ENVIRONMENTAL PERMIT APPLICATION

ODOUR IMPACT ASSESSMENT

PEMBROKESHIRE ECO-PARK

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About WRAP

WRAP is a climate action NGO working around the globe to tackle the causes of the climate crisis and give the planet a sustainable future.

Our core purpose is to help you tackle climate change and protect our planet by changing the way things are produced, consumed, and disposed of.

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WRAP Cymru, 2023, Cardiff, Odour Impact Assessment, Prepared by SLR Consulting Ltd.

Written by: SLR Consulting Ltd

Executive summary

SLR has undertaken a detailed Odour Impact Assessment of the proposed new Pembrokeshire Eco Park in Milford Haven ('the Site'). The Eco Park will consist of a Waste Transfer Station (WTS), a Waste and Recycling Centre (WRC) and depot facilities.

Proposed operations at the site will be to accept and process a maximum of 74,999 tonnes per annum of non-hazardous and hazardous waste arising from household and commercial premises. Waste will be delivered via Pembrokeshire County Council (PCC)'s collection vehicles to the WTS, or via commercial or resident's private vehicles to the WRC. PCC's fleet of waste collection vehicles will operate from the Site. As such, facilities for vehicle maintenance, refuelling and cleaning would be provided at the Site.

The Site will introduce a new source of potential odours within the local area with a potential to impact upon the amenity of existing sensitive receptors in the surrounding area. The principal objective of this Odour Impact Assessment is to determine whether odour emissions are effectively dispersed so that no unacceptable odour pollution will occur when the Site is operational.

The Site is situated approximately 3km northwest of Milford Haven and 8km southwest of Haverfordwest. There are a number of sensitive receptors in proximity to the Site; the closest of which are a holiday let and an existing residential property, located within approximately 25m north and 75m northwest of the Site boundary respectively. A number of further isolated residential properties are located at a distance of 230m or more to the northwest of the permit boundary. Puma Energy, an industrial Fuel Storage Facility (COMAH site) which is separately permitted by NRW, borders the Site to the south.

The potential odour impact from the Site has been quantified by dispersion modelling in AERMOD, applying a precautionary approach and model inputs as part of a robust assessment. Odour emission rates for use in the dispersion modelling were determined in reference to recent odour monitoring data gathered from similar waste facilities in Wales.

In adoption of a precautionary assessment approach, the results of the dispersion modelling predict that the odour concentrations resulting from proposed Site operations are well below the relevant benchmark criterion at all nearby receptors. Therefore, in accordance with National Resources Wales' H4 Odour Management guidance there is no unacceptable odour pollution as a result of potential odour from the proposed Site operations.

Contents

Tables

Figures

Acknowledgements

The content of this Report has been based upon information provided by WRAP Cymru and Pembrokeshire County Council.

1.0 Introduction

The Waste and Resource Action Programme (WRAP), on behalf of Pembrokeshire County Council (PCC) has retained SLR Consulting Limited (SLR) to undertake a detailed Odour Impact Assessment (OIA) for the proposed new PCC Eco Park in Milford Haven (the 'Site'). The Site will require an Environmental Permit (EP) to be issued by Natural Resources Wales (NRW) before it can operate.

The Eco Park will consist of a Waste Transfer Station (WTS), a Waste and Recycling Centre (WRC) and depot facilities.

1.1 Background

An indicative Site layout plan has been provided which illustrates the proposed layout of the Site. SLR has also produced an Odour Management Plan (OMP) for the Site[1] which accompanies this OIA and the wider EP documentation, outlining the likely odour sources and associated mitigation measures which would be adopted at the Site.

1.2 Scope

The Site will introduce a new source of potential odours within the local area with a potential to impact upon the amenity of existing sensitive receptors in the surrounding area.

The principal objective is to assess whether odour emissions are effectively dispersed so that no unacceptable odour pollution will occur when the Site is operational.

This report presents the approach, detailed methodology and findings of this OIA.

1.3 Report Structure

The remainder of this report is structured as follows:

- Section 2.0 presents an overview of the relevant legislation and guidance;
- Section 3.0 details the site operations;
- Section 4.0 details the assessment methodology;
- Section 5.0 identifies sensitive receptors;
- Section 6.0 presents the dispersion model input parameters and assumptions;
- Section 7.0 presents the results of the dispersion model; and
- Section 8.0 concludes the study.

[1] Document reference: 416.V00798.00039_Puma WTS OMP.

2.0 Relevant Legislation and Guidance

2.1 Acceptability of Predicted Odour Impact

The potential for odorous compounds to cause nuisance is dependent upon a wide range of factors, including:

- The rate of emission of the compound(s);
- The duration and frequency of exposure;
- The time of the day that this emission occurs;
- The prevailing meteorology;
- The sensitivity of the receptors to the emission, i.e. whether the odorous compound is more likely to cause nuisance, such as the sick or elderly, who may be more sensitive;
- The odour detection capacity of individuals to the various compound(s); and
- The individual perception of the odour, (i.e. whether the odour is regarded as unpleasant). This is greatly subjective and may vary significantly from individual to individual.

There are neither European nor United Kingdom (UK) specific regulatory standards for the assessment of the impact of odours. However, it may be reasonably argued that complaints are likely to occur when odours become detectable and recognisable. The longer the odour detection persists for an individual, the greater the level of complaints may be expected, particularly if the odours are unpleasant.

On this basis, odour impact criteria are typically based upon guideline documents (predominately based on research from outside of the UK), case law and research. These documents typically indicate a numerical concentration limit of between 1.5 and 6 ou_E/m^3 (European odour units per cubic metre of air), (based on the 98^{th} percentile of hourly averages), depending on the offensiveness of the odour and sensitivity of the location. The lower criterion are typically applied to odours categorised as most offensive in more urban areas, and higher criterion to less offensive / more pleasant odours in rural or industrial areas where odours are more likely to be tolerated.

2.1.1 NRW's H4 Odour Management Guidance

NRW's H4 Odour Management Guidance[2] (the 'H4 Guidance') proposes installation-specific exposure criteria (benchmarks) on the basis that not all odours are equally offensive.

[2] Horizontal Guidance H4: Odour Management – How to comply with your Environmental Permit, NRW, 2014.

The H4 Guidance proposes the following benchmarks levels for the assessment and indication of unacceptable odour pollution:

- $1.5ou_E/m^3$ (as a 98th percentile of 1-hour average concentrations) for the most offensive odours;
- $3.0ou_E/m^3$ (as a 98th percentile of 1-hour average concentrations) for moderately offensive odours; and
- $6.0ou_E/m^3$ (as a 98th percentile of 1-hour average concentrations) for less offensive odours.

The H4 Guidance refers to the application of the $1.5ou_E/m^3$ criterion against the most offensive odorous sources, such as those processes involving handling of municipal waste.

2.1.2 IAQM – Odour Assessment for Planning Guidance

The Institute of Air Quality Management (IAQM) '*guidance on the assessment of odour for planning*'[3] (the 'IAQM Guidance') summarises the typical requirements and approaches for undertaking an odour assessment to determine the potential amenity impacts, in support of planning applications. Whilst this guidance does not form Environmental Permitting guidance, it is considered that if odour exposure does not cause significant detriment to amenity, then it cannot be causing unacceptable odour pollution.

To facilitate the assessment of the significance of predicted odour exposure on amenity, the guidance defines receptor sensitivity and proposes 'odour effect descriptors' which combine the relative sensitivity of the receptors, the nature (or offensiveness) of the odour with quantitative predicted odour exposure levels.

The IAQM receptor sensitivity types are summarised in Table 2-1.

Table 2-1: IAQM Odour Receptor Sensitivity

Receptor Sensitivity	Example Land-uses
High sensitivity receptors	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 receptors	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

[3] IAQM Guidance on the assessment of odour for planning. IAQM July 2018.

	■ 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 receptors	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

The IAQM Odour Guidance then presents a matrix for 'most offensive' and 'moderately offensive' odour types. Municipal waste is typically associated with a 'most offensive' odour, as referenced within NRW's H4 Guidance. As such, this assessment has considered the matrix for 'most offensive' odours and the associated IAQM Odour Guidance effect descriptor as summarised in Table 2-2. It is noted that impact descriptors apply equally to cases where there are increases and decreases in odour exposure as a result of a development. Therefore, the terms 'adverse' and 'beneficial' should be applied to the descriptors as appropriate.

Table 2-2: IAQM Odour Effect Descriptors (Most Offensive Odours)

Most Offensive Odours	Receptor Sensitivity		
Predicted Odour Exposure $C_{98,1\text{-hour}}$ ou_E/m^3	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

As presented in Table 2-2, in relation to impacts upon a 'high sensitivity' receptor (i.e. residential dwellings) by a 'most offensive' odour; the IAQM Odour Guidance matrix indicates that exposure greater than $C_{98\text{-}\%ile,\ 1\ hour}$ $1.5ou_E/m^3$ would be classified as a 'moderate adverse' odour effect. For a receptor of 'low sensitivity' (i.e. industrial areas, farmhouses or footpaths), the IAQM Odour Guidance matrix indicates that exposure greater than $C_{98\text{-}\%ile,\ 1\ hour}$ $5.0ou_E/m^3$ would be classified as a 'moderate adverse' odour effect. This 'moderate adverse' effect would be considered to represent a 'significant adverse' effect, which correlates with NRW's H4 Guidance criterion for unacceptable odour pollution.

3.0 Site Operations

3.1 Site Location

The Site is situated approximately 3km northwest of Milford Haven and 8km south-west of Haverfordwest at approximate National Grid Reference (NGR) x189000, y209300.

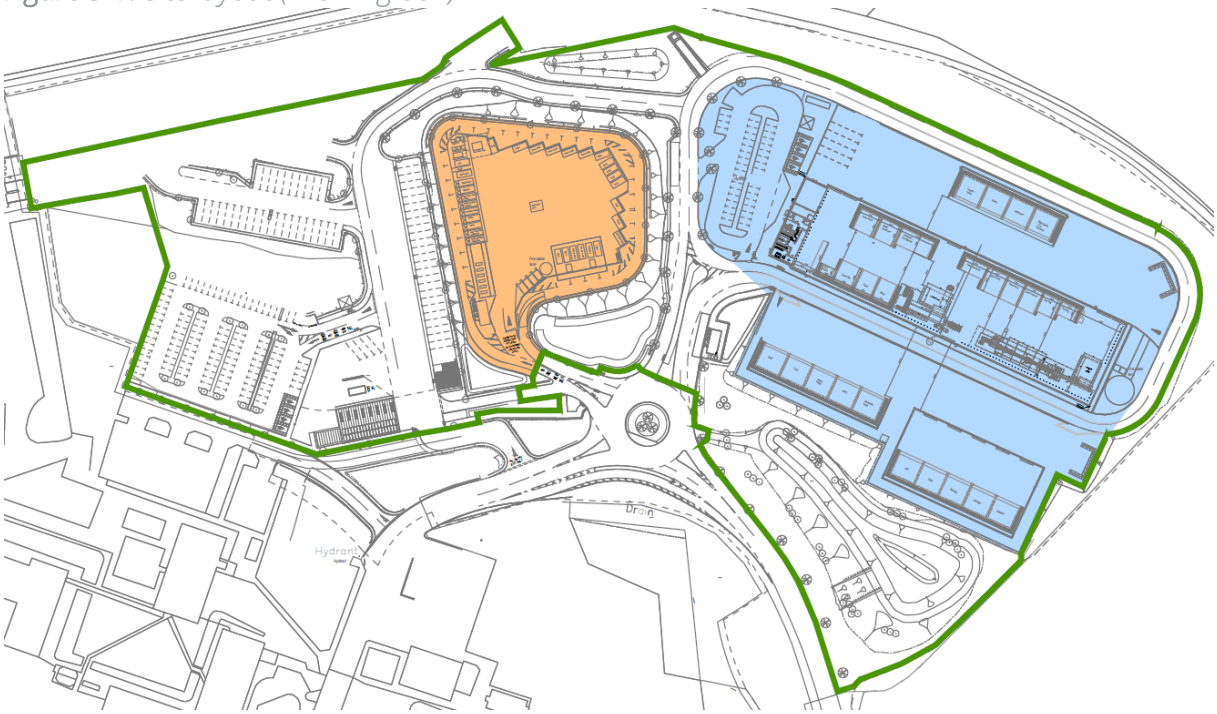
3.2 Process Description

The Eco Park will consist of a WTS, WRC and depot facilities. Proposed operations at the site will be to accept and process a maximum of 74,999 tonnes per annum (tpa) of non-hazardous and hazardous waste arising from household and commercial premises. Waste will be delivered via local authority collection vehicles to the WTS, or via commercial or resident's vehicles to the WRC.

PCC's fleet of waste collection vehicles will operate from the Site. As such, the Site will also provide facilities for vehicle maintenance, refuelling and cleaning.

The layout of the Site is presented in Figure 3-1 below.

Figure 3-1: Site layout (Drawing 001)



3.2.1 WTS Operations

The WTS would receive a range of waste types, comprising primarily:

- Residual waste;
- Mixed recyclables (cardboard, plastics, mixed metals and food and beverage cartons);
- Food waste; and
- Absorbent Hygiene Products (AHP).

A full list of waste types to be received at the Site is presented in Appendix C.

Material would be received at the WTS via road by a fleet of Recycling and Refuse Collection Vehicles (RRVs) and Commercial Collection Vehicles (CCVs). Loads carried by RCVs and CCVs would be inspected for any contaminants or hot loads prior to being directed to the WTS to offload as part of the waste-acceptance procedure.

Waste collections (via RRVs and CCVs) and ongoing haulage of transferred materials would typically be undertaken at the WTS from 07:00 to 17:00, Monday to Friday. To ensure continuity of service, the Site would occasional be operational (and waste collections would be undertaken) on Saturdays and Sundays, public holidays and over the Christmas and New Year period.

Food waste will arrive on Site in pods/stillages within RRVs or trade waste vehicles. Where possible, this material will be tipped directly into the designated skip or trailer. In some instances, food waste will be tipped into the designated food waste bay prior to transfer to the designated skip/trailer. The skip/trailer would typically be removed from the Site several times each day on weekdays, and (and replaced with an empty skip/trailer) would be in place for up to 72-hours over the weekend, prior to removal.

The following treatment activities will be carried out within the recycling building at the WTS:

- Bulking for transfer;
- Automated and manual sorting;
- Separation; and
- Baling.

The WTS area will comprise three distinct operational areas: the Recycling Building, the Residual Waste Building and the External Waste Bays. The waste types and operations within these areas are summarised in Table 3-1 below.

Table 3-1: WTS Waste Types and Operations

Operation Area	Waste Types Received	Storage Location	Associated Operations
Recycling Building	Food waste	Designated bay and skip / trailer within building	Receipt, storage and bulk export
	Cardboard	Designated bay within building	Receipt, storage and baling prior to bulk export
	News and Pams (wastepaper)	Designated bay within building	Receipt, storage and baling prior to bulk export
	Mixed metals, plastics, and food and beverage cartons	Designated bay within building	Receipt, storage, manual / automated sorting (to remove cartons) and baling prior to bulk export

	Household batteries, WEEE and textiles	Designated storage bins within building	Receipt, storage and bulk export
Residual Waste Building	Residual waste, AHP waste and dry mixed recyclables	Designated bay and/or skip / trailer within building	Receipt, storage and bulk export
External Sheltered and Covered Waste Bays	Wood, scrap metal, rigid plastics, carpets and tyres	Designated external covered bay	Receipt, storage and bulk export
	Glass	Designated external covered bay	Receipt, storage and reduced in size (by pushing/crushing of material against bay walls) prior to bulk export

Vehicles would gain access to the Recycling Building via seven roller shutter doors; five on the northern façade and two on the southern façade of the building. It is anticipated that five of these roller shutter doors would be in regular use during normal operations. Passive ventilation (facilitated by louvres on the northern and southern walls of the building) would facilitate air changes within the building when the doors are closed.

Vehicles would gain access to the Residual Waste Building via five roller shutter doors on the northern façade of the building. It is anticipated that three of these roller shutter doors would be in regular use during normal operations. Passive ventilation (facilitated by louvres on the northern and southern walls of the building) would facilitate air changes within the building when the doors are closed.

A number of the roller shutter doors (as outlined above) would remain open during extended periods during operational hours, due to the requirement for frequent vehicle access to the buildings for waste import, export and handling operations.

Under normal operational conditions, waste delivered to the Site would be stored for the following periods prior to removal:

- Residual waste would be stored within the residual waste bay for the following typical periods:
  - Weekdays: up to 24-hours; and
  - Weekends: up to 72-hours.
- Food waste would be stored within the food waste bay for the following typical periods:
  - Weekdays: up to 24-hours; and
  - Weekends: up to 72-hours.
- AHP waste would be stored within the AHP bay for up to 25-hours, and within the AHP skip/trailer for up to 14-days.

All materials would be transferred off-site for processing, recovery, or disposal via third party hauliers or PCC haulage vehicles, as appropriate.

3.2.2 WRC Operations

The WRC would receive a wide range of waste types, including:

- Residual waste;
- Recyclables;
- Green waste / wood;
- Bric-a-brac (i.e. textiles, books, shoes);
- Electronics;
- Scrap metal / appliances; and
- Furniture.

A full list of waste types to be received at the Site is presented in Appendix C.

It is anticipated that the WRC will be open to the public 7 days a week during the summer months (1st April to 31st October) and 5 days a week during the winter months from 8am to 6pm. In order to maintain the site for public use, the site is serviced by vehicles and operatives between 6:30am and 8pm.

Material is received at the WRC via private vehicles and deposited within the appropriate waste storage areas. Material would also be received via commercial vehicles, which would be visually inspected for contaminants or hot loads before depositing load, in accordance with the commercial waste policy and procedure.

The following treatment activities will be carried out within the recycling building at the WTS:

- Bulking for transfer;
- Manual sorting (i.e. of residual waste to remove recyclable material); and
- Separation.

The WRC area will comprise an impermeable area in which the permitted waste types would be received and stored in appropriate containers / waste trailers. Residual waste would be compacted and stored within two designated containers.

All materials would be periodically transferred off-site for processing, recovery, or disposal via third party hauliers or PCC haulage vehicles as appropriate. Further details on the waste retention time for specific waste types received are presented in Appendix C.

3.2.3 Other Operations

PCC's fleet of waste collections vehicles will operate from the Site, therefore garage and workshop, re-fuelling, vehicle washing and parking facilities would be provided.

Garage and workshop facilities would enable routine checks, inspections, and minor maintenance of the RRV/CCV fleet to be undertaken. Vehicles operating from this site will also be able to re-fuel on-site from a dedicated fuelling area. On-site facilities for vehicle washing would also be provided. Parking for RRVs, CCVs and employee vehicles is provided at the Site. On returning to the Site at the end of each shift, RRVs and CCVs may need to be re-fuelled. RRVs and CCVs would be periodically washed using the on-site facilities, as detailed within the accompanying OMP.

3.3 Identification of Odour Sources

Potential sources of odour from the Site have been identified on the basis of a review of the design, as described in Section 3.2 above, and outlined in the following sections.

3.3.1 WTS Odour Sources

The odour potential of waste types received at the Site are presented in Appendix C, to identify which waste types warrant inclusion within the OIA to assess the potential associated odour impact. The waste types received/stored at the WTS which warrant inclusion within the OIA (i.e. are identified to have a significant potential for odour generation) are:

- Residual waste;
- Food waste; and
- Absorbent Hygiene Products (AHP).

The remaining waste types received/stored at the WTS (such as recyclables, glass, wood, scrap metal, and household batteries) are considered to be of negligible odour potential. Therefore, as such waste types are considered to represent a negligible odour potential they have not been considered further within this assessment.

3.3.2 WRC Odour Sources

The odour potential of waste types received at the Site are presented in Appendix C, to identify which waste types warrant inclusion within the OIA to assess the potential associated odour impact. The only waste type received/stored at the WRC which warrants inclusion within the OIA (i.e. is identified to have a significant potential for odour generation) is residual waste.

In consideration of the similarity of green waste odours to those currently present within the site setting (agricultural)[4], the sensitivity of nearby residential receptors to green-waste type odours is likely to be low. In consideration of the above, green waste is not considered to represent an odour generating potential above that currently occurring in the Site locale. Therefore green waste has not been considered further within this assessment.

[4] Green waste is typically associated with a 'grassy' or 'musty' odour, similar to that experienced in agricultural areas.

The remaining waste types received/stored at the WRC (such as recyclables, bric-a-brac, scrap metal, and furniture) are considered to represent a negligible odour potential. Therefore, such waste types have not been considered further within this assessment.

3.3.3 Other Odour Sources

When not in use, RRVs and CCVs are parked at the Site in the designated bays. There is potential for RRVs and CCVs to be a source of odours following use in collection operations as a result of waste residue retained in or on the vehicles. Therefore, a cleaning regime is in place to remove waste residuals in or on the RRVs and CCVs following use, as detailed within the accompanying OMP. In consideration of the cleaning regime, potential odour emissions from the parked RRVs and CCVs are considered negligible and have not been considered further within this assessment.

The Site would also include a garage and workshop facility, office, welfare facilities, weighbridge, staff parking, refuelling station and vehicle cleaning area. These sources are considered to represent a negligible potential for odour generation and, therefore, have not been considered further within this assessment.

4.0 Assessment Methodology

4.1 Derivation of Source Term

In order to quantify odour impacts as part of this OIA, odour emission rates have been defined for the odour sources identified which warrant further assessment (as detailed in Section 3.3) in reference to recent odour monitoring data gathered from similar waste facilities in Wales. These odour monitoring studies were undertaken in application of accredited methods, as outlined in BS EN13725:2022[5].

The source term and corresponding emission rates for the odour sources identified at the Site were derived with consideration of the following data sources:

- odour monitoring of food waste and residual waste at the Rhayader bulking facility in April 2022; and
- odour monitoring of AHP at the Crymlyn Burrows waste management facility in January 2021.

Further details on the methods and results of the odour monitoring undertaken at the Rhayader bulking facility and the Crymlyn Burrows waste management facility are presented in Appendix D.

4.2 Quantification of Odour Impact

Odour assessments are undertaken using the concept of the European Odour Unit (ou_E), as defined in BS EN13725:2022. This approach allows impact assessment of any odorous gas as it is independent of chemical constituents and centres instead on multiples of the detection threshold (i.e. the physiological response of a human) of the gas in question.

As the odour unit is a Standard Unit in the same way as gram or milligram, the notation used in odour assessment follows the conventions of any mass emission unit as follows:

- Concentration: ou_E/m^3;
- Emission: ou_E/s; and
- Specific emission (emission per unit area): $ou_E/m^2/s$.

As per air quality standards for individual pollutants, exposure to odour is given in terms of a percentile of averages over the course of a year. The exposure criteria most accepted in the UK at present is given in terms of (concentration) European Odour Units as a 98th percentile (C_{98}) of hourly averages. This allows 2% of the year when the impact may be above the limit criterion (175 hours). The notation for impact is therefore: $C_{98,\ 1\ hour}$ X ou_E/m^3.

[5] BS EN13725:2022 stationary source emissions – determination of odour concentration by dynamic olfactometry and odour emission rate.

4.3 Modelling Approach

In order to predict potential odour impacts within the vicinity of the Site a quantitative assessment using the AERMOD dispersion model[6] was undertaken. AERMOD is a regulatory model approved for the United States Environmental Protection Agency (US EPA) and is used extensively for odour impact assessment in the UK.

The detailed dispersion modelling has been used to predict the concentration of odour at a height of 1.5m AOD in accordance with the relevant NRW guidance. In accordance with the H4 Guidance, an average of the odour concentrations modelled with the application of 2018 – 2022 meteorological data has been presented. In addition, the modelling results from each individual meteorological year considered are presented for completeness.

4.4 Acceptability of Predicted Odour Impacts

The magnitude of the predicted odour effect (i.e. impact significance) has been determined in reference to the NRW H4 Guidance (Section 2.1.1) and in consideration of the IAQM Odour Guidance (Section 2.1.2), with specific consideration given to the likely offensiveness of odours from the Site as well as the sensitivity of the nearby receptors.

For the purposes of this Odour Impact Assessment, odours from the Site have been considered 'most offensive'. Residential dwellings (including farms) have been considered to be of a 'high sensitivity' to odours. Industrial premises (such as Puma Energy) have been considered to be of 'low sensitivity' to odours.

In consideration of the offensiveness of odours and receptor sensitivities outlined above, and in reference to the odour criterions outlined within NRW's H4 Odour Guidance as well as the IAQM Odour Guidance, the following odour criterion have been applied within this assessment to present the point at which the adverse effect of odours could be considered 'significant pollution':

- $C_{98,\ 1\text{-hour}}$ 1.5ou_E/m^3 odour criterion has been applied for all residential receptors (including farmhouses); and
- $C_{98,\ 1\text{-hour}}$ 5.0ou_E/m^3 odour criterion has been applied for all industrial receptors and transient public access areas (such as footpaths or roads).

[6] Aermod model executable 21121.

5.0 Identification of Sensitive Receptors

There are a number of sensitive receptors in proximity to the Site, the closest of which is an existing holiday let located approximately 25m north of the Site boundary at Robeston Cross and an existing residential property located approximately 75m northwest of the Site boundary at Robeston West. A number of isolated residential properties and farmhouses are located at a distance 230m or more to the northwest of the permit boundary. Puma Energy, an industrial facility, borders the Site to the south.

Table 5-1 presents the sensitive receptors identified surrounding the Site, as considered within the dispersion modelling. The closest sensitive receptors in each direction surrounding the Site have been identified, this does not represent an exhaustive list.

Table 5-1: Sensitive Receptors

Receptor	Receptor Type	Receptor Sensitivity	Distance from:	
			Permit Boundary	Odour Source
DR1	Holiday let	High	25m	120m
DR2	Residential dwelling	High	75m	220m
DR3	Residential dwelling	High	230m	400m
DR4	Residential dwelling	High	330m	560m
DR5	Residential dwelling	High	590m	660m
Puma Energy	Industrial	Low	At boundary	120m

Figure 5-1 illustrates the sensitive receptors (green triangle markers), Puma Energy facility (green shaded area), permit boundary (red outline), WTS area (blue shaded area) and WRC area (orange shaded area).

Figure 5-1: Sensitive Receptors

It should be noted that the structures directly southeast of the Site boundary are agricultural (animal housing), and as such do not represent receptors with a sensitivity to odours.

6.0 Model Input Data

6.1 Modelled Assumptions

A range of assumptions have been applied within the dispersion modelling assessment, defined on the basis of operational information provided by PCC. A precautionary approach has been adopted for the study, to represent 'worst-case' odour emissions from the Site.

The key assumptions applied within the dispersion modelling study are as follows:

- Containment/abatement:
  - The majority of odorous waste types considered within the assessment (as detailed in Section 3.3) are stored within the Recycling Building and Residual Waste Building. These building would provide a level of containment to odours resulting from the waste types stored within the buildings. However, the dispersion modelling has been undertaken without consideration of the containment provided by these structures; modelling all odour sources as uncovered area emission sources, therefore reflecting a worst-case modelling approach; and
  - Residual waste would be stored within two designated containers which would provide a level of containment to odours. However, the dispersion modelling has been undertaken without consideration of the containment provided by these containers.
- Residual waste:
  - Under normal operations, the WTS would be operational between 07:00 and 17:00 Monday to Friday. Residual waste may also be stored at the Site overnight, as required. Therefore it has been assumed that residual waste would be present within the designated bays within the Residual Waste Building continuously (i.e. 24-hours per day, 365-days per year);
  - Under normal operations, the WRC would be operational between 06:30 and 20:00, 7-days per week in the summer and 5-days per week in the winter. Waste would also be present at the Site overnight. As such, it has been assumed that residual waste would be present within the designated containers within the WRC continuously (i.e. 24-hours per day, 365-days per year);
  - The volume of residual waste within the designated bays / storage areas would be variable, depending on waste delivery and transfer operations. However, as a precautionary approach it has been assumed that that all bays / storage areas would be filled to capacity with residual waste at all times (i.e. 24-hours per day, 365-days per year);

- Under normal site operations, the retention time of residual waste at the WTS on weekdays would be 24-hours, and up to 72-hours over the weekend. Therefore, decomposition of the waste during this short retention time would be minimal and has not been considered further; and
- The odour emission rate for residual waste stored at the Site has been defined in consideration of the 'freshly tipped' emission rate as measured during the monitoring study at Rhayader (see Appendix D). This reflects a worst-case approach in regard to odour emissions from the waste (i.e. following agitation when emissions are periodically elevated).

- Food waste:
  - Under normal operations, the WTS would be operational between 07:00 and 17:00 Monday to Friday. Food waste is also stored at the Site overnight, where required. Therefore, it has been assumed that food waste would be present within the designated bay and skip/trailer within the Recycling Building continuously (i.e. 24-hours per day, 365-days per year);
  - The volume of food waste within the designated bay and skip/trailer would be variable, depending on waste delivery and transfer operations. However, as a precautionary approach it has been assumed that the designated bay and skip/trailer would both be filled to capacity (with food waste) at all times;
  - Under normal Site operations, food waste received within the food waste bay over the day would be transferred to the food waste skip/trailer at the end of the day. As such, the retention time of food waste within the bay would not exceed 24-hours;
  - It is assumed that one skip/trailer (filled with food waste) would be present within the Recycling Building at all times; and
  - Under normal site operations, each food waste skip/trailer will remain on Site for no more than 72-hours. As such, the odour emission rate calculated for the skip/trailer has been defined in consideration of 72-hours-aged food waste (as the odour potential of food waste increases over time, this reflects a worst-case approach in regard to waste decomposition).

- AHP waste:
  - Under normal operations, the WTS would be operational between 07:00 and 17:00 Monday to Friday. AHP waste is also stored at the Site overnight where required. Therefore, it has been assumed that AHP waste would be present within the designated bay and skip/trailer within the Residual Waste Building continuously (i.e. 24-hours per day, 365-days per year);
  - The volume of AHP waste within the designated bay and skip/trailer would be variable throughout the day, depending on waste delivery and transfer operations.

However, as a precautionary approach, it has been assumed that the designated bay and skip/trailer would be filled to capacity with AHP waste at all times (i.e. 24-hours per day, 365-days per year);

- Under normal Site operations, AHP waste received within the AHP waste bay over the day would be transferred to the AHP waste skip/trailer at the end of the day. As such, the retention time of AHP waste within the bay would not exceed 24-hours;
- It is assumed that one skip/trailer (filled with AHP waste) would be present within the Residual Waste Building at all times (i.e. 24-hours per day, 365-days per year); and
- Under normal site operations, each AHP waste skip/trailer will remain on Site for no more than 14 days. AHP waste does not have a significant potential for waste decomposition, as the waste primarily comprises sanitary/hygiene products (which are inorganic in nature). As such, the odour emission rate applied for the AHP waste skip/trailer (which would be stored for up to 14-days) is the same as that applied for the AHP waste bay (stored for up to 24-hours).

- Seasonal variation:
  - The odour emission rates defined for food and residual waste (on the basis of monitoring data collected during mild conditions in April) have been applied in the dispersion modelling for 365-days-per-year, without any consideration of a reduction factor (i.e. during the winter months when temperatures and therefore odour potential is anticipated to be lower).

6.2 Modelled Sources and Emission Rates

Reference should be made to Table 6-1 and Table 6-2 for details of the odour emission rates defined for the area and volume (enclosed) sources modelled, respectively.

Table 6-1: Odour Emission Rates - Area Sources

Odour Source	Assumed Waste Retention Time	Area Odour Emission Rate ($ou_E/m^2/s$)	Total Surface Area (m^2)	Calculated Odour Emission Rate (ou_E/s)	Data Source
Residual waste bays (WTS)	24-hours on weekdays, 72-hours over the weekend	1.9	300	570	Measured data from Rhayader (see Table D-1)
Residual waste containers (WRC)	4-days		30	57	

Food waste bay	24-hours	2.2	22.4	49	Measured data from Rhayader (see Table D-1)
Food waste skip/trailer	72-hours	19.8 (A)	29.9	592	Measured data from Rhayader (A)
AHP waste bay	24-hours	1.1	100	110	Measured data from Crymlyn Burrows (see Table D-3)
AHP waste skip/trailer	14-days	1.1	29.9 (B)	33	

Table notes:

(A) Calculated through extrapolation of the measured 'fresh' odour emissions rate (2.2 $ou_E/m^2/s$) factored to represent 72-hour aged food waste, in reference to the monitoring data presented within Table D-1 and D-2 in Appendix D (i.e. factor of 9x has been applied).

(B) The surface area of the largest skip/trailer which may be used has been considered (11.5m long by 2.6m wide). Under normal operations it is anticipated that the skip/trailer in use would be smaller than this. Therefore the surface area applied reflects a worst-case approach.

Further to the odour emission data presented above, Table 6-2 presents a summary of the emission parameters and odour emission rates applied for the odour sources identified.

Table 6-2: Odour Emission Parameters Summary

Odour Source	Emission Source Type	General Source Location	Assumed Nature of Release	Odour Emission Rate (ou_E/s)
Residual waste bays (WTS)	Area	Residual Waste Building	Continuous	570
Residual waste containers (WRC)	Area	WRC	Continuous	57
AHP waste bay	Area	Residual Waste Building	Continuous	110
AHP waste skip/trailer	Area	Residual Waste Building	Continuous	33
Food waste bays	Area	Recycling Building	Continuous	49
Food waste skip/trailer	Area	Recycling Building	Continuous	592

The individual emission sources defined within the dispersion modelling as presented in Table 6-3 below.

Table 6-3: Odour Emission Source Parameters

Odour Source	Source Description	Specific Source Location (BNG)	Surface Area (m^2)	Area Odour Emission Rate ($ou_E/m^2/s$)	Release height (m)
Residual waste bays (WTS)	Residual waste bay 1	x189106, y209246	100	1.9	3.0
	Residual waste bay 2	x189116, y209241	100		3.0
	Residual waste bay 3	x189125, y209236	100		3.0
Residual waste containers (WRC)	Residual waste container 1	x188954, y209332	15	1.9	2.7
	Residual waste container 2	x188958, y209333	15		2.7
Food waste bay	Food waste bay	x189053, y209327	22.4	2.2	3.0
Food waste skip/trailer	Food waste skip/trailer	x189051, y209328	29.9	19.8	3.8
AHP waste bay	AHP waste bay	x189086, y209255	100	1.1	3.0
AHP waste skip/trailer	AHP waste skip/trailer	x189091, y209266	29.9	1.1	3.8

6.3 Assessment Area

The modelling has been undertaken using a nested receptor grid across the study area, as well as discrete receptors located at the sensitive receptors identified in proximity to the Site (see Section 5.0). Odour exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the predicted odour concentration to be calculated in the local area surrounding the Site.

A nested receptor grid was defined to cover the study area as follows:

- A grid of 200m by 200m with a spacing of 20m;
- A grid of 500m by 500m with a spacing of 50m;
- A grid of 1km by 1km with a spacing of 100m; and
- centred at NGR coordinates x189000, y209330.

6.4 Meteorological Data

The most important meteorological parameters governing the atmospheric dispersion of pollutants are as follows:

- Wind direction: determines the broad transport of the emission and the sector of the compass into which the emission is released;
- Wind speed: will affect ground level emissions by determining the initial dilution of pollutants emitted; and
- Atmospheric stability: is a measure of the turbulence, particularly of vertical motions.

The nearest meteorological recording station to the Site is Milford Haven Conservancy Boar ('Milford Haven'), located approximately 4km south of the Site. The Milford Haven recording station is located within approximately 200m of the shoreline of the Milford Haven Estuary.

As such, in consideration of the close proximity of the Milford Haven recording station, this recording station was determined to be representative of the Site locale and has been utilised within this study.

Recent meteorological data (covering the period 2018 to 2022, inclusive) was obtained in '.met' format from the data supplier. The data was converted to the required surface and profile formats for use in AERMOD, in accordance with the latest guidance[7] using the 'AerMet View' meteorological pre-processor. Details specific to the meteorological recording station were used to define surface roughness, albedo and bowen ratio in the conversion (see Table 6-4) utilising the AerSurface tool within AerMet.

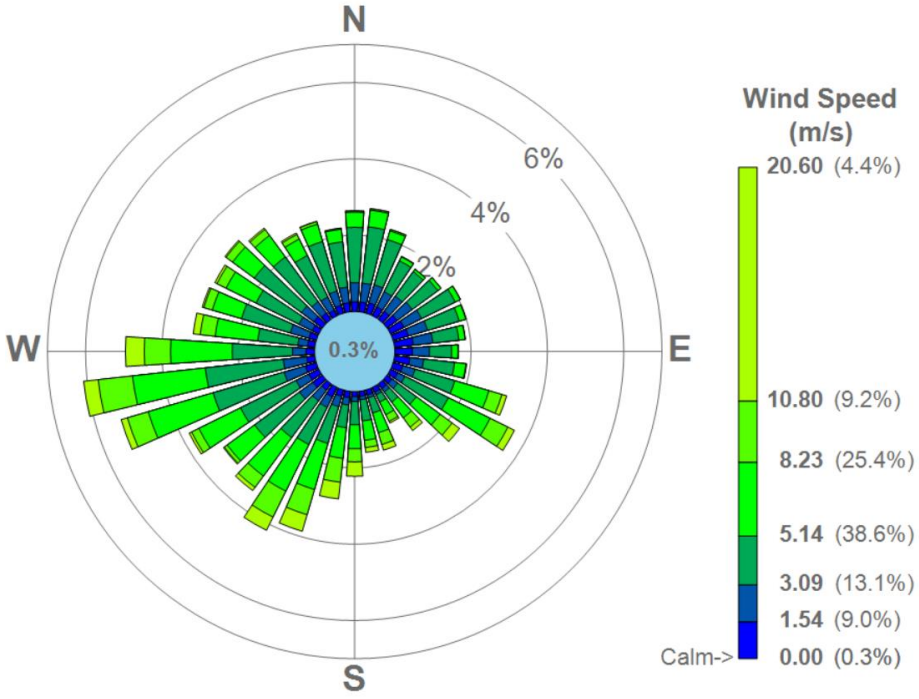
Table 6-4: Meteorological Data Preparation

Zone (Start and End Sectors)	Albedo	Bowen	Surface Roughness
0 – 30°	0.16	0.4	0.290
30 – 60°	0.16	0.4	0.290
60 - 90°	0.16	0.4	0.300
90 - 120°	0.16	0.4	0.031
120 - 150°	0.16	0.4	0.003
150 - 180°	0.16	0.4	0.005
180 - 210°	0.16	0.4	0.002
210 - 240°	0.16	0.4	0.003
240 - 270°	0.16	0.4	0.014
270 - 300°	0.16	0.4	0.059
300 - 330°	0.16	0.4	0.112
330 - 0°	0.16	0.4	0.246

[7] AERMOD Implementation guide. AERMOD implementation workgroup, USEPA. Last revised July 2021.

A composite wind rose from Milford Haven meteorological recording station, showing the frequency of wind speed and direction used in the assessment is presented in Figure 6-1 below. Individual wind-roses for each year of meteorological data are presented in Appendix B. The windrose shows winds from the west and southwest are most prevalent.

Figure 6-1: Milford Haven Recording Station Wind Rose (2018 - 2022 average)

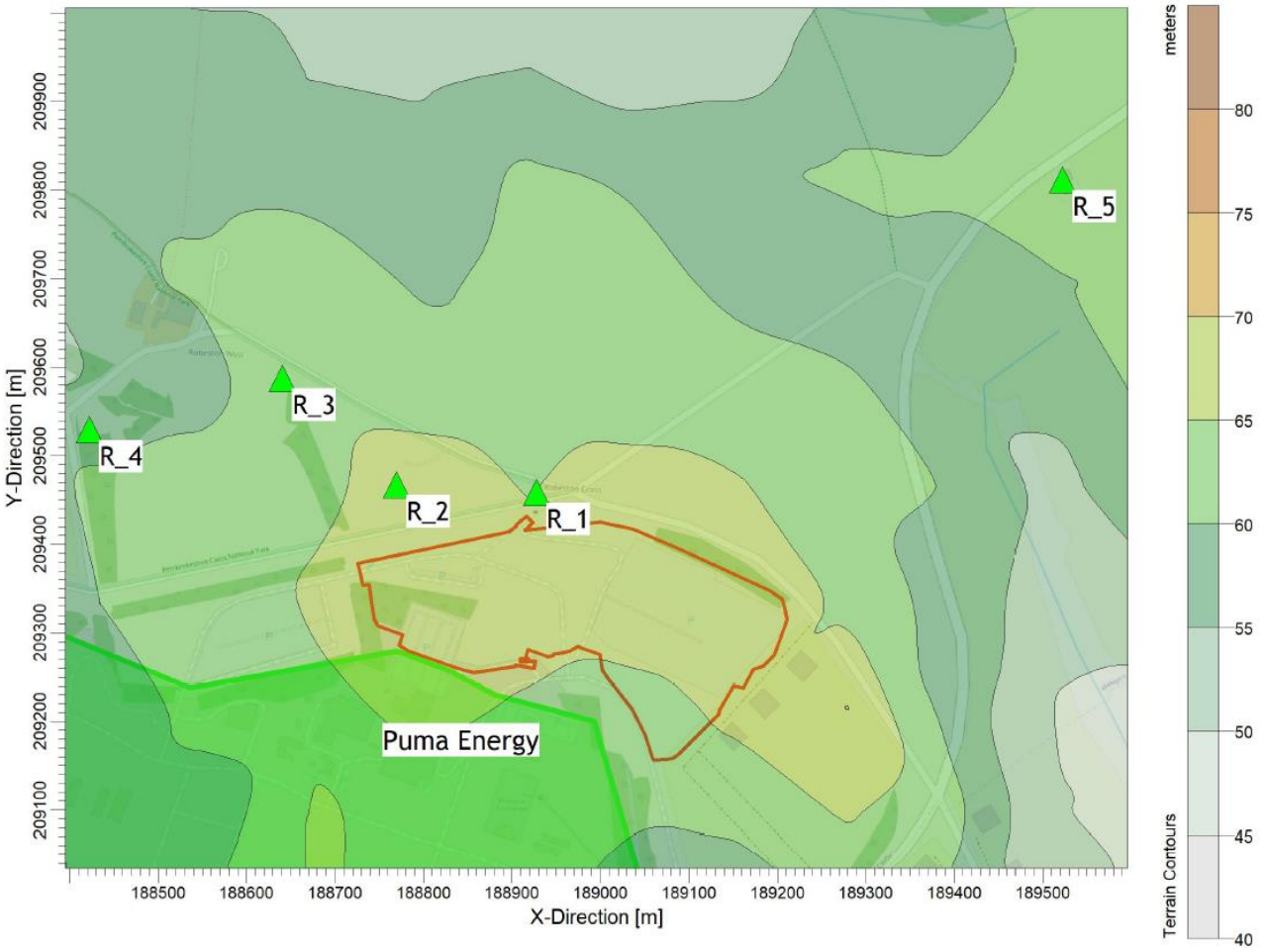


6.5 Terrain Data

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission (SRTM) terrain data. Data was processed by the AERMAP function within AERMOD to calculate terrain heights (see Figure 6-2).

The Site is situated in relatively flat area of between 60m and 70m AOD. The land dips gently to approximately 50m to the north, east and west of the site. As such, topography has been incorporated into the model.

Figure 6-2: Terrain Data



7.0 Prediction of Impact

This section provides a presentation of the predicted odour impact of the Site, as determined through the detailed dispersion modelling study.

The odour exposures predicted as a result of emissions from the Site, in adoption of the precautionary approach outlined, are presented below.

7.1 Predicted Odour Concentrations at Sensitive Receptors

The predicted concentrations may be compared against the relevant benchmark criterion of $1.5ou_E/m^3$ for 'high sensitivity' (holiday let or residential) receptors such as DR1 to DR5, and $5.0ou_E/m^3$ for 'low sensitivity' industrial receptors (such as Puma Energy) and transient public access areas (such as footpaths or roads).

The odour exposures predicted as a result of emissions from the Site at the identified sensitive receptors are presented in Table 7-1 below.

Table 7-1: Predicted Odour Concentrations at Sensitive Receptors

Receptor	Receptor Sensitivity	Relevant Criterion ($C_{98,\ 1\text{-hour}}$ ou_E/m^3)	Predicted Odour Concentration ($C_{98,\ 1\text{-hour}}$ ou_E/m^3)					
			2018	2019	2020	2021	2022	Average 5-years
DR1	High	1.5	0.2	0.2	0.1	0.2	0.2	0.2
DR2	High	1.5	0.1	0.1	0.1	<0.1	<0.1	0.1
DR3	High	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DR4	High	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DR5	High	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Puma Energy (A)	Low	5.0	0.3	0.3	0.3	0.4	0.3	0.3

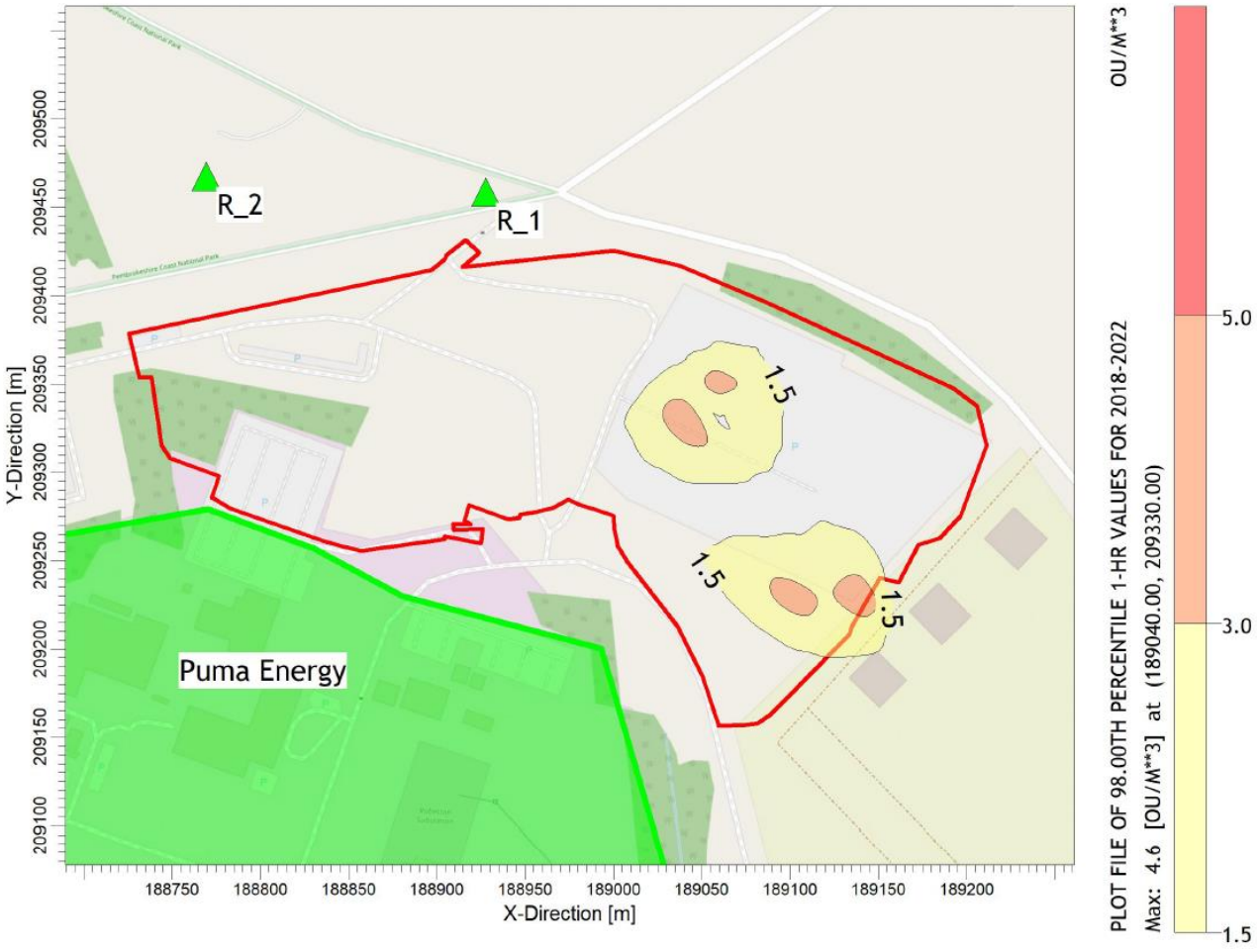
Table notes:
(A) The maximum odour concentration predicted across the entire Puma Energy site is presented.

7.2 Isopleth Maps

The results of the dispersion modelling have been presented as isopleths of 98th percentile of 1-hour mean concentrations. The predicted concentrations may be compared against the relevant benchmark criterion of $C_{98,\ 1\text{-hour}}$ $1.5ou_E/m^3$ for 'high' sensitivity receptors and $C_{98,\ 1\text{-hour}}$ $5.0ou_E/m^3$ for 'low sensitivity' receptors.

Figure 7-1 presents the modelled dispersion of odours from the Site when considering the average of the 5-years'meteorological data investigated to represent *'typical'* dispersion trends.

Figure 7-1: Modelled $C_{98\ 1\text{-}hour}$ Odour Concentrations - 2018 to 2022 Meteorological Data



Whilst it is noted that this is not a requirement of the NRW's H4 Odour Management guidance, the modelled dispersion of odours from the Site when considering each of the individual meteorological years investigated are presented for completeness in Appendix A.

7.3 Interpretation of Results

The dispersion modelling predicts that the odour concentrations resulting from the Site operations are well below the relevant benchmark criterion at all sensitive receptors identified. Furthermore, off-site odour concentrations are not predicted to exceed the relevant benchmark criterion ($C_{98,\ 1\text{-}hour}$ 5.0ou_E/m^3) for transient public access areas, such as footpaths or roads of low sensitivity as defined by the IAQM Odour Guidance.

Therefore, in accordance with NRW's H4 Odour Guidance there is no risk of unacceptable odour pollution at any of the nearby sensitive receptors.

8.0 Summary and Conclusion

SLR has undertaken an OIA of identified sources of odour from the WTS and WRC operations at the proposed Pembrokeshire Eco-Park near Milford Haven, Pembrokeshire, to support an Environmental Permit application to NRW.

The potential odour impact from the Site has been quantified by dispersion modelling in AERMOD, applying a precautionary approach and model inputs as part of a robust assessment. Odour emission rates for use in the dispersion modelling were determined in reference to previous odour monitoring studies undertaken by SLR at the Rhayader bulking facility and the Crymlyn Burrows waste management site.

Dispersion modelling of odour from the standard operation of the Site has been compared against the odour impact criterion of $C_{98,1\text{-hour}}$ 1.5ou_E/m^3 (for 'high sensitivity' receptors) and $C_{98,1\text{-hour}}$ 5.0ou_E/m^3 (for 'low sensitivity' receptors), with receptor sensitivities defined in reference to the IAQM Odour Guidance, and in consideration of a 'most offensive' odour as defined by NRW's H4 Odour Guidance.

In adoption of a precautionary assessment approach, the results of the dispersion modelling predict that the odour concentrations resulting from proposed Site operations are well below the relevant benchmark criterion at all nearby sensitive receptors identified.

Therefore, in accordance with NRW's H4 Odour Guidance there is no risk of unacceptable odour pollution as a result of the Site operations.

Appendix A: Modelled Odour Contours and Impact Descriptors

Figure A-1: Modelled $C_{98\ 1\text{-}hour}$ Odour Concentrations - 2018 Meteorological Data

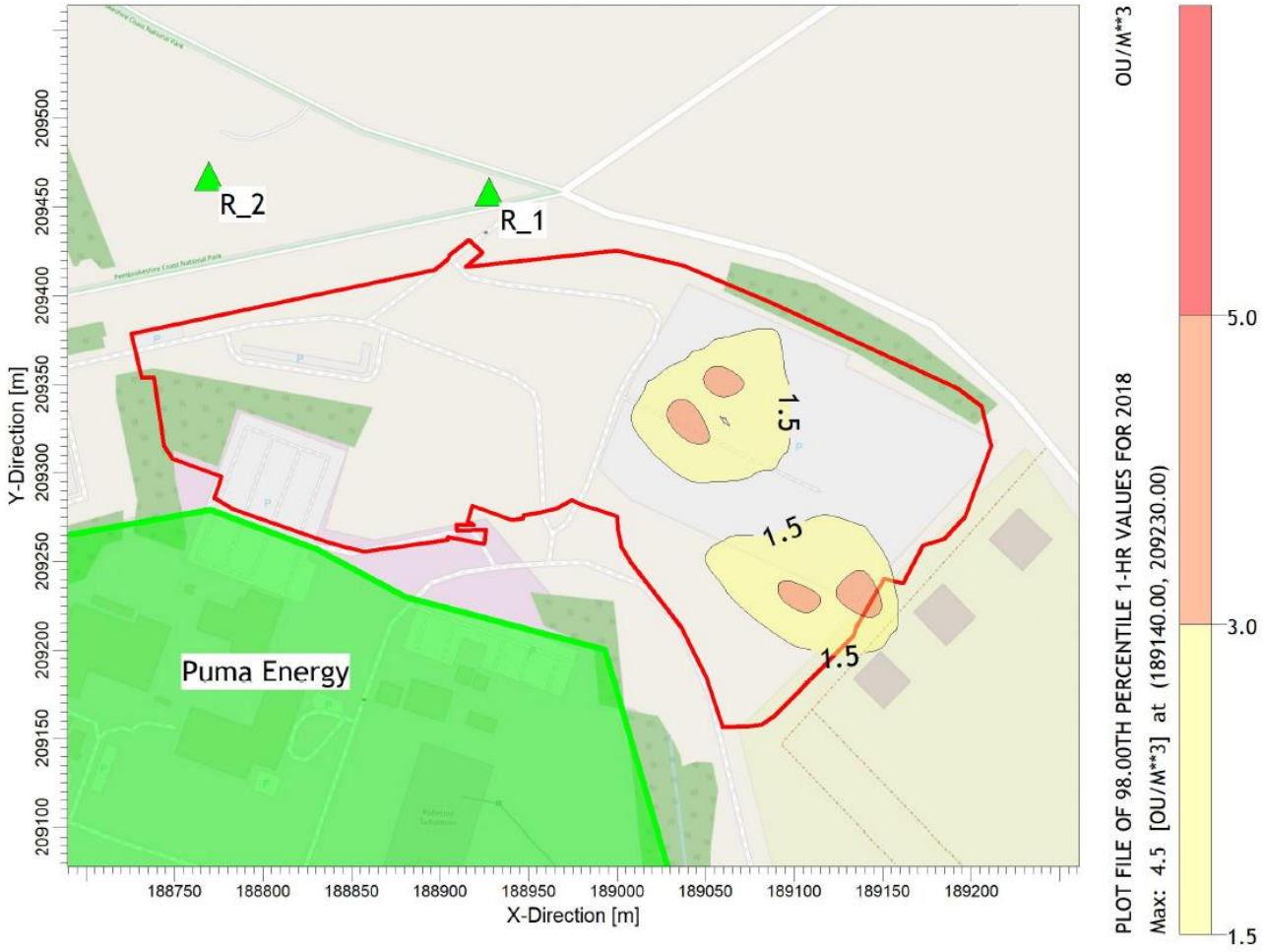


Figure A-2: Modelled $C_{98\ 1\text{-}hour}$ Odour Concentrations - 2019 Meteorological Data

Figure A-3: Modelled $C_{98\ 1\text{-}hour}$ Odour Concentrations - 2020 Meteorological Data

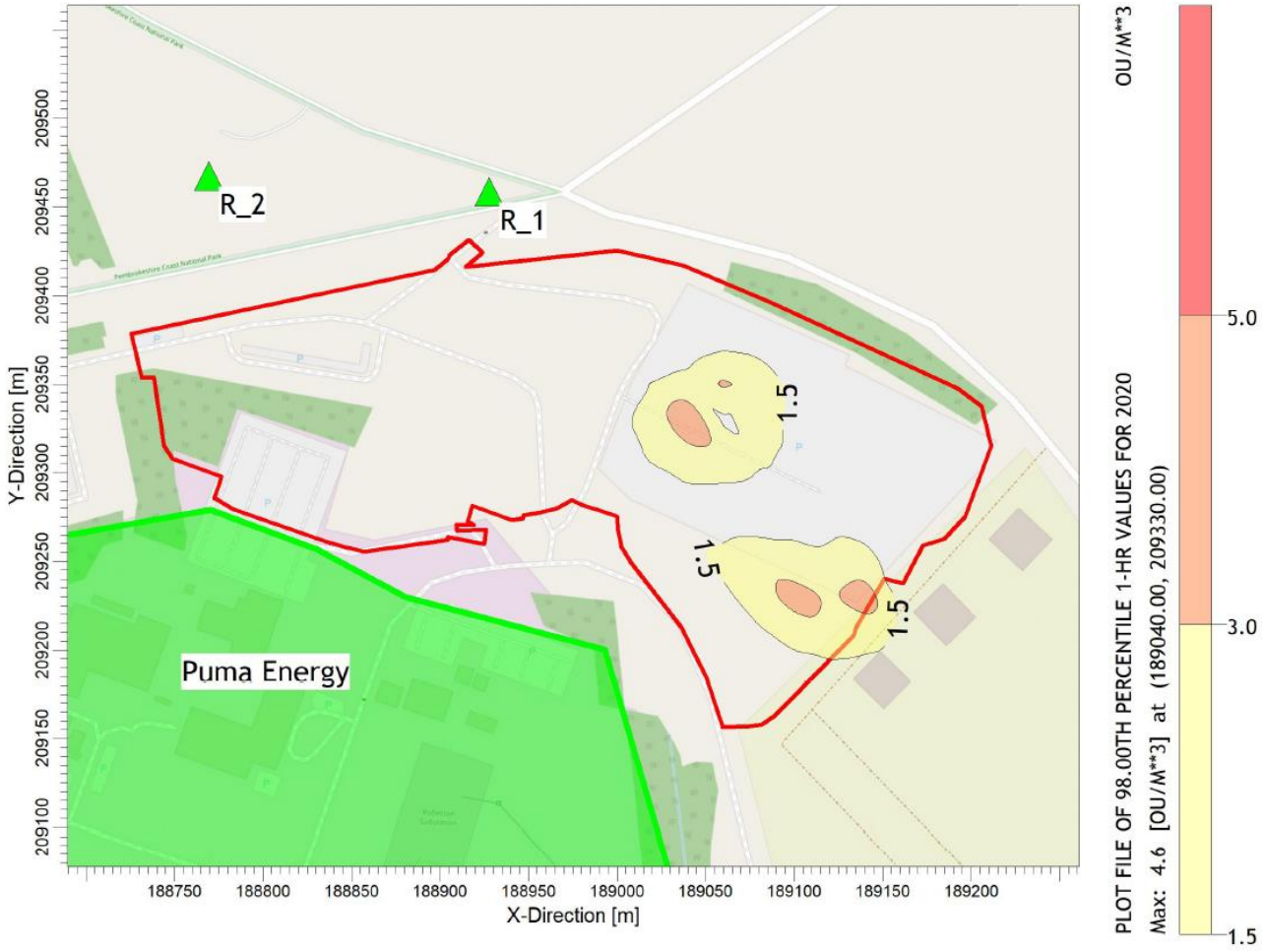


Figure A-4: Modelled $C_{98\ 1\text{-}hour}$ Odour Concentrations - 2021 Meteorological Data

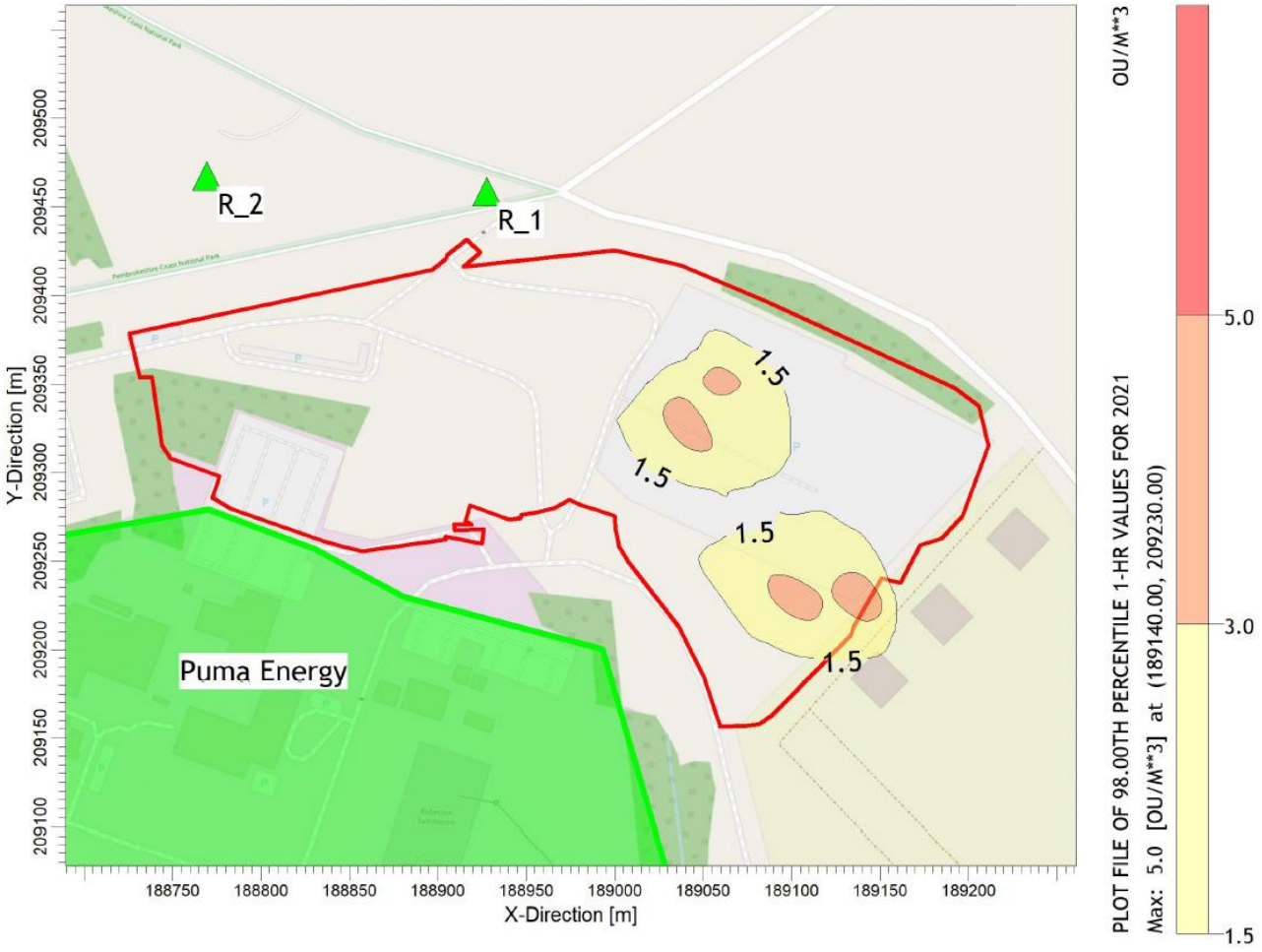


Figure A-5: Modelled $C_{98\ 1\text{-}hour}$ Odour Concentrations - 2022 Meteorological Data

Appendix B: Meteorological Data Wind Roses

Figure B-1: Milford Haven Recording Station Wind Rose (2018)

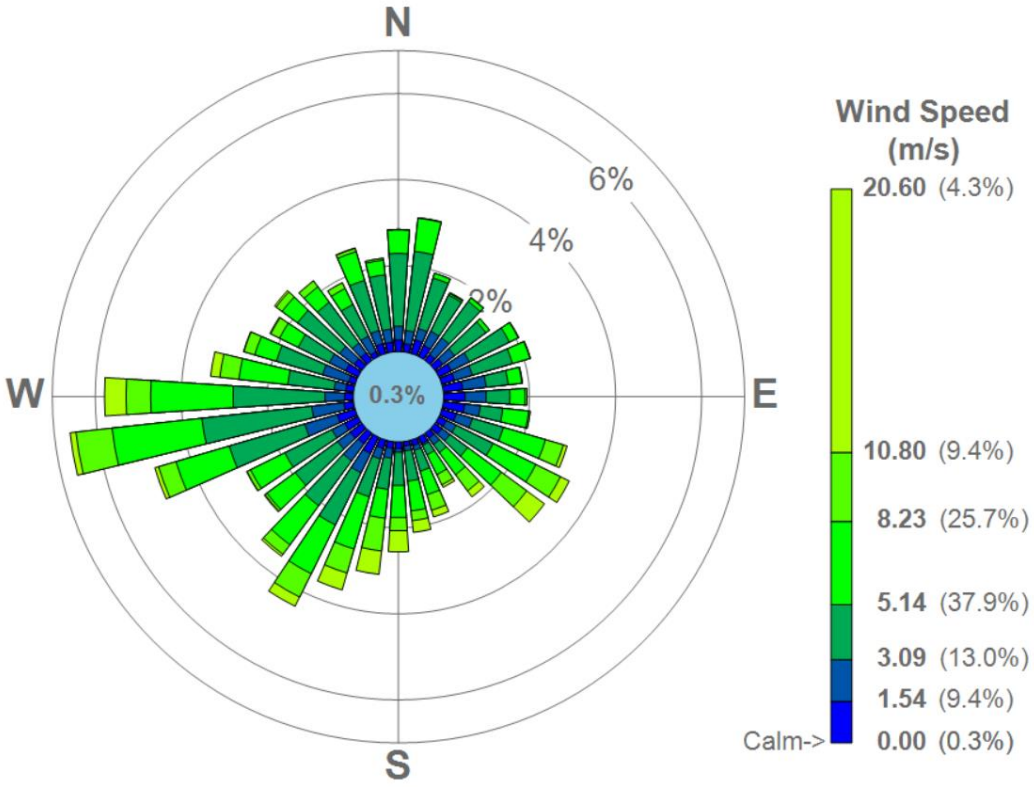


Figure B-2: Milford Haven Recording Station Wind Rose (2019)

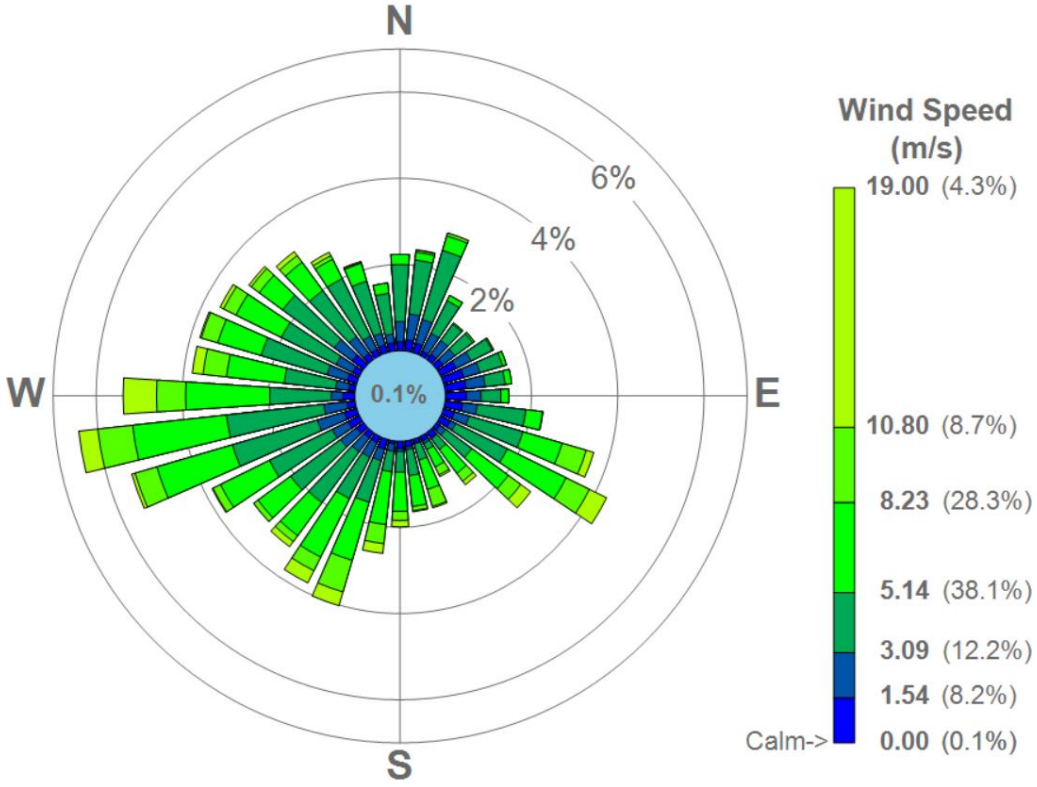


Figure B-3: Milford Haven Recording Station Wind Rose (2020)

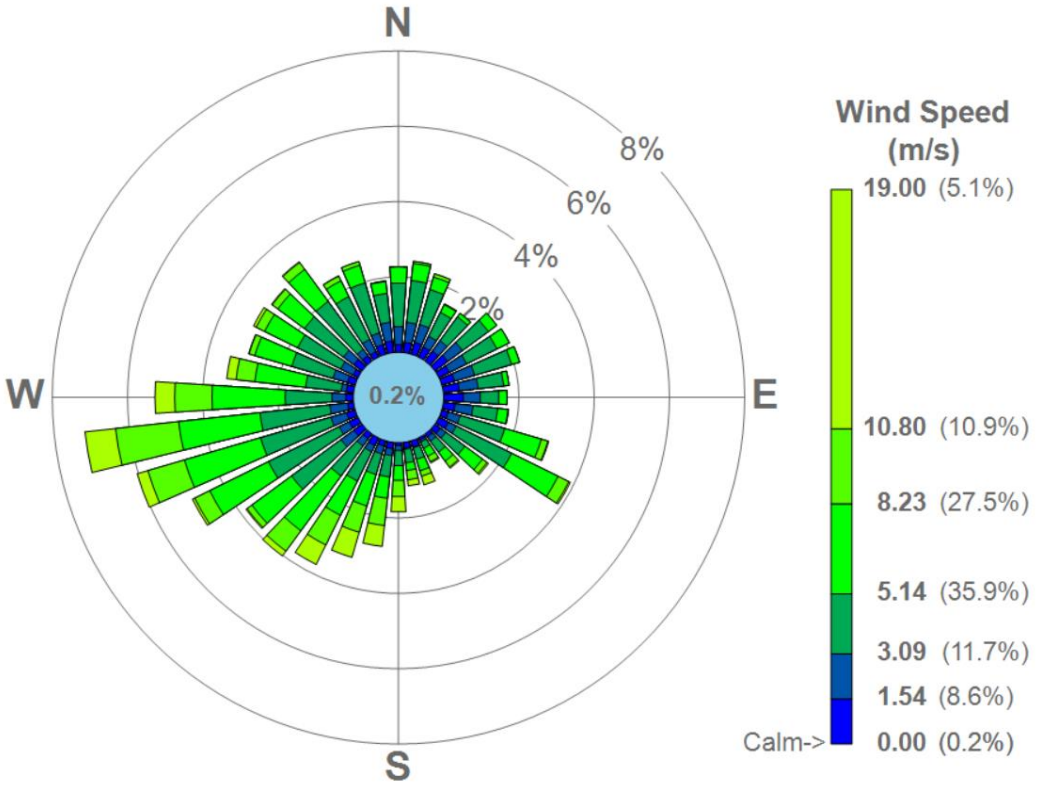


Figure B-4: Milford Haven Recording Station Wind Rose (2021)

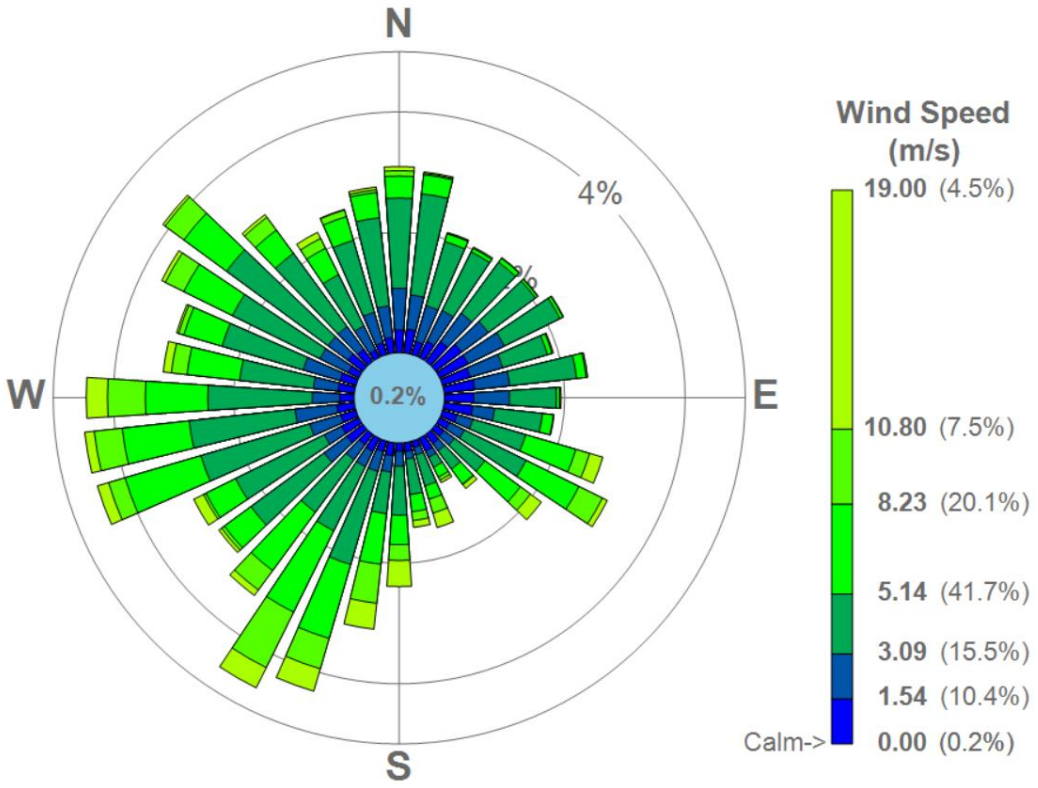
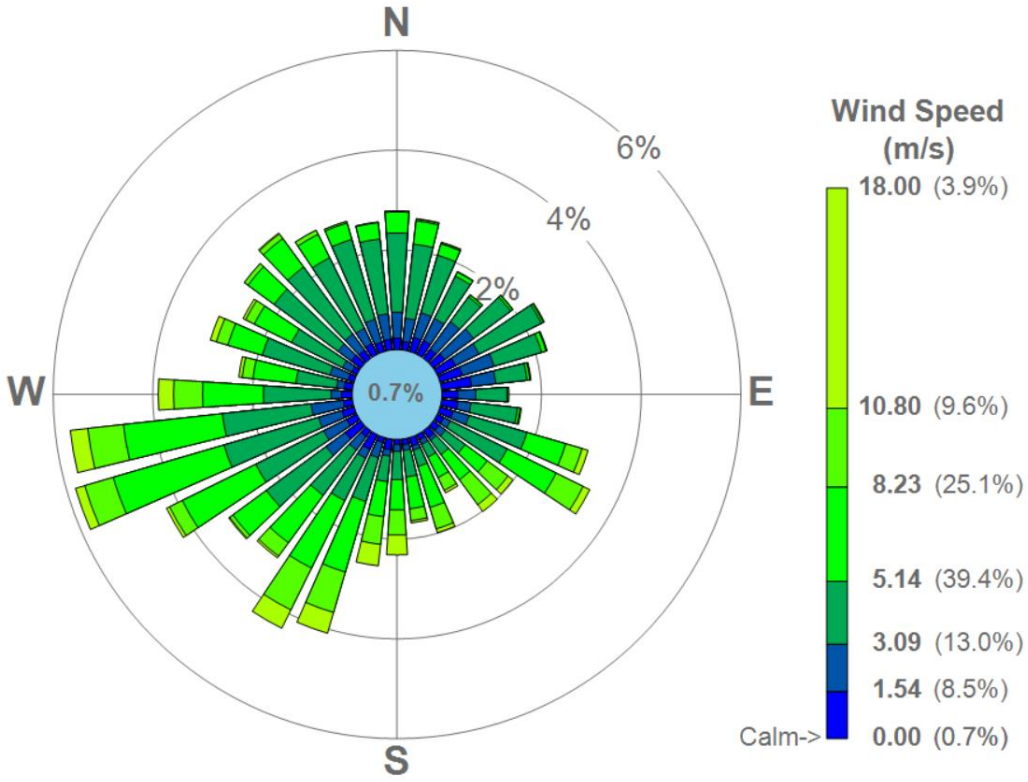


Figure B-5: Milford Haven Recording Station Wind Rose (2022)



Appendix C: Odour Potential of Waste Types

The Pembrokeshire Eco Park Facility accepts and processes a variety of material types prior to bulk removal. The Site would receive a maximum of 74,999 tpa of waste, the types of which are presented in Table C-1 below.

The inclusion of waste material types and associated odour within the Odour Impact Assessment has been determined on the basis of the considered odour potential and anticipated volume of that waste type to be received, stored and processed at the Site.

The odour potential of the different types of material has been determined in reference to recent odour monitoring studies, as well as monitoring data from a range of sites around the UK, the IAQM Odour Guidance and BREF Waste Treatment Guidance[8]. The general trend observed is that the lower the organic content of the waste type, the lower the odour potential (and also the inverse).

Green waste is an exception in that it is comprised almost entirely of organic matter but is typically associated with a low odour potential. In consideration of the similarity of green waste odours to those currently present within the site setting (agricultural)[9], the sensitivity of nearby residential receptors to green-waste type odours is likely to be low. Therefore green waste has not been considered further within this assessment.

Table C-1: Waste Types Received

Material Type	Storage Area Location	Anticipated Maximum Material Retention Time (during normal operations)	Approximate Maximum Storage Volume (m^3)	Associated Odour Potential	Considered Further Within This Assessment?
Food Waste (bay)	WTS: within Recycling Building	24-hours	25	Medium-to-high (dependent on retention time)	Yes
Food Waste (skip/trailer)		72-hours	110		
Loose Film		1-week	98	Negligible	No
Cardboard		72-hours	130	Negligible	No
Paper		1-month	130	Negligible	No
Loose Paper Bay		1-month	150	Negligible	No
Baled Cardboard		1-week	160	Negligible	No
Loose Cardboard		72-hours	120	Negligible	No
Baled Aluminium		4-months	70.2	Negligible	No
Baled Plastic		1-month	115.6	Negligible	No

[8] Best Available Techniques (BAT) Reference Document for Waste Treatment, European Commission, 2018.
[9] Green waste is typically associated with a 'grassy' or 'musty' odour, similar to that experienced in agricultural areas.

Material Type	Storage Area Location	Anticipated Maximum Material Retention Time (during normal operations)	Approximate Maximum Storage Volume (m^3)	Associated Odour Potential	Considered Further Within This Assessment?
Baled Steel		1-month	115.6	Negligible	No
Baled Cartons		4-months	115.6	Negligible	No
Red Bag (mixed recyclables)		72-hours	310	Negligible	No
Baled Carpets	WTS: external bays	3-months	210	Negligible	No
Wood		1-week	230	Negligible	No
Mattresses		1-month	216	Negligible	No
Rigid Plastic		3-months	120	Negligible	No
Glass Bay		1-week	135	Negligible	No
Tyres Bay		6-months	230	Negligible	No
Scrap Metal Bay		1-month	230	Negligible	No
UPVC Bay		6-months	230	Negligible	No
Baled Plastic Film Bay		3-months	210	Negligible	No
Residual waste	WTS: within Residual Waste Building	24-hours (weekday) 72-hours (weekend)	650	Medium	Yes
AHP (bay)		24-hours	220	Medium-to-low	Yes
AHP (skip/trailer)		14-days	110		yes
DMR		1-week	196.0	Negligible	No
Residual Waste	WRC: external bays/skips/ containers	4-days	50	Medium	Yes
Green Waste		1-week	30	Low	No
Books		3-months	1	Negligible	No
Cans and Plastics		2-weeks	1	Negligible	No
Cardboard		2-weeks	25	Negligible	No
Carpets		1-month	20	Negligible	No
Furniture - Reusable		2-weeks	30	Negligible	No
Furniture – Non - Reusable		2-weeks	30	Negligible	No
Flo Tubes		3-months	<1	Negligible	No
Gas Bottles		3-months	Bottle cage	Negligible	No
Inert/ Rubble		1-month	20yd3 skip	Negligible	No

Material Type	Storage Area Location	Anticipated Maximum Material Retention Time (during normal operations)	Approximate Maximum Storage Volume (m^3)	Associated Odour Potential	Considered Further Within This Assessment?
Litter Recycling (Bulking)		1-week	1	Negligible	No
Mattresses		2-weeks	30	Negligible	No
Mixed Glass		1-month	15	Negligible	No
Newspapers & Magazines		3-months	25	Negligible	No
Paints		3-months	30	Negligible	No
Paper		3-months	1	Negligible	No
Plastic – Hard/Rigid		2-months	30	Negligible	No
Plasterboard		2-months	30	Negligible	No
Scrap Metal		1-month	30	Negligible	No
Tetrapaks		4-months	1	Negligible	No
Textiles/ Clothing/ Shoes		2-months	1	Negligible	No
Tyres		2-months	30	Negligible	No
WEEE - CRT		1-month	TV Stillage	Negligible	No
WEEE LDA and Fridge Freezers		1-month	30	Negligible	No
WEEE SDA		1-month	15	Negligible	No
Wood/ MDF		1-week	30	Negligible	No
UPVC		3-months	30	Negligible	No

Appendix D: Odour Monitoring Data

Residual and Food Waste

Odour monitoring of residual and wood waste was undertaken by SLR in 2022 at the Rhayader bulking facility. Food waste is segregated from residual waste within the catchment of the Rhayader bulking facility (as would be the case at the Site).

The monitoring was undertaken using methods outlined in BS EN13725:2022[10]. For area sources (i.e. the surface of different types of waste), collection of odour samples was undertaken using a ventilated canopy known as a 'Lindvall hood'. The canopy was placed on the odorous material and ventilated at a known rate with clean odourless air. The odour samples were collected from the outlet of the hood using the pneumatic extraction method.

The air flow rate of ventilation air blown into the hood was measured during the monitoring exercise and utilised to calculate a specific odour emission rate per unit area per second (E_{sp}). Odour emission rates for sources where a Lindvall sampling hood was used were calculated in odour units per square metre per second ($ou_E/m^2/s$) using the following equation:

E_{sp} ($ou_E/m^2/s$) = C_{hood} x L x V

Where:

C_{hood} is the concentration result from the laboratory analysis in ou_E/m^3.

V is the flow presented to the hood in m^3/s.

L is the Lindvall hood factor: $\frac{flow\ path\ cross\ section\ of\ the\ hood\ in\ m^2}{Covered\ area\ in\ m^2}$

The 'L' factor for the specific Lindvall hood used during the Rhayader monitoring was 0.009.

For enclosed sources (i.e. the headspace within enclosed skips), collection of odour samples was undertaken using pneumatic extraction ('ambient' method). The extract air was collected into 40-litre Nalophan sampling bags for transport. The samples were then analysed at a UKAS accredited laboratory as specified in BS EN13725:2022.

The results of the monitoring are presented in Table D-1 and Table D-2 below.

[10] BS EN13725:2022 stationary source emissions – determination of odour concentration by dynamic olfactometry and odour emission rate.

Table D-1: Odour Monitoring Data – Rhayader (Area Sources)

Monitoring Location	Odour Concentration (ou_E/m^3)	Area Odour Emission Rate ($ou_E/m^2/s$)	
		Replicates	Geomean
Residual waste Import - Location 1 (A)	253	1.9	1.9
	95	0.7	
	248	1.9	
Residual waste Import - Location 2 (B)	634	4.6	
	295	2.2	
	236	1.7	
Food Waste Import #1 (A)	305	2.4	2.2
	349	2.8	
	282	2.2	
Food Waste Import #2 (A)	271	2.0	
	255	1.9	
	287	2.2	

Table notes:
(A) Monitoring undertaken within 1-hour of waste being deposited into designated bay by collection vehicle, representing the period of peak odour emissions (immediately following agitation).
(B) Monitoring undertaken within 2-hours of waste being deposited into designated bay by collection vehicle.

Table D-2: Odour Monitoring Data – Rhayader (Enclosed Sources)

Monitoring Location	Odour Concentration (ou_E/m^3)		Factor
	Replicates	Geomean	
Food Waste Skip - 24-hrs after storage (A)	2,752	2,680	1.0
	2,456		
	2,848		
Food Waste Skip - 48-hrs after storage (B)	8,647	8,037	3.0 (A)
	7,807		
	7,690		

Table notes:
(A) In consideration of the relationship observed between food waste stored for 24-hours and 48-hours, it can be extrapolated that food waste stored for 72-hours would have emissions 9 times greater than that of food waste stored for 24-hours.

Food waste has a very high organic content, and as such decomposition and putrefaction of the organic content can lead to an increase in odour emissions over time. This is evidenced by the three-fold increase in measured odour concentration between the 24- and 48-hour food waste storage skips.

AHP Waste

Odour monitoring of AHP waste was undertaken by SLR in 2021 at the Crymlyn Burrows waste management facility, as presented in Table D-3 below. This monitoring data was collected using the same methodologies and techniques as outlined in the section above. The 'L' factor for the specific Lindvall hood used during the Crymlyn Burrows monitoring was 0.015.

The AHP received at Crymlyn Burrows was sourced from local residential collection routes, and did not comprise clinical or trade-waste sources. Therefore, the AHP received at Crymlyn Burrows is considered representative of that which would be received at the Site.

Table D-3: Odour Monitoring Data – Crymlyn Burrows

Waste Type	Monitoring Date	Hood Ventilation Air Flow Rate (m^3/s)	Odour Concentration (ou_E/m^3)	Area Odour Emission Rate ($ou_E/m^2/s$)	
				Replicates	Geomean
AHP waste	21/01/2022	0.60	145	1.1	1.1
			115	1.3	
			102	0.9	

WRAP's vision is a thriving world in which climate change is no longer a problem.

Our mission is to make the world a more sustainable place. We bring people together, we act on the facts, and we drive change.

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