

Odour Assessment: Houghton Main Energy Centre, Barnsley

November 2018



Experts in air quality
management & assessment



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1 Introduction

- 1.1 This report describes the assessment of the potential odour effects associated with the proposed development of an Energy Centre using primarily Refuse Derived Fuel (RDF) as the feedstock at Houghton Main in Barnsley. The assessment has been carried out by Air Quality Consultants Ltd (AQC) on behalf of Enzygo Ltd and is provided to support the Section 73 planning application for the facility.
- 1.2 It is proposed that the Energy Centre will use RDF to generate electricity. The processes undertaken at the Energy Centre have the potential to generate odours which may adversely impact upon nearby sensitive properties if adequate mitigation measures are not taken.
- 1.3 The assessment identifies the potential odour effects associated with the operation of the Energy Centre using a qualitative odour risk assessment.

2 Odour in Legislation, Policy and Guidance

Odour Guidance

Environment Agency Guidance

- 2.1 The Environment Agency has produced a horizontal guidance note (H4) on odour assessment and management (Environment Agency, 2011), which is designed for operators of Environment Agency-regulated processes (i.e., those which classify as Part A(1) processes under the Pollution Prevention and Control (PPC) regime). The H4 guidance document is primarily aimed at methods to control and manage the release of odours, but also contains a series of recommended assessment methods which can be used to assess potential odour impacts.

Institute of Air Quality Management Guidance

- 2.2 The latest UK guidance on odour was published by the Institute of Air Quality Management (IAQM) in 2018 (IAQM, 2018). The IAQM guidance sets out assessment methods which may be utilised in the assessment of odours for planning applications. It is the only UK odour guidance document which contains a method for estimating the significance of potential odour impacts.

National Legislation

Environmental Protection Act

- 2.3 There are currently no statutory standards in the UK covering the release and subsequent impacts of odours as odours are not directly related to impacts on health.
- 2.4 The Environmental Protection Act 1990 (1990) recognises that odours may be a cause for nuisance and outlines that a regulatory body (i.e. a local authority or Environment Agency) can require measures to be taken where any:

“dust, steam, smell or other effluvia arising on an industrial, trade and business premises and being prejudicial to health or a nuisance”

- 2.5 It is therefore necessary to ensure that appropriate odour controls are considered in the design and operation of any land uses which have potential to be a source of odours.

Environmental Permitting Regulations

- 2.6 The Environmental Permitting Regulations (2016) set the legislative background for environmental permitting in England and Wales. The regulations include a commitment to controlling and minimising emissions to air from permitted processes, which includes odours.

- 2.7 The overall purpose of the Environmental Permitting Regulations is to prevent and control the environmental impact of all regulated industrial processes. In the case of processes where odour emissions may occur, a process operator will be required to develop an Odour Management Plan, which will be approved and regulated by the regulatory authority (in England, this is the Environment Agency) and will set the framework for operating the process in a such a way as to prevent any environmental impacts (annoyance, nuisance or loss of amenity) being caused by odours.

Planning Policy

National Planning Policy Framework

- 2.8 The National Planning Policy Framework (NPPF) (2018) sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development, and that the planning system has three overarching objectives, one of which is an environmental objective:

“to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy”.

- 2.9 To prevent unacceptable risks from air pollution, the NPPF states that:

“Planning policies and decisions should contribute to and enhance the natural and local environment by...preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air quality”.

and

“Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development”.

- 2.10 The NPPF is now supported by Planning Practice Guidance (PPG) (DCLG, 2018), which includes guiding principles on how planning can take account of the impacts of new development on air quality, but also makes clear that *“Odour and dust can also be a planning concern, for example, because of the effect on local amenity”.*

- 2.11 It also provides guidance on options for mitigating impacts, outlining that *“Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact”*.

3 Assessment Approach

- 3.1 There are a number of odour assessment methods and tools that have been developed which are widely used in the UK, including desk-based methods, such as complaints analysis and qualitative risk assessment, through to field odour testing (sniff testing) and dispersion modelling. The scale and location of odorous processes is important in selecting appropriate assessment methodologies, with more simple methodologies often sufficient for small or remotely located processes.
- 3.2 The approach to assessing the odour effects from the Energy Centre has been to use the qualitative risk-assessment approach described in the IAQM guidance on assessment of odours for planning (IAQM, 2018).

Odour Risk Assessment

- 3.3 The odour risk assessment set out in the IAQM guidance follows a Source-Pathway-Receptor approach. This approach describes the concept that, in order for an odour impact (such as annoyance or nuisance) to occur, there must be a source of odour, a pathway to transport the odour to an off-site location, and a receptor (e.g. people) to be affected by the odour.
- 3.4 The risk of odour effects at a given receptor location may be estimated using the following fundamental relationship:

$$\text{Effect} \approx \text{Dose} \times \text{Response}$$

- 3.5 In this relationship, the **dose** is a measure of the likely exposure to odours, in other words the **impact**. The **response** is determined by the sensitivity of the receiving environment and thus the overall **effect** is the result of changes in odour exposure at specific receptors, taking into account their sensitivity to odours.
- 3.6 In order to determine the risk of potential odour effects from the Energy Centre, the 'FIDOR' factors for odour exposure have been used. These factors are commonly used in the assessment of odours and are outlined in the IAQM guidance, but are also described in the Environment Agency's H4 guidance document on odour management (Environment Agency, 2011), as well as Defra's odour guidance for local authorities (Defra, 2010). The FIDOR factors are:
- **F**requency – the frequency with which odours are detected;
 - **I**ntensity – the intensity of odours detected;
 - **D**uration – the duration of exposure to detectable odours;
 - **O**ffensiveness – the level of pleasantness or unpleasantness of odours; and

- **Receptor** – the sensitivity of the location where odours are detected, and/or the proximity of odour releases to an odour-sensitive location.

3.7 Odour emissions from the Energy Centre have been assigned a risk-ranking based on the “effect \approx dose x response” relationship, whereby the dose (impact) is determined by the “FIDO” part of FIDOR, and the response is determined by the “R” (receptor sensitivity). The risk of odour effects can therefore be described as:

$$\text{Effect} \approx \text{Impact (FIDO)} \times \text{Receptor Sensitivity (R)}$$

- 3.8 The key factors that will influence the effects of odours are the magnitude of the odour source(s), the effectiveness of the pathway for transporting odours, and the sensitivity of the receptor. The methodology set out in the IAQM guidance document describes in detail a Source-Pathway-Receptor approach to odour risk assessment, and includes tables and matrices to assist in determining the likely risk of odour effects. The IAQM methodology is outlined below. It includes an element of professional judgement.
- 3.9 The assessment examines the source odour potential (source magnitude) of the Energy Centre, and then identifies the effectiveness of the pathway and receptor sensitivity at sensitive locations.
- 3.10 Table 1 describes the risk-rating criteria (high, medium and low) for source odour potential, pathway effectiveness and receptor sensitivity applied in this assessment. This table has been adapted from Table 8 in the IAQM odour guidance.

Table 1: Source-Pathway-Receptor Risk Ratings

Source Odour Potential	Pathway Effectiveness	Receptor Sensitivity
Large Source Odour Potential: Large-scale odour source and/or a source with highly unpleasant odours (hedonic tone -2 to -4); no odour control.	Highly Effective Pathway: Very short distance between source and receptor; receptor downwind of source relative to prevailing wind; ground level releases; no obstacle between source and receptor.	High Sensitivity: Highly sensitive receptors e.g. residential properties and schools.
Medium Source Odour Potential: Medium-scale odour source and/or a source with moderately unpleasant odours (hedonic tone 0 to -2); basic odour controls.	Moderately Effective Pathway: Receptor is local to the source; releases are elevated, but compromised by building effects.	Medium Sensitivity: Moderately sensitive receptors e.g. commercial and retail premises, and recreation areas.
Small Source Odour Potential: Small-scale odour source and/or a source with pleasant odours (hedonic tone +4 – 0); best practice odour controls.	Ineffective Pathway: Long distance between source and receptor (>500 m); receptors upwind of source relative to prevailing wind; odour release from stack/high level.	Low Sensitivity: Receptors not sensitive e.g. industrial activities or farms.

3.11 The risk ratings for source magnitude and pathway effectiveness (for each receptor) identified using the criteria in Table 1 are then combined using the matrix shown in Table 2 to estimate an overall risk of odour impact at each specific receptor location.

Table 2: Assessment of Risk of Odour Impact at a Specific Receptor Location

Pathway Effectiveness	Source Odour Potential (Source Magnitude)		
	Large	Medium	Small
Highly Effective	High Risk	Medium Risk	Low Risk
Moderately Effective	Medium Risk	Low Risk	Negligible Risk
Ineffective	Low Risk	Negligible Risk	Negligible Risk

3.12 The next stage of the risk assessment is to identify the potential odour effect at each receptor location. This is done using the matrix presented in Table 3, which combines the overall odour impact risk descriptor for each receptor with the receptor sensitivity determined using the criteria in Table 1.

Table 3: Assessment of Potential Odour Effect at a Specific Receptor Location

Risk of Odour Impact	Receptor Sensitivity		
	High	Medium	Low
High Risk	Substantial Adverse Effect	Moderate Adverse Effect	Slight Adverse Effect
Medium Risk	Moderate Adverse Effect	Slight Adverse Effect	Negligible Effect
Low Risk	Slight Adverse Effect	Negligible Effect	Negligible Effect
Negligible Risk	Negligible Effect	Negligible Effect	Negligible Effect

3.13 As a final stage of assessment, an overall significance of odour effects is determined, based on professional judgment and taking into account the significance of the effect at each specific receptor location.

4 Odour Impact Assessment

Process Description

- 4.1 The proposed Energy Centre will process up to a maximum of 260,000 tonnes per annum of RDF to generate low-carbon electrical power. RDF is a mixture of processed materials residual non hazardous waste. This feedstock will all be delivered to the facility by road vehicles, which will enter the reception hall through fast-acting doors screened with air knives. The building will be maintained under negative pressure to ensure that any escape of odorous air is kept to an absolute minimum.
- 4.2 The RDF will be heated to very high temperatures within a combustion chamber and the release of heat energy will then be used to generate electricity within a steam turbine.
- 4.3 The gaseous emissions from the process will be discharged following flue gas treatment to the atmosphere via a 45 m stack; designed to achieve a predicted efflux velocity of 17.8 m/s with an exhaust temperature of 146°C. When discharged at this height, velocity and temperature, any residual odours are expected to be minimal and to disperse very effectively.

Source Odour Potential

- 4.4 The first step of the odour risk assessment is to identify the source odour potential, or 'odour magnitude'. This takes into account the scale and nature of the odorous processes; the continuity, intensity and offensiveness of odour releases; and any odour control measures that are used. In essence, it must consider the odour potential of the source with respect to the FIDO part of FIDOR (see Paragraph 3.6).
- 4.5 The plant will primarily use an RDF feedstock which will have been well-processed by the time it reaches the facility, and which is very different to waste handled at a household waste centre, for example. RDF is combustible waste that has had most of the potentially odorous organic matter which was originally within the waste removed during processing. Some organic matter will undoubtedly remain, and thus the feedstock for the plant remains a potential odour source, but overall, the potential odour magnitude of the RDF is judged to be low.
- 4.6 There are various potential ways in which odours may be released from the RDF. The first will be from the transport of the feedstock to the facility, with odours potentially released from the RDF as it is transported by road. The second will be from the process buildings themselves, primarily the intake hall where the waste is deposited and stored. The final potential odour source is the gases released via the main stack; however, the gases released here, at a height of 45 m, are not expected to be especially odorous, and will be released into a good environment for dispersion.

- 4.7 The entire building will be maintained under negative pressure to ensure that there is no fugitive release of odorous air, with all potentially odorous process air being passed through the combustion process and released via the stack. In the event that gases need to be bypassed from the stack, then they will be diverted to a dedicated, back-up odour control unit (OCU) for the removal of odours prior to release to the atmosphere.
- 4.8 The main potential odour sources and overall source odour potential for the Energy Centre are described in Table 4.

Table 4: Identification of Odour Sources and Overall Source Odour Potential

Odour Source	Description	Frequency and Duration	Intensity and Offensiveness
Transport of Feedstock	The delivery of the RDF feedstock to the facility by HGV in enclosed trailers.	Deliveries are expected to take place regularly and are assumed to be operational for 7 days per week.	<p>There is the potential for the RDF to produce odours. Delivery vehicles will, however, be enclosed/covered to minimise odorous emissions, and any emissions should be transient as the vehicles pass by any sensitive receptors on their way to the facility.</p> <p>Furthermore, the HGVs will deposit all waste within the reception hall of the main facility building, which will be maintained under negative pressure to minimise fugitive release of odours. Air Knives will also be installed on the access doors to further minimise the release of odours. In addition, and assuming that the RDF has been processed correctly, the odour emission potential of the waste itself is likely to be low under typical conditions.</p>
Process Buildings	Handling of the waste fuel.	The operating process will be continuous, so RDF will be moved continuously. The RDF residence time in the reception hall will be short; RDF will be stored only for a short period before being treated.	There is some potential for the RDF to produce odours during handling. However, the process building will be maintained under negative pressure, with extracted air used in the combustion process and discharged via a high-level stack, and at high velocity, so the potential for these odours to be released from the building doors and fabric will be very low.
Flue Gases	The leftover gases from the combustion process, post-cleaning.	The operating process will be continuous, so flue gases will be emitted continuously.	The flue gas is expected to have a low intensity and low offensiveness, as most odorous compounds will be destroyed in the combustion process.
Overall Source Odour Potential	<p>The Energy Centre is judged to be a Medium-scale odour source in terms of the amount of odour released.</p> <p>This represents a very conservative assessment, as the facility will employ measures to minimise fugitive odour releases that are in accordance with Best Available Technique (BAT). Gases that are actively discharged from the facility will be low in odour intensity and offensiveness due to the high temperature combustion process, and will be released to the atmosphere at a height of 45 m and at high velocity. In the event that the stack cannot be used, the facility will contain a back-up OCU to treat any odours prior to discharge to the atmosphere. Overall, with the proposed best practice odour controls in place it would be appropriate to consider the Energy Centre as a Small odour source in accordance with the criteria in Table 1, but for the purposes of a conservative assessment, a Medium odour source potential has been assumed.</p>		

Pathway Effectiveness

4.9 In order to consider the effectiveness of the pathway, it is important to consider receptor locations in terms of their proximity to the odour source and the prevailing wind direction. Thirteen receptor locations have been selected for this assessment, which represent worst-case locations surrounding the proposed facility, for both residential and commercial use. These receptor locations are shown in Figure 1.

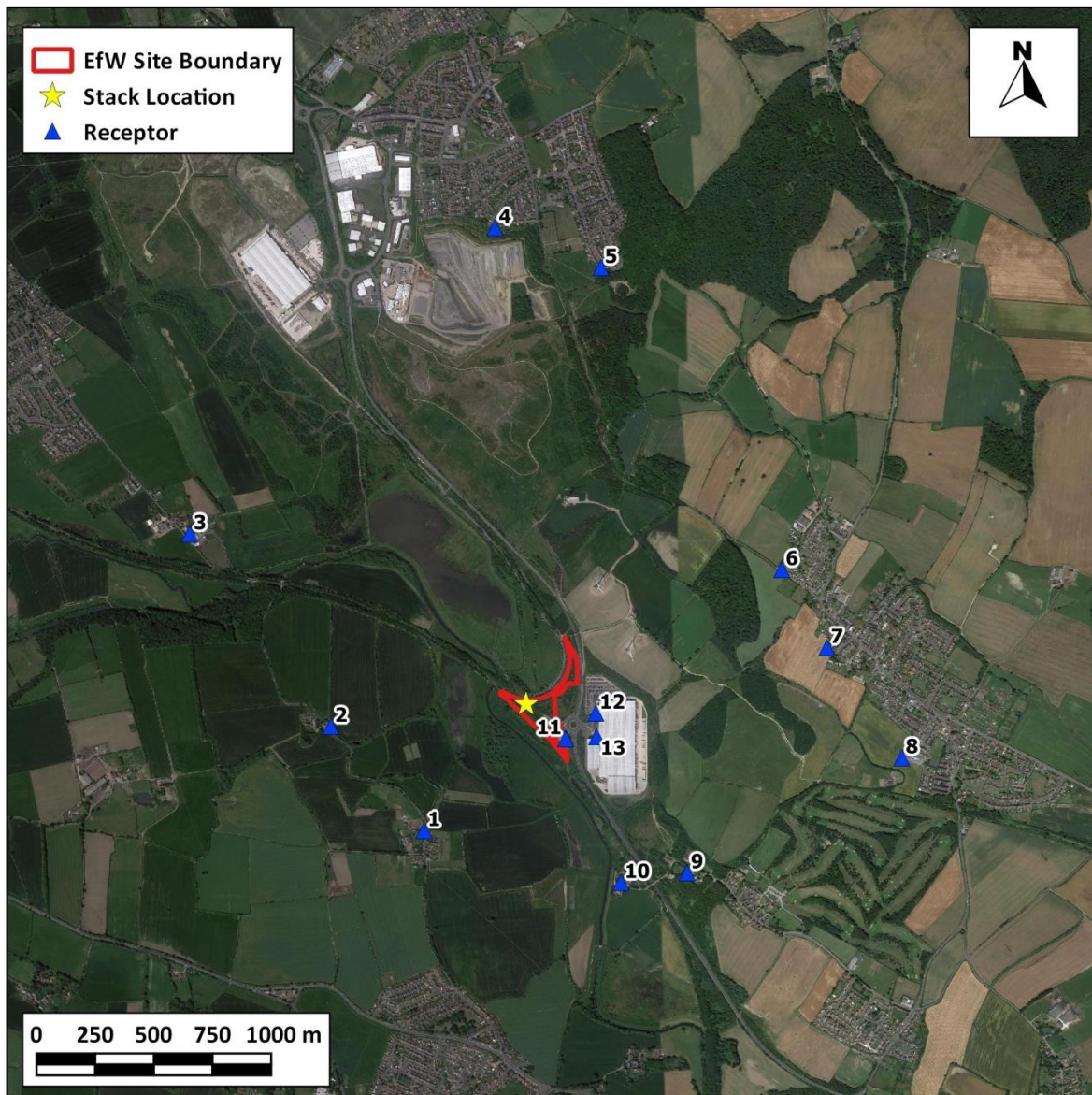


Figure 1: Receptor Locations
Imagery ©2018 Google

4.10 The Robin Hood meteorological station is located approximately 25 km southeast of the proposed facility, and the wind roses for 2012 to 2016 presented in Figure 2 demonstrate that the prevailing wind in the region is from the southwest, with other significant components from the west and south. In general, odours will be transported by the wind and will not be detectable at locations upwind of a source. The exception to this is during very light wind conditions when odours may disperse against the wind direction, although typically only for relatively short distances.

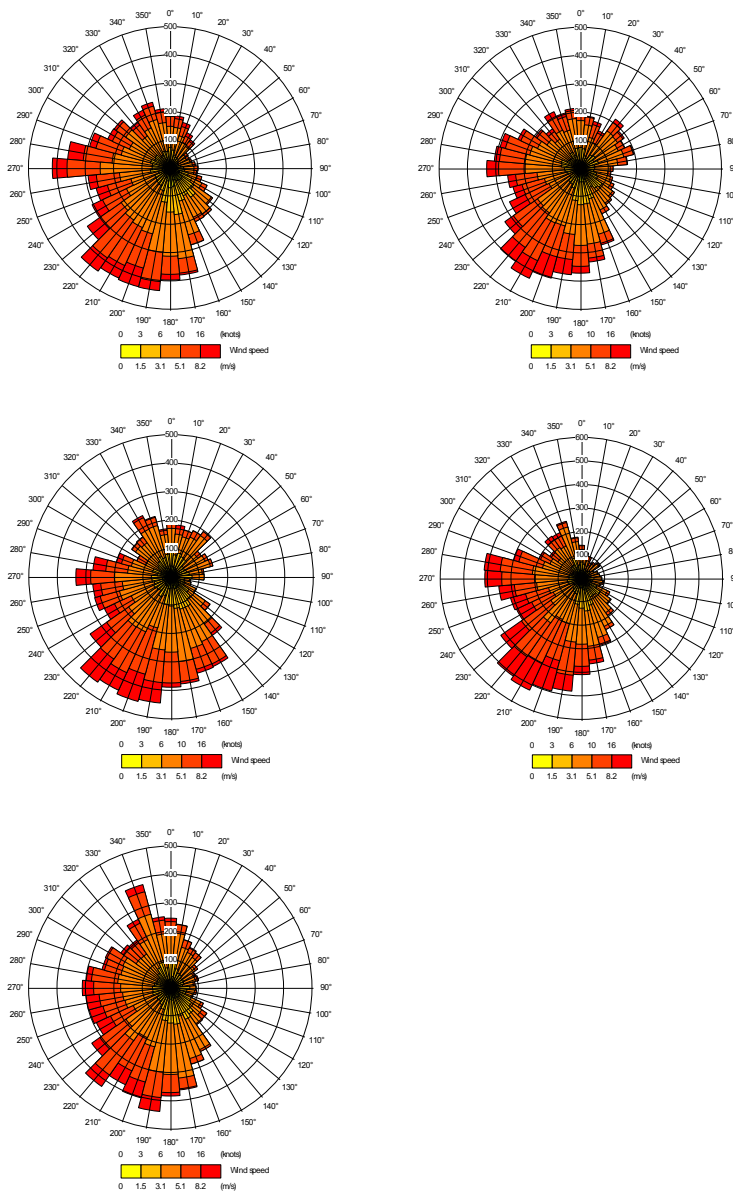


Figure 2: Wind Rose for Robin Hood Meteorological Station for 2012 to 2016 (left to right, top to bottom)

4.11 The effectiveness of the odour pathway between the Energy Centre main stack and the nearby sensitive receptors is summarised in Table 5, which draws upon the guidance set out in Table 1.

Table 5: Effectiveness of Odour Pathway

Receptor		Distance from Source ^a	Direction from Main Stack (°)	% Winds from Source ^b	Pathway Effectiveness ^c
ID	Location				
1	Residential Property	693	219	1.8	Ineffective
2	Residential Property	838	263	1.3	Ineffective
3	Residential Property	1607	297	1.5	Ineffective
4	Residential Property	2034	357	4.5	Ineffective
5	Residential Property	1888	11	5.0	Ineffective
6	Residential Property	1232	64	3.3	Ineffective
7	Residential Property	1305	81	3.4	Ineffective
8	Residential Property	1618	100	3.8	Ineffective
9	Residential Property	993	137	2.2	Ineffective
10	Residential Property	861	152	2.7	Ineffective
11	Commercial Property	224	132	2.3	Moderately Effective
12	Commercial Property	300	114	3.8	Moderately Effective
13	Commercial Property	331	98	3.1	Moderately Effective

^a Measured as distance to the main stack of Energy Centre.

^b Average wind frequency in each 10° sector is 2.49% across all wind directions.

^c Overall pathway effectiveness is based on professional judgement, taking account of distance between source and receptor, and frequency of winds with respect to the average.

4.12 The pathway effectiveness between the Energy Centre stack and each of the residential receptors (receptors 1 to 10) is judged to be ineffective. All of these receptors are located well over 500 m from the odour source, with each pathway obstructed by various areas of woodland. Furthermore, the residential receptors which will experience above-average wind frequencies are generally located over 1 km from the Energy Centre stack. The pathway effectiveness between the odour source and the commercial receptors is judged to be moderately effective. Although these receptors are located in closer proximity to the source than the residential properties, and two of the three will experience above-average wind frequencies, the odours will be discharged from an elevated source which is considerably higher than the respective commercial properties.

Receptor Sensitivity

4.13 The sensitivity of each of the receptors is described in Table 6. Receptor sensitivities are based on the descriptors presented in Table 1. Residential properties (receptors 1 to 10) are of High Sensitivity to odours, the nearby ASOS commercial premises (receptors 12 and 13) are of Medium Sensitivity and the electrical generation facility (receptor 11) is of Low Sensitivity as it is understood to be largely unmanned.

Potential Odour Effects

4.14 The assessments of the potential odour effects at sensitive receptor locations are presented in Table 6. This brings together the source odour potential, effectiveness of pathway and receptor sensitivity identified using the criteria described in Table 1, to identify an overall potential for odour effects, using the matrices set out in Table 2 and Table 3.

Table 6: Assessment of Potential Odour Effects from the Energy Centre

Receptor	Risk of Odour Impact (Dose)			Receptor Sensitivity	Likely Odour Effect
	Source Odour Potential	Effectiveness of Pathway	Risk of Odour Impact		
1	Medium	Ineffective	Negligible	High	Negligible
2	Medium	Ineffective	Negligible	High	Negligible
3	Medium	Ineffective	Negligible	High	Negligible
4	Medium	Ineffective	Negligible	High	Negligible
5	Medium	Ineffective	Negligible	High	Negligible
6	Medium	Ineffective	Negligible	High	Negligible
7	Medium	Ineffective	Negligible	High	Negligible
8	Medium	Ineffective	Negligible	High	Negligible
9	Medium	Ineffective	Negligible	High	Negligible
10	Medium	Ineffective	Negligible	High	Negligible
11	Medium	Moderately Effective	Low	Low	Negligible
12	Medium	Moderately Effective	Low	Medium	Negligible
13	Medium	Moderately Effective	Low	Medium	Negligible

4.15 The potential odour effects have been identified using the effect \approx dose x response relationship identified in Paragraph 3.4. The process is described as follows:

1) Identify the impact:

4.16 Based on a medium source odour potential; where the pathway is deemed to be ineffective, then the risk of odour impacts (dose) is judged to be negligible risk (see Table 2). Where the effectiveness of pathway is deemed to be moderately effective, the risk of odour impacts is low.

2) Consider the response:

4.17 Based on the matrix presented in Table 3, the odour effects at each receptor are identified as follows: A negligible risk of odour impacts will lead to a negligible odour effect regardless of receptor sensitivity. A low risk of odour impact at a medium sensitivity receptor will lead to a negligible odour effect.

- 4.18 The potential odour effects at each receptor location are summarised in the final column of Table 6. The final stage of the risk assessment is to make an overall judgement as to the likely significance of effects.
- 4.19 In this case it is judged that that overall significance of odour effects is ***insignificant***. This conclusion is based on the findings of the risk assessment that have identified a negligible to low risk of odour effects at all receptor locations and all resultant predicted odour effects are negligible.

5 Summary

- 5.1 The odour effects of the proposed Energy Centre on nearby sensitive receptor locations has been assessed using a qualitative odour risk assessment.
- 5.2 Overall, it is judged that the Energy Centre will lead to ***insignificant*** odour effects at all nearby sensitive receptor locations.

6 References

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7 Appendices

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A1 Professional Experience

Penny Wilson, BSc (Hons) CSci MEnvSc MIAQM

Ms Wilson is an Associate Director with AQC, with more than seventeen years' relevant experience in the field of air quality. She has been responsible for air quality assessments of a wide range of development projects, covering retail, housing, roads, ports, railways and airports. She has also prepared air quality review and assessment reports and air quality action plans for local authorities and appraised local authority assessments and air quality grant applications on behalf of the UK governments. Ms Wilson has arranged air quality and dust monitoring programmes and carried out dust and odour assessments. She has provided expert witness services for planning appeals and is Member of the Institute of Air Quality Management and a Chartered Scientist.

Paul Outen, BSc (Hons) MEnvSc MIAQM

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

Full CVs are available at www.aqconsultants.co.uk.