IAQM guidance.
5	**Sources of Odour Off Site**	The cumulative impact of odour should be considered which includes off site sources of emissions such as land spreading etc.	The surrounding area is rural with no other significant sources of odour such as intensive farming or sewage treatment works. There is understood to be a poultry farm located approximately 900 m to the northeast; however, over this distance it is judged that the odours from this farm will not adversely impact upon the worst-case receptors in the study area. In terms of the spreading of manure on the surrounding farmland, this is an infrequent event and it is not practical to quantify the odours from such activities. The nearest sensitive receptors to the proposed development are located upwind (to

Row	Parameter	NLC Comments	AQC Comments
			the southwest), and thus the probability of local manure spreading occurring at the same time as north-easterly winds – which are demonstrated to be very infrequent in Figure 3 of the assessment report – is judged to be low. The cumulative impacts of odours from the proposed poultry sheds and any odours from infrequent nearby land spreading are judged to be not significant.
6	**Odour Emission Rate from Broiler Chickens and Roof Vent Odour Concentration from Each Stack**	It is advised that these figures are based on Odour Emission Rates for broiler chickens from Verein Deutscher Ingenieure (VDI) Guidance. The full reference was not provided however this department has at this stage assumed the publication is as detailed here: German data: VDI Guideline VDI 3894, Blatt 1 (2011): Emissions and immissions from animal husbandry – Housing systems and emissions – Pigs, cattle, poultry, horses. Beuth Verlag, Berlin. The relevance of this figure to the application site has not been fully justified and the growing size of the broilers from chick through to the maximum weight of around 2.5kg does not appear on face value to be accounted for in the modelling undertaken. Modelling across the production cycle would be a more robust approach.	The correct VDI document has been referenced within the report and is the same as the document referred to by NLC. The modelling has adopted a worst-case approach by assuming that the chickens are at full weight for the entire cycle. Modelling at varying weights across the cycle would reduce odour emissions and thus reduce the predicted odour concentrations. The maximum emission for mature broiler chickens presented in the VDI guidance has been used. Whilst modelling across the production cycle may be more representative, the use of the worst-case assumption regarding the weight of the birds allows for a conservative approach to account for uncertainty in the odour model.
7	**Dimensions of Shed**	No building dimensions provided in the modelled data. This data should be provided.	The sheds have been modelled at 6.096 m in height, and were built into the model using GIS-registered plans. The approximate shed dimensions are 103.5 x 24.5 m. A visual representation of the sheds, overlain on a scale plan of the proposed development, is shown in Figure 1 of the assessment report.
8	**Number of Roof Extract Fans**	Modelled for 5 units but Permit allows 4 units. A change to the Permit would be required or the number of sheds reduced to 4.	N/A – erroneous comment relating to incorrect permit. Four sheds are proposed with 12 roof extracts per shed.
9	**High Velocity Roof Extract Fans**	Modelled for 5 units but Permit allows 4 units. A variation to the Permit would be required or the number of units for the application reduced to 4.	N/A – erroneous comment relating to incorrect permit. Four sheds are proposed with 12 roof extracts per shed.

Row	Parameter	NLC Comments	AQC Comments
10	**Max Velocity of Roof Extract Fans**	4% fan capacity has been assumed in the odour assessment. No robust evidence has been provided for this single figure and modelling over the range of velocities including the worst case scenario would be expected.	The reasoning for the assumption that the fans will run at 4% is detailed in the report; this flow rate results in an efflux velocity of 1.0 m/s through the each fan, which has been chosen to be deliberately conservative to help account for uncertainty in the modelling. A low velocity reduces the buoyancy of the exhaust plume and therefore reduces the odour concentrations. Assuming a constant low efflux velocity of 1 m/s is therefore worst-case. It should be noted that at higher velocities, the volume of air extracted would be higher, but the mass odour emission rate (OU_E/s) would be the same, as this is calculated based on the number of birds using the VDI emissions data. Modelling a range of efflux velocities would result in periods with much higher velocities and thus increased buoyancy which would result in lower predicted odour concentrations.
11	**Max Height of Roof Extract Fans**	It appears that 12 stacks x 5 sheds has been modelled using this stack height. Permit only allows for 4 sheds.	N/A – erroneous comment relating to incorrect permit.
12	**Gable End Extract Fans (required for periods of hot weather or where there is ridge fan breakdown)**	Impact of odour emissions from these outlets have not been modelled or considered. The report advises that these fans operate during hot weather conditions and therefore they should be modelled to represent the worst case scenario.	The use of these fans would be very intermittent, and only for short durations. Further details on the omission of short-term odour events from the dispersion model are set out in Paragraph 2.11.
13	**Internal Temperature of Sheds**	Modelled at 21 centigrade. Para 2.24 of the Environmental Statement confirms that 'The houses are warmed to a temperature of around 32°C at the beginning of the crop and is decreased to 21°C towards the end of the crop.' No robust evidence has been presented for the modelling of this single figure and consideration of the range of temperatures over the cycle has not been taken into account. It is not considered that this represents the worst case scenario.	Modelling at a consistent temperature which represents the lowest temperature from the possible range throughout the cycle represents a worst-case assessment. The buoyancy of a plume from a stack reduces as the temperature reduces, and thus the use of a lower temperature will result is lower buoyancy and thus reduced dispersion. The comment that *"It is not considered that this represents the worst case scenario"* is thus incorrect.
14	**Nested Cartesian Grid Spacing**	The rationale behind the grid spacing's has not been presented or the potential impact on the modelling in the event that these are altered. It is	The grid spacing is suitable to produce accurate contours; the grid resolution is high close to the proposed development and decreases with distance as odour concentrations

Row	Parameter	NLC Comments	AQC Comments
		unclear whether the grid spacing is small enough in all cases.	reduce. This is the best-practice approach to modelling across a grid of receptors. In terms of assessing impacts at individual, sensitive locations, discrete receptors have been used.
15	**Receptor Height**	The modelling appear to only represent receptors at this static height and the impact of changing this parameter has not been modelled or discussed particularly in terms of ground level and first floor bedrooms.	The difference in modelled odour concentrations between the ground and first-floor locations of nearby properties will be negligible as the odour releases are at low level (only 6 m above ground) and have low buoyancy (low efflux velocity and temperature), causing the plume to ground quickly. Any slight differences in the predicted odour concentrations between ground and first floor height receptors would be very minor, and would not change the predicted impacts or the conclusions of the assessment.

2.3 The comments set out in the table above demonstrate that considerable effort has been made to present a realistic worst case assessment to overcome the uncertainty associated with the model. The adopted approach is therefore considered both robust, and adequately conservative.

Comment 2 – Dispersion Model Sensitivity Analysis

2.4 The odour assessment includes the following sensitivity analyses in order to provide a robust assessment and sufficiently account for any uncertainty associated with the assessment methods used.

Multiple Assessment Methods

2.5 The odour assessment used two approaches: a qualitative odour risk assessment and quantitative dispersion modelling. As described in the IAQM guidance, using two or more assessment methods is a best-practice approach to reduce the uncertainty associated with using a single assessment method to determine the significance of odour effects.

Meteorological Data

2.6 The IAQM guidance *"recommends that individual [meteorological] years be modelled and five years of data should be used"*. Five years of meteorological data have been used in the modelling, with the worst-case year presented in the main body of the report in accordance with the IAQM guidance. Furthermore, a variable surface roughness file was used in the modelling; the use of this file, as opposed to the use of a single roughness value for the study area, will significantly increase the accuracy of the effects of surface roughness on the dispersion of the odour plume.

Terrain

2.7 The effect of complex terrain in the modelling changes the plume trajectory and dispersion to account for the changes in the airflow that are caused by the terrain. Whilst the model was run with a complex terrain file, no sensitivity test was undertaken for the influence of terrain on the dispersion of the plume. However, the model only takes account of the terrain effects where the gradient exceeds 1:10. The study area is relatively flat, and the gradient between the proposed development and the nearest receptor is 1:28. A sensitivity test which involves modelling without terrain effects is therefore not required.

Buildings

2.8 As a sensitivity test, each modelled meteorological year was run once with the building downwash module, and once without building downwash. The maximum predicted concentration at each grid point from either scenario was presented in the assessment.

Worst-Case Assumptions

2.9 The modelling adopted several realistic worst-case assumptions to ensure that the approach was conservative. It is therefore judged that the impacts will have been overpredicted, particularly at the worst-case receptor locations close to the proposed development. A summary of the worst-case assumptions are as follows:

- the use of a constant temperature from the roof vents which represents the lowest possible temperature in the sheds throughout the entire cycle (see Table Row 13);
- the use of a constant odour emission rate for each bird which represents the highest possible odour emission from any stage in the growth cycle (see Table Row 6); and
- the use of a constant efflux velocity for the roof vents which represents the lower end of the range of potential fan speeds (see Table Row 10).

2.10 In addition to these factors, only the worst-case model results from each of the meteorological year and building downwash sensitivity tests have been presented in the assessment, meaning the odour impacts are identified and assessment conclusions are drawn on the worst-case model predictions.

Intermittent and Fugitive Odour Emissions

2.11 For infrequent, short-duration, fugitive odour emission sources such as the cleaning out of sheds, it is judged that the modelling of these sources would not be suitable; this is in accordance with the IAQM guidance (see Table Row 4). The assessment of emissions from these sources was thus undertaken qualitatively using the IAQM risk assessment guidance. It should also be noted that the worst-case receptors closest to the proposed development are located to the southwest of the sheds. Figure 3 in the assessment report demonstrates that the prevailing wind is from the southwest, with

no other significant components. For intermittent sources which are relatively short in duration (e.g. carcass removal and shed cleaning), the likelihood of these activities taking place during the infrequent north-easterly winds is low, and thus under typical meteorological conditions any odours generated by these activities will be transported with the prevailing wind and away from the nearby sensitive receptors.

Comment 3 – Model Input Parameters

2.12 The assessment report included full details of the model input parameters; the 'Model Inputs' section (Paragraphs 3.14 to 3.18, Tables 4 and 5 and Figure 1) sets out all relevant parameters used in the modelling. In terms of the model files, these are not usually submitted as part of a planning application as planning authorities do not tend to hold model licences required to allow the model files to be opened and audited; an audit of the model files is though usually carried out by the Environment Agency as part of the environmental permit application process.

2.13 The model input parameters have also been justified in this section where appropriate, and a conservative assessment has been adopted to account for the uncertainty in modelling and to provide a worst-case assessment.

Comment 4 – EIA Regulations

2.14 Paragraphs 4.30 and 4.31 of the odour assessment report set out the reasons why the overall odour effects are judged to be 'not significant'. The dispersion modelling adopted a number of worst-case assumptions (see the table above) which will have led to an overprediction of the extent of the odour impacts. The points raised by NLC regarding modelling a more 'realistic' scenario across the growth cycle would have led to reduced odour impacts at the nearest properties. Furthermore, in three of the five meteorological years considered in the modelling the impacts were slight adverse at the worst-case property. The overall assessment of significance has used elements of the professional judgement of the odour practitioners undertaking the assessment; the professional experience of the practitioners has been included as an appendix to this note.

Dust and Bioaerosols

2.15 NLC has provided the following comment in relation to dust from the proposed development:

"The Environmental Statement has concluded that an assessment of dust is not required due to the fact that relevant sensitive receptors are located in excess of 500m from the application site. This department does not agree with this conclusion as the nearest sensitive receptors appear to be located within 200m of the application site.

The Environmental Statement appears to contradict the Design and Access Statement and Odour Assessment in terms of separation distances. This department would advise that this potential impact is considered further, taking into account all of the receptor locations."

2.16 NLC also provided the following comment in relation to bioaerosols from the proposed development:

"A suitable assessment in relation to bio-aerosols in line with Environmental Protections request is required. In order to adequately assess the potential impact it would be usual to gather background data that currently exists at the site. This may be a requirement of the Environmental Permit and therefore a copy of the Permit already granted in 2018 and any supporting bio aerosol assessment should be submitted with the application."

2.17 The nearest receptor to the proposed development boundary is located 103.5 m to the south, as shown in Figure 1 below. The Environment Agency's guidance document *Intensive farming risk assessment for your environmental permit* states that a developer for a new poultry farm must *"produce and submit a dust and bioaerosol management plan with [an] application if there are relevant receptors within 100 metres of [the] farm, such as the farmhouse or farm worker's houses"*.

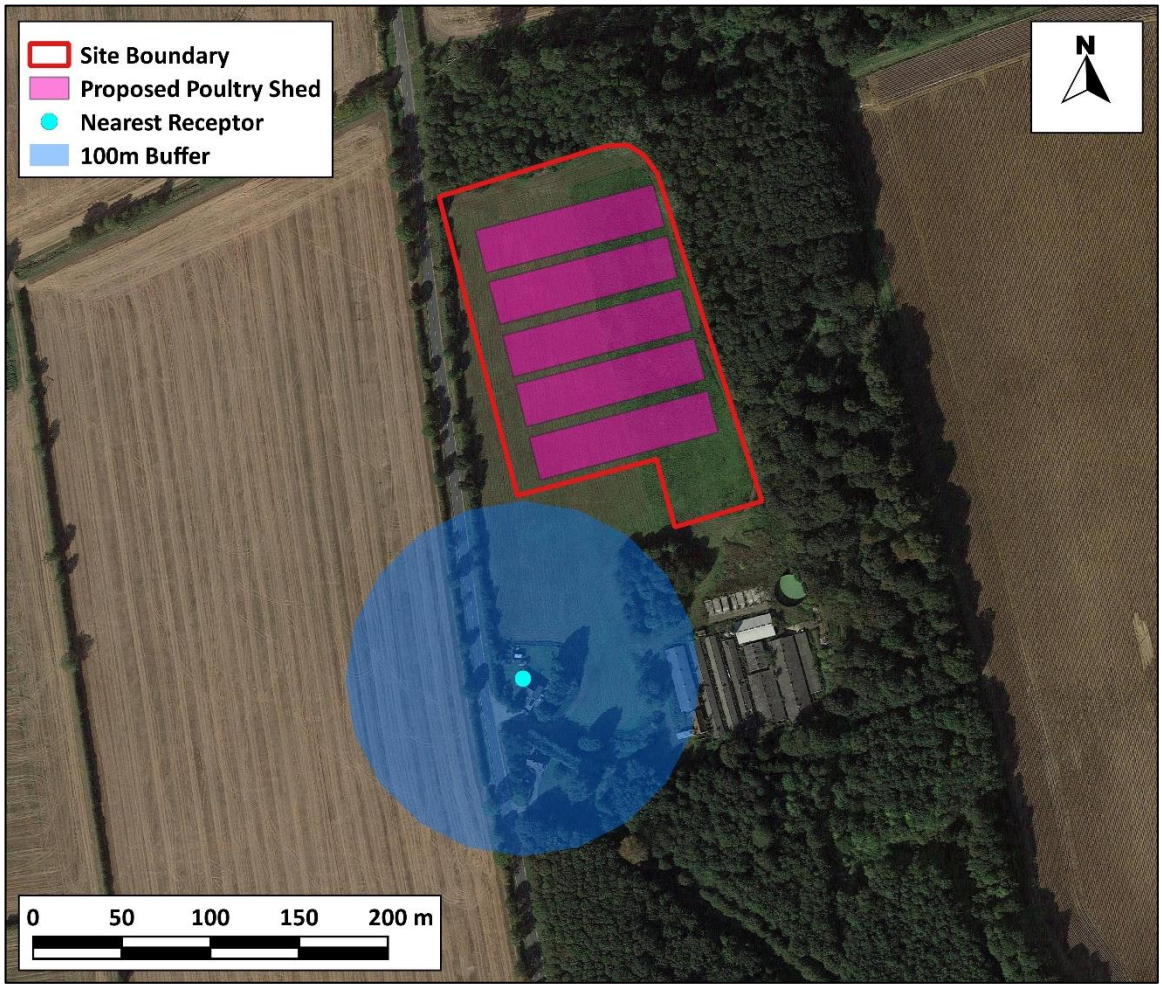

Figure 1: Nearest Receptor Location

Imagery ©2020 Google.

2.18 It is therefore judged that an assessment of dust and bioaerosols is not required for the proposed development and the risks of dust and bioaerosols impacts is negligible. If any potential risk of bioaerosol or dust impacts or nuisance emerge once the development becomes operational, this will be dealt with as part of the EA permit conditions for the facility.

Appendix 1 Professional Experience

Laurence Caird, MEarthSci CSci MIEnvSc MIAQM

Mr Caird is an Associate Director with AQC, with over 14 years' experience in the field of air quality and odour management and assessment. He has carried out air quality and odour assessments for a wide range of residential and commercial developments, airports, industrial processes, road schemes and energy-from-waste installations throughout the UK and abroad. Mr Caird's experience in terms of odour assessment includes odours from poultry farms and other intensive livestock farming, waste water treatment, brewing and distilling, meat processing, sugar refining, various processes using paints and solvents and a large number of commercial kitchens. He has acted as expert witness in relation to the assessment of air quality or odour impacts at a number of previous planning appeals, and is a contributory author to the IAQM's *Guidance on the assessment of odours for planning.*

Paul Outen, BSc (Hons) MIEnvSc MIAQM

Mr Outen is a Senior Consultant with AQC, having joined in 2014. He undertakes air quality and odour assessments for AQC, covering residential and commercial developments, industrial installations, road schemes, energy centres and mineral and waste facilities. These involve qualitative assessments, and quantitative modelling assessments using the ADMS dispersion models, for both planning and permitting purposes. He has also presented evidence at public hearings. Mr Outen has a particular interest in odour assessment, and has extensive experience in the assessment of odours across a wide range of industries throughout the UK, Europe and Asia. He also has experience in pollutant monitoring techniques, and played a key role in the development and standardisation of isokinetic bioaerosol sampling in the UK. He regularly undertakes site audits for various installations to advise on pollution control and mitigation strategies. He is a Member of both the Institute of Environmental Sciences and Institute of Air Quality Management.