[redacted]

From: steve raasch [stephenraasch@gmail.com]
Sent: 05 June 2014 13:52
To: [redacted]
Subject: EPR/FP3533ZX/A001 - Frogmore Poultry Unit

Hi [redacted]

A few things I can confirm straight away;
1 + 2. Top up cheque and advertising cheque will be sent early next week (will put application no. on rear)
3. Apologies there has been no EIA carried out as yet.
4.a. Vent heights will be greater than 5.5m, efflux velocity of roof extraction fans will be 10m/s.
b. Gable fans at northern end of houses will be for hot weather cooling only, not used during normal ventilation.
c. Dust accumulations will be regularly monitored and kept clean, due to the infrequency of operation of these fans dust accumulations will be negligible.
5. All condensate from heat exchangers will be directed to underground dirty water tanks as shown on drainage plan, in accordance with the position statement.
6. Information and revised plan to follow.
7. Oil storage facilities will be fully compliant with the requirements of S3.2 of SGN How to comply - Intensive Farming Version 2
8. Footbaths will be covered to prevent ingress of water and not overfilled to prevent spillage, spent footdips will be emptied into dirty water tanks,to comply with the requirements of S3.2 of SGN How to comply - Intensive Farming Version 2.
9, Any chemical storage on site will be capable of retaining spillage, resistant to fire, frost free and secure taking into account the appropriate measures in S3.2 of SGN How to Comply – Intensive Farming, Version 2.
10. Feed storage will be in dedicated sealed vermin proof silos, collision protection will be by means of location or physical barriers. Exhausts from silos will have dust containment measures in the form of water traps or filters.
11. Revised OMP to follow in light of the public interest, NB nearest residence is beyond the 400m criteria.

Regards

Steve

ps. Have a good holiday

This message has been scanned and no issues discovered.

[redacted]

From: steve raasch [stephenraasch@gmail.com]
Sent: 16 June 2014 15:27
To: [redacted]
Subject: Frogmore
Attachments: Odour Management Plan.docx; OMP assessment checklist.docx; Technical Standards.docx

Hi [redacted]

Please see attached revised odour plan and checklist.
With regard to the site plan, concrete area is marked on plan with no concrete at northern end of installation by the gable fans. The outfall from the swale is marked on plan and will discharge into a ditch leading to Piddle Brook to the northeast referenced in SCR. The release of the clean water will be by means of a restricted outlet limited to 22l/s, which is the allowable discharge rate from greenfield development.
Please let me know if you require anything further.

Regards

Steve

This message has been scanned and no issues discovered.

[redacted]

From: steve raasch [stephenraasch@gmail.com]
Sent: 18 June 2014 10:41
To: [redacted]
Subject: Odour Frogmore
Attachments: 12_01083_FUL-ENVIRONMENTAL_STATEMENT-_APPENDIX_4_ODOUR_IMPACT_ASSESSMENT-316284.pdf

Hi [redacted]

Please see attached odour modelling for a similar unit, is not too far away from Frogmore and would have same met data and terrain.
Page 15 shows an OS map showing the odour plume and the distance concentrations.
Page 16 shows the levels at receptors, none quite match the same distances however the paragraph below states that the odour unit concentration falls below 3 at 250m from site, this would demonstrate that odour pollution beyond site boundary at the nearest receptor would be well within the bounds of acceptability.

The grid reference for the outfall from swale/attenuation pond 395727,254037.
This may move marginally as this is a greenfield site.

Regards

Steve

This message has been scanned and no issues discovered.

[redacted]

From: steve raasch [stephenraasch@gmail.com]
Sent: 18 June 2014 13:25
To: [redacted]
Subject: Re: Frogmore Farm - Request for further information

Hi [redacted]

Can confirm as our discussion earlier, please disregard the example odour modelling, in discussion with the applicant we will conduct odour modelling for the proposed installation given the concerns raised at this location.
Acceptable that Duly Made will be completed when this modelling and data files have been submitted, would hope to have this by end of June.

The area surrounding the poultry houses to the north,east and west will be grassed areas acting as soakaways.

Regards

Steve

On 18 June 2014 13:10, [redacted] wrote:

Hi Steve

As discussed this morning there are still a few outstanding points with regards to the Not duly Made questions posed.

As we discussed, the odour modelling sent through as detailed in your email below will be disregarded as this farm is currently not operational and the modelling was carried out for fewer birds than is proposed for Frogmore Farm (200,000 opposed to 250,000). Can you confirm that you are happy to withdraw this modelling report?

You have indicated that you intend to carry out detailed modelling at Frogmore Farm to answer the following not duly made question:

11. **Odour management:**

B) Please provide evidence that there is negligible risk of odour pollution beyond the installation boundary for 250,000 broilers? For example, has some form of impact assessment been carried out for other farms of a similar size, operation and for similar distances to nearby receptors, or has odour modelling for this site (for 250,000 broilers) been carried out? If you do submit odour modelling, please also submit the electronic date input files.

As I made clear in our phone call, we are not insisting that modelling is carried out at this stage, but if you feel that this method best answers the above question, then that is your choice. When the report is submitted please also submit the relevant data files. Can you confirm that you understand that the application will not be duly made until the above question is answered?
As we also discussed, the modelling needs to reflect the 'worst case scenario' and that the information used to carry out the modelling accurately reflects the appropriate measures that will be used on the farm. During the determination of the application, the modelling data will be examined in combination with the Odour Management Plan. Depending on this assessment, we may need to revisit the odour modelling and OMP as necessary.

In addition to the above, can you confirm that the 3 sides of the sheds where concrete is not present (i.e. the northern, eastern and western sides), are grassed areas which act as soakaways?

For your information and for future reference please note that the Technical Standards document that has been provided doesn't reflect in full that which was provided in the example application document sent through when the application was not duly made. Below the 'Slurry spreading and manure management planning –off-site-activity' section there are a number of subsequent sections: Emissions and monitoring, fugitive emissions, dust, carcass management, flies, bunding and containment, agriculture fuel oil and other chemical storage, foodstuff, odour, noise and vibration.

I look forward to hearing from you.

Kind regards

From: steve raasch [mailto:stephenraasch@gmail.com]
Sent: 18 June 2014 10:41
To:
Subject: Odour Frogmore

Hi

Please see attached odour modelling for a similar unit, is not too far away from Frogmore and would have same met data and terrain.

Page 15 shows an OS map showing the odour plume and the distance concentrations.

Page 16 shows the levels at receptors, none quite match the same distances however the paragraph below states that the odour unit concentration falls below 3 at 250m from site, this would demonstrate that odour pollution beyond site boundary at the nearest receptor would be well within the bounds of acceptability.

The grid reference for the outfall from swale/attenuation pond 395727,254037.

This may move marginally as this is a greenfield site.

Regards

Steve

This message has been scanned and no issues discovered.

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This message has been scanned and no issues discovered.

[redacted]

From: steve raasch [stephenraasch@gmail.com]
Sent: 30 June 2014 13:34
To: [redacted]
Subject: Frogmore

Hi [redacted]

Apologies for the confusion, as it is a greenfield site the fan velocity can be changed, so if the modelling report is using 12m/s then I can confirm that this will be the efflux velocity used at the installation.

Regards

Steve

This message has been scanned and no issues discovered.

A Dispersion Modelling Study of the Impact of Odour from the Proposed Poultry Unit at Frogmore Farm, Naunton Road, Upton Snodsbury in Worcestershire

Prepared by Steve Smith

AS Modelling & Data Ltd.

Email: steve@asmodata.co.uk

Telephone: 01952 462500

19th June 2014

1. Introduction

AS Modelling & Data Ltd. has been instructed by Kinsey Hearn of F C Jones & Co. to use computer modelling to assess the impact of odour emissions from the proposed broiler rearing unit at Frogmore Farm, Naunton Road, Upton Snodsbury, Worcestershire. WR7 4PD.

Odour emission rates from the proposed poultry unit have been assessed and quantified based upon an emissions model that takes into account the likely internal odour concentrations and ventilation rates of the poultry houses. The odour emission rates so obtained have then been used as inputs to an atmospheric dispersion model which calculates odour exposure levels in the surrounding area.

This report is arranged in the following manner;

- Section 2 provides relevant details of the site and potentially sensitive receptors in the area.

- Section 3 provides some general information on odour; details of the method used to estimate odour emissions from the proposed poultry unit; relevant guidelines and legislation on exposure limits and where relevant details of likely background levels of odour.

- Section 4 provides some information about ADMS, the dispersion model used for this study and details the modelling parameters and procedures.

- Section 5 contains the results of the modelling.

- And Section 6 provides a discussion of the results and conclusions.

2. Background Details

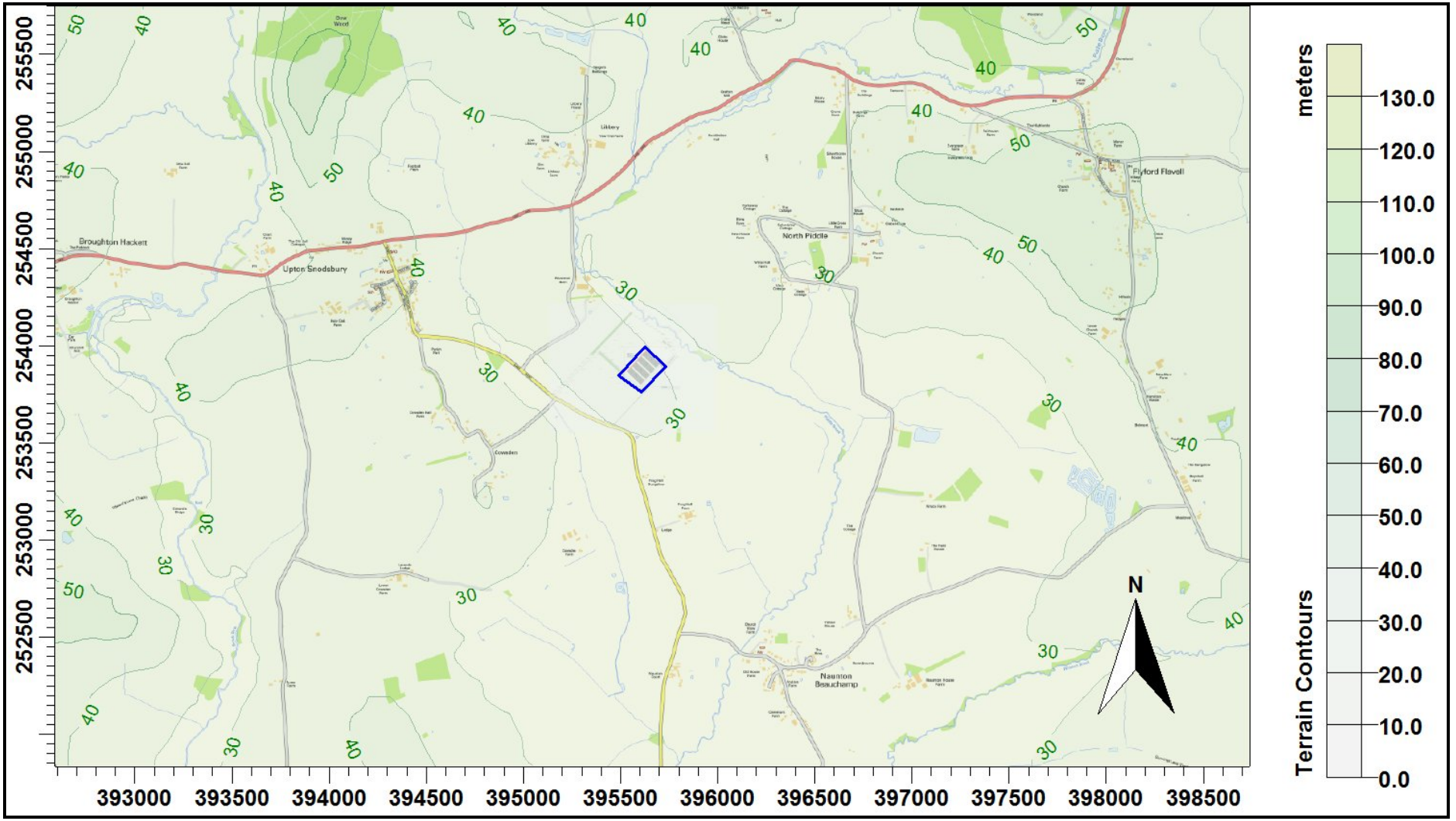
The site of the proposed broiler rearing unit at Frogmore Farm is in an isolated rural area. The surrounding land is used primarily for arable farming although there are also several orchards and isolated wooded areas. The site is at an altitude of around 31 m in a gently rolling landscape.

It is proposed that four new broiler rearing houses be constructed at the site. These four houses would provide accommodation for up to 250,000 broiler chickens and would be ventilated primarily by uncapped high speed ridge mounted fans, each with a short chimney. The chickens would be reared from day old chicks to up to 38 days old and there would be approximately 7.5 flocks per annum.

There are isolated residences and commercial properties in the area surrounding the site of the proposed poultry unit. The closest of these are at; Moorend Barn, approximately 360 m to the north-west; Froghall Bungalow, approximately 470 m to the south; residences at Crowden approximately 730 m to the south-west and at Vine Cottage and Butts Cottage on the southern outskirts of North Piddle, approximately 720 m to the north-east.

A map of the surrounding area is provided in Figure 1; the position of the proposed poultry unit at Frogmore Farm is outlined in blue.

Figure 1. The area surrounding the site of the proposed poultry unit at Frogmore Farm



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3. Odour, Emission Rates, Exposure Limits & Background Levels

3.1 Odour concentration, averaging times, percentiles and FIDOR

Odour concentration is expressed in terms of European Odour Units per metre cubed of air (ou_E/m^3). The following definitions and descriptions of how an odour might be perceived by a human with an average sense of smell may be useful, however, it should be noted that within a human population there is considerable variation in acuity of sense of smell.

- 1.0 ou_E/m^3 is defined as the limit of detection, in laboratory conditions.
- At 2.0 – 3.0 ou_E/m^3 a particular odour might be detected against background odours in an open environment.
- When the concentration reaches around 5.0 ou_E/m^3 a particular odour will usually be recognisable, if known, but would usually be described as faint.
- At 10.0 ou_E/m^3 most would describe the intensity of the odour as moderate or strong and if persistent, it is likely that the odour would become intrusive.

The character, or hedonic tone, of an odour is also important; typically odours are grouped into three categories;

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

And Less offensive

- brewery
- confectionery
- coffee roasting
- bakery

Dispersion models usually calculate hourly mean odour concentrations and Environment Agency guidelines and findings from UK Water industry Research (UKWIR) are also framed in terms of hourly mean odour concentration.

The Environment Agency guidelines and findings from UKWIR use the 98th percentile hourly mean; this is the hourly mean odour concentration that is equalled or exceeded for 2% of the time period considered, which is typically one year. The use of the 98th percentile statistic allows for some consideration of both frequency and intensity of the odours.

At some distance from a source, it would be unusual if odour concentration remained constant for an hour and in reality, due to air turbulence and changes in wind direction, short term fluctuations in concentration are observed. Therefore, although average exposure levels may be below the detection threshold, or a particular guideline, a population may be exposed to short term concentrations which are higher than the hourly average. It should be noted that a fluctuating odour is often more noticeable than a steady background odour at a low concentration. It is implicit that within the models hourly averaging time and the Environment Agency guidelines and findings from UKWIR that there would be variation in the odour concentration around this mean i.e. there would be short periods when odour concentration would be higher than the mean and lower than the mean.

The FIDOR acronym is a useful reminder of the factors that will determine the degree of odour pollution.

- **F**requency of detection.
- **I**ntensity as perceived.
- **D**uration of exposure.
- **O**ffensiveness.
- **R**eceptor sensitivity.

3.2 Environment Agency guidelines

In April 2011, the Environment Agency published H4 Odour Management guidance (H4). In Appendix 3 – Modelling Odour Exposure, benchmark exposure levels are provided. The benchmarks are based on the 98th percentile of hourly mean concentrations of odour modelled over a year at the site/installation boundary. The benchmarks are;

- 1.5 ou_E/m^3 for most offensive odours.
- 3.0 ou_E/m^3 for moderately offensive odours
- 6.0 ou_E/m^3 for less offensive odours.

Any modelled results that project exposures above these benchmark levels, after taking uncertainty into account, indicates the likelihood of unacceptable odour pollution.

3.3 UK Water industry Research findings

The main source of research into odour impacts in the UK has been the wastewater industry. An in-depth study of the correlation between modelled odour impacts and human response was published by UKWIR in 2001. This was based on a review of the correlation between reported odour complaints and modelled odour impacts in relation to nine wastewater treatment works in the UK with on-going odour complaints. The findings of this research and subsequent UKWIR research indicated the following. Based on the modelled 98th percentile of hourly mean concentrations of odour;

- At below 5.0 ou_E/m^3, complaints are relatively rare, at only 3% of the total registered.

- At between 5.0 ou_E/m^3 and 10.0 ou_E/m^3, a significant proportion of total registered complaints occur; 38% of the total.

- The majority of complaints occur in areas of modelled exposures of greater than 10.0 ou_E/m^3, 59% of the total.

3.4 Choice of Odour Benchmarks for this Study

Odours from poultry rearing are usually placed in the moderately offensive category. Therefore, for this study, the Environment Agency's benchmark for moderately offensive odours, a 98th percentile hourly mean of 3.0 ou_E/m^3 over a one year period, is used to assess the impact of odour emissions from the proposed poultry unit at potentially sensitive receptors in the surrounding area. The UKWIR research is also considered.

3.5 Quantification of Odour Emissions

Odour emission rates from broiler houses depend on many factors and are highly variable. At the beginning of a crop cycle, when chicks are small, litter is clean and only minimum ventilation is required, the odour emission rate may be small. Towards the end of the crop, odour production within the poultry housing increases rapidly and ventilation requirements are greater, particularly in hot weather, therefore emission rates are considerably greater than at the beginning of the crop.

Peak odour emission rates are likely to occur when the housing is cleared of spent litter at the end of each crop. There is little available information on the magnitude of this peak emission, but it is likely to be greater than any emission that might occur when there are birds in the house. There are measures that can be taken to minimise odour production whilst the housing is being cleared of spent litter and the time taken to perform the operation is usually around an hour per shed. Also, there is usually some discretion as to when the operation is carried out, therefore, to avoid high odour levels at nearby sensitive receptors it may be possible to time the operation to coincide with winds blowing in a favourable direction. It should be noted that it is normal to maintain ventilation during clearing out.

To calculate an odour emission rate it is necessary to know the internal odour concentration and ventilation rate of the poultry house. For the calculation, the internal concentration is assumed to be a function of the age of the crop and the stocking density.

The internal concentrations used in the calculations increase exponentially from 300 ou_E/m^3 at day 1 of the crop, to approximately 1,000 ou_E/m^3 at day 32 of the crop and to approximately 2,000 ou_E/m^3 at day 48 of the crop. These figures are obtained from a review of available literature.

The ventilation rates used in the calculations are based on industry standard practices and bird growth factors. Target internal temperature is 29 Celsius at the beginning of the crop and is decreased to 19.5 Celsius by day 32 of the crop. If the external temperature is 6 Celsius, or more, lower than the target temperature, minimum ventilation only is assumed for the calculation. If the external temperature is 3 Celsius, or more, greater than the target temperature then the maximum ventilation rate is assumed. A transitional ventilation rate is calculated between these extremes.

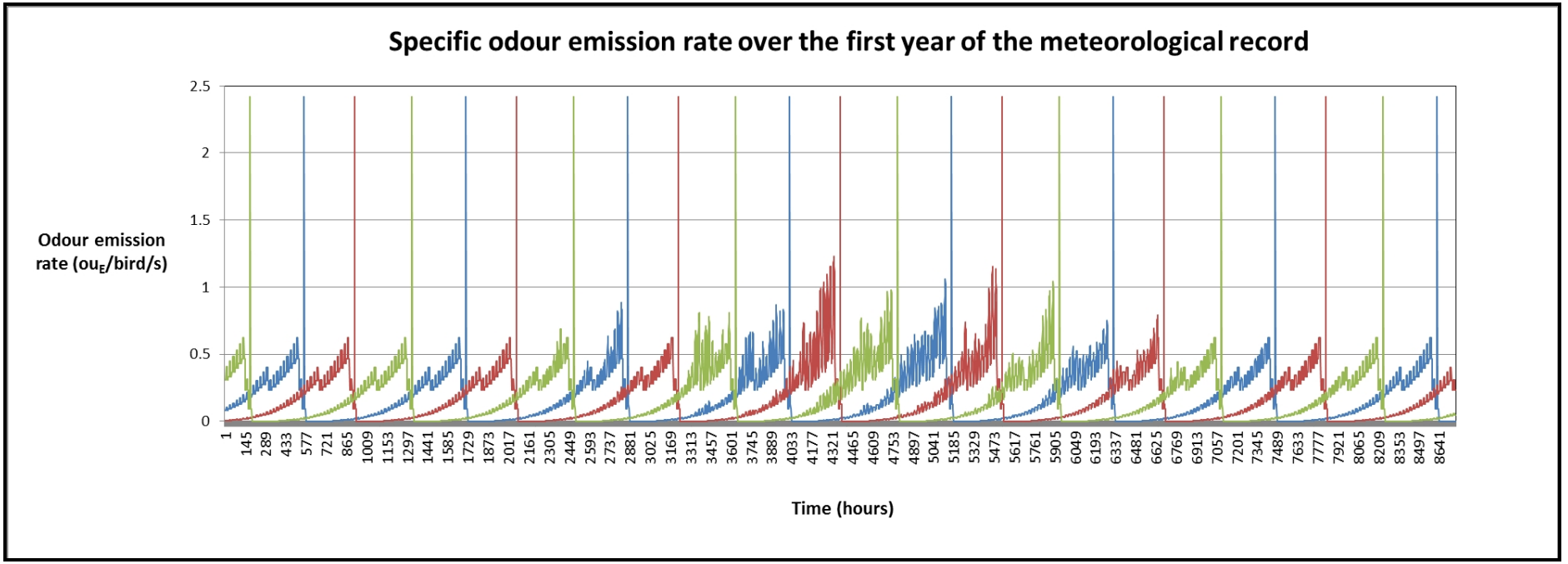
Based upon these principles, an emission rate for each hour of the period modelled is calculated by multiplying the concentration by the ventilation rate. Both the crop length and period the housing is empty can be varied. An estimation of the emission during the cleaning out process can also be included.

In this case the crop length is 38 days and an empty period of 10 days after each crop is assumed for the calculations. To provide robust statistics three sets of calculations were performed; the first with the first day of the meteorological record coinciding with day 1 of the crop cycle, the second coinciding with day 16 of the crop and the third coinciding with day 32 of the crop. A summary of the emission rates used in this study is provided in Table 1. The specific odour emission rate used for the clearing process is approximately 2.40 ou_E/bird/s (as stocked) and the 98th percentile emission rate is approximately 0.65 ou_E/bird/s (as stocked). As an example, a graph of the specific emission rate over the first year of the meteorological record for each of the three crop cycles is shown in Figure 2.

Table 1. Summary of odour emission rates (average/maximum of all 3 cycles)

Emission rate (ou_E/s per bird as stocked, during crop)				
Season	Average	Night-time Average	Day-time Average	Maximum
Winter	0.169	0.152	0.203	0.644
Spring	0.189	0.153	0.225	1.230
Summer	0.219	0.155	0.257	1.356
Autumn	0.180	0.152	0.208	0.852

Figure 2. Specific emission rate over the first year of each of the three crop cycles



4. The Atmospheric Dispersion Modelling System (ADMS) and model parameters

The Atmospheric Dispersion Modelling System (ADMS) ADMS 5 is a new generation Gaussian plume air dispersion model, which means that the atmospheric boundary layer properties are characterised by two parameters; the boundary layer depth, and the Monin-Obukhov length rather than in terms of the single parameter Pasquill-Gifford class.

Dispersion under convective meteorological conditions uses a skewed Gaussian concentration distribution (shown by validation studies to be a better representation than a symmetrical Gaussian expression).

ADMS has a number of model options including: dry and wet deposition; NO_x chemistry; impacts of hills, variable roughness, buildings and coastlines; puffs; fluctuations; odours; radioactivity decay (and γ-ray dose); condensed plume visibility; time varying sources and inclusion of background concentrations.

ADMS has an in-built meteorological pre-processor that allows flexible input of meteorological data both standard and more specialist. Hourly sequential and statistical data can be processed, and all input and output meteorological variables are written to a file after processing.

The user defines the pollutant, averaging time (which may be an annual average or a shorter period), which percentiles and exceedence values to calculate, whether a rolling average is required or not and the output units. The output options are designed to be flexible to cater for the variety of air quality limits, which can vary from country to country, and are subject to revision.

4.1 Meteorological data

Computer modelling of dispersion requires hourly sequential meteorological data and to provide robust statistics the record should be of a suitable length; preferably four years or longer.

The meteorological data used in this study is obtained from assimilation and short term forecast fields of the Numerical Weather Prediction (NWP) system known as the Global Forecast System (GFS). The GFS is a spectral model and data are archived at a horizontal resolution of 0.5 degrees (approximately 50 km over the UK). The GFS resolution adequately captures major topographical features and the broad-scale characteristics of the weather over the UK. Smaller scale topological features may be included in the dispersion modelling by using the flow field module of ADMS (FLOWSTAR). The use of NWP data has advantages over traditional meteorological records because;

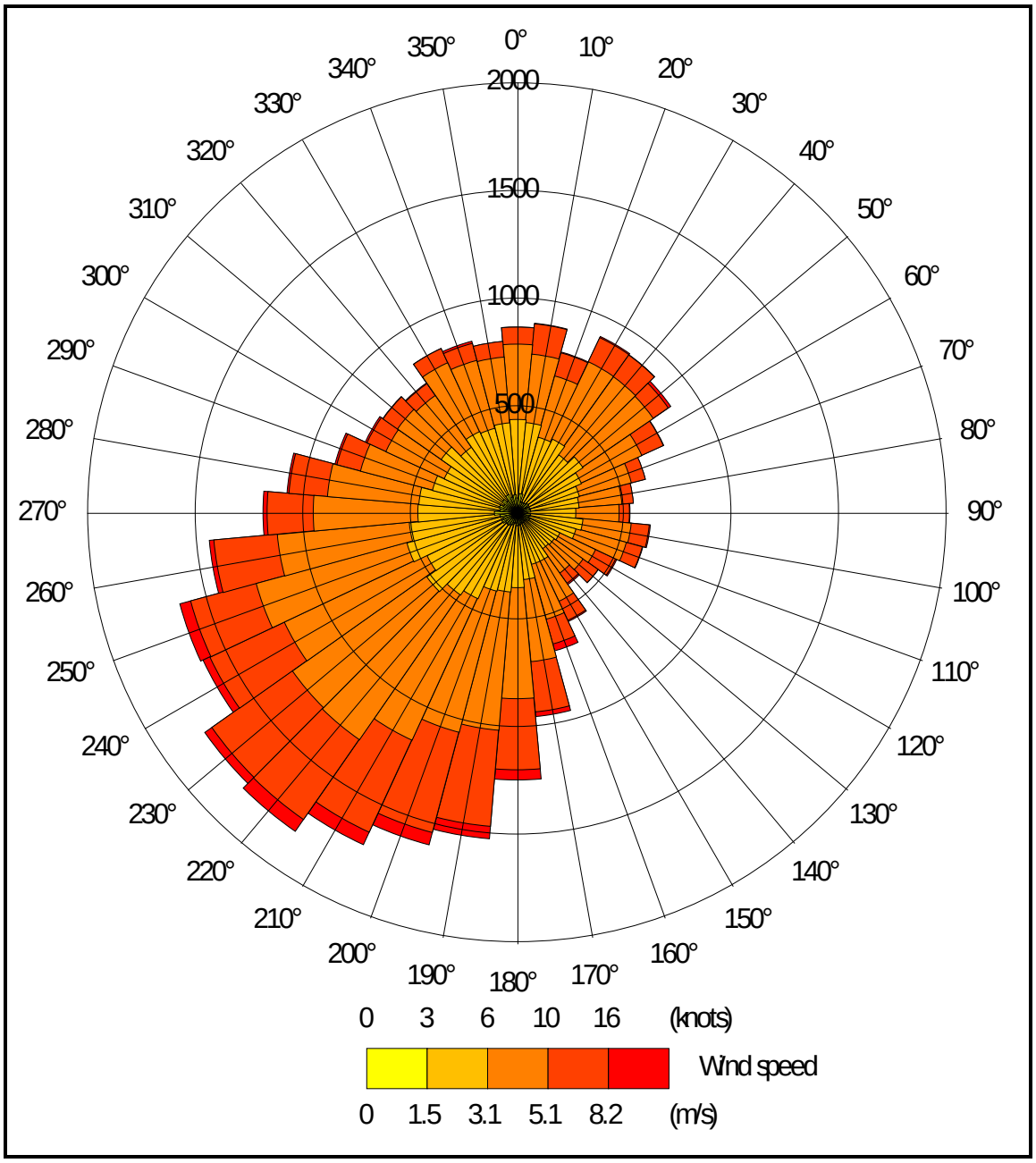
- Calm periods in traditional records may be over represented, this is because the instrumentation used may not record wind speed below approximately 0.5 m/s and start up wind speeds may be greater than 1.0 m/s. In NWP data, the wind speed is continuous down to 0.0 m/s, allowing the calms module of ADMS to function correctly.

- Traditional records may include very local deviations from the broad-scale wind flow that would not necessarily be representative of the site being modelled; these deviations are difficult to identify and remove from a meteorological record. Conversely, local effects at the site being modelled are relatively easy to impose on the broad-scale flow and provided horizontal resolution is not too great, the meteorological records from NWP data may be expected to represent well the broad-scale flow.

- Information on the state of the atmosphere above ground level which would otherwise be estimated by the meteorological pre-processor may be included explicitly.

A wind rose showing the distribution of wind speeds and directions in the GFS derived data is shown in Figure 3. N.B where terrain data is included in the modelling these wind speeds and directions will be modified. These data are derived for latitude 52.183 degrees North, longitude 2.064 degrees West.

Figure 3. The wind rose. GFS derived data, for 52.183 N, 2.064 W, 2010 - 2013



4.2 Emission sources

Emissions from the chimneys of uncapped high speed ridge fans on the proposed poultry houses (PR1 a, b & c to PR4 a, b & c), are represented by three point sources per house within ADMS. Details of the point source parameters are shown in Table 2a. The positions of the point sources may be seen in Figure 4.

The poultry houses would also have gable end fans to provide additional ventilation during hot weather conditions. The emissions from these gable end fans are represented by a single volume source within ADMS. Details of the volume source parameters are shown in Table 2b. The positions of the volume source may be seen in Figure 4. N.B. The volume source is assumed to emit 50% of the total emissions when the ambient temperature equals or exceeds 21 Celsius; when the volume source is emitting, emissions from the point sources are reduced by 50%.

Odour emissions from heat exchanger units on the poultry houses would be small in comparison to other emission points and would arise from stacks with similar characteristics to the chimneys of the ridge mounted fans and they are therefore not modelled explicitly.

Table 2a. Point source parameters

Source ID	Height (m)	Diameter (m)	Efflux velocity (m/s)	Emission temperature (ºC)	Emission rate per source (ou_E/s)
PR1 a, b & c	6.5	0.8	12.0	Variable [1]	Variable [1]
PR2 a, b & c	6.5	0.8	12.0	Variable [1]	Variable [1]
PR3 a, b & c	6.5	0.8	12.0	Variable [1]	Variable [1]
PR4 a, b & c	6.5	0.8	12.0	Variable [1]	Variable [1]

1. Dependent on crop stage and ambient temperature, reduced by 50% when the ambient temperature equals or exceeds 21 Celsius.

Table 2b. Volume source parameters

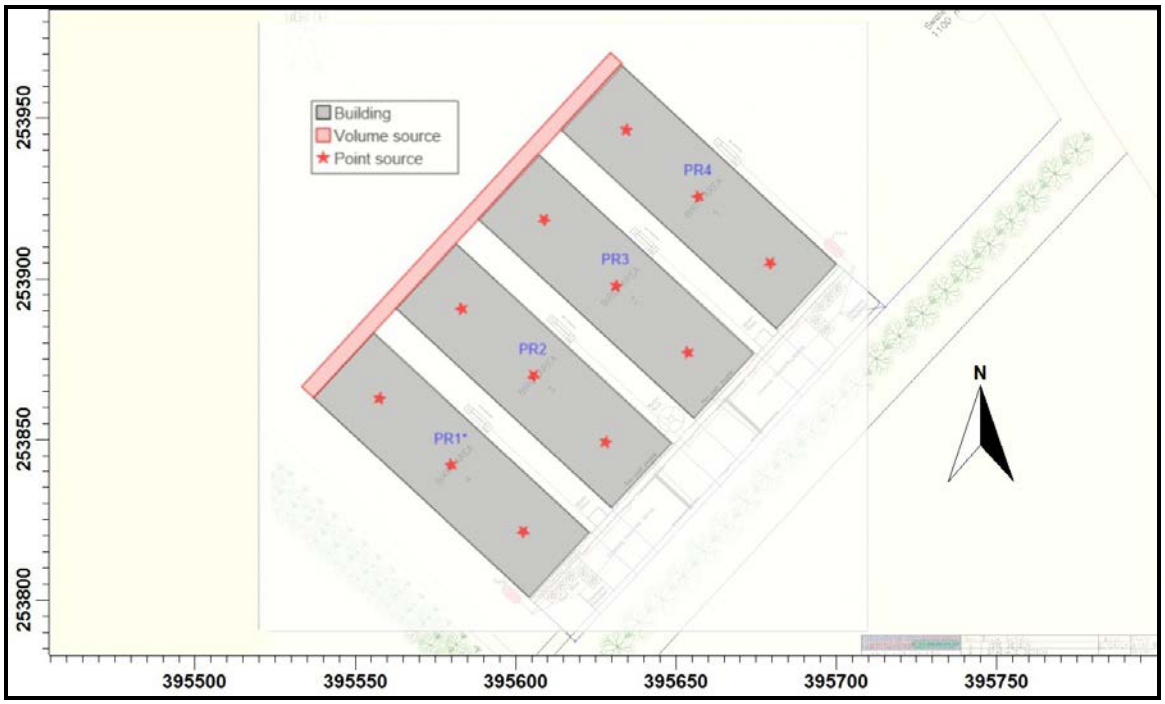
Source ID	Base Height (m)	Depth (m)	Volume (m^3)	Temperature (ºC)	Emission rate (ou_E/s)
GAB	0.0	3.0	2122.5	Ambient	Variable [2]

2. 50% of total emissions only emitted when the ambient temperature equals or exceeds 21 Celsius.

4.3 Modelled buildings

The structure of the proposed poultry houses may affect the odour plumes from the point sources. Therefore, the buildings are modelled within ADMS; the modelled building heights are 5.5 m. The positions of the modelled buildings may be seen in Figure 4 where they are marked by grey rectangles.

Figure 4. The positions of modelled buildings & sources



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4.4 Discrete receptors

Seventeen discrete receptors have been defined at a selection of nearby residences and commercial properties. The receptors are defined at 1.5 m above ground level within ADMS and their positions may be seen in Figure 5 where they are marked by enumerated pink rectangles.

4.5 Nested Cartesian grid

To produce the contour plots presented in Section 5 of this report, a nested Cartesian grid has been defined within ADMS. The grid receptors are defined at 1.5 m above ground level within ADMS. The positions of the receptors may be seen in Figure 5 where they are marked by green crosses.

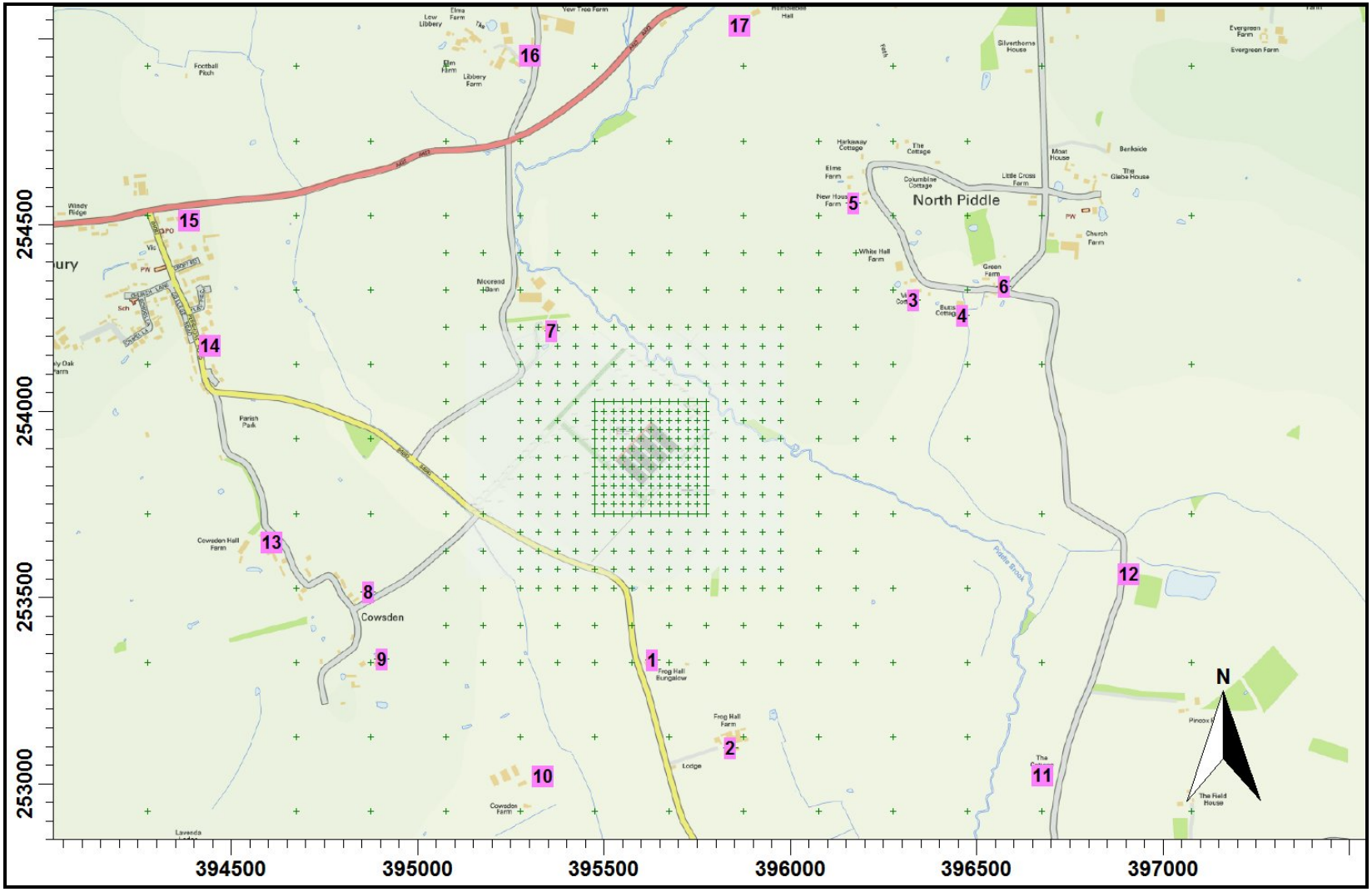
4.6 Terrain data

There are some slopes and hills that might affect wind flow and dispersion of odour in the area around Frogmore Farm; therefore, terrain has been considered in the modelling. The terrain data used are derived from the Ordnance Survey 50 m Digital Elevation Model. These data are resampled at a 100 m horizontal resolution for use within ADMS.

4.7 Other model parameters

A fixed surface roughness length of 0.3 m has been applied over the entire modelling domain. As a precautionary measure, the GFS meteorological data is assumed to have a roughness length of 0.1 m. The effect of the difference in roughness length is precautionary as it increases the frequency of low wind speeds and the stability and therefore increases predicted ground level concentrations.

Figure 5. The discrete receptors and nested Cartesian grid receptors.



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5. Details of the Model Runs and Results

For this study ADMS was run in three modes;

- With neither calms, nor terrain;
- With calms and without terrain;
- Without calms and with terrain.

To provide robust statistics three emission files were created and three sets of runs were performed for each mode; the first with the first day of the meteorological record coinciding with day 1 of the crop cycle, the second coinciding with day 16 of the crop and the third coinciding with day 32 of the crop cycle. This is to ensure that there is a reasonable chance that high emission rates towards the end of each crop occur in all weather conditions.

ADMS was run a total of thirty-six times (three times for each year of the four year meteorological record, in each of the three modes and for each of the three crop cycles). Statistics for the annual 98th percentile hourly mean odour concentration at each receptor were compiled for each of the thirty-six runs.

A summary of the results of these thirty-six runs at the discrete receptors is shown in Table 3a where the maximum annual mean for each mode is shown. A contour plot of the maximum annual 98th percentile hourly mean odour concentration is shown in Figure 6.

In Table 3a, predicted odour exposures in excess of the Environment Agency's benchmark of 3.0 ou_E/m^3 as an annual 98th percentile hourly mean are coloured blue; those in the range that UKWIR research suggests gives rise to a significant proportion of complaints, 5.0 ou_E/m^3 to 10.0 ou_E/m^3 as an annual 98th percentile hourly mean, are coloured orange and predicted exposures likely to cause annoyance and complaint are coloured red.

Odours that arise during the clearing out process although short in duration can be quite intense. AS Modelling & Data Ltd. do include a peak in emissions when modelling broiler rearing (See Section 3.5); however, as the duration of the emission is short, this has little effect on the predicted 98th percentile statistics, on which guidance on the acceptability or not of odour is based.

To address this, 99.5th and 99.8th percentile statistics, which the cleaning out process will have a more significant effect upon than it does on the 98th percentile statistics, have also been compiled. N.B. the 99.5th percentile is the value equalled or exceeded for 0.5% of the time and the 99.8th percentile is the value equalled or exceeded 0.2% of the time. The results are presented in Table 3b. No comment on the significance/acceptability is made as there is no guidance available; however, the descriptions in Section 3.1 of the main report may be useful when interpreting the results.

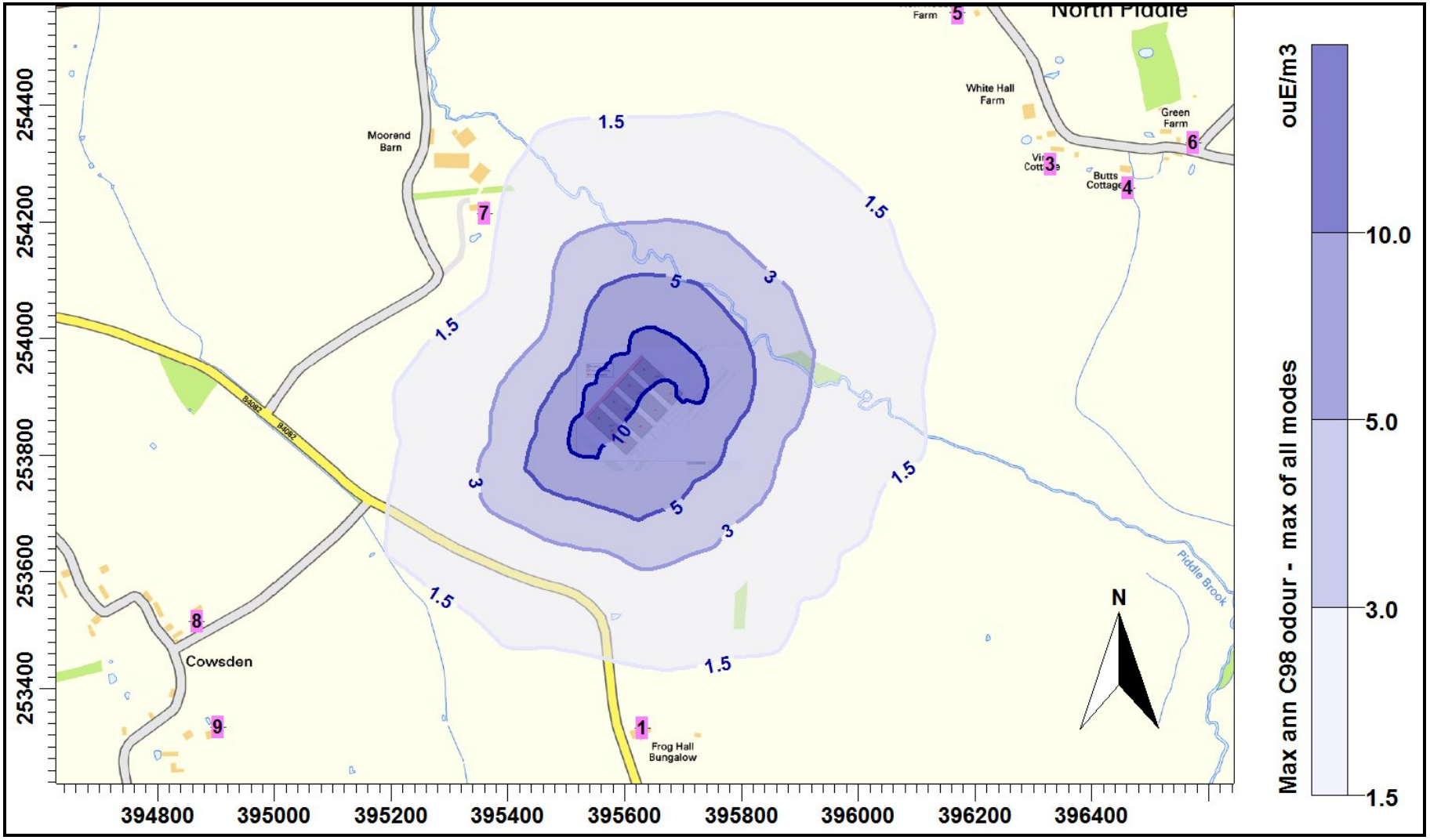
Table 3a. Predicted maximum annual 98th percentile hourly mean odour concentrations at the discrete receptors

Receptor number	X(m)	Y(m)	Maximum annual 98th percentile hourly mean odour concentration (ou_E/m^3)			
			No Calms	Calms	Terrain	Maximum (all modes)
1	395630	253332	1.04	1.03	1.04	1.04
2	395840	253097	0.53	0.52	0.59	0.59
3	396329	254299	0.73	0.72	0.77	0.77
4	396462	254258	0.62	0.62	0.64	0.64
5	396170	254559	0.67	0.67	0.71	0.71
6	396573	254336	0.51	0.51	0.53	0.53
7	395360	254215	1.16	1.15	1.32	1.32
8	394867	253514	0.57	0.55	0.54	0.57
9	394904	253334	0.54	0.53	0.53	0.54
10	395337	253022	0.42	0.42	0.50	0.50
11	396676	253024	0.23	0.23	0.27	0.27
12	396909	253562	0.30	0.30	0.38	0.38
13	394608	253649	0.30	0.30	0.30	0.30
14	394443	254177	0.20	0.20	0.24	0.24
15	394389	254512	0.15	0.15	0.18	0.18
16	395301	254955	0.34	0.34	0.38	0.38
17	395865	255035	0.40	0.40	0.40	0.40

Table 3b. Predicted maximum annual 98th, 99.5th and 99.8th percentile hourly mean odour concentrations at the discrete receptors (maximum of all modes)

Receptor number	X(m)	Y(m)	Maximum annual hourly mean odour concentration (ou_E/m^3)		
			98th percentile	99.5th percentile	99.8th percentile
1	395630	253332	1.04	2.86	4.03
2	395840	253097	0.59	1.53	2.26
3	396329	254299	0.77	2.08	3.38
4	396462	254258	0.64	1.63	2.97
5	396170	254559	0.71	1.97	3.00
6	396573	254336	0.53	1.44	2.39
7	395360	254215	1.32	2.80	4.10
8	394867	253514	0.57	1.63	2.57
9	394904	253334	0.54	1.37	2.23
10	395337	253022	0.50	1.43	2.12
11	396676	253024	0.27	1.01	1.66
12	396909	253562	0.38	1.07	1.81
13	394608	253649	0.30	0.98	1.89
14	394443	254177	0.24	1.33	2.23
15	394389	254512	0.18	0.68	1.36
16	395301	254955	0.38	0.89	1.75
17	395865	255035	0.40	1.06	1.73

Figure 6. Predicted maximum annual 98th percentile hourly mean odour concentration in the area surrounding the proposed poultry unit



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6. Summary and Conclusions

AS Modelling & Data Ltd. has been instructed by Kinsey Hearn of F C Jones & Co. to use computer modelling to assess the impact of odour emissions from the proposed broiler rearing unit at Frogmore Farm, Naunton Road, Upton Snodsbury, Worcestershire. WR7 4PD.

Odour emission rates from the proposed poultry unit have been assessed and quantified based upon an emissions model that takes into account the likely internal odour concentrations and ventilation rates of the poultry houses. The odour emission rates so obtained have then been used as inputs to an atmospheric dispersion model which calculates odour exposure levels in the surrounding area.

The results of the modelling indicate that, should the proposed development of the poultry unit at Frogmore Farm proceed, the 98th percentile hourly mean odour concentration at nearby residences would be below the Environment Agency's benchmark for moderately offensive odours, a 98th percentile hourly mean of 3.0 ou_E/m^3 over a one year period.

7. References

Environment Agency, April 2007. H4 Odour Management, How to comply with your environmental permit.
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R. E. Lacey, S. Mukhtar, J. B. Carey and J. L. Ullman, 2004. A Review of Literature Concerning Odors, Ammonia, and Dust from Broiler Production Facilities.
http://japr.fass.org/content/13/3/500.full.pdf+html

Odour Related Issue	Potential Risks and Problems	Actions taken to minimise odour and odour risks at Frogmore Poultry Farm	Completion date
Manufacture and selection of feed	Milling and mixing of compound feeds. The use of poor quality and odorous ingredients. Feeds which are 'unbalanced' in nutrients, leading to increased excretion and litter moisture and emissions of ammonia and other odorous compounds to air.	No on-site milling and mixing. Feed specifications are prepared by the feed compounder's nutrition specialist. Feed is supplied only from UKASTA accredited feed mills, so that only approved raw materials are used. Protein is reduced in accordance with SGN EPR6.09 'How to comply with your environmental permit for intensive farming' 'How to comply with your environmental permit for intensive farming'.	In place
Feed delivery and storage	Spillage of feed during delivery and storage. Creation of dust during feed delivery.	Feed delivery systems are sealed to minimise atmospheric dust. Any spillage of feed around the bin is immediately swept up. The condition of feed bins is checked frequently so that any damage or leaks can be identified. Feed deliveries are monitored to avoid dust and spills.	In place

Ventilation and heating Systems	Inadequate air movement in the house, leading to high humidity and wet litter Inadequate system design, causing poor dispersal of odours. Extraction fans located close to sensitive receptors.	The ventilation and heating system is regularly adjusted to match the age and requirements of the flock. The ventilation system is designed to efficiently remove moisture from the house. Gable end fans operated only during hot weather to aid cooling.	In place
Litter management	Odours arising from wet litter (see above).	Controls on feed and ventilation (see above) help to maintain litter quality. Additional controls include:- Use of nipple drinkers with drip cups to minimise spillage. Daily checks of drinker height and pressures to avoid capping. Insulated walls and ceilings to prevent condensation. Concrete floors to prevent ingress of water. Stocking levels at optimum to prevent overcrowding. Use of veterinarian bespoke health plan.	In place
Carcase disposal	Inadequate storage of carcasses on site.	Carcasses stored in sealed, shaded and vermin proof containers away from sensitive receptors.	In place
House clean out	Creation of dust associated with litter removal from houses. Use of odorous products during cleaning.	Litter carefully placed into trailers positioned under the covered apron close to doors. Trailers sheeted before leaving fill position. Only approved and suitable products used. Wash water tank levels monitored during washing and emptied as required to prevent overfill. Clean out carried out as soon as possible following destocking.	In place

Used Litter	Storage of used litter on site. Transport of litter and land spreading.	No storage on site at any time. All trailers sheeted before leaving fill position. Avoidance of double handling. Any land spread under the control of separate farming business with written agreement.	In place
Dirty water management	Standing dirty water during the production cycle or at clean out. Application of dirty water to land.	Working areas around houses are concreted and kept clean during production cycle. At clean out dirty water from houses together with lightly contaminated yard wash is directed to the underground storage tanks, before being removed off site and spread to land under control of a separate farming business. Written agreement is in place.	In place

Plan to be reviewed after every 4 years from permit issue date or following any complaint.

Odour Management Plan

The following plan has been prepared as part of the EPR permit application as there are sensitive receptors within 400m of site boundary.

The following tables highlight the likely sources of odour arising from poultry broiler production at Frogmore Farm.

Actions and measures are listed that will prevent where possible or minimise odour emissions at Frogmore Farm

On Site and OMP assessments

Source of Odour	Method	On Site Check	OMP Check	Comments
OMP	Manage day to day activities in accordance with this OMP	**Yes**	**Yes**	
Feed	Reduce protein content of feed in accordance with H2C	**Yes**	**Yes**	**Feed documentation recorded**
	Avoid fine grinding of feed	**N/A**		
	Follow good housekeeping and clean up all spills	**Yes**	**Yes**	
	Feed deliveries monitored to avoid dust or spills	**Yes**	**Yes**	
	Enclosed handling, storage and on site transport	**Yes**	**Yes**	
	When moving feed, avoid drops and open chutes	**Yes**	**Yes**	
	Relocation of any odorous activities, storage or extraction points from buildings			
	Avoidance of and immediate treatment of any pests	**Yes**	**Yes**	**Pet control contract in force**
Litter and manure management - water	Use of nipple drinkers with drip cups	**Yes**	**Yes**	
	Daily checks of water lines to avoid leaks/capping of litter	**Yes**	**Yes**	
	Maintenance of water lines to avoid spills	**Yes**	**Yes**	
Litter – (dry matter 70% DM)	Litter/manure DM measurements			
	Humidity controlled with daily checks	**Yes**	**Yes**	
	Temperature controlled with daily checks	**Yes**	**Yes**	
	Choice of most absorbent bedding used	**Yes**	**Yes**	
	Addition of litter when capping occurs	**Yes**	**Yes**	**As required**
Ventilation	Extraction is to a single point (Not really practical for large sheds due to large volume of air required)	**N/A**		
	Extraction via roof vents	**Yes**	**Yes**	**High velocity roof extraction 6m release height**
	Use of increased fan velocity away from sensitive receptors			

	Ventilation matched to bird needs	**Yes**	**Yes**	**Minimum ventilation program in place**
Catching / destocking	Doors kept closed or catching curtains used when birds being removed	**Yes**	**Yes**	**Covered loading area**
	Vehicles sited away from sensitive receptors	**Yes**	**Yes**	**House orientation**
Cleaning out	Clean out contained to avoid odours	**Yes**	**Yes**	
	Buildings sealed during and/or after cleanout	**Yes**	**Yes**	
	Separate collection system for wash-water	**Yes**	**Yes**	
	Building ventilation reduced to a minimum during cleanout	**Yes**	**Yes**	
	Areas kerbed to avoid run-off	**N/A**	**N/A**	**Concrete levels designed to prevent run off**
	Clean out starts to take place within one day of destocking	**Yes**	**Yes**	
	Clean out over whole site takes place in as short a time as possible	**Yes**	**Yes**	
	Tanks are emptied regularly to prevent overflowing	**Yes**	**Yes**	**Monitored during wash down**
Spent litter/manure	Transfer to trucks in contained area if not stored on site	**Yes**	**Yes**	
	Vehicles with litter/manure kept covered unless loading	**Yes**	**Yes**	
	Avoidance of double handling once out of the sheds	**Yes**	**Yes**	
	Vehicles sited away from sensitive receptors as far as possible	**Yes**	**Yes**	**House orientation**
Carcasses	Frequent collections	**Yes**	**Yes**	
	Storage containers kept cool / shaded	**Yes**	**Yes**	
	Storage containers kept covered and locked	**Yes**	**Yes**	
	Leaks prevented from storage containers	**Yes**	**Yes**	
	Storage location away from sensitive receptors	**Yes**	**Yes**	
	Use of odour suppressant near container	**N/A**	**N/A**	
	Avoid production and build up stagnant water	**Yes**	**Yes**	
	Carcasses disposed of promptly on-site via incinerator, if used	**N/A**	**N/A**	
	Incinerator licensed and well maintained	**N/A**	**N/A**	
	Incinerator ash disposed of promptly and appropriately	**N/A**	**N/A**	
Infrastructure	Buildings maintained to ensure integrity	**Yes**	**Yes**	
	Use of landscaping trees, banking	**Yes**	**Yes**	
Dust	Avoid build up at any location	**Yes**	**Yes**	**Levels monitored and cleaned regularly**
Monitoring	Weather station installed and maintained in	**N/A**	**N/A**	

	accordance with manufacturer's instructions but sited using the instructions in the following paper http://www.rmets.org/pdf/guidelines/aws-guide. pdf			
	Shed humidity recorded	**Yes**	**Yes**	
	Monitoring of complaints	**Yes**	**Yes**	
	Daily checks of surrounding area by persons who do not work regularly on the farm Proactively ask neighbours what the overall situation is and record the results	**N/A**	**N/A**	
	Ammonia spot monitoring	**N/A**	**N/A**	
	Visual (and nasal) inspections of potentially odorous activities	**N/A**	**N/A**	
Contingencies	List of 'routine' abnormalities and fixes – such as fire; electricity, gas and water failure; sick staff	**Yes**	**Yes**	
	Daily checks to detect abnormally high housekeeping odours	**Yes**	**Yes**	
	Daily checks to detect the effects from any disease	**Yes**	**Yes**	
	Monitoring of high ammonia levels and how to bring under control	**Yes**	**Yes**	
	Monitoring of high litter/manure moisture content and how to bring under control	**Yes**	**Yes**	
	Monitoring of high offsite odour (self assessed or complaints) – investigate, contact neighbours to see if it is a problem for them, consider if further actions needed	**Yes**	**Yes**	
	Plan in place for staff un-availability	**Yes**	**Yes**	
	Potential site specific low tech options			
	Change of feed ration			
	Use of feed additives			
	Stagger cycles in different sheds to avoid peak odours			
	Grow birds to a lower weight			
	Reduce number of cycles			
	Use of litter additives e.g. PLT (not an option for layer systems)			

	Use of masking / neutralising agents			
	Potential site specific higher tech options			
	Use of water misters to minimise evaporation and dust			
	Forced air drying			
	Under floor heating			
	Heat exchanger	**Yes**	**Yes**	
	Perforated flooring with forced air etc			
	Presence of elevated stack(s)			
	Scrubber/s present			
	Biofilter/s present			
	Indirect Heating	**Yes**	**Yes**	Lower humidity reduced ventilation

Appendix 5: Technical Standards

Operations

The operation of the farm will be in accordance with SGN EPR6.09 ‘How to comply with your environmental permit for intensive farming’.

Feed

Selection and use of feed is in accordance with SGN EPR6.09 ‘How to comply with your environmental permit for intensive farming’.
Protein is reduced over the growing cycle by providing different feeds.
Phosphorus levels in rations are reduced over the production cycle.
Feed storage bins are specifically designed to accommodate the required feeding regime.

Housing

Housing design and management is in accordance with SGN EPR6.09 ‘How to comply with your environmental permit for intensive farming’.
The housing is well insulated and the sheds have a damp proof course.
The sheds are fully insulated with a U-Value of approximately 0.4 W/m_2/°C to reduce condensation and heat lost.
The sheds are fan ventilated with a fully littered floor equipped with non-leaking drinking systems. In each of the four broiler houses ventilation is provided by side inlets and high velocity ridge extract fans. Gable end fans on each house are fitted to provide additional cooling during times of extreme hot weather.
Litter is kept loose and friable. The quality is regularly inspected to ensure it does not become excessively wet or dry. Steps as described in SGN EPR6.09 ‘How to comply with your environmental permit for intensive farming’ will be taken to rectify any changes to the quality of the litter.
Temperature in the sheds meets the health and welfare needs for the age and number of the birds. Blown hot water radiators are spaced regularly within the sheds to prevent cold spots and extremes of temperature. The fans are fitted with back draft shutters to prevent drafts and unnecessary heat loss.
The shed is accessed via the control room/vestibule area, which prevent drafts.
A computer automatically controls ventilation and heating so that heat is not wasted by being drawn out of the building.
The ventilation management system controls the ventilation rates depending on the health and welfare needs of the birds and the outside weather conditions.

General Management

In accordance with the management system at the farm, the buildings are regularly inspected and maintained. The floors and walls of the sheds are kept clean.
The site is regularly inspected and well maintained.

Livestock Numbers and Movements
A system is in place to record the number animal places and animal movements.
These records will be available for inspection.

Slurry spreading and manure management planning - off site-activity
Litter is not stored at the installation.
Litter is not spread on land belonging to the Operator.
Litter is exported from the installation. Records are kept of the quantities, destination and the date of transfer to separate farming businesses.
Contingency arrangements are in place with surrounding farms to accept the manure in case of an emergency.
In these circumstances where the litter is exported for spreading to land, records are kept of the names and addresses of the receiving farms.
The receiver of the manure confirms by signing a docket that litter is spread to land in accordance with the Code of Good Agricultural Practice, or in accordance with the manure management plan for the receiving land.

Improvement Program

Not applicable, all proposed buildings will be constructed to BAT.

Emissions and Monitoring

Table of emission points

Emission point description/source and location	Source
Air	
Roof fan outlets on Broiler Houses as shown on the site layout plan	Broiler Houses 1 - 4
Exhaust stacks from Biomass boilers as shown on site layout plan	Boilers
Vent from fuel oil tank for generator as shown on site layout plan	Generator fuel oil tank
Exhaust on generator as shown on site layout plan	Generator
Exhaust from Heat exchangers	Heat exchangers
Vents from LPG Tanks	LPG Tank
Land	
Swale as identified on the site drainage plan	Roof water from broiler houses and the surrounding yard area.
Water	
Outlet from Swale discharging to off-site ditch as shown on the site drainage plan.	Swale treating roof water from poultry houses.

Fugitive Emissions
Appropriate measures for preventing and minimising fugitive emissions are in place in accordance with the SGN EPR6.09 'How to comply with your environmental permit for intensive farming'
Buildings will be constructed to BAT.
Areas around buildings will be kept free from build-up of manure, slurry and spilt feed.
Footbaths will be managed so that they do not overflow.
Drainage from animal housing and water from cleaning out will be collected in underground storage tanks as shown on the site drainage plan. Diverter bungs will be used during wash down periods to prevent the contamination of surface water systems and to divert the wash water to the dirty water tanks. Clean drainage systems will not be contaminated.
Drainage from yards contaminated by litter or wash water will be collected in a dirty water tanks.

The wash water tanks will be built to conform to specifications in SGN EPR6.09 'How to comply with your environmental permit for intensive farming'.
Spent disinfectants will be added to the dirty water collection tanks.

Dust
Feed is stored in purpose built covered feed silos located next to the broiler sheds.
No milling or mixing of feed takes place at the farm. All feed is delivered to the farm by lorry from feed suppliers. Feed is blown directly from the lorry into the storage silos.
Feed is piped from the silos to the sheds minimising dust emissions.
Ventilation systems are operated to achieve optimum humidity levels for the stage of production in all weather and seasonal conditions.
Control of minimum ventilation rates is planned to avoid the build-up of moisture in the house. Ventilation is appropriate to the age and weight of the animal.

The sheds are managed to maintain the poultry litter in as dry and friable condition as possible. Dust is controlled through the management of litter and air quality.
All broiler houses will have roof ventilation outlets. Rainwater run-off will be collected by the guttering system and routed to the swale. The swale will be constructed to treat the lightly contaminated rainwater runoff from the shed roofs. The slow movement of water along the swale, aided by grass and check dams, encourages deposition of the solids washed off the roof and helps to remove nutrients such as phosphorus before it enters the ditch running along the northern boundary of the farm.
Litter is not stored on the site.

Carcass management
Fallen stock is disposed of in accordance with the current Animal By-Products Regulations. Carcasses will be stored in sealed vermin proof containers awaiting regular collection by a licensed renderer. Records of dates, quantities and destination will be held on site.

Flies/Pest Control
A pest control contract will be in place using a specialist contractor. Appropriate actions will be put into place to prevent and control flies should a nuisance arise.

Bunding and containment

Agriculture Fuel oil and other chemical storage
The fuel oil storage tank for the generator is bunded. The bunds meet the requirements of the Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) Regulations 2010 (SSAFO Regulations) and meet the requirements outlined in SGN EPR6.09 'How to comply with your environmental permit for intensive farming'. The tank will be regularly inspected.
The Liquid Petroleum Gas tanks are protected from collision damage by guard rails.
Pesticides and veterinary medicines will be kept in a store capable of retaining spillage, resistant to fire, dry, frost free and secure.

Foodstuff
Feed is kept in silos adjacent to the broiler sheds. No liquid feed is stored at the site.
The silos are sited away from site traffic and protected from collision damage by guard rails.

Odour
There is a neighbour (sensitive receptor) within 400m of the farm.
In accordance with the SGN EPR6.09 'How to comply with your environmental permit for intensive farming' refer to - Odour Management Plan.

Noise and vibration
There is a neighbour (sensitive receptor) within 400m of the farm.
In accordance with the SGN EPR6.09 'How to comply with your environmental permit for intensive farming' refer to - Noise Management Plan.