BURO HAPPOLD

069979 Aston Boiler House

Air Quality Impact Assessment

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1 Introduction

1.1 Rationale

The proposed increase to the MCPD permitting for the Aston site forms part of a wider review of all existing permits being undertaken in preparation for forthcoming regulatory changes. This proactive approach is intended to future-proof the site, ensure continued compliance with evolving environmental requirements, and align permitted capacity with realistic operational and strategic needs. Reviewing and updating the permit at this stage enables the site to maintain regulatory certainty while supporting planned investment and operational efficiencies.

The site is also undergoing a programme of decarbonisation, which includes changes to the operational role of plant, particularly with respect to backup generation. As part of this transition, operational hours for backup plant are being reviewed to ensure that they remain appropriate, effective, and sufficient to support a lower-carbon heat supply solution. Increasing the MCPD permitting capacity allows greater operational flexibility for backup plant, which in turn underpins the business case for capital investment in cleaner technologies and low-carbon infrastructure, while maintaining resilience and security of supply.

In parallel, the Aston site is being developed as a strategic contributor to the expansion of the Birmingham heat network. The connection of Aston into the wider network will enable it to support heat supply across a broader geographical area, improving efficiency and resilience at a system level. Increasing the MCPD permitted capacity ensures that the site can meet its role within the expanded network, accommodate growth in heat demand, and contribute effectively to a coordinated, low-carbon heat supply for Birmingham city centre.

1.2 Overview

This document presents the Air Quality Assessment to support a variation to the existing Specified Generator (SG) permit for the Aston University Energy Centre (hereby referred to as the 'Energy Centre'). It also assists in the application of a new Medium Combustion Plant Directive (MCPD) permit application, which will be applicable to the Energy Centre from 1 January 2029.

The Energy Centre is located within the administrative area of Birmingham City Council and is situated close to both Aston and Birmingham City Universities on the side of the A47 Jennens Road. It consists of two CHP units with a thermal input of 4.95 and 2.90 MWth, as well as two gas-fired boilers of which both have a thermal input of 3.95 MWth. Collectively, the combustion plant has a combined thermal input of 15.75 MWth. The CHP units and boiler vent to air through two stacks, which are both approximately 50m tall. Three gas-boilers were first commissioned in 1970, one of which has since been de-commissioned in 2023. The two CHP units were added in 2009.

The Energy Centre has an existing specified generator permit, issued in 2019. This was accompanied by an Air Quality Impact Assessment[1] (hereby referred to as the "Previous Air Quality Assessment"). At the time of this permit application, there were three boilers at the Energy Centre.

The assessment of emission from these units under the regulations is limited to nitrogen dioxide (NO_2) as gas fired units have negligible particulate matter (PM_{10} and $PM_{2.5}$) emissions and no emissions of sulphur dioxide (SO_2). NO_2 concentrations have been assessed through detailed dispersion modelling, using the proprietary model ADMS (version 6.0.0.1). The assessment has been carried out in accordance with the Environment Agency's (EAs) Air Emissions risk assessment for your environmental permit guidance[2].

Emissions to air have been modelled to determine the likely worst-case Predicted Environmental Concentration (PEC) at sensitive human receptor locations, which have then been assessed against the relevant air quality standards.

[1] AECOM. (2018). ENGIE Aston Boiler House - Air Quality Impact Assessment.
[2] EA and Department for Environment, Food & Rural Affairs. (2025). Guidance – Air emissions risk assessment for your environmental permit. First published in February 2016, last updated in July 2025. https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

Where suitable, the methodology and reporting have been kept consistent with the Previous Air Quality Assessment. This is clearly indicated at the beginning of the relevant sections to aid with reading.

1.3 Scope of Assessment

The text in this section is unchanged relative to the Previous Air Quality Assessment other than the change of dispersion modelling software from AERMOD to ADMS and an update to the modelled grid area.

The predicted impacts of emissions from the Energy Centre are quantified through the use of the atmospheric dispersion model, ADMS (version 6.0.0.1) to calculate the concentration of released pollutants from the on-site combustion plant. The model considers the dispersion of emissions under the meteorological conditions that have been experienced at a representative location (Birmingham Airport) during a period of five years. The spatial extent of the modelled grid is an area of approximately 2 km by 2 km, which is centred around the Energy Centre. Within this area are numerous human sensitive receptors, located within the city-wide Air Quality Management Area (AQMA).

There are no European designated ecologically sensitive receptors (i.e. RAMSAR, Special Areas of Conservation (SAC), Special Protection Areas (SPA)) located within five kilometres of the site. There are no nationally designated sites (i.e. Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR) or Local Nature Reserves (LNR)) within 2km. As such, no ecological sites are included within this assessment. The locations of the human sensitive receptors are shown in Figure 1.

The assessment considers the impact on the local air quality at relevant human sensitive receptor locations including residential properties. The assessment focusses on the likely changes in the long-term and short-term concentrations of NO_2.

2 Assessment criteria

2.1 Environmental Standards

2.1.1 Environmental Standards for the Protection of Human Health for England

The text in this section is unchanged relative to the Previous Air Quality Assessment.

The UK National Air Quality Strategy (AQS)[3] was initially published in 2000, under the requirements of the Environment Act 1995[4].The most recent revision of the strategy[5] sets objective values for key pollutants as a tool to help Local Authorities manage local air quality improvements in accordance with the EU Air Quality Framework Directive. Some of these objective values have subsequently been laid out within the Air Quality (England) Regulations 2000[6] and later amendments[7].

The value of the objectives and limit values are listed in Table 1 are the current values at the time of writing.

Table 1 AQS objectives for the protection of human health for NO_2.

Pollutant	Source	Limit (µg/m³)	Averaging Period
Nitrogen Dioxide (NO_2)	EU Air Quality Limit Values	40	Annual mean
		200	1-hour mean, not to be exceeded more than 18 times a year.

2.2 Local Air Quality Management

Under the requirements of Part IV of the Environment Act (1995)[4], Birmingham City Council has carried out a phased review and assessment of local air quality. The report states that the city continues to have air quality breaches against the annual mean objective for NO_2 with known exceedance areas being within the city centre. The primary source of air quality issues within Birmingham is road transport.

The implementation of the Birmingham clean air zone was introduced in 2021 with the intention of reducing air pollution, promote health, and drive compliance.

2.3 Air Quality Management Areas

The main air quality issue in Birmingham is elevated levels of NO_2, particularly within the city centre area as a result of road traffic emissions. Birmingham City Council has consequently declared a city-wide AQMA covering their administrative area. The AQMA is described below in Table 2.

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[3] Defra (2000), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. https://assets.publishing.service.gov.uk/media/5a758459ed915d731495a940/pb12654-air-quality-strategy-vol1-070712.pdf

[4] H.M. Government (1995) The Environment Act. https://www.legislation.gov.uk/ukpga/1995/25/enacted/data.xht?view=snippet&wrap=true

[5] Defra (2007), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. https://assets.publishing.service.gov.uk/media/5a79b5f3ed915d07d35b789c/pb12670-air-quality-strategy-vol2-070712.pdf

[6] H.M. Government. (2000). The Air Quality (England) Regulations 2000. Statutory Instrument No 928. The Stationary Office. https://www.legislation.gov.uk/uksi/2000/928/contents/made

[7] H.M. Government. (2002). The Air Quality (England) (Amendment) Regulations 2002. Statutory Instrument No 3043. The Stationary Office. https://www.legislation.gov.uk/uksi/2002/3043/contents

Table 2 Declared Air Quality Management Areas by Birmingham City Council

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City/Town	Description	Level of Exceedance (µg/m³) at declaration	2024	Action Plan
Birmingham AQMA	05/05/2005	NO_2 Annual Mean	Birmingham	Whole borough	46	31*	Birmingham City Council Air Quality Action Plan[8]

*Figure derived from average 2024 concentration from all roadside diffusion tubes within the Birmingham City Council administrative area.

The Energy Centre itself is situated within the AQMA.

[8] Birmingham City Council. (2021). Air Quality Action Plan, In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management.

3 Methodology

3.1 Overview

This section describes the approach taken to the assessment of emissions associated with the operation of the Energy Centre. An assessment scenario of the Energy Centre running at all hours of the year has been run, which is deemed to be a worst-case assumption.

3.2 Modelled operating hours

For the purposes of determining the process contribution (PC) from the Energy Centre, the model assumes continuous operation at 100% load of each of the plant throughout each of the five modelled years (8,760 hours). This is a worst-case assumption as the boilers are unlikely to be required at full load at all times in addition to the CHPs.

3.3 Screening assessment methodology

3.3.1 Human health significance criteria

The text in this section is unchanged relative to the Previous Air Quality Assessment.

The Environment Agency's screening criteria for significance of the emissions have been applied to the outcome of the dispersion modelling[9]. The predicted PCs have been compared with the appropriate AQS objective, referred to as the environmental standard within the Environment Agency (EA) guidance, to determine the significance of the pollutant emission.

The total pollutant emission is defined in the Environment Agency's Risk Assessment guidance as having an insignificant impact where:

- PC <1% of the AQS or environmental standard, or the PEC [Predicted Environmental Concentration i.e. PC + background pollutant concentration] <70% of the AQS or environmental standard for long term releases.
- PC <10% of the AQS of environmental standard, or the PC is less than 20% of the AQS or environmental standard minus twice the long-term background concentration, for short term releases.

The Environment Agency's risk assessment guidance indicates that where the AQS or environmental standard values are likely to be breached, as a result of contributions from an installation, or where installation releases constitute a major proportion of the standard or objective, such releases are likely to be considered unacceptable.

3.4 Dispersion model selection

The models software used was ADMS (v6.0.0.1) utilising meteorological data from Birmingham Airport (2020-2024). Data has been downloaded from the National Oceanographic and Atmospheric Administration Integrated Surface Database[10], via the worldmet R package[11].

3.5 Modelling of emissions from the Energy Centre stacks

3.5.1 Model inputs

The model inputs are identical to the Previous Air Quality Assessment, with the exception of the removal of Boiler 3.

[9] Environment Agency. (2025). Air emissions risk assessment for your environmental permit. First published February 2016, last updated July 2025. https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

[10] NOAA. (2025). Global Hourly - Integrated Surface Database (ISD). Accessed March 2026. https://www.ncei.noaa.gov/products/land-based-station/integrated-surface-database

[11] Carslaw, D., Davidson, J. (2026). worldmet - open source tools to access NOAA meteorological observations. R package version 1.0.0.9000, https://openair-project.github.io/worldmet/.

The general model conditions used in the assessment are summarised in Table 3. Other more detailed data used to model the dispersion of emissions is considered below.

Table 3 ADMS Model Conditions

Parameter	Unit	CHP1	CHP2	Boiler 1 / Boiler 2
Stack Grid Reference	m	407683, 287325		407686, 287323
Stack Height	m	50		
Surface roughness	m	1		
Receptors		Coordinates presented in Table 6.		
Flue internal diameter	m	0.65*	0.60*	0.51
Flue temperature	°C	120		223
Emission velocity	m/s	10.2	9.86	10.4
Volumetric flow (normalised)**	Nm^3/s	2.35	1.94	1.17
Volumetric flow (actual)	m^3/s	3.39	2.79	2.13

* assumed to give a velocity approximating 10m/s as typically used as a minimum for CHP units, as exact stack tip diameter data is not available

** normalised to standard temperature and pressure, 0% H_2O, 5% O_2

Note: The boiler emissions data has been calculated through scaling data from a similar capacity of boiler, for which emissions data was available, due to no model specific data being available for the boilers installed. The scaling has been completed based upon the gross rated thermal input for the boilers included within the site, full details of the scaling are provided within Appendix B.

3.5.2 Emissions data

The text in this section is mostly unchanged relative to the Previous Air Quality Assessment, with the exception of the table excluding Boiler 3, which was removed after the Previous Air Quality Assessment was published.

There are four emissions points at Aston Boiler House which have been considered in the assessment. The emissions rates for each of these sources are listed in Table 4.

Table 4 Source Emission Rates

Pollutant	Emission Rate (g/s)			
	CHP 1	CHP 2	Boiler 1	Boiler 2
NO_x	1.18	0.97	0.29	0.29

Note: Emissions have been calculated based on the emissions limit provided by the unit manufacturers, which are based on 5% O_2 for the CHP. Converting the modelled manufacturers emission limit of 500 mg/Nm^3 at 5% O_2 to 15% O_2, as set out in the Medium Combustion Plant Directive, gives an emission concentration of 187.5 mg/Nm^3 i.e. an emission rate consistent with the 190 mg/Nm^3 required under the regulations [Calculated assuming 500*((21-15)/(21-5))].

3.6 Use of measurement data

3.6.1 Birmingham City Council

The Birmingham City Council (BCC) monitoring locations in the vicinity of the Energy Centre are shown in Table 5, with locations in Figure 2. As shown in Figure 3, the closest monitoring locations relative to the Energy Centre have all shown an overall decline trend, and a significant decrease since the Previous Air Quality Assessment (latest data used was 2016). For example, annual average NO_2 concentrations at BHM63 has decreased by ~40% from 2016 to 2024.

Table 5 Annual average NO_2 concentrations at Birmingham City Council diffusion tubes and automatic monitoring stations within vicinity of the Energy Centre

Site type	Monitoring site	Grid Reference	Distance from Energy Centre	Site Type	Annual mean NO_2 concentration ($\mu g/m^3$)				
					2020	2021	2022	2023	2024
Automatic	BCA07	407402, 286918	500m SW	Roadside	-	32.0	33.4	34.0	29.9
	BCA01	406974, 287101	700m W	Roadside	31.9	26.7	27.6	29.0	19.5
	BCA02	407107, 287577	600m NW	Roadside	37.1	**40.3**	**43.2**	39.1	30.2
	BCA09	407828, 288067	750m NE	Roadside	-	34.3	32.9	30.4	29.7
Non-automatic	BHM63	407828, 288067	180m SW	Roadside	25.0	25.5	24.0	21.6	20.9
	BHM44	407628, 287121	200m S	Roadside	30.3	32.4	30.2	29.8	32.1
	BHM43	407611, 287110	200m S	Roadside	32.5	32.7	31.0	32.3	33.1
	BHM45	407604, 287032	300m S	Roadside	39.4	**40.7**	32.4	36.9	37.5
	BHM46	407547, 287047	300m S	Roadside	**42.3**	**50.3**	**47.3**	**58.8**	**67.5**
	BHM42	407548, 287107	250m SW	Roadside	32.3	32.8	32.3	31.2	31.3
	BHM40	407407, 287092	350m SW	Roadside	**43.8**	**50.0**	**50.0**	**51.5**	**52.6**
	BHM41	407399, 287078	370m SW	Roadside	**41.8**	**50.9**	35.0	38.9	36.3
	BHM39	407259, 287110	460m SW	Roadside	30.5	33.6	-	-	33.4
	BHM16	407321, 287531	400m NW	Roadside	34.7	32.7	31.5	29.2	26.9
	BHM50	407433, 286922	450m SW	Roadside	**41.1**	**41.1**	36.8	**41.4**	**40.0**

Note: exceedances of the AQO are shown in **bold**.

Several of the monitoring locations which are located near to congested roads experience annual mean nitrogen dioxide above the annual mean objective. However, BHM63, the closest monitoring site to Aston Boiler House, has not recorded exceedances of the annual mean objective in the previous five years.

3.7 Modelled domain - sensitive human receptors

3.7.1 Sensitive human receptors

The modelled sensitive human receptor locations have remained unchanged from the Previous Air Quality Assessment, with the exception of additional receptors at new residential buildings.

NO_2 concentrations have been predicted at sensitive human receptors, as listed in Table 6. The locations of the sensitive human receptors are displayed in Figure 1. Concentrations have been modelled at 3 m intervals to the maximum building height, so that concentrations representative of upper floors can be assessed. The sensitive human receptors have been selected to be representative of residential dwellings and recreational areas around the Energy Centre. For ground floor sensitive human receptors, the height has been set at 1.5 m as a representative breathing height.

Receptors R30 and R31 are new relative to the Previous Air Quality Assessment, added as a result of the construction of the new One Eastside Tower development to the south-west of the Energy Centre.

Table 6 Sensitive human receptors information

Receptor ID	X (m)	Y (m)	Min height (m)	Max height (m)	Height interval (m)	Description	Direction and distance from source
R1	407623	287097	1.5	19.5	3	Birmingham City University	240 m SW
R2	407658	287171	1.5	7.5	3	Housing	160 m SW
R3	407671	287144	1.5	31.5	3	Unite Students Jennens	180 m SW
R4	407684	287244	1.5	16.5	3	Birmingham Science Museum	80 m S
R5	407744	287198	1.5	16.5	3	Millennium Point	140 m SE
R6	407809	287293	1.5	13.5	3	Birmingham Arts Design and Media	130 m E
R7	407813	287363	1.5	19.5	3	Birmingham University Conservatoire	140 m E
R8	407744	287299	1.5	31.5	3	Birmingham Ormiston Academy	60 m SE
R9	407859	287496	1.5	4.5	3	Nursery	240 m NE
R10	407765	287486	1.5	10.5	3	Neuro Science Research	180 m N
R11	407748	287443	1.5	10.5	3	Academy of Life Sciences Building	135 m NE
R12	407685	287504	1.5	13.5	3	Library	180 m N
R13	407713	287348	1.5	22.5	3	Unite Students James Watt	40 m E
R14	407715	287409	1.5	28.5	3	Unite Students James Watt	90 m NE
R15	407689	287358	1.5	1.5	3	Football pitch	30 m NE

Receptor ID	X (m)	Y (m)	Min height (m)	Max height (m)	Height interval (m)	Description	Direction and distance from source
R16	407556	287451	1.5	13.5	3	University Building (accommodation)	180 m NW
R17	407595	287513	1.5	13.5	3	University Building (accommodation)	210 m N
R18	407665	287470	1.5	46.5	3	Unite Students James Watt	145 m N
R19	407563	287498	1.5	25.5	3	University Building (accommodation)	210 m NW
R20	407539	287439	1.5	13.5	3	University Building (accommodation)	180 m NW
R21	407518	287400	1.5	13.5	3	University Building (accommodation)	180 m NW
R22	407484	287395	1.5	52.5	3	University Building (accommodation)	210 m NW
R23	407519	287373	1.5	3	3	Bike Shed	170 m W
R24	407518	287358	1.5	10.5	3	University Building (accommodation)	170 m NW
R25	407485	287360	1.5	19.5	3	University Building (accommodation)	210 m W
R26	407554	287288	1.5	28.5	3	University Building (accommodation)	130 m W
R27	407508	287244	1.5	46.5	3	University Building (accommodation)	190 m W
R28	407573	287240	1.5	25.5	3	University Building (accommodation)	140 m W
R29	407659	287288	1.5	22.5	3	Birmingham Met College	40 m SW
R30	407548	287262	1.5	49.5	3	One Eastside Tower	150 m SW
R31	407582	287185	1.5	154.5	3	One Eastside Tower	175 m SW

3.8 Summary of background air quality

The annual background concentration of NO_2 (Table 7) has been sourced from monitoring at the BHM63 diffusion tube site operated by BCC. The short term NO_2 concentration (Table 8) has been calculated by multiplying the annual mean concentration by two. The local background concentrations have been applied to all sensitive human receptors considered.

Table 7 Long-Term Background contribution for each sensitive human receptor

	Long-Term Background Concentration (NO_2)				
Receptor	2020	2021	2022	2023	2024
All-Sensitive Human Receptors	25.0	25.5	24.0	21.6	20.9

Table 8 Short-term background concentration used for each sensitive human receptor

	Short-Term Background Concentration (NO_2)				
Receptor	**2020**	**2021**	**2022**	**2023**	**2024**
All- Sensitive Human Receptors	50.0	51.0	48.0	43.2	41.8

As shown in Table 9, the latest available data from BCC diffusion tube BHM63 shows a considerable reduction in annual average NO_2 concentration, with a 11.5 - 15.1 μg/m^3 decrease (approximately 32 - 42%) when comparing the latest data utilised in the Previous Air Quality Assessment to the most recent data. As a result, this air quality assessment updates the baseline to reflect current observed air quality conditions.

Table 9 Comparison of latest available data for baseline background concentrations for the Previous Air Quality Assessment and this study

Assessment	Year	Background annual average NO_2 concentration utilised (μg/m^3)	Source
Previous Air Quality Assessment	2016	36.0	BHM63 diffusion tube
Current Air Quality Assessment	2020 - 2024	25.5 - 20.9	BHM63 diffusion tube

3.8.1 Modelled domain - receptor grid

The dispersion model output is reported as a grid of values, in addition to the sensitive human receptors detailed above. The grid extends approximately 1950 m in the x direction and 1850 m in the y direction. Details of the receptor grid are summarised in Table 10. Gridded model reports are reported at the height of 1.5 m. Both long term and short term modelled grids represent concentrations for the worst-case year (2021).

Table 10 Modelled grid resolution

Grid Spacing (m)	Dimensions (m)	No. of Nodes in Each Direction	National Grid Reference of SW corner
20	1950 x 1850	100	406697, 286438

3.9 Meteorological data

This section is unchanged relative to the Previous Air Quality Assessment, with the exception of the years of meteorological data used.

Hourly sequential data from Birmingham International Airport meteorological station for the years 2020 to 2024 inclusive were used in this study. The station is situated within Elmdon, approximately 10 km to the south west and is considered to be representative of meteorological conditions experienced at the point of release. Due to the amount of missing data in the dataset, gap filling of data has been carried out using the Coleshill meteorological station, 13 km to the east of the Energy Centre. This ensures that there is well over 80% data availability for each year.

A visual representation of the meteorological data used in the assessment is shown in the wind roses presented in Figure 4 . The wind roses demonstrate that the wind is predominantly from the south-south-east round to the north west, with very few incidences occurring from the east or north east.

3.10 Building downwash effects

The buildings surrounding the Energy Centre have the potential to generate turbulence and effect pollutant dispersion. Buildings also have the potential to entrain emissions and to reduce the effective release height of the emission. ADMS has therefore been used to model the effects of building downwash.

The buildings present directly around the stack, considered to be of sufficient height and massing to potentially impact on the dispersion of emissions from the release points as defined by EA criteria[12], have been included in the model. ADMS resolves buildings as a single "effective building" and one "main building". The option to automatically select the main based on the source location and each meteorological data line was selected.

This differs to the Previous Air Quality Assessment which utilised the AERMOD building effects modules. It also includes only the buildings that meet the criteria in the current guidance and therefore less buildings are included in the model compared to the Previous Air Quality Assessment.

Table 11 presents the buildings included within the model and these are also illustrated in Figure 1.

Table 11 Building parameters

Building	X(m)	Y(m)	Height (m)	Length (m)	Width (m)	Angle (Degrees)
BLD_1	407726.2	287270.6	26	19	59	138
BLD_2.1	407641.3	287261.0	35	60	19	225
BLD_2.2	407595.5	287262.6	35	54	19	323
BLD_2.3	407590.3	287240.2	35	24	18	253
BLD_3	407689.6	287206.4	34	40	53	45
BLD_4	407815.9	287344.5	25	78	27	51
BLD_5.1	407724.2	287373.8	27	14	14	43
BLD_5.2	407746.3	287374.1	27	79	14	43
BLD_5.3	407748.6	287415.9	27	14	39	44
BLD_6	407723.3	287426.1	29	15	33	129
BLD_7.1	407701.9	287458.3	37	58	15	133
BLD_7.2	407675.9	287460.7	32	17	18	132
BLD_8.1	407673.3	287485.9	47	22	15	316
BLD_8.2	407665.4	287476.9	47	8	9	221
BLD_10	407576.1	287471.0	14	49	16	48
BLD_11	407519.3	287417.7	14	15	31	86

[12] i.e. the stack height is less than 2.5 times the height of a building and the distance of a building from the stack is less than 5L – where L is the lesser dimension of the building height and maximum projected width (such as the distance between 2 opposing corners of a roof), as per EA guidance on specified generators: dispersion modelling assessment (https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment#model-the-effect-of-buildings-and-terrain)

Building	X(m)	Y(m)	Height (m)	Length (m)	Width (m)	Angle (Degrees)
BLD_14	407561.1	287517.0	26	31	14	145
BLD_17	407480.9	287452.3	27	16	46	107
BLD_18	407474.1	287412.7	52	14	31	74
BLD_20	407499.8	287255.5	47	19	17	89
BLD_22	407537.6	287294.4	29	13	24	51
BLD_23	407488.6	287309.2	20	100	12	347
BLD_23.1	407551.9	287241.8	50	37	17	143
BLD_24	407549.0	287190.5	155	31	58	41

3.11 Terrain

The model domain does not contain any significant gradients that would be anticipated to significantly impact air pollutant dispersion (i.e. with a greater than 1:10 ratio). Therefore, terrain effects have not been included in the modelling. This differs from the Previous Air Quality Assessment that did include terrain effects within AERMOD.

3.12 Surface Roughness

The surface roughness used is unchanged relative to the Previous Air Quality Assessment.

A surface roughness of 1 m was used to represent the surface roughness of the land surrounding the Energy Centre and fits the description of the landscape between the emission points and the closest sensitive human receptors.

3.13 Specialised Model Treatments

The text in this section is unchanged relative to the Previous Air Quality Assessment.

Emissions have been modelled such that they are not subject to dry and wet deposition or depleted through chemical reactions. The assumption of continuity of mass is likely to result in an overestimation of impacts at sensitive human receptors.

3.14 Oxides of nitrogen to nitrogen dioxide conversion

The text in this section is unchanged relative to the Previous Air Quality Assessment.

Emissions of oxides of nitrogen (NOx) from the main stack will consist mainly of nitric oxide (NO) at the point of release.

A number of mechanisms are known that result in an increasing proportion of the oxides of nitrogen being in the form of nitrogen dioxide with increasing distance from the point of release. The approach undertaken in the assessment of effects from continuously operating power plant is to use default values from Environment Agency's risk assessment methods, which are:

- to assume 70% of oxides of nitrogen present as nitrogen dioxide at ground level, plus the background nitrogen dioxide concentration in the calculation of long-term annual mean calculations; and
- to assume 35% oxides of nitrogen present as nitrogen dioxide at ground level, plus double the background nitrogen dioxide concentration in the calculation of short-term hourly concentrations.

3.15 Modelling Limitations and Assumptions

The plant was consented some years ago and not all the model input information associated with a new build Energy Centre is to hand. Therefore, reasonable assumptions have been made that are consistent with the Previous Air Quality Assessment.

The key limitations and assumptions are:

- The boiler emissions data has been calculated through scaling data from a similar capacity of boiler, for which emissions data was available, due to no model specific data being available for the boilers installed. The scaling has been completed based upon the gross rated thermal input for the boilers included within the Energy Centre, full details of the scaling are provided within Appendix B.
- The operator of the Energy Centre was unable to supply an internal diameter for the flue at the point of release. Therefore, the stack diameter for the CHP has been estimated, on the basis that it is commonplace for a CHP to achieve a velocity of 10 m/s.
- The background concentration used within the assessment already accounts for the operation of the modelled plant. As such, the results presented provide a worst-case scenario.
- Within ADMS (v6.0.0.1), modelled buildings are represented as simple rectangular blocks, only accounting for height, width, length, and orientation. The model then further simplifies these into an "effective building" and a "main building". As a result, complex geometries are not explicitly defined within the modelling software. Additionally, ADMS does not allow for the modelling of more than 25 buildings.
- There is inherent uncertainty in dispersion modelling as it is attempting to resolve real-work conditions using a series of algorithms. Therefore, a series of worst-case assumptions have been made to help account for this uncertainty. This includes use of ground level background concentrations even at upper levels and assuming that all plant is running at 100% load for the entire year.

4 Impact Assessment

4.1 Human Health Impacts

This section presents the magnitude of the impacts at sensitive human receptor locations in terms of the contribution from the current activity, also termed the Process Contribution (PC). The total pollutant concentration (also termed the predicted environmental concentration (PEC)) is the sum of the contribution from background sources and the process contribution and is also reported at all sensitive human receptors. For each table the maximum PC has been reported for each building and a note made as to which height this PC occurred. The discussion of the significance of the effect of the predicted impacts is set out in Section 4.1.3 after the tabulated results.

Table 12 includes the predicted maximum annual mean NO_2 concentrations at modelled sensitive human receptors with comparison against the assessment level criteria of 40μg/m^3. Table 13 presents the predicted maximum 1-hour 99.79th NO_2 concentrations at modelled sensitive human receptors against the assessment level criteria of 200μg/m^3.

Figure 5 displays contours of the annual mean NO_2 PEC for the worst-case meteorological year of 2021 at 1.5 m, derived from the gridded model output. Similarly, Figure 6 displays the 99.79th percentile NO_2 PC for the meteorological year of 2021.

4.1.1 Annual Mean Nitrogen Dioxide

Table 12 Modelled Results for annual mean NO_2.

Receptor	Height of most impacted receptor	Process Contribution of NO_2 ($\mu g/m^3$)					Max Process Contribution of NO_2 ($\mu g/m^3$)	PC as a proportion of the criteria for annual NO2 (%)	Maximum Total PEC ($\mu g/m^3$)	Year of Max PEC	PEC as a proportion of criteria for annual NO_2 (%)
		2020	2021	2022	2023	2024					
R1	19.5	1.1	1.5	1.0	1.2	1.1	1.5	3.8	27.0	2021	68
R2	7.5	0.6	0.9	0.6	0.7	0.6	0.9	2.3	26.4	2021	66
R3	25.5	1.3	2.0	1.4	1.6	1.4	2.0	4.9	27.5	2021	69
R4	16.5	0.5	0.8	0.6	0.6	0.5	0.8	1.9	26.3	2021	66
R5	16.5	0.8	1.1	1.0	0.9	0.9	1.1	2.8	26.6	2021	67
R6	13.5	0.2	0.2	0.3	0.3	0.3	0.3	0.8	25.7	2021	64
R7	19.5	2.0	1.5	1.7	2.1	2.0	2.1	5.1	27.0	2021	68
R8	31.5	0.7	0.8	1.0	0.9	1.0	1.0	2.5	26.3	2021	66
R9	4.5	2.1	1.7	1.8	2.2	2.0	2.2	5.5	27.2	2021	68
R10	10.5	4.1	3.7	3.7	3.9	4.0	4.1	10.3	29.2	2021	73
R11	10.5	4.3	3.8	3.8	4.0	4.1	4.3	10.7	29.3	2020	73
R12	13.5	3.8	3.5	4.1	3.3	3.6	4.1	10.1	29.0	2021	73
R13	22.5	0.4	0.3	0.3	0.4	0.4	0.4	1.0	25.8	2021	65
R14	1.5	2.2	1.9	1.9	2.0	2.0	2.2	5.5	27.4	2021	69
R15	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	25.5	2021	64
R16	13.5	1.2	1.0	1.5	1.2	1.3	1.5	3.8	26.5	2021	66
R17	13.5	2.1	1.8	2.6	1.9	2.0	2.6	6.5	27.3	2021	68

Receptor	Height of most impacted receptor	Process Contribution of NO_2 (μg/m^3)					Max Process Contribution of NO_2 (μg/m^3)	PC as a proportion of the criteria for annual NO2 (%)	Maximum Total PEC (μg/m^3)	Year of Max PEC	PEC as a proportion of criteria for annual NO_2 (%)
		2020	2021	2022	2023	2024					
R18	46.5	8.4	8.6	10.1	8.8	8.7	10.1	25.2	34.1	2021	85
R19	25.5	2.0	1.8	2.6	2.1	2.1	2.6	6.5	27.3	2021	68
R20	13.5	0.9	0.8	1.2	1.0	1.1	1.2	3.0	26.3	2021	66
R21	13.5	0.7	0.7	0.8	0.8	0.8	0.8	2.1	26.2	2021	66
R22	52.5	1.2	1.6	1.5	1.6	1.9	1.9	4.7	27.1	2021	68
R23	6.0	0.5	0.6	0.6	0.6	0.6	0.6	1.6	26.1	2021	65
R24	10.5	0.6	0.7	0.6	0.7	0.6	0.7	1.8	26.2	2021	66
R25	19.5	0.7	0.8	0.7	0.8	0.7	0.8	2.1	26.3	2021	66
R26	28.5	1.9	2.0	1.6	1.8	1.4	2.0	5.1	27.5	2021	69
R27	46.5	1.9	2.2	1.5	1.8	1.7	2.2	5.5	27.7	2021	69
R28	25.5	2.1	2.3	1.5	1.9	1.8	2.3	5.7	27.8	2021	69
R29	22.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	25.5	2021	64
R30	49.5	3.1	3.6	2.4	2.9	2.8	3.6	8.9	29.1	2021	73
R31	58.5	4.5	5.3	3.7	4.0	4.6	5.3	13.3	30.8	2021	77

4.1.2 Hourly Mean Nitrogen Dioxide

Table 13 Modelled results for 99.79th percentile of hourly mean NO_2.

Receptor	Height of most impacted receptor	Process Contribution of NO_2 (µg/m³)					Max Process Contribution of NO_2 (µg/m³)	PC as a proportion of the criteria for annual NO2 (%)	Maximum Total PEC (µg/m³)	Year of Max PEC	PEC as a proportion of criteria for annual NO_2 (%)
		2020	2021	2022	2023	2024					
R1	19.5	14.4	17.0	16.6	17.3	15.0	17.3	8.7	68.0	2021	34
R2	7.5	13.9	17.2	18.3	15.7	15.2	18.3	9.1	68.2	2021	34
R3	25.5	21.4	25.2	26.6	24.0	23.4	26.6	13.3	76.2	2021	38
R4	16.5	10.4	15.7	14.4	16.1	11.9	16.1	8.0	66.7	2021	33
R5	16.5	13.9	20.6	16.6	19.1	13.9	20.6	10.3	71.6	2021	36
R6	13.5	5.2	6.2	6.2	6.6	5.7	6.6	3.3	57.2	2021	29
R7	19.5	16.6	16.1	18.6	17.7	19.3	19.3	9.7	67.1	2021	34
R8	31.5	16.5	18.3	17.8	18.1	18.0	18.3	9.2	69.3	2021	35
R9	4.5	14.3	14.7	14.6	14.6	14.6	14.7	7.4	65.7	2021	33
R10	10.5	17.7	17.9	18.0	18.4	18.7	18.7	9.3	68.9	2021	34
R11	10.5	17.4	18.9	19.2	19.8	19.7	19.8	9.9	69.9	2021	35
R12	13.5	17.5	17.9	17.7	18.2	17.9	18.2	9.1	68.9	2021	34
R13	22.5	5.2	6.2	5.4	7.3	6.4	7.3	3.7	57.2	2021	29
R14	1.5	11.7	13.8	14.2	14.2	14.7	14.7	7.4	64.8	2021	32
R15	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	51.0	2021	26
R16	13.5	14.8	13.7	14.4	13.2	13.2	14.8	7.4	64.8	2020	32
R17	13.5	15.2	15.4	15.6	15.2	15.7	15.7	7.8	66.4	2021	33

Receptor	Height of most impacted receptor	Process Contribution of NO_2 (µg/m³)					Max Process Contribution of NO_2 (µg/m³)	PC as a proportion of the criteria for annual NO2 (%)	Maximum Total PEC (µg/m³)	Year of Max PEC	PEC as a proportion of criteria for annual NO_2 (%)
		2020	2021	2022	2023	2024					
R18	46.5	92.6	99.3	98.7	100.5	97.9	100.5	50.2	150.3	2021	75
R19	25.5	16.3	16.6	17.0	16.7	16.5	17.0	8.5	67.6	2021	34
R20	13.5	13.9	12.8	13.8	12.8	12.9	13.9	7.0	63.9	2020	32
R21	13.5	13.1	12.0	12.1	12.4	12.0	13.1	6.6	63.1	2020	32
R22	52.5	35.6	40.9	36.9	37.1	40.9	40.9	20.5	91.9	2021	46
R23	6	12.1	11.9	11.2	10.4	10.6	12.1	6.1	62.9	2021	31
R24	10.5	12.4	12.1	11.8	10.1	10.4	12.4	6.2	63.1	2021	32
R25	19.5	12.4	12.1	12.2	11.4	11.7	12.4	6.2	63.1	2021	32
R26	28.5	28.2	26.8	25.5	23.9	25.0	28.2	14.1	78.2	2020	39
R27	46.5	31.0	34.8	29.9	29.6	36.7	36.7	18.4	85.8	2021	43
R28	25.5	20.7	22.3	22.0	19.7	21.2	22.3	11.1	73.3	2021	37
R29	22.5	2.6	3.0	3.2	2.4	2.1	3.2	1.6	54.0	2021	27
R30	49.5	51.8	58.3	48.8	49.2	64.6	64.6	32.3	109.3	2021	55
R31	61.5	107.9	83.3	87.6	90.7	90.8	107.9	53.9	157.9	2020	79

4.1.3 Human Health Receptors Discussion

The predicted impact on annual mean NO_2 concentrations are less than 1% of the AQS objective for annual mean nitrogen dioxide, i.e. less than 0.4 µg/m^3, at three sensitive human receptors; R6, R15 and R29 (Table 12). These receptors can, therefore, be screened out because the predicted changes are insignificant as per the EA Screening Criteria.

The remaining sensitive human receptors cannot be screened out on the basis of PC alone and have therefore been considered using PECs. The annual mean PECs at all sensitive human receptors are below the AQS objective of 40 µg/m^3, with the maximum PEC predicted to be 34.1 µg/m^3 at receptor R18 at 46.5 m above ground level at the James Watt building. This is equivalent to approximately 85% of the AQS objective. Therefore, no sensitive human receptors are within 90% of the AQS objective and no significant adverse effects on human health are expected in terms of annual mean NO_2 concentrations.

The maximum short-term PCs are less than 10% of the 1-hour mean NO_2 AQS objective (200 µg/m^3) at 22 receptors and can therefore be screened out as insignificant in accordance with EA screening criteria. All sensitive human receptors experience 99.79th percentile PECs in compliance with the AQS objective. The maximum predicted short term PEC is 157.9 µg/m^3 at receptor R31 at 61.5 m above ground level of the One Eastside tower. This is approximately 79% of the 1-hour AQS objective. As such, no significant adverse effects on human health are expected in terms of hourly average NO_2 concentrations.

This is despite the modelling utilising several worst-case assumptions, for example it does not account for improvements in background concentrations at height (worst-case modelled concentrations were at 46.5 m above ground level for long-term and 61.5 m for short-term concentrations). Furthermore, it should also be noted that as Aston Boiler House are already operational, its emissions are already included within background NO_2 concentrations, and as such the PC from Aston Boiler House has been doubled counted within the PEC.

Additionally, the model assumes continuous operation of the Energy Centre at 100% load for each of the plant for every hour of the year. In reality, the boilers are unlikely to be required at full load at all times in addition to the CHPs.

4.2 Summary

The air quality assessment has predicted the long and short term impacts on air quality at the sensitive human receptors in the area surrounding the Energy Centre, based on the meteorological conditions experienced at a representative location during a period of five years (2020-2024). The predicted pollutant concentrations therefore represent the range of impacts that are likely to occur in future years, including the year to year variability of weather experienced within the study area.

The emissions from the Energy Centre under full load with continuous operations of all plant simultaneously would not result in sensitive human receptors being exposed to any exceedances of the AQS objective for the protection of human health. This is despite a number of worst-case assumptions being made in the modelling.

All long-term and short-term PECs are below the AQS objective and, as such, no significant air quality effects on sensitive human receptors are predicted to occur.

Appendix A Figures

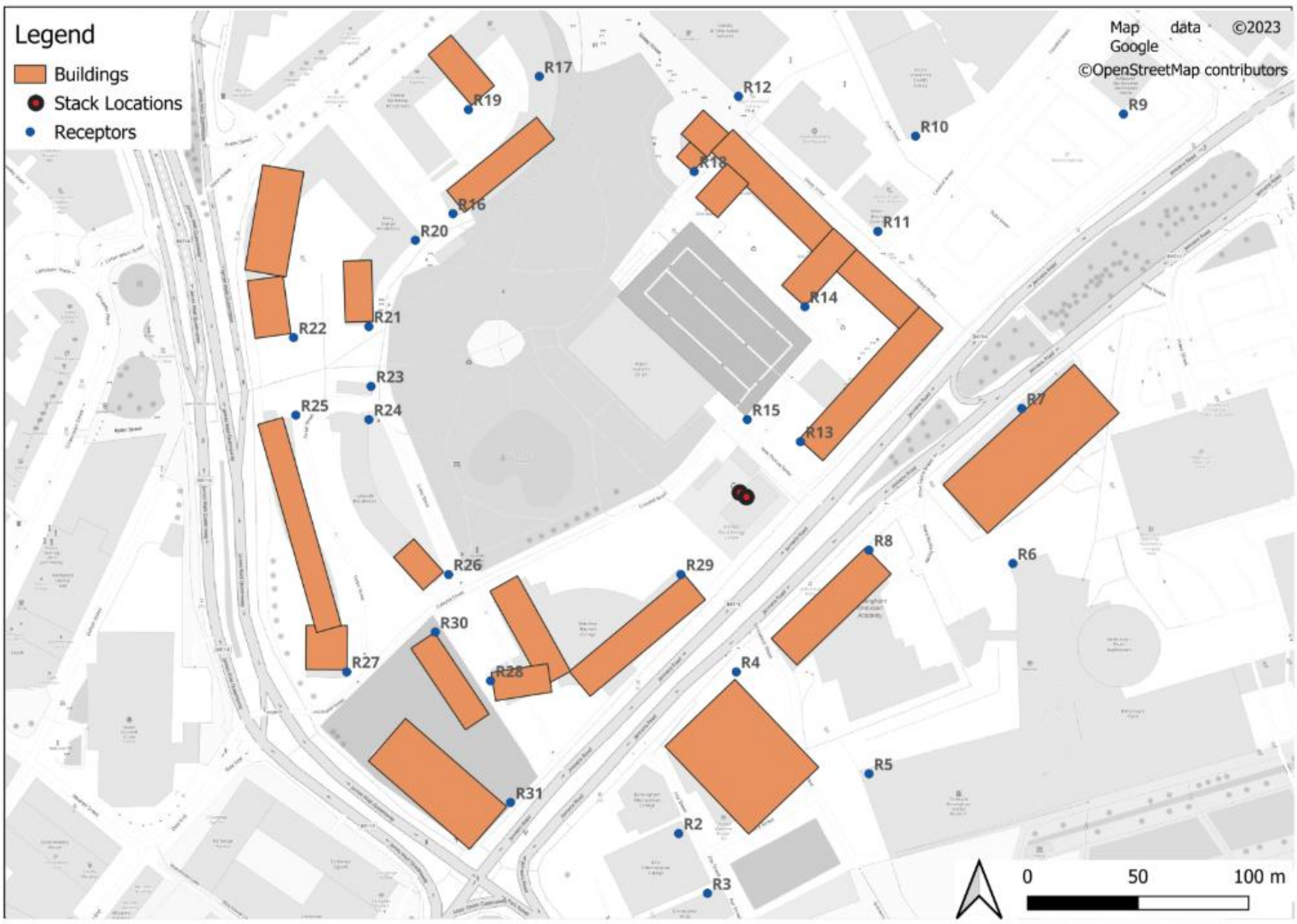

Figure 1 ADMS modelled buildings, sensitive human receptor locations, and stack locations

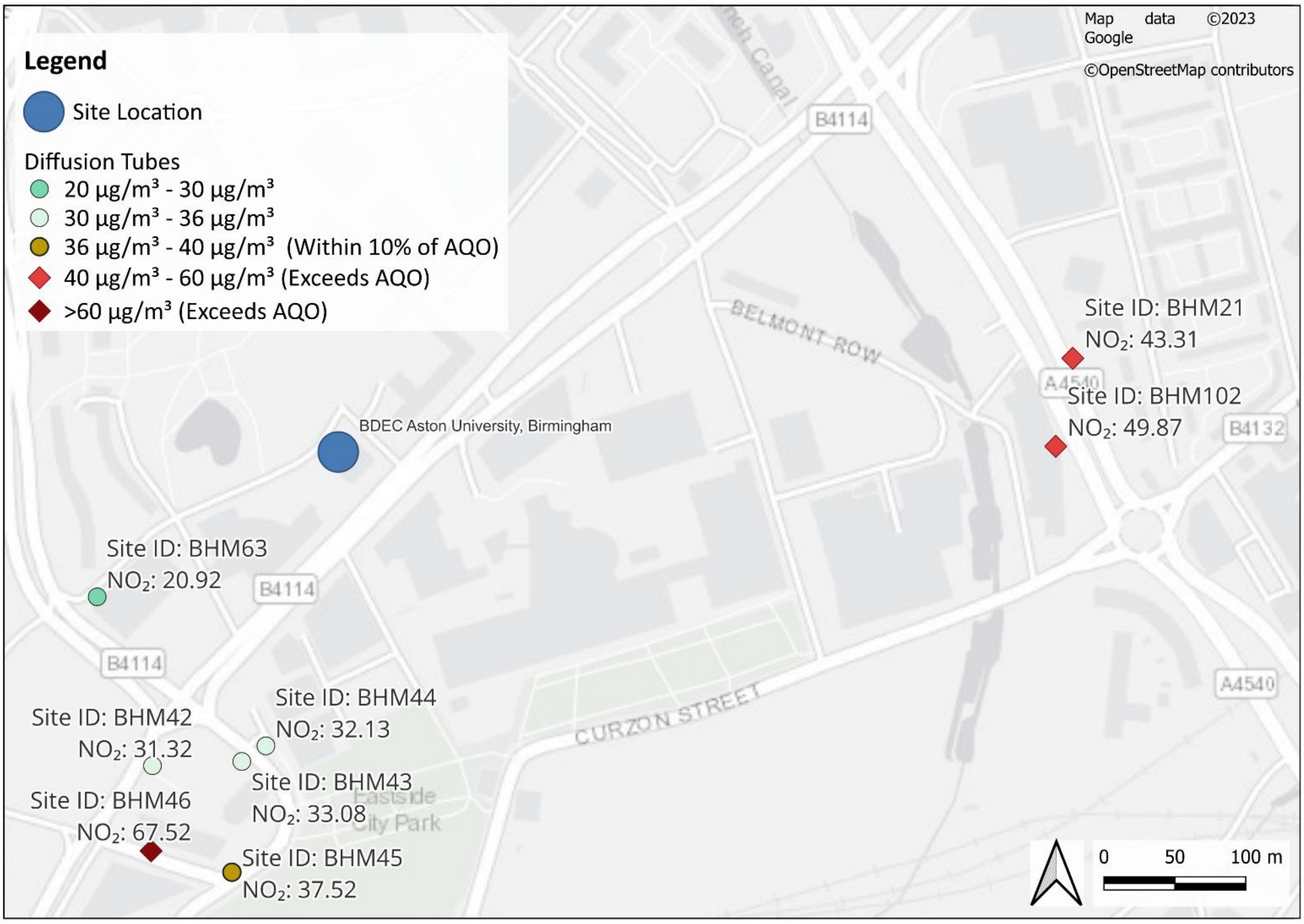

Figure 2 BCC air quality monitoring locations in the vicinity of the Energy Centre with 2024 concentrations labelled.

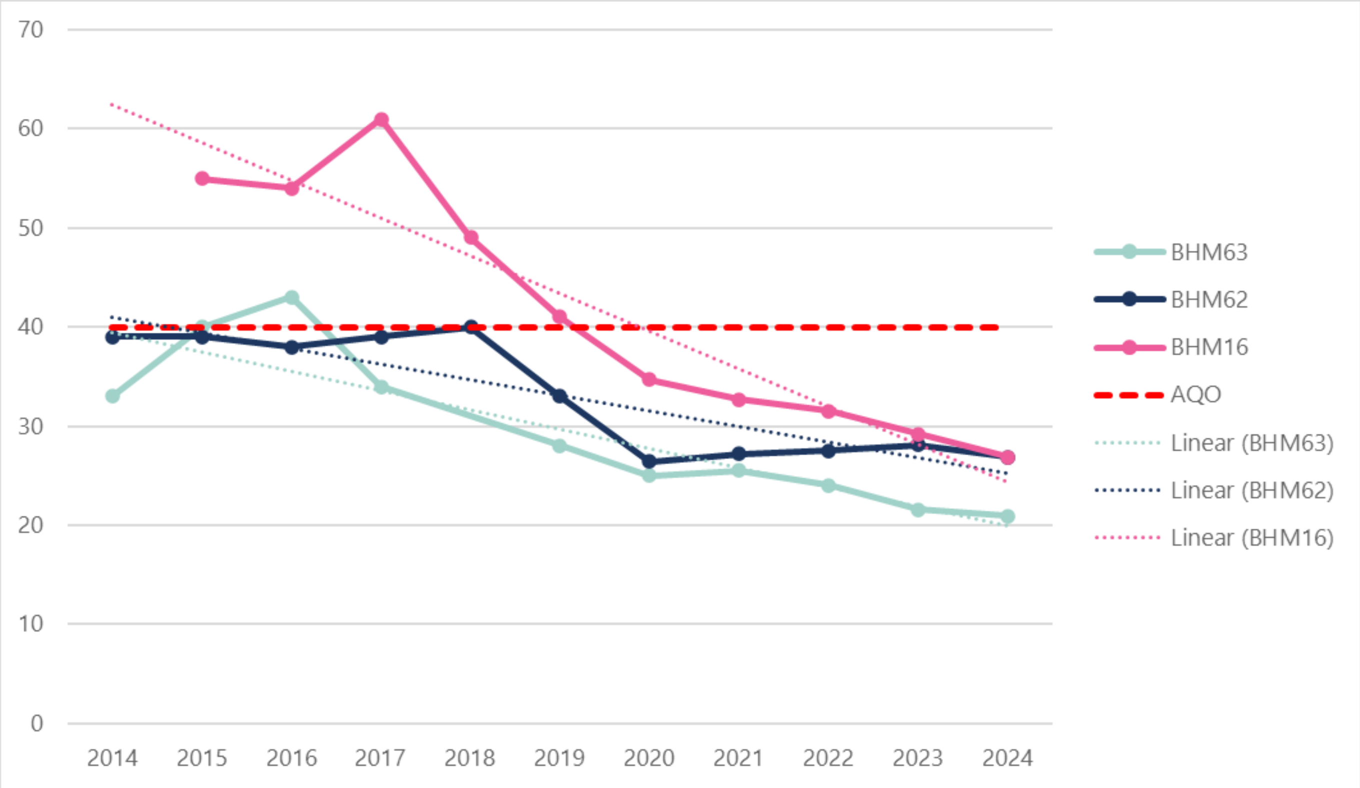

Figure 3 Trends in annual average NO_2 at diffusion tubes in the vicinity of the site (BHM16, BHM62, BHM63), referenced in the Previous Air Quality Assessment

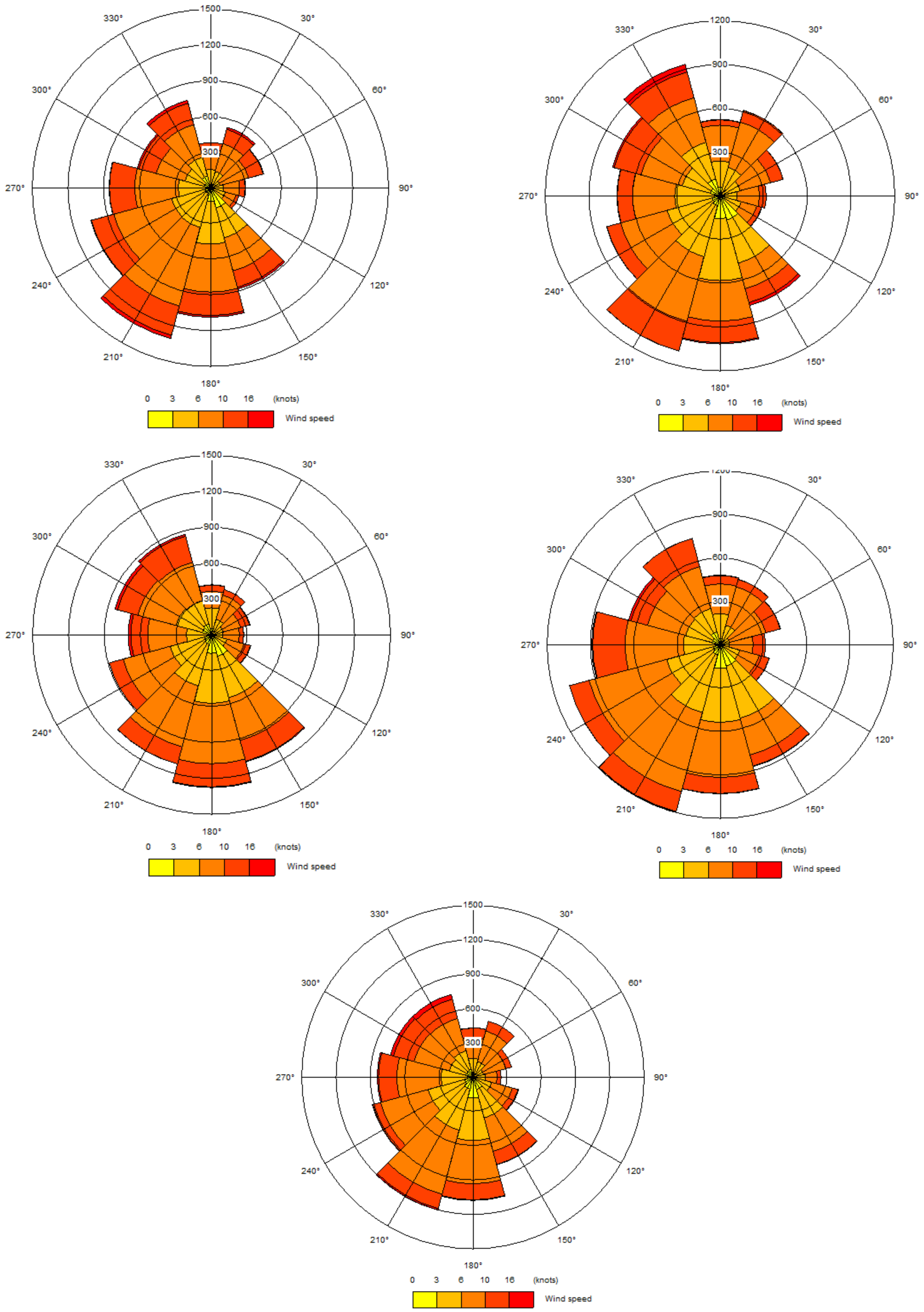

Figure 4 Wind Roses for Birmingham Elmdon (2020 - 2024, from top left)

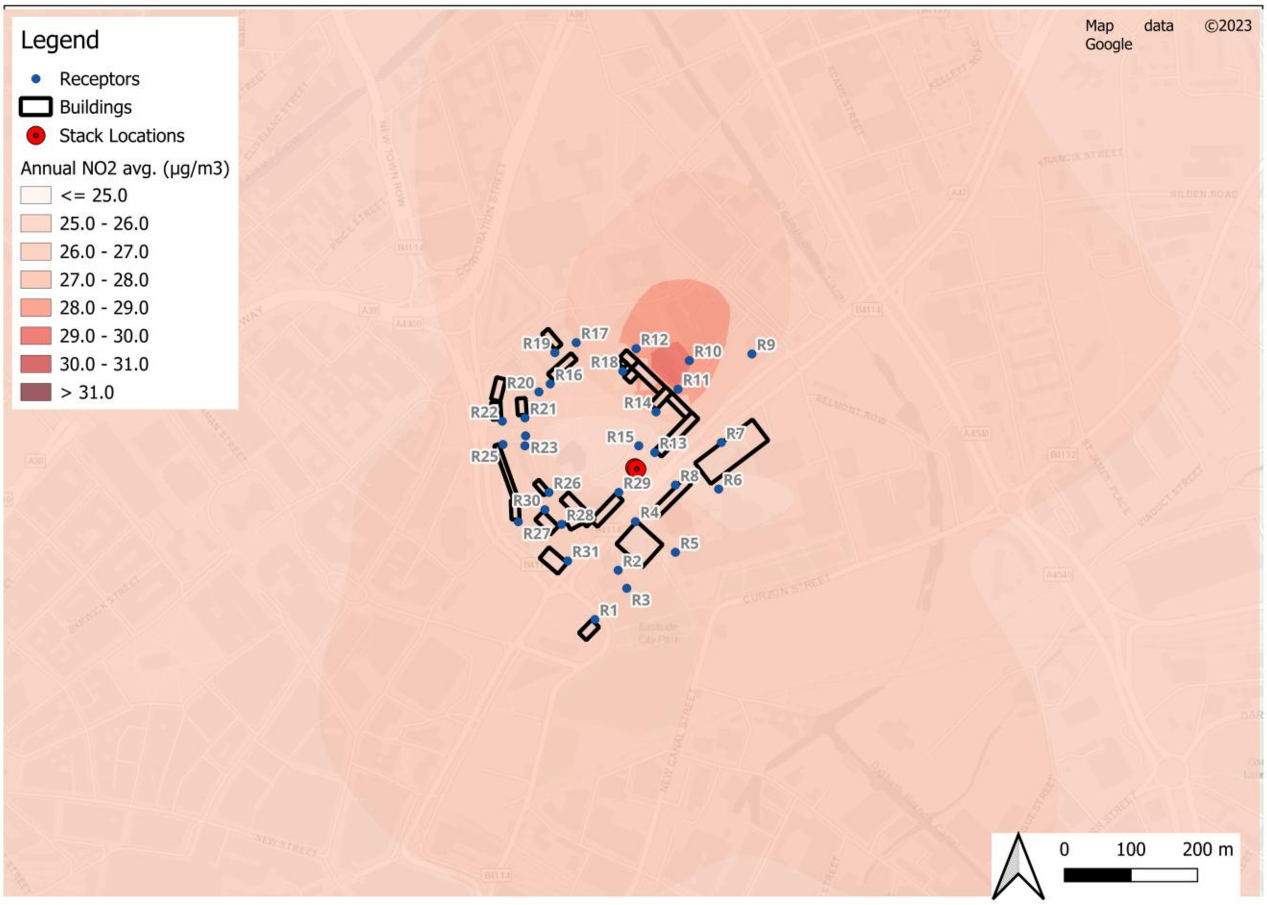

Figure 5 Modelled 2021 annual average NO_2 concentrations (µg/m^3) at 1.5 m above ground level

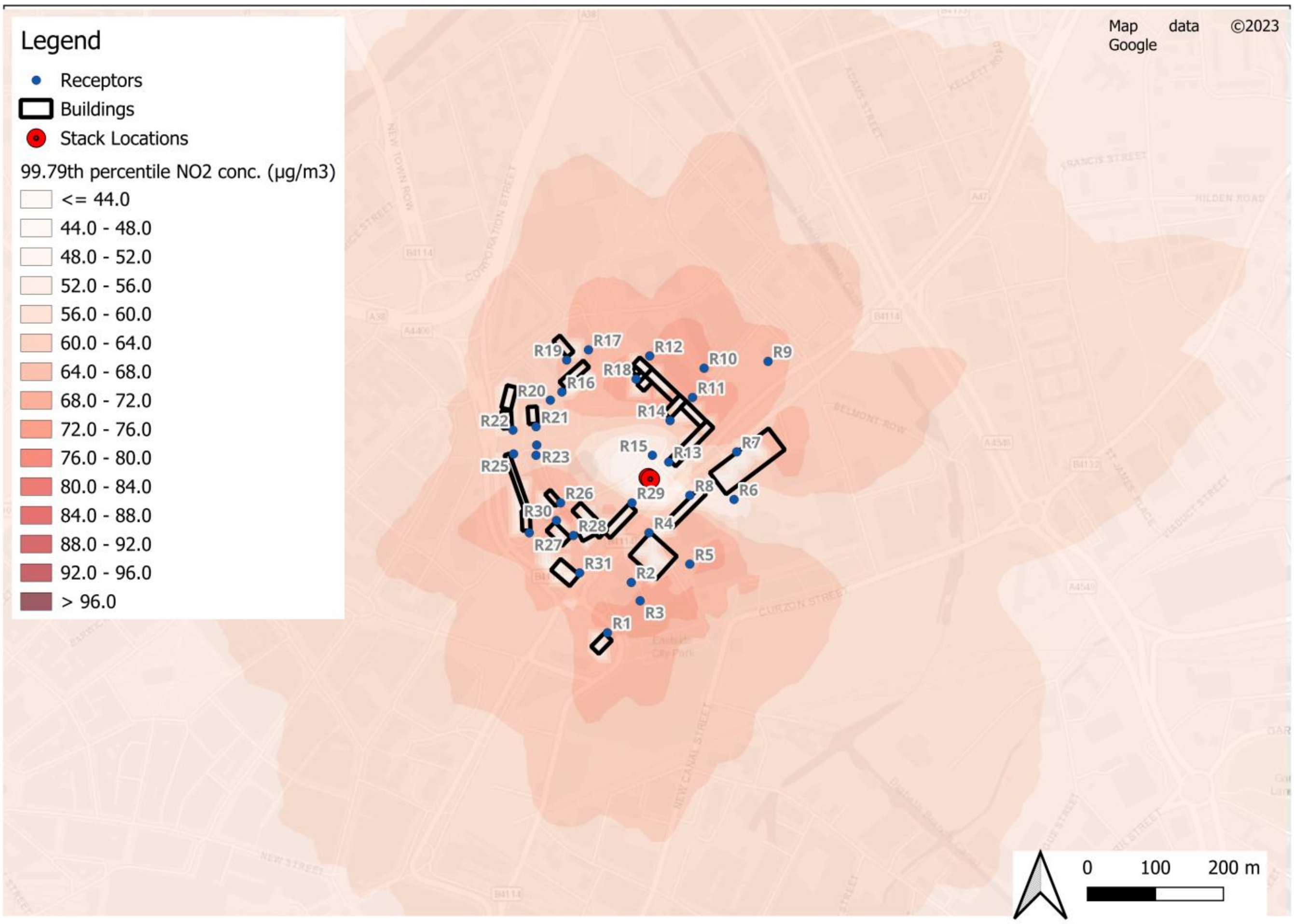

Figure 6 Modelled 2020 99.79th percentile NO_2 concentrations (µg/m^3) at 1.5 m above ground level

Appendix B Boiler emissions scaling

This section is unchanged from the Previous Air Quality Assessment

Parameter	Units	Data for Cochran 3.5MW Boiler	Aston Boiler House Boiler 1	Aston Boiler House Boiler 2
Capacity	kWt	3500	3510	3510
Rated thermal input (MW) (Gross)	MW	4118	4387.5	4387.5
Rated thermal input (MW) (Net or Lower for report)	MW	3709.5	3952.7	3952.7
Ratio for Calculating Input Data (based on thermal input)	-	1	1.07	1.07
Flue Gas Temp	°C	223	223	223
Flue Gas Volume	m^3/s	2	2.13	2.13
Efflux Velocity	m/s	12.55		
NOx Emission Rate	mg/Nm^3	250	250	250
Flue gas vol at STP at HF (GAS)	Nm^3/s	1.101	1.17	1.17
NOx emissions	g/s	0.28	0.29	0.29
Stack Height	m	30	50	50
Flue Diameter	m	0.455	0.51	0.51

COCHRAN

COCHRAN LTD

Boiler Emission Calculations

Boiler Serial Numbers = 29/6737

Boiler Rating = 3000 kW (Gas Firing)
0 kW (Oil Firing)

	Gas Firing	Oil Firing	
Flue Gas Exit Temperature	223	0	°C
Flue Gas Volume @ H.F.	2	0	m^3/s
Flue Gas Efflux Velocity	12.55	0	m/s
Nox Formed From Data Sheet	120	0	mg/Nm^3

Natural Gas Consumption	248.04	kg/hr
Oil Consumption	0	kg/hr

Above Values To Be Inputed From SDS Or Taken From Exist

Flue Gas Volume @ STP Conditions @ H.F.

Gas Firing

$$= 2 \times \frac{273}{273.00 + 223}$$

$$= \boxed{1.101}\ Nm^3/s$$

Oil Firing

$$= 0 \times \frac{273}{273.00 + 0}$$

$$= \boxed{0.000}\ Nm^3/s$$

CO_2 Formed / hr @ H.F.

Gas Firing = 2.69837 x 248.04
= 669.3 kg/hr

Oil Firing = 3.1861 x 0.00
= 0.0 kg/hr

CO Produced / hr @ H.F.

For Calculation purposes assume $20 mg/Nm^3$ On Both Fuels

Gas Firing

$$= \frac{1.101 \times 20 \times 3,600}{1000 \times 1000}$$

$$= \boxed{0.08} \text{ kg/hr}$$

Oil Firing

$$= \frac{0.000 \times 20 \times 3,600}{1000 \times 1000}$$

$$= \boxed{0.00} \text{ kg/hr}$$

Nox Formed / hr

Gas Firing

$$= \frac{1.101 \times 120 \times 3,600}{1000 \times 1000}$$

$$= \boxed{0.48} \text{ kg/hr}$$

Oil Firing

$$= \frac{0.000 \times 0 \times 3,600}{1000 \times 1000}$$

$$= \boxed{0.00} \text{ kg/hr}$$

SO_2 Formed / hr Assuming 0.05% Sulphur In Fuel Oil

$$= \frac{0.000 \times (0.05\% \times 1700) \times 3,600}{1000 \times 1000}$$

$$= \boxed{0.00} \text{ kg/hr}$$

Appendix C Glossary

Glossary

Term	Definition
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ASR	Annual Status Report
BCC	Birmingham City Council
BDEC	Birmingham District Energy Centre
EA	Environment Agency
MCPD	Medium Combustion Pant Directive
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
PC	Process contribution
PEC	Process environmental contribution

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