REPORT

Boston Alternative Energy Facility – Preliminary Environmental Information Report

Appendix 14.2 Dispersion Modelling Methodology

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Disclaimer

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A14 Appendix 14.2: Dispersion Modelling Methodology

A14.1.1 This technical Appendix provides the dispersion modelling methodology for each of the assessments carried out for the preliminary Air Quality Assessment at the Preliminary Environmental Information Report (PEIR) stage.

A14.1 Construction and Operational Road Traffic Emission Assessment Methodology

A14.1.1 The Atmospheric Dispersion Modelling System for Roads (ADMS-Roads) Version 4.1.1.0 was used to assess the potential impact on local air quality associated with vehicle exhaust emissions generated during both the construction and operational phases of the Facility. The main traffic-related pollutants of concern for human health are nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). Concentrations of these pollutants were therefore the focus of the ADMS-Roads assessment at the identified receptors located adjacent to the assessed road network.

A14.1.2 A base year of 2018 was considered in the assessment to enable model verification to be undertaken. This is the most recent full calendar year for which both meteorological data and local air quality monitoring data were available.

A14.1.3 The 2018 base year included traffic flows for the existing road network near the Application Site, which were derived from 2018 traffic count data, as provided by the Environmental Impact Assessment (EIA) project transport specialists.

A14.1.4 Peak construction of the Facility is anticipated to occur in 2021 and the Facility is anticipated to be fully completed by 2025 (See **Chapter 19 Transport**). Future assessment years of 2021 and 2025 were therefore considered, which included appropriate background traffic growth.

A14.1.5 In summary, the following scenarios were considered in the road traffic emissions assessment:

- Scenario 1 – Base / verification year (2018);
- Scenario 2 – 2021 peak construction year 'without construction';
- Scenario 3 – 2021 peak construction year 'with construction';
- Scenario 4 – 2025 operational year 'without the Facility'; and,

- Scenario 5 – 2025 operational year 'with the Facility'.

Traffic Data

A14.1.6 Traffic data for use in the air quality assessment was provided as Annual Average Daily Traffic (AADT) flows and HDV percentages on the surrounding road network. The data were derived from traffic flow and turning counts undertaken in 2018.

A14.1.7 Traffic data for the following roads were included in the air quality assessment:

- Marsh Lane;
- A16 North and South of Marsh Lane Roundabout;
- A16 Spalding Road;
- A52 Liquorpond Street;
- A16 John Adams Way;
- B1397 London Road;
- Wyberton Low Road;
- Nursery Lane / Lealand Way;
- Bittern Way.

A14.1.8 The traffic network included road links within the Boston Air Quality Management Area (AQMA). It was anticipated that there would be no change in road traffic movements through the Bargate Bridge AQMA because of the Facility, therefore roads within this AQMA were not considered in the assessment. The road networks utilised in the assessment for the Base Year and Future Year Scenarios are detailed in **Figure 14.1**.

A14.1.9 Traffic speeds were included in the dispersion model setup as follows:

- Speed data for free-flowing traffic conditions were assumed to be road link speed limits;
- Queues were included in the model at junctions where traffic lights or pedestrian crossings were present, and on entry to roundabouts. Queues were modelled as a reduced average speed of 20 kph, except for the A52 / Sleaford Road / West Street roundabout, which was modelled at 10 kph to reflect the conditions at this junction;

- All roads within the Boston AQMA were modelled at 20 kph (except for the A52 / Sleaford Road / West Street roundabout, as detailed above, which was modelled at 10kph); and
- The average speed on roundabouts was modelled at 20 kph (except for the A52 / Sleaford Road / West Street roundabout, as detailed above, which was modelled at 10 kph).

A14.1.10Traffic data used in the assessment are detailed in **Table A14.2.1**.

Table A14.2.1 Traffic Data used in the Assessment

Road Link	Verification Year (2018)		Year of Peak Construction 'without the Facility' (2021)		Year of Peak Construction 'with the Facility' (2021)		Year of Peak Operation 'without the Facility' (2025)		Year of Peak Operation 'with the Facility' (2025)		Speed
	AADT	HDV	AADT	HDV	AADT	HDV	AADT	HDV	AADT	HDV	
Marsh Lane – East of Wyberton Low Road junction	6,654	6.5%	6,921	6.5%	7,118	8.6%	7,404	6.5%	7,632	7.0%	48
Marsh Lane – West of Wyberton Low Road junction	9,165	4.9%	9,532	4.9%	9,730	6.5%	10,198	4.9%	10,427	5.3%	48
A16 – South of Marsh Lane Roundabout	19,143	4.9%	19,911	4.9%	20,131	5.7%	21,303	4.9%	21,379	5.1%	64
A16 – North of Marsh Lane Roundabout	24,535	3.9%	25,519	3.9%	25,773	4.5%	27,303	3.9%	27,504	4.0%	64
A16 (Spalding Road)	27,324	4.0%	28,420	4.0%	28,673	4.5%	30,406	4.0%	30,581	4.1%	64
A52 (Liquorpond Street)	29,808	2.3%	31,003	2.3%	31,257	2.8%	33,170	2.3%	33,283	2.4%	48
A16 (John Adams Way)	39,970	3.6%	41,573	3.6%	41,793	3.9%	44,479	3.6%	44,591	3.7%	48

Road Link	Verification Year (2018)		Year of Peak Construction 'without the Facility' (2021)		Year of Peak Construction 'with the Facility' (2021)		Year of Peak Operation 'without the Facility' (2025)		Year of Peak Operation 'with the Facility' (2025)		Speed
	AADT	HDV	AADT	HDV	AADT	HDV	AADT	HDV	AADT	HDV	
B1397 (London Road)	12,315	1.9%	12,809	1.9%	12,865	1.9%	13,704	1.9%	13,731	1.9%	48
Wyberton Low Road	2,924	0.3%	3,042	0.3%	3,042	0.3%	3,254	0.3%	3,254	0.3%	48*
Nursery Road / Lealand Way	1,600	6.3%	1,664	6.3%	1,862	14.4%	1,780	6.3%	2,009	8.0%	48
Marsh Lane	3,200	6.3%	3,328	6.3%	3,328	6.3%	3,561	6.3%	3,561	6.3%	48
Bittern Way	1,050	4.8%	1,092	4.8%	1,092	4.8%	1,168	4.8%	1,168	4.8%	48
* Part of this road has a 32 kph school slow speed zone, which was modelled at 32 kph											

Meteorological Data

A14.1.11 Hourly sequential meteorological data from the RAF Coningsby recording station for 2018 were used in the ADMS-Roads model. This recording station is located approximately 17.8 km north-west of the Application Site, and recorded data are representative of conditions at the Application Site. The use of these data was agreed with Boston Borough Council (BBC) during consultation.

A14.1.12 The wind rose from the RAF Coningsby recording station for 2018 is shown in **Plate A14.2.1**.

Model Verification

A14.1.13 Model verification is the process of adjusting model outputs to improve the consistency of modelling results with respect to available monitored data. In this assessment, model uncertainty was minimised following Defra (Defra, 2018) and Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) (IAQM & EPUK, 2017) guidance.

A14.1.14 Monitoring locations within the air quality Study Area were reviewed to establish the suitability for use in model verification. Locations were considered where the assessed road links provided suitable representation of road traffic activity and emission sources that would affect monitored concentrations at that point.

A14.1.15 A review of the monitoring data identified five NO_2 diffusion tubes operated by BBC which were located on the road network under consideration and were suitable for use in the verification process.

A14.1.16 The derivation of the model adjustment factor is detailed in **Table A14.2.2**.

Table A2.2 Model Verification

	NO_2 Diffusion Tube Monitoring Location				
	1	2	3	4	12
2018 Monitored Total NO_2 (µg.m^{-3})	42.4	44.5	48.3	39.4	31.8
2018 Background NO_2 (µg.m^{-3})	14.0	14.0	14.0	14.0	14.0
Monitored Road Contribution NO_X (total – background) (µg.m^{-3})	60.5	65.7	75.3	53.2	36.0
Modelled Road Contribution NO_X (excludes background) (µg.m^{-3})	29.7	34.2	27.9	40.4	20.3
Ratio of Monitored Road Contribution NOx / Modelled Road Contribution NOx	2.0	1.9	2.7	1.3	1.8
Adjustment Factor for Modelled Road Contribution*	**1.85**				
Adjusted Modelled Road Contribution NO_X (µg.m^{-3})	54.9	63.3	51.7	74.8	37.5
Modelled Total NO_2 (based on empirical NO_X / NO_2 relationship) (µg.m^{-3})	40.1	43.6	38.7	48.1	32.5
2018 Monitored Total NO_2 (µg.m^{-3})	42.4	44.5	48.3	39.4	31.8
% Difference [(modelled – monitored) x 100]	-5%	-2%	-20%	22%	2%

A14.1.17 As shown in **Table A14.2.2**, the verification process highlighted that model performance varied at the monitoring locations considered, which reflects the uncertainties in each of a range of factors which will influence this relationship (including the representation of road traffic flow data, vehicle speeds, and individual vehicle emissions compared to emission factors, as well as model performance in representing dispersion). The average ratio between the modelled and monitored nitrogen oxides (NOx) road contribution across the five sites was used to determine the adjustment factor applied.

A14.1.18 There is no monitoring of PM_{10} and $PM_{2.5}$ carried out within the Study Area. Therefore, the derived NOx adjustment factor was applied to the modelled PM_{10} and $PM_{2.5}$ concentrations to provide a conservative assessment (in accordance with guidance in Local Air Quality Management (LAQM) Technical Guidance TG(16), (Defra, 2018)).

Emission Factors

A14.1.19 Emission factors were obtained from the Emission Factor Toolkit v9.0 provided by Defra (Defra, 2019a). 2018 emission factors were used in Scenario 1, 2021 emission factors were used in Scenarios 2 and 3, and 2025 emission factors were used in Scenarios 4 and 5. This assumes a reduction in vehicle fleet emissions into the future.

NO_X to NO_2 Conversion

A14.1.20 NO_X concentrations were predicted using the ADMS-Roads model. The modelled road contribution of NO_X at the identified receptor locations was then converted to NO_2 using the NO_X to NO_2 calculator (v7.1) (Defra, 2019b), in accordance with the Defra guidance (Defra, 2018).

Calculation of Short-term Pollutant Concentrations

A14.1.21 Defra guidance (Defra, 2018) sets out the method for the calculation of the number of days in which the PM_{10} 24-hour Objective is exceeded, based on a relationship with the predicted PM_{10} annual mean concentration. The calculation utilised in the prediction of short-term PM_{10} concentrations was:

- No. 24-hour mean exceedances = -18.5 + 0.00145 x annual mean^3 + (206/annual mean)

A14.1.22 Research projects completed on behalf of Defra and the Devolved Administrations (Laxen and Marner, 2003, and AEAT, 2008) concluded that the hourly mean NO_2 Objective is unlikely to be exceeded if annual mean concentrations are predicted to be less than 60 µg.m^{-3}. This value was therefore used as an annual mean equivalent threshold to evaluate likely exceedance of the hourly mean NO_2 Objective.

Background Pollutant Concentration

A14.1.23 The ADMS-Roads assessment requires the use of background pollutant concentration data which correspond to the year of assessment, to which contributions from the assessed roads are added. Background NO_2, PM_{10} and $PM_{2.5}$ concentrations corresponding to the 1 km x 1 km grid squares covering the site and receptor locations were obtained from the LAQM support tools provided by Defra (Defra, 2019c) for use in the air quality assessment.

A14.1.24 Background concentrations for the verification year (2018) and future years (2021 and 2025) were obtained to establish baseline air quality conditions at the receptor locations identified.

A14.2 Operational Phase Vessel Emissions Assessment Methodology

A14.2.1 The Atmospheric Dispersion Modelling System-5 (ADMS-5) Version 5.2.4.0 was used to assess the potential impact on local air quality from vessel emissions during the operational phase of the Facility. The main pollutants of concern for human health relating to vessel emissions are NO_2, PM_{10}, $PM_{2.5}$ and sulphur dioxide (SO_2) and these pollutants were therefore the focus of the dispersion modelling assessment. Model inputs are detailed in **Figure 14.1**.

Assessment Scenarios

A14.2.2 Emissions from existing vessel activities movements on The Haven are included in the Defra mapped background pollutant concentrations. Therefore, only the impact of the additional vessel movements associated with the operation of the Facility were modelled in the assessment.

Vessel Data

A14.2.3 The estimated number of vessels that will visit the berth associated with the Facility is 1.6 per day (see **Chapter 18 Navigational Issues**). This includes both cargo vessels delivering RDF waste, and bulk vessels servicing the lightweight aggregate (LWA) plant, both with a capacity of approximately 2,500 tonnes. The engine sizes for typical bulk carriers were estimated to be higher than cargo vessels, and it was assumed that two bulk carriers would visit the Facility per day for the full duration of the year, to present a conservative scenario.

Calculation of Emissions

A14.2.4 The emission parameters and emission rates used in the dispersion model were derived using the GloMEEP Port Emission Toolkit Guidance (GloMEEP & IAPH, 2018), information provided by the client team, and previous vessel emission modelling experience.

A14.2.5 The GloMEEP guidance provides emission factors for the pollutants considered in the assessment. Since 1 January 2015, vessels travelling in the North Sea (and thus entering The Haven) are required to use ship fuel oil that does not exceed a sulphur content of 0.1% to comply with the limits for a Sulphur Emission

Control Area (SECA). These are laid down in Annex VI of the International Maritime Organisation (IMO) Maritime pollution (MARPOL) Convention. The SO_2 emission factors in the GloMEEP guidance are specified for fuel with a sulphur content of 2.7%. As such, a conversion factor of 0.037 (the ratio of 0.1 and 2.7) was applied to the SO_2 emission factors to represent expected emissions from vessels serving the Facility.

A14.2.6 Emissions associated with vessels moving in The Haven (assumed to be a Reduced Speed Zone (RSZ)), and during manoeuvring at the turning area of the Knuckle point at The Port of Boston, were represented separately in the assessment. Due to the width of the channel, it was assumed that vessels travelling up The Haven would travel at reduced speeds. Conservative speeds of 4 knots for vessels in the RSZ, and 2 knots manoeuvring at the Knuckle, were used in the ADMS model.

A14.2.7 As vessels will not operate their main or auxiliary engines once berthed at the Facility's wharfs, it was assumed that no emissions would be emitted during hotelling at the new berths.

A14.2.8 The height of the vessel stacks were estimated from representative vessel parameters. The efflux velocities, stack diameters and emission temperatures were based on previous project experience for comparable vessels.

A14.2.9 The emission parameters and emission rates input into the dispersion model for each scenario are detailed in **Table A14.2.3** and **Table A14.2.4**.

Table A2.3 Emission Parameters

Parameter		Bulk Carrier
Stack height (m)		10
Stack diameter (m)		1
Efflux velocity (m/s)	RSZ	10
	Manoeuvring	10
Temperature (C)		200

Table A2.4 Pollutant Emission Rates for Two Bulk Carriers

Pollutant	Modelled Emission Rate for Two Bulk Carrier	
	RSZ ($g.m^{-1}.s^{-1}$)	Manoeuvring ($g.m^{-1}.s^{-1}$)
Oxides of Nitrogen (NO_X)	0.00015028	0.0058676
Sulphur Dioxide (SO_2)	0.00000453	0.0001771
Particulate Matter (PM_{10})	0.00001488	0.0005754
Particulate Matter ($PM_{2.5}$)	0.00001395	0.0005394

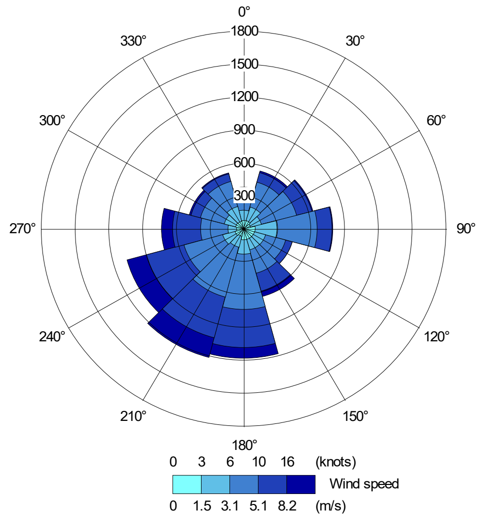
Representation of Operational Hours

A14.2.10 The tidal window for navigating The Haven is 2.5 hours before and 1.5 hours after high tide, therefore a maximum of eight hours a day. Annual mean concentrations of NO_x, PM_{10} and $PM_{2.5}$ were therefore factored by 0.33 (i.e. 8 hours divided by 24 hours).

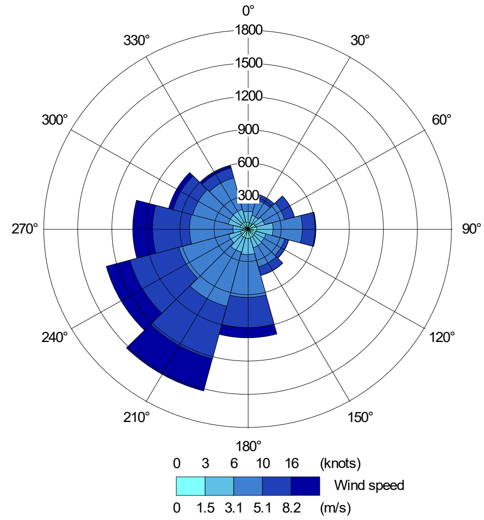
Meteorological Data

A14.2.11 Five years of hourly sequential meteorological data from the RAF Coningsby recording station were used in the dispersion model (2014 – 2018). The highest result across each of the five years of meteorological data were reported, for each pollutant and averaging time, to provide a worst case scenario. Wind roses for 2014 – 2018 are provided in **Plate A14.2.1**. These show reasonable consistency in average conditions over a five-year period but the varying peak short-term conditions are also represented.

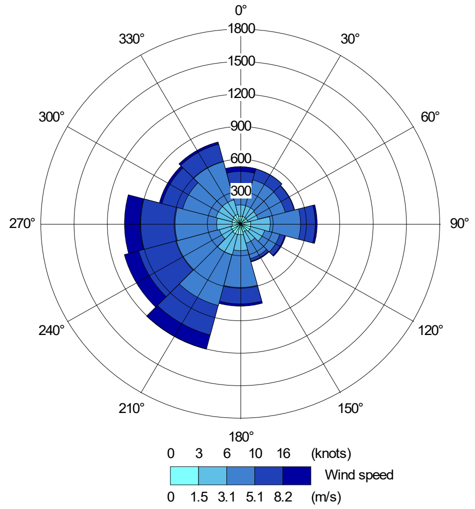
RAF Coningsby Wind Rose 2014



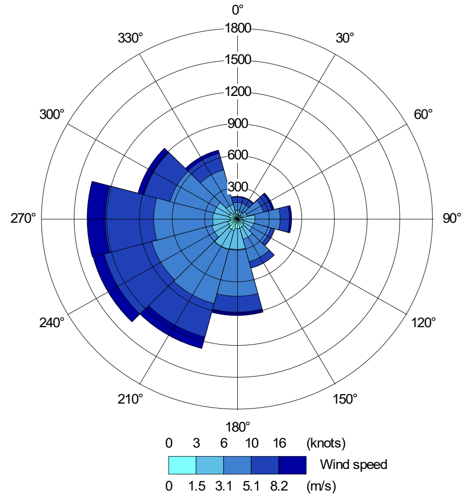
RAF Coningsby Wind Rose 2015



RAF Coningsby Wind Rose 2016



RAF Coningsby Wind Rose 2017



RAF Coningsby Wind Rose 2018

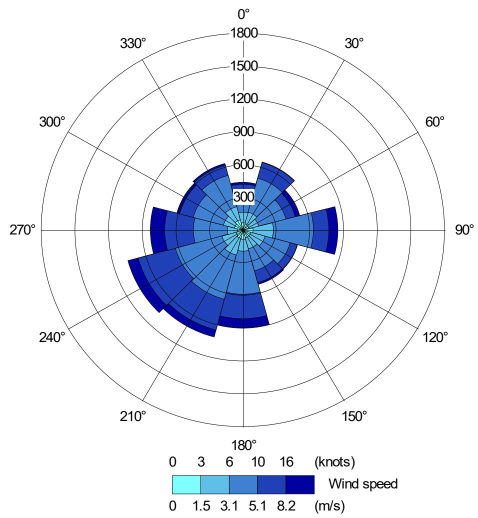


Plate A14.2.1 Coningsby Wind Rose 2014 - 2018

Terrain Data

A14.2.12 The terrain within the dispersion modelling is relatively flat (less than 1 in 10 or 10%). In accordance with the model technical guidance (CERC, 2016), terrain data were not input into the dispersion model.

Conversion of NO_X to NO_2

A14.2.13 Environment Agency (EA) technical guidance (EA, 2006) provides an approach to the conversion rates for NO_X to NO_2 in modelling studies for stack-based sources. In accordance with this guidance, the short term (1 hour) and long term (annual mean) concentrations of NO_2 were derived from the predicted NO_X concentrations using the following approach: 35% of NO_X to NO_2 for short term and 70% of NO_X to NO_2 for long term average concentrations.

A14.3 Operational Phase Stack Emissions Assessment Methodology

A14.3.1 Pollutant emissions from the proposed stacks were modelled using ADMS-5. Dispersion modelling was utilised to predict concentrations of pollutants at receptors near the Facility as a result of emissions from the stacks.

Consideration of Metals

A14.3.2 The EA published guidance in 2012, updated in 2016 (EA, 2016), regarding the consideration of Group 3 metals in dispersion modelling. This advises that a three-step approach is followed when considering Group 3 metals, which are subject to an aggregated emission limit for nine metals (antimony, arsenic, chromium, cobalt, copper, lead, manganese, nickel, vanadium and their components):

- Step 1: Assume each metal will be emitted at 100% of the emission limit modelled (i.e. 0.5 $mg.m^{-3}$). Where an exceedance of any of the assessment criteria below is predicted, proceed to Step 2:
  - Long-term Process Contribution < 1% or short-term process contribution < 10%; or
  - Long-term and short term predicted environmental concentration (PEC) <100%.
- Step 2: Make predictions assuming each metal comprises 11% of the total group (i.e. 0.5 $mg.m^{-3}$ apportioned across the nine metals). Where the impact of any metal is above the assessment criteria given in Step 1 above, proceed to Step 3.
- Step 3: justification of specific emission levels.

A14.3.3 On the basis of this screening approach, further consideration was required for hexavalent chromium, nickel and arsenic (Cr(VI), Ni and As).

A14.3.4 The EA guidance also recommends the assumption that Cr(VI) comprises 20% of the total background chromium. As not all chromium emitted from the gasifier and LWA stacks will be Cr(VI), a factor was calculated using the Cr(VI) analysis in the EA guidance document. The percentage of Cr(VI) in monitored pollutant concentrations from facilities similar to the Facility was calculated, using the mean Cr(VI) emission concentration in air pollution control (APC) residues and the total measured concentration of chromium. The maximum emission concentration of chromium as Cr(VI) was assumed to be $1.3x10^{-4}$ (Environment Agency, 2016). This factor was therefore applied to modelled total chromium values to provide a Cr(VI) concentration as emitted from the Facility.

A14.3.5 The maximum emissions concentration for Ni (0.22 $mg.Nm^{-3}$) and As (0.025 $mg.Nm^{-3}$) were obtained from the EA guidance (Environment Agency, 2016) to predict emissions of these pollutants from the Facility.

A14.3.6 For the assessment of cadmium, thallium and mercury, it was assumed that each could be emitted at the maximum emission limit concentration of 0.05 $mg.Nm^{-3}$ to provide a conservative assessment.

Process Emissions

A14.3.7 In the absence of site-specific emissions monitoring data for the proposed gasifier and LWA stacks, and to undertake a worst case assessment, the relevant Industrial Emissions Directive (Directive 2010/75/EU) (IED) emission limits, as prescribed in the Environmental Permitting (England and Wales) Regulations 2016 (as amended), were assumed for the purposes of the dispersion modelling assessment. Furthermore, it was conservatively assumed in the dispersion modelling assessment that the emissions will occur for 24 hours a day and 7 days a week (i.e. 8,760 hours per year). The actual annual operating hours will be lower due to scheduled plant downtime (e.g. planned maintenance), with a guide operation of 8,000 hours for the gasification units and 7,800 hours for the LWA. Stack emission parameters such as volumetric flow rate and temperature were provided by the design team.

A14.3.8 A stack height of 70 m was considered for the PEIR to provide a preliminary assessment. At the Environmental Statement (ES) stage, a range of stack heights will be tested for the air quality assessment.

A14.3.9 The long-term and short-term emission rates, according to the IED emissions limits for each stack considered in the assessment, are detailed in **Table A14.2.5** and **Table A14.2.6** respectively. Release parameters from each of the stacks were obtained from plant specifications.

Table A2.5 Long-Term Process Emission Rate at Proposed Gasifier Stack, LWA Stack 1&2

Parameter	Gasifier Stack	LWA Stack 1	LWA Stack 2
Release height (m)	70	70	70
Stack diameter (m)	4	3	2
Efflux velocity ($m.s^{-1}$)	28.4	23.9	26.9
Actual volumetric flow rate ($Am^{-3}.s^{-1}$)	356.9[a]	169[b]	84.5[b]
Efflux temperature (˚C)	142	110	110
Normalised volumetric flow rate ($Nm^{-3}.s^{-1}$)[c]	218.8	110	55
Pollutant Concentration ($mg.Nm^{-3}$)[c]			
PM_{10}	10.0	10.0	10.0
TOC	10.0	10.0	10.0
HCl	10.0	10.0	10.0
HF	1.0	1.0	1.0
CO	50.0	50.0	50.0
SO_2	50.0	50.0	50.0
NOx	200.0	200.0	200.0
Group I Metals (as Cd and Tl)	0.05	0.05	0.05
Group II Metals (as Hg)	0.05	0.05	0.05
Group III Metals (as Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V)	0.5	0.5	0.5
Dioxins and Furans	0.0000001	0.0000001	0.0000001
PAHs (as BaP)	0.001	0.001	0.001
NH_3	4.0	4.0	4.0

Parameter	Gasifier Stack	LWA Stack 1	LWA Stack 2
Maximum Emission Rates ($g.s^{-1}$)			
PM_{10}	2.19	1.1	0.55
TOC	2.19	1.1	0.55
HCl	2.19	1.1	0.55
HF	0.22	0.11	0.06
CO	10.94	5.5	2.75
SO_2	10.94	5.5	2.75
NOx	43.76	22	11
Group I Metals (as Cd and Tl)	0.011	0.0055	0.0028
Group II Metals (as Hg)	0.011	0.0055	0.0028
Group III Metals (as Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V)	0.11	0.055	0.028
Dioxins and Furans	0.00000002188	0.000000011	0.0000000055
PAHs (as BaP)	0.0002188	0.00011	0.000055
NH_3	0.88	0.44	0.22

[a] Actual volumetric flow rate at 415K, 10% O_2 and 17% H_2O
[b] Actual volumetric flow rate at 383K, 10% O_2 and 17% H_2O
[c] Reference Conditions: 273K, 11% O_2 and 101.3 kPa, dry gas

Table A2.6 Short-Term Process Emission Rate at Proposed Gasifier Stack, LWA Stacks 1&2

Parameter	Input for Dispersion Model		
	Gasifier Stack	LWA Stack 1	LWA Stack 2
Release height (m)	70	70	70
Stack diameter (m)	4	3	2
Efflux velocity ($m.s^{-1}$)	28.4	23.9	26.9
Actual volumetric flow rate ($Am^{-3}.s^{-1}$)	357[a]	169[b]	84.5[b]

Parameter	Input for Dispersion Model		
	Gasifier Stack	LWA Stack 1	LWA Stack 2
Efflux temperature (˚C)	142	110	110
Normalised volumetric flow rate ($Nm^{-3}.s^{-1}$)[c]	219	110	55
Pollutant Concentration ($mg.Nm^{-3}$)[c]			
PM_{10}	30.0	30.0	30.0
TOC	20.0	20.0	20.0
HCl	60.0	60.0	60.0
HF	4.0	4.0	4.0
CO	100.0	100.0	100.0
SO_2	200.0	200.0	200.0
NOx	400.0	400.0	400.0
Group I Metals (as Cd and Tl)	0.05	0.05	0.05
Group II Metals (as Hg)	0.05	0.05	0.05
Group III Metals (as Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V)	0.5	0.5	0.5
Dioxins and Furans	0.0000001	0.0000001	0.0000001
PAHs (as BaP)	0.001	0.001	0.001
NH_3	4.0	4.0	4.0
Maximum Emission Rates ($g.s^{-1}$)			
PM_{10}	6.6	3.3	1.7
TOC	4.4	2.2	1.1
HCl	13.1	6.6	3.3
HF	0.9	0.4	0.2
CO	21.9	11.0	5.5

Parameter	Input for Dispersion Model		
	Gasifier Stack	LWA Stack 1	LWA Stack 2
SO_2	43.8	22.0	11.0
NOx	87.5	44.0	22.0
Group I Metals (as Cd and Tl)	0.0109	0.0055	0.0028
Group II Metals (as Hg)	0.0109	0.0055	0.0028
Group III Metals (as Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V)	0.109	0.055	0.028
Dioxins and Furans	0.000000022	0.000000011	0.0000000055
PAHs (as BaP)	0.00022	0.00011	0.000055
NH_3	0.88	0.44	0.22

[a] Actual volumetric flow rate at 415K, 10% O_2 and 17% H_2O
[b] Actual volumetric flow rate at 383K, 10% O_2 and 17% H_2O
[c] Reference Conditions: 273K, 11% O_2 and 101.3 kPa, dry gas

Meteorological Data

A14.3.10 Five years (2014 – 2018) of hourly sequential meteorological data from the RAF Coningsby recording station were used in the ADMS-5 model. Annual wind roses for 2014 – 2018 are provided in **Plate A14.2.1**.

Terrain

A14.3.11 The terrain within the dispersion modelling is relatively flat (less than 1 in 10 or 10%). In accordance with the model technical guidance (CERC, 2016), terrain data were not input into the dispersion model, because the potential effects of elevated or undulating terrain on plume dispersion is not considered to be significant in this location.

Treatment of Buildings

A14.3.12 Buildings were incorporated into the dispersion model to predict the impact of their interaction on plume dispersion.

A14.3.13 Building dimensions and heights were provided by the design team. All buildings and structures within the site boundary were included in the model, as detailed in **Table A14.2.7**.

Table A2.7 Buildings Included in the ADMS-5 Stack Emissions Model

Building Description	Height (m)	Length (m)	Width (m)
Gasifier Plant	35.6	92	92
Workshop	17.0	40	15
LWA Plant	44.4	77	38
RDF Plant	25.0	138	100
ASCO Plant	12.2	20	30
Air Cooler Condensers	30.0	63	42
Turbine Generator Hall	17.0	40	53
Storage Silos	30.2	65	100
Office	10.0	20	20
Biomass UK No. 3 Ltd Main Building	19.0	94	40
Biomass UK No. 3 Ltd Gasifiers	23.0	100	40

Conversion of NO_X to NO_2

A14.3.14 Environment Agency technical guidance (EA, 2006) provides a conservative approach to the conversion rates for NO_X to NO_2 in modelling studies. In accordance with this guidance, the short-term (1 hour) and long-term (annual) mean concentrations of NO_2 were derived from the predicted NO_x concentrations using the following approach: 35% of NO_x to NO_2 for short-term and 70% of NO_X to NO_2 for long-term average concentrations.

A14.4 References

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