Environmental Visage

BIOMASS UK NO. 4 LIMITED; DARTMOOR ODOUR ASSESSMENT

BIOMASS UK NO. 4 LIMITED
BLYTHE HOUSE, BLYTHE BUSINESS PARK
STOKE ON TRENT, ST11 9RD

Report Issue No: DRAFT
Report Date: August 2021
Report Author: Amanda Owen

Registered in England and Wales no. 4907297. Registered office: c/o SLS Accountants, 78 Draycott, Cam, Glos, GL11 5DH

Executive Summary

Environmental Visage Limited (Envisage) was commissioned by Biomass UK No. 4 Limited to undertake an odour emissions assessment in support of planning and Environmental Permit application submissions to convert the existing Dartmoor Bio Power facility in Robrough, Plymouth, from a wood waste advanced gasification facility to a Refuse Derived Fuel (RDF) process. Although the historical waste wood process undertaken at the site has limited potential for significant odour emissions to occur, the potential odours associated with the receipt and storage of RDF, necessitate appropriate consideration and control of odour potential from the proposed process, and quantification of the likely impact of residual emissions from the plant.

Biomass UK No. 4 Limited will implement an Odour Management Plan for the operations, to control and minimise odour pollution and to reduce the risk of odour releasing incidents or accidents. Negative pressure will be employed across the key process areas and, when the combustion process is operational, the ventilation air with the highest potential odour concentration will be drawn through the gasification plant as combustion air, effectively destroying any odour. Other potentially odorous air will be discharged through a Carbon filter to reduce the levels of odour prior to discharge through a 16 m high stack. During periods of abnormal operation, when the gasification process is not available, all odorous ventilation air will pass through the Carbon filter.

In order to quantify the potential impact of the odour emissions from the proposed RDF facility, a dispersion modelling assessment has been undertaken to assess the likely odour concentrations that might be experienced in the locality of the site once the site is adapted and operational. Modelling has confirmed that, at sensitive receptor points, around the site boundary, and across the entire modelled grid, the 98th percentile odour concentration remains within the 3 OU_E m^{-3} assessment level appropriate for moderately offensive odours and is considered to be negligible. Odour emissions from the proposed RDF facility are therefore unlikely to be a nuisance or cause annoyance for people living or working in the area.

Contents

Issue and Revision Record

Issue	Date	Author	Review / Authorise	Description
DRAFT	02/08/2021	Amanda Owen	ENVISAGE	Initial draft for Client comment

1. Introduction

Environmental Visage Limited (Envisage) was commissioned by Biomass UK No. 4 Limited to undertake an odour emissions assessment in support of planning and Environmental Permit application submissions. This assessment considers the management, abatement and release of odorous compounds from the proposed development and models their dispersion and resultant impact.

Biomass UK No. 4 Limited propose to convert the existing Dartmoor Bio Power facility, based off Belliver Way in Robrough, Plymouth from a wood waste advanced gasification facility to a Refuse Derived Fuel (RDF) process. The total output capacity of the site will remain the same despite the change in fuel, at 4.3 MW_e. For the purpose of this study, the plant is assumed to operate at maximum output, that is, at the maximum allowable emission limit values, continually throughout the year. As limited nuisance odour might be anticipated from the storage and gasification of waste wood odour issues and control have not been considered in any detail previously. However, with the conversion of the plant to RDF firing, it is appropriate to consider the potential for odours to be generated, the need for their control, and to confirm the likely impact of residual emissions from the plant.

The installation will utilise approximately 40,000 tonnes per annum (dry basis) of RDF from local waste management activities. As a pre-prepared fuel, the RDF will be delivered to an agreed specification which is low in moisture and putrescible content, and so will have a low propensity for the generation of offensive odours. Nevertheless, the RDF fuel is still potentially odorous and, with sensitive receptors nearby, it is essential that the operation of the facility does not give rise to a reasonable cause for neighbourhood odour nuisance complaints.

The gasification plant will operate in compliance with the operational conditions of an Environmental Permit to be issued by the Environment Agency prior to commissioning of the facility. The Permit will include a range of operational conditions to ensure that the operation of the proposed plant does not cause harm to the environment, including conditions to prevent and minimise the impact of odour release that could give rise to reasonable cause for complaint from neighbouring properties.

The potential for odour release from the proposed operations relates primarily to fugitive odour that may escape from process buildings if they are not effectively sealed and do not provide effective containment. Odour release associated with process emissions to atmosphere from the 35 metre high chimney will be negligible as any potentially odorous substance generated by the thermal treatment of the RDF will decompose completely within the secondary combustion section of the gasification plant where temperatures will be in excess of 850 ºC for a residence time of at least 2 seconds. Combustion air for the gasifier will be drawn from within the main process building, maintaining a slight negative pressure that will minimise the potential for fugitive release of odour, and ensures that odours from within the building are destroyed by the treatment process.

In addition, and in order to maintain a slight negative pressure within the fuel reception and storage hall, an extraction fan routes the air from within the fuel hall via a bag filter to minimise the dust loading and a Carbon filter to abate any potential odour emissions, prior to discharging the ventilation air to atmosphere via a 16 m stack. Ventilation from the main process area will also route via the Carbon filter when the gasification plant is not operational.

This report details the potential odour sources and summarises the proposed management and control of odour from the installation, before presenting the results of a detailed dispersion modelling assessment to confirm the anticipated odour levels that might be experienced at the site boundary and at local receptors which may be sensitive to odour.

2. Managing Odour

The Biomass No. 4 plant will be operated in line with procedures outlined in an Odour Management Plan (OMP). This is currently in draft form, but will be submitted to and agreed with the Environment Agency through the Environmental Permit variation process. The OMP will consider sources, releases and impacts of odour, and will use these to identify the relevant control methods for odour management. It is designed to:

- Employ appropriate methods, including monitoring and contingencies, to control and minimise odour pollution.
- Prevent unacceptable odour pollution at all times.
- Reduce the risk of odour releasing incidents or accidents by anticipating them and planning accordingly.

The OMP identifies that, for the Biomass No. 4 installation, the key areas for management and control of odorous emissions to atmosphere include the RDF fuel reception, preparation, storage and handling systems within the installation buildings. The subsequent gasification, oxidation and steam / electricity generation processes are not inherently odorous. The other output from the gasification process, the residual ash or "char" has been through a high-temperature process and is not noticeably odorous, and the only other potential output from the process will be any unsuitable material that is rejected during the RDF preparation process, which could be odorous and will be handled and managed accordingly.

The OMP goes on to detail the sources, infrastructure and procedures for the control of odour as follows:

- Section 3 – Installation details, RDF composition and reception, preparation and handling processes.
- Section 4 – Identification of odour-sensitive receptors in the vicinity of the installation.
- Section 5 – Source, pathway, receptor assessment of odour emissions.
- Section 6 - Identification of odour management and control measures, including management and housekeeping measures, and the outline design of the odour abatement plant.
- Section 7 – Routine monitoring of the effectiveness of odour management and control measures.
- Section 8 – Dealing with complaints about odour emissions.
- Section 9 – Dealing with abnormal operating conditions and contingency provisions.
- Section 10 – Provisions for regular review and updating of the OMP.

3. Building Arrangement and Ventilation

Potentially odorous areas of the Biomass No. 4 installation can be detailed as the fuel reception hall, where in-coming waste is deposited for inspection on arrival at the site, and the fuel preparation and handling area, including the fuel storage bunker. From this point on, the refuse derived fuel is contained within the gasification system and any potentially odorous substances will be completely decomposed by the combustion process.

To minimise fugitive odour release to the external environment from these potentially odorous areas, and to maintain an acceptable interior working environment, these buildings will be maintained under a slight negative pressure and will be continuously ventilated and purged in the waste flow direction, i.e. from the fast-acting roller shutter doors to the fuel storage bunker.

Ventilation air from the fuel reception hall and main processing area totals 40,320 $m^3\ hr^{-1}$ (11.2 $m^3\ s^{-1}$) in volume. This will be discharged via a bag-filter to arrest any particulate carried over from the processing area, before passing through a Carbon filter to abate odour. An additional 21,547 $m^3\ hr^{-1}$ (5.99 $m^3\ s^{-1}$) will be extracted from the processing building as the combustion air supply for the energy from waste plant.

The diameter of the release point from the Carbon filter was specified to provide a maximum efflux velocity for the release of 15.2 m s^{-1} in order to avoid any potential for noise nuisance to be generated by the release.

With temperatures in excess of 850 ^oC and a residence time of at least 2 seconds any odours in the combustion air are destroyed by the treatment process, prior to discharge of the flue-gases through a 35 m high chimney. At any point that the combustion process is not operational, this additional ventilation air will pass via the Carbon filter prior to release to atmosphere.

3.1 Levels of Odour from the Process

Information on a typical odour concentration in the building ventilation air associated with energy from waste plant waste storage areas was obtained from a report prepared by Burmeister & Wain Scandinavian Contractor A/S for a similar facility operated by Hooton Bio Power Limited[1] and suggests an odour concentration of 2,500 OU_E m^{-3} could be expected once the plant is operational. Discussion with a supplier of Carbon filter technologies[2] suggests that at a maximum inlet concentration of 5,000 OU_E m^{-3}, appropriately designed Carbon filtration systems can achieve discharge concentrations of less than 1,000 OU_E m^{-3}.

This assessment therefore assumes that the filtered discharge will include 1,000 OU_E m^{-3} in order to provide a robust and worst-case assessment.

3.2 Emissions During Normal Operation

During normal operations, the emissions of ventilation air from the potentially odorous areas of the process will be as follows:

Table 1 Discharge Points for Odorous Air During Normal Operations

Stack	Main Release Point	Carbon Filter
Height (m)	35	16
Diameter (m)	1	1.2
Volume of Odorous Air ($Am^3\,hr^{-1}$)	21,547*	40,320
Velocity ($m\,s^{-1}$)	44,784#	9.9
Temperature (^oC)	185	Ambient
Odour Concentration ($OU_E\,m^{-3}$)	None detected	1,000
Odour Discharge Rate ($OU_E\,s^{-1}$)	None detected	11,200

* Volume of odorous air contributing to the total discharge
# Total volume of flue-gases discharged

3.3 Emissions During Abnormal Operation

During abnormal operations, the emissions of ventilation air from the potentially odorous areas of the process will be as follows:

Table 2 Discharge Points for Odorous Air During Abnormal Operations

Stack	Main Release Point	Carbon Filter
Height (m)	35	16
Diameter (m)	1	1.2
Volume of Odorous Air ($Am^3\,hr^{-1}$)	0	61,867
Velocity ($m\,s^{-1}$)	0	15.2
Temperature (^oC)	Ambient	Ambient
Odour Concentration ($OU_E\,m^{-3}$)	None	1,000
Odour Discharge Rate ($OU_E\,s^{-1}$)	None	17,185.28

4. Details of the Dispersion Model

Detailed dispersion modelling has been undertaken to assess the impact of odorous emissions from the Biomass No. 4 plant, during both normal and abnormal operations. It should be noted that, although the maximum releases associated with abnormal occurrences have been modelled over the course of five years, with the maximum modelled results presented here, abnormal operations will, in reality, only occur for short periods and will not necessarily happen during weather conditions which might have a negative impact on local dispersion. As such, the modelling and consideration of the abnormal conditions could be considered to be overly-conservative, but ensures that a thorough and worst-case approach is applied to the modelling exercise.

Similar to the detailed modelling undertaken for the main air quality assessment, a number of factors were included in the modelling exercise and a number of assumptions have been made in preparing this report. In summary:

The Atmospheric Dispersion Modelling System (ADMS) Version 5.2 modelling software was applied and is one of a range of models available for assessing the impact of pollutant emissions to atmosphere on local air quality, including odour emissions.

Modelling was undertaken using hourly average meteorological data from the nearby Plymouth Mount Batten measurement station which is considered to be the most representative of local conditions.

The operating conditions of the plant are assumed to be continual (24 hours, seven days per week) whether considering normal or abnormal operations and odour discharges. This effects a worst-case assessment of the potential for abnormal conditions to occur at any time, but is likely to be overly-conservative.

A 4 km x 4 km Cartesian grid with 20-metre grid spacing was utilised in the model in order to calculate maximum predicted concentrations in the vicinity of the Biomass No. 4 plant.

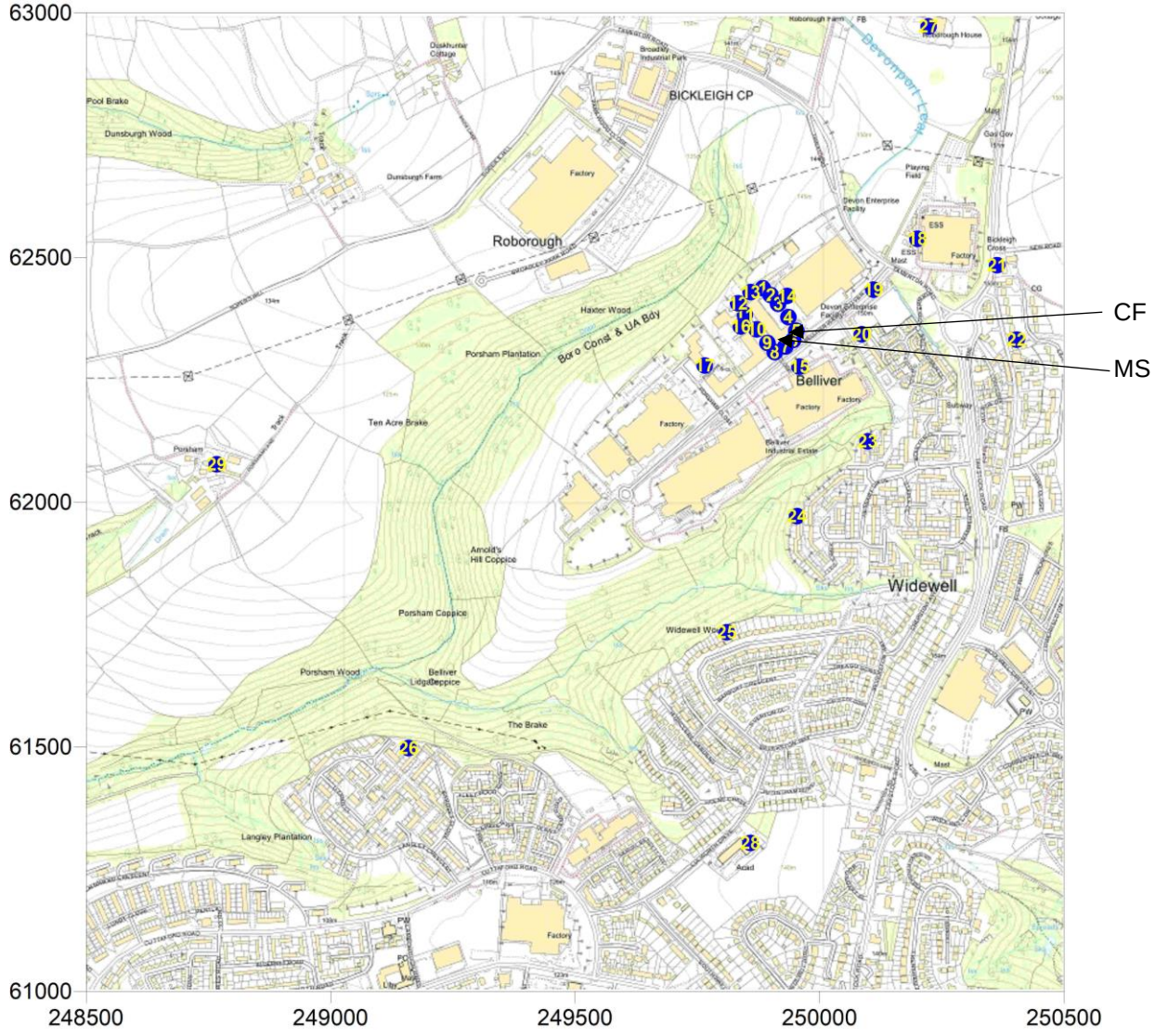
Specific odour receptor locations were also included in the model to assess the odour concentrations around the site boundary and to provide a detailed assessment of odour sensitive receptors in the local area as follows:

Table 3 Local Odour Sensitive Receptors

Number	Grid Reference (X)	Grid Reference (Y)	Description
1	249884	062437	Site Boundary
2	249900	062423	Site Boundary
3	249915	062405	Site Boundary
4	249936	062378	Site Boundary
5	249952	062350	Site Boundary
6	249946	062331	Site Boundary
7	249930	062318	Site Boundary
8	249908	062306	Site Boundary
9	249893	062325	Site Boundary
10	249871	062353	Site Boundary
11	249847	062383	Site Boundary
12	249833	062406	Site Boundary
13	249859	062429	Site Boundary
14	249933	062421	Burts Crisps
15	249959	062277	Becton Dickinson
16	249839	062359	SC Conversions
17	249765	062279	Porsham MOT
18	250200	062538	Plessey
19	250110	062434	Residential Property; Belliver Way
20	250086	062343	Residential Property; lady Fern Road
21	250363	062484	Care Home; A386 Woolwell
22	250403	062332	Care Home; Tavistock Road
23	250098	062124	Residential Property; Hessary Drive
24	249954	061971	Residential Property; Legis Walk
25	249810	061734	Residential Property; Beverston Way
26	249159	061497	Residential Property; Langley Crescent
27	250223	062972	Care Home; Roborough House
28	249858	061303	Widewell Primary Academy
29	248767	062077	Soper's Hill Farm

Figure 1 over page shows the location of each of the receptors, and includes the stack release points marked as 'MS' to denote the main stack and 'CF' to denote the location of the Carbon Filter exhaust.

Figure 1 Discharge Points and Receptor Locations



Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office, © Crown Copyright 100055158 Environmental Visage Limited (2021)

Spatially variable terrain and surface roughness files were employed within the modelling, and the dimensions of local buildings were also included.

The following model default values were incorporated:

Surface Albedo; 0.23 representing an area of non-snow covered land.

Priestley-Taylor Parameter; 1 representing moist grassland.

Minimum Monin-Obukhov Length; 1 m

Five years' worth (2016 – 2020) of meteorological data from the Plymouth Mount Batten measurement station was employed in the modelling exercise.

Finally, recognising the location of the proposed flue in the vicinity of one of the higher sections of the main building, the height of the Carbon filter exhaust has been modelled at 16 m. This ensures that the discharge point is 3 m or more above the ridge of the fuel reception hall, and also does not discharge below the roof-level of the highest local building.

In light of the differing building heights in close proximity to the proposed Carbon filter discharge, a sensitivity analysis was undertaken to determine which building may have the most significant effect on the dispersion from the filter. Models were generally run with the fuel hall (12.89 m high), which is immediately adjacent the Carbon filter stack, specified as the main building of influence on the dispersion of the odorous release. When the main building was amended to represent the elevated section of the process building (15.9 m high), results were of a similar order and, although some of the predicted concentrations increased over those when modelling the fuel hall as the main building, the majority of the results were lower. Thus, the fuel hall was modelled as the building with the main potential influence over the discharge from the Carbon filter release.

5. Determining Significance

The perception of odour requires three inputs: a source; a pathway and the presence of receptors. The scale of the impact is determined by parameters collectively referred to as FIDOL (Frequency, Intensity, Duration, Offensiveness and Location), which are described in more detail in the table below, and are taken from guidance provided by the Institute for Air Quality Management (IAQM)[3].

Frequency	How often an individual is exposed to odour
Intensity	The individual's perception of the strength of the odour
Duration	The overall duration that individuals are exposed to an odour over time.
Odour unpleasantness	Odour unpleasantness describes the character of an odour as it relates to the 'hedonic tone' (which may be pleasant, neutral or unpleasant) at a given odour concentration/intensity. This can be measured in the laboratory as the hedonic tone, and when measured by the standard method and expressed on a standard nine-point scale it is termed the hedonic score.
Location	The type of land use and nature of human activities in the vicinity of an odour source. Tolerance and expectation of the receptor. The 'Location' factor can be considered to encompass the receptor characteristics, receptor sensitivity, and socio-economic factors.

Based on the FIDOL factors, IAQM defines three levels of sensitivity for nearby receptors that can be applied when defining the odour impact risk using atmospheric dispersion modelling techniques. These assessment criteria are defined in terms of a minimum concentration of odour (reflecting the intensity / strength) that occurs for a minimum period of time (reflecting duration and frequency) over a typical meteorological year. The concentration element of these criteria can be increased or lowered to reflect variations in the offensiveness of the odours released from a specific type of facility, and the sensitivity of nearby locations.

High sensitivity receptor	Surrounding land where: • users can reasonably expect enjoyment of a high level of amenity; and • people would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium sensitivity receptor	Surrounding land where: • users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or • people wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples may include places of work, commercial/retail premises and playing/recreation fields.
Low sensitivity receptor	Surrounding land where: • the enjoyment of amenity would not reasonably be expected; or • there is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial use, farms, footpaths and roads.

In terms of the above sensitivity criteria, residential properties and schools in the vicinity of the Biomass No. 4 installation (receptor numbers 19 – 29) would be classified as "high sensitivity receptors", while receptor numbers 1 - 18 would be "low sensitivity" receptors.

IAQM guidance states that:

"*a high sensitivity receptor subject to a large odour exposure will experience a substantial adverse effect, and a low sensitivity receptor subject to a small odour exposure will experience a negligible effect; however, between these extremes the various combinations will give rise to a gradation of effects for which no descriptor terms have been universally agreed.*"

and proposes the following general framework of descriptors for the magnitude of effects for receptors of different sensitivities.

Relative Odour Exposure (Impact)	Receptor Sensitivity: Low	Medium	High
Very Large	Moderate adverse	Substantial adverse	Substantial adverse
Large	Slight adverse	Moderate adverse	Substantial adverse
Medium	Negligible	Slight adverse	Moderate adverse
Small	Negligible	Negligible	Slight adverse
Negligible	Negligible	Negligible	Negligible

Applicable to odours at the "most offensive" end of the relative-unpleasantness spectrum

In terms of defining the magnitude and significance of the impact, the IAQM guidance proposes the following assessment matrix when considering the most offensive odours:

Odour Exposure Level C_{98}, ou_E/m^3	Receptor Sensitivity: Low	Medium	High
≥10	Moderate	Substantial	Substantial
5-<10	Moderate	Moderate	Substantial
3-<5	Slight	Moderate	Moderate
1.5-<3	Negligible	Slight	Moderate
0.5-<1.5	Negligible	Negligible	Slight
<0.5	Negligible	Negligible	Negligible

It should be noted that the Table applies equally to cases where there are increases and decreases in odour exposure as a result of this development, in which case the appropriate terms "adverse" or "beneficial "should be added to the descriptors.

The Odour Exposure Level is expressed as the 98th percentile of the modelled hourly averages. The IAQM states within their guidance that:

"Odour assessment methodology, as it has developed in Europe and UK over the last 35 years, has become well-established. The predictive, quantitative approach involves obtaining estimates of the odour source emission rate, use of the emissions in a dispersion model to predict 98th percentile concentration at sensitive receptors and comparison of these with criteria that have evolved from research and survey work. At the present time, this remains an accepted technique and the IAQM supports this."

However, the level of offensiveness of any odour must also be taken into account as some process odours may of course be pleasant. Within their 'H4' odour management guidance[4], the Environment Agency suggests the following criterion for differing odour sources:

Criterion, C_{98} ou_E/m^3	Offensiveness	Odour Emission Sources
1.5	Most Offensive	Processes involving decaying animal or fish remains Processes involving septic effluent or sludge Biological landfill odours
3.0	Moderately Offensive	Intensive livestock rearing Fat frying (food processing) Sugar beet processing Well aerated green waste composting
6.0	Less Offensive	Brewery Confectionery Coffee

Accordingly, an EAL of 3 OU_E m^{-3}, appropriate for the assessment of moderately offensive odours, was used as the basis for the assessment of odour releases from the Biomass No. 4 process. It is noted that both of the preceding odour exposure tables detail the impact of the 'most offensive' odours and hence, for a 'moderately offensive' odour, a level of judgement must be applied to the assessment.

For the purpose of this assessment therefore, the magnitude and significance matrix for the impact of moderately offensive odours is applied as follows:

Odour Exposure Level C_{98}, ou_E/m^3	Receptor Sensitivity		
	Low	Medium	High
≥10	Moderate	Substantial	Substantial
5-<10	Slight	Moderate	Moderate
3-<5	Negligible	Slight	Moderate
1.5-<3	Negligible	Negligible	Slight
0.5-<1.5	Negligible	Negligible	Negligible
<0.5	Negligible	Negligible	Negligible

It should be noted that the Table applies equally to cases where there are increases and decreases in odour exposure as a result of this development, in which case the appropriate terms "adverse" or "beneficial "should be added to the descriptors.

6. Results and Discussion

As noted in the proceeding section, an assessment level of 3 OU_E m^{-3} was applied to the modelled results at each of the receptor points detailed in Table 3. The reported results present the maximum 98th percentile concentration when considering five years' worth of meteorological conditions. Additionally, the 100th percentile value is reported to specify the maximum hourly average odour concentration modelled across the five years' worth of data. This worst-case result is not directly comparable with the assessment level, but states the maximum odour concentration predicted to occur at a given location, over the course of the modelled years.

The assessment begins with a statement of the maximum modelled odour concentration predicted to occur across the modelled 4 km by 4 km grid. Although this concentration may be higher than those predicted to occur at the odour sensitive receptor locations, it will not necessarily occur at the location of a sensitive receptor, where odour nuisance may occur.

6.1 Maximum Odour Concentration

The results from detailed modelling are presented in Table 4 below, in terms of the maximum hourly average process contribution for odour, expressed as the 98th percentile value.

Table 4 Maximum Predicted Odour Concentrations Across the Modelled Grid

Statistic	Environmental Assessment Level (OU_E m^{-3})	Grid Reference	Process Contribution (OU_E m^{-3})	PC as a % of the EAL
Extraction from the Fuel Hall only				
Annual	-	249940 062380	0.11	-
Maximum Hourly (100 %)	-	249940 062400	9.2	-
Hourly Average (98 %)	3.0	250020 062360	0.83	27.8 %
Extraction during abnormal operations				
Annual	-	250000 062400	0.12	-
Maximum Hourly (100 %)	-	249940 062400	7.37	-
Hourly Average (98 %)	3.0	249880 062420	0.94	31.5 %

Each of the concentrations reported in Table 4 above occur close to the Biomass No. 4 site, either within the site yard, in the neighbouring factory car-park, or alongside Belliver Way where there would be no particularly sensitive receptor. Each of these locations would be considered to be of low sensitivity.

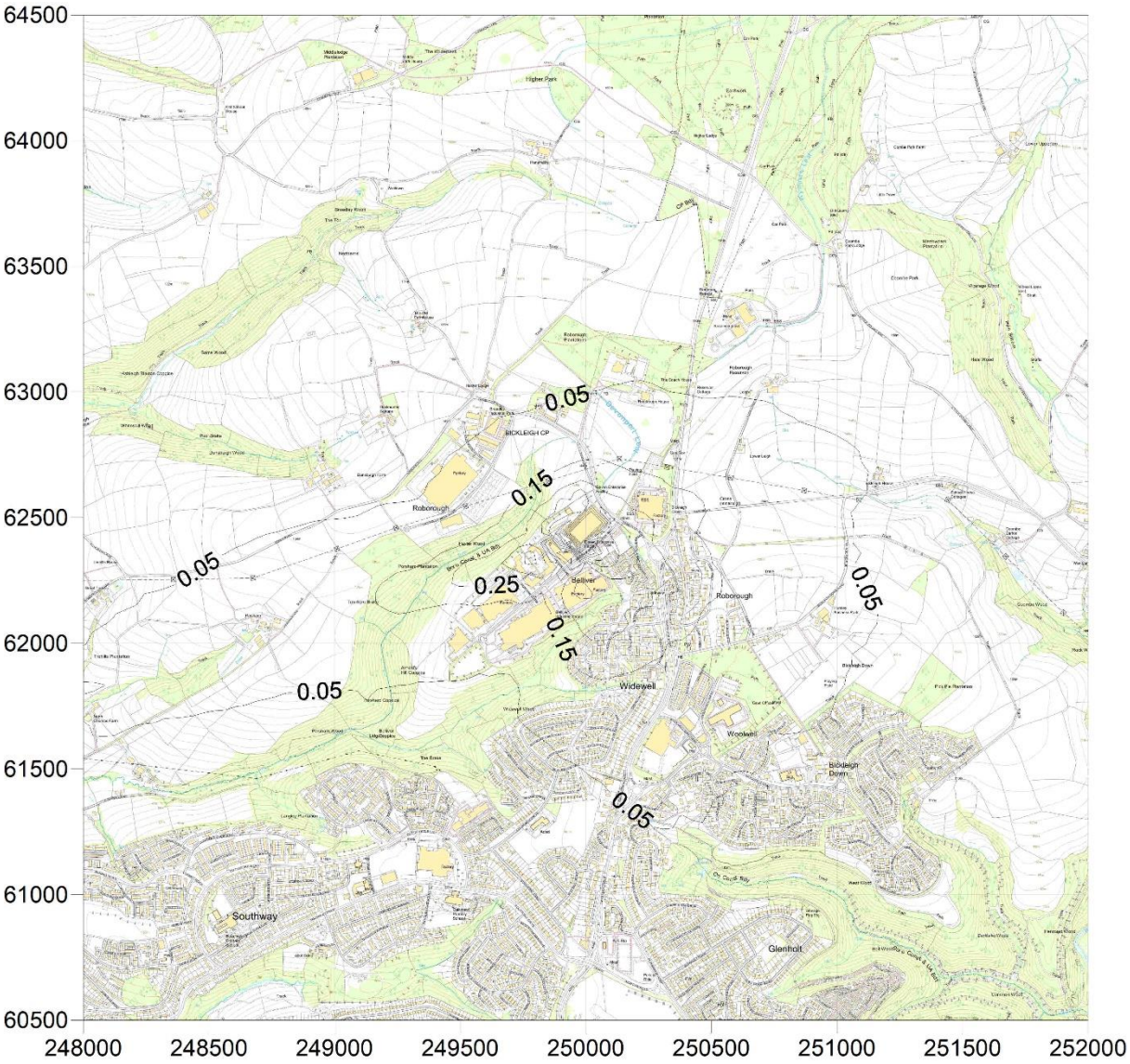
Irrespective of the receptor classification, detailed modelling predicted that the maximum 98th percentile hourly average process contributions equate to less than one third of the assessment level for moderately offensive odours, and therefore are unlikely to be the cause of any nuisance in the local area. An odour concentration of 1.0 OU_E m^{-3} is the threshold for detection by members of the general public with a “typically average” sense of smell. Accordingly, the process odour contributions across the modelled grid, as predicted by detailed modelling, will normally be imperceptible and unlikely to be a reasonable cause for annoyance for people living and working at these locations.

A plot of the 98th percentile process contributions across the modelled grid is presented in Figure 2 over page and applies meteorological conditions from 2017, as the year which reported the highest 98th percentile concentrations when considering 2016 – 2020 meteorological conditions and normal operating conditions.

Consideration can also be given to the 100th percentile, worst-case hourly process contribution to determine if, and for how many hours across the year odour concentrations might be experienced which exceed 3 OU_E m^{-3}. The results show that, with a maximum odour concentration of 9.2 OU_E m^{-3}, meteorological conditions during 2016 produced the highest odour levels when considering normal operations, although, only two locations across the entire modelled grid resulted in hourly average concentrations of more than 3 OU_E m^{-3}. Modelled meteorological conditions which returned lower maximum hourly average odour concentrations could exceed the assessment level on more occasions, but at lower concentrations. For example, modelling 2020 meteorological data returned a total number of four concentrations equalling 3 OU_E m^{-3} or more, but with a maximum concentration of 5.7 OU_E m^{-3}.

Whilst these levels may be observable and could perhaps cause some discomfort to people at that location at the time of the occurrence, the fact that these levels occur for very short periods across the year, are not necessarily at any location of sensitivity or prolonged exposure, and the fact that the 98th percentile values do not reach the assessment level of 3 OU_E m^{-3}, results in confidence that the reported results are unlikely to lead to any nuisance issue or reasonable cause for annoyance at any point across the modelled grid.

Figure 2 Maximum Modelled 98th Percentile Odour Concentration (OU_E m^{-3}) When Modelling 2017 Meteorology and Normal Operating Conditions



6.2 Concentrations Around the Site Boundary

Receptor points 1 – 13 represent locations around the Biomass No. 4 site boundary and were included to predict the maximum odour concentrations on leaving the site. It is usual for environmental regulators to assess the potential for nuisance to occur outside of an operational site boundary and therefore modelling the worst-case odour concentrations at the site boundary indicates the potential for any odour nuisance to be caused. Table 5 presents the predicted odour concentrations during normal and abnormal operating conditions around the boundary of the site.

Table 5 Maximum Predicted Odour Concentrations at Points Around the Biomass No. 4 Site Boundary

Receptor Number	Normal Operations			Abnormal Operations		
	98th Percentile Concentration (OU_E m^{-3})	% of the EAL	IAQM Significance Criterion	98th Percentile Concentration (OU_E m^{-3})	% of the EAL	IAQM Significance Criterion
1	0.735	24%	Negligible	0.933	31%	Negligible
2	0.745	25%	Negligible	0.856	29%	Negligible
3	0.686	23%	Negligible	0.648	22%	Negligible
4	0.819	27%	Negligible	0.758	25%	Negligible
5	0.719	24%	Negligible	0.636	21%	Negligible
6	0.008	0.3%	Negligible	0.003	0.1%	Negligible
7	0.009	0.3%	Negligible	0.002	0.1%	Negligible
8	0.036	1.2%	Negligible	0.019	0.6%	Negligible
9	0.617	21%	Negligible	0.502	17%	Negligible
10	0.721	24%	Negligible	0.612	20%	Negligible
11	0.235	8%	Negligible	0.176	6%	Negligible
12	0.325	11%	Negligible	0.305	10%	Negligible
13	0.592	20%	Negligible	0.745	25%	Negligible

When considering the 98th percentile odour concentration from normal operations against an assessment level of 3 OU_E m^{-3} for moderately offensive odours, concentrations around the site boundary range from less than 1 % of the assessment level, to a maximum of 27 % of the assessment level. The site boundary is not a sensitive receptor in its own right and as such, with the 98th percentile concentrations remaining within 3 OU_E m^{-3}, the contributions to odour concentrations are considered to be negligible.

When considering abnormal releases, the maximum 98th percentile value of 0.933 OU_E m^{-3} equates to approximately 31 % of the assessment level and hence contributions during other than normal operating conditions would still be considered to be negligible.

Comparing contributions against the 98th percentile value of hourly average values throughout the whole year, translates into a maximum number of permissible exceedances of 175 per year. However, none of the boundary locations were reported to reach or exceed the 3 OU_E m^{-3} assessment level as an hourly average (100th percentile) during any of the meteorological conditions modelled.

6.3 Concentrations at Local Odour Sensitive Receptors

Receptor points 14 – 29 represent businesses, residential, educational and care facilities located in the vicinity of the Biomass No. 4 site. Such sites include a mix of lew sensitivity (industrial areas and farm land) and high sensitivity (residential locations, schools and care-homes) receptors. Table 6 over page presents the predicted odour concentrations during normal and abnormal operating conditions at each of the sensitive receptor locations.

Similar to the assessment at the boundary of the Biomass No. 4 site, the results in Table 6 demonstrate that the 98th percentile odour concentration from normal and abnormal operations remain well within the assessment level of 3 OU_E m^{-3} for moderately offensive odours. Normal concentrations can be higher than when assessing the boundary conditions, ranging from 1 % of the assessment level, to a maximum of 35 % of the assessment level, the latter observed at the receptor point chosen for Burts Crisps. However, in all cases, the 98th percentile concentrations remain within 3 OU_E m^{-3}, and the contributions to odour concentrations are therefore considered to be negligible when considering the IAQM guidance for assessing moderately offensive odours. Additionally, none of the sensitive receptor locations were reported to reach or exceed the 3 OU_E m^{-3} assessment level as an hourly average (100th percentile) during any of the meteorological conditions modelled.

Table 6 Maximum Predicted Odour Concentrations at Sensitive Receptors Close to the Biomass No. 4 Site

Receptor Number	Normal Operations			Abnormal Operations		
	98th Percentile Concentration (OU_E m^{-3})	% of the EAL	IAQM Significance Criterion	98th Percentile Concentration (OU_E m^{-3})	% of the EAL	IAQM Significance Criterion
14	1.059	35%	Negligible	1.083	36%	Negligible
15	0.275	9%	Negligible	0.230	8%	Negligible
16	0.349	12%	Negligible	0.284	9%	Negligible
17	0.408	14%	Negligible	0.469	16%	Negligible
18	0.237	8%	Negligible	0.299	10%	Negligible
19	0.441	15%	Negligible	0.493	16%	Negligible
20	0.511	17%	Negligible	0.604	20%	Negligible
21	0.195	6%	Negligible	0.265	9%	Negligible
22	0.194	6%	Negligible	0.260	9%	Negligible
23	0.285	10%	Negligible	0.344	11%	Negligible
24	0.222	7%	Negligible	0.260	9%	Negligible
25	0.078	3%	Negligible	0.098	3%	Negligible
26	0.029	1.0%	Negligible	0.038	1.3%	Negligible
27	0.061	2%	Negligible	0.093	3%	Negligible
28	0.041	1.4%	Negligible	0.056	1.9%	Negligible
29	0.129	4%	Negligible	0.132	4%	Negligible

7. Conclusions

Environmental Visage Limited (Envisage) was commissioned by Biomass UK No. 4 Limited to undertake an odour emissions assessment in support of planning and Environmental Permit application submissions to convert the existing Dartmoor Bio Power facility, based off Belliver Way in Robrough, Plymouth from a wood waste advanced gasification facility to a Refuse Derived Fuel (RDF) process.

As limited nuisance odour was anticipated from the previous storage and gasification of waste wood, odour issues and control have not historically been considered for the site operations. However, with the conversion of the plant to RDF firing, it is appropriate to consider the potential for odours to be generated, the need for their control, and to confirm the likely impact of residual emissions from the plant.

A dispersion modelling assessment has therefore been undertaken to assess the likely odour concentrations that might be experienced in the locality of the site once operational with RDF, when generally using some potentially odorous air in the combustion process, but with the remainder, and all ventilation air during abnormal operating conditions, discharging via a Carbon filter fitted with a 16 m discharge point. An Odour Management Plan will also be implemented to ensure that appropriate methods are employed to control and minimise odour pollution, aiming to prevent unacceptable odour pollution at all times and to reduce the risk of odour releasing incidents or accidents by anticipating them and planning accordingly.

The results of the detailed modelling confirm that, at sensitive receptor points, around the site boundary, and across the modelled grid, the 98th percentile odour concentration remains within the 3 OU_E m^{-3} assessment level for moderately offensive odours. Indeed, concentrations at almost all modelled points remained within 1.0 OU_E m^{-3} across the five years of meteorological data applied. As 1.0 OU_E m^{-3} is the threshold for detection by members of the general public with a “typically average” sense of smell it can be concluded that the maximum odour process contributions at nearby businesses, residential properties, schools and care-homes, will likely be imperceptible by most people and is unlikely to be a reasonable cause for annoyance for people living or working at these locations.

8. References

[1] Burmeister & Wain Scandinavian Contractor A/S: Hooton Bio Power Project, Odour related technical description. 2019

[2] Personal correspondence - E-mail from Chris Jackson; AAC Eurovent to Amanda Owen; Environmental Visage Limited - Wednesday 28/7/2021 11:48

[3] Guidance on the assessment of odour for planning. Version 1.1, Institute of Air Quality Management. July 2018

[4] Additional guidance for H4 Odour Management. How to comply with your environmental permit. Environment Agency. March 2011. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/296737/geho0411btqm-e-e.pdf