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EUROPEAN METAL RECYCLING LTD

UNITS 4-7, DUDDESTON MILL TRADING ESTATE

AIR QUALITY ASSESSMENT

DECEMBER 2024

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AIR QUALITY ASSESSMENT

DECEMBER 2024

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APPENDICES

DRAWINGS	TITLE	SCALE
ST20838-001	Existing Sensitive Human Receptors	1:2,500

EXECUTIVE SUMMARY

An air quality assessment has been undertaken to accompany an Environmental Permit variation application for the installation of three proposed stack emission sources at the existing European Metal Recycling Ltd facility in Duddeston Mill Trading Estate, Birmingham. The assessment has been undertaken to consider the potential air quality effects associated with the operation of the three proposed stacks, together with emissions from the stack currently in operation, with potential effects considered at a number of existing sensitive human receptors.

Concentrations of particulate matter (PM_{10}) and Total Volatile Organic Compounds (TVOC) have been predicted at the closest relevant human receptor locations to the site.

The assessment shows that, with all four stacks in operation, pollutant concentrations will be below the relevant air quality objectives at all existing human receptors assessed.

The overall air quality effects associated with the emissions from the proposed stacks are therefore considered to be not significant.

1 INTRODUCTION

1.1 Background

1.1.1 This report details an assessment undertaken to consider the potential significance of dust (PM_{10}) and Total Volatile Organic Compound (TVOC) emissions associated with three proposed and one existing stack emission sources at the existing site in Duddeston Mill Trading Estate.

1.1.2 The assessment has been undertaken using the AERMOD atmospheric dispersion model. Emissions of particulate matter (PM_{10}) and TVOC's associated with the stacks have been modelled at a number of representative existing human sensitive receptor points.

1.1.3 Predicted pollutant concentrations have been assessed against the relevant air quality objectives, to determine the risk of exceedance or potential for impact. Based on this, a conclusion has been reached on whether the emissions from the stacks are considered to be significant.

1.2 Site Description

1.2.1 The European Metal Recycling Ltd (EMR) site is already permitted to shred lithium ion batteries, and EMR are seeking to undertake further processing of the waste after battery dismantling, allowing the recovery of metals from the black mass.

1.2.2 The facility is located within Duddeston Mill Trading Estate, off Duddeston Mill Road, approximately 2.38km to the east of Birmingham city centre. The site location is shown on drawing ST20838-001.

1.2.3 From information provided, it is understood that the new battery recovery activity will be located in Units 4 to 7. This means that the existing small waste processing equipment will be moved into units 9 to 12.

2 LEGISLATION AND POLICY CONTEXT

2.1 Relevant Air Quality Legislation and Guidance

2.1.1 The air quality assessment has been undertaken in accordance with the following legislation and guidance:

- The Environment Act 1995, as amended 2021;
- Department of Environment, Food and Rural Affairs, The Air Quality Strategy for England, August 2023;
- The Air Quality Standards Regulations 2010;
- Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance LAQM.TG(22), August 2022;
- Environment Agency, Air Emissions Risk Assessment for Your Environmental Permit, May 2024;
- Environment Agency, Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air, March 2014.

2.1.2 Further details of these documents are included in **Appendix A**.

2.2 Assessment Criteria

Existing Sensitive Human Receptors

2.2.1 The relevant air quality objectives used in the assessment of air quality effects at existing sensitive human receptors, are included within Table 1.

Table 1: Air Quality Objectives Relevant to the Assessment[a]

Pollutant	Objective/Limit Value	Averaging Period	Obligation
Particulate Matter (PM_{10})	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	All local authorities
	40µg/m^3	Annual mean	All local authorities
Benzene[b]	5µg/m^3	Annual Mean	England and Wales

[a] *In accordance with the Air Quality Standards Regulations 2010*

[b] *In line with guidance from the Environment Agency, TVOC emissions have been assessed against the annual mean objective for Benzene in the absence of specific objectives for TVOC*

2.2.2 Further details of where these objectives apply are detailed in **Appendix A**.

3 ASSESSMENT METHODOLOGY

3.1 Atmospheric Dispersion Modelling

3.1.1 Potential emissions to atmosphere have been modelled using AERMOD (Lakes Environmental model version 12.0). This is a proprietary quantitative atmospheric dispersion model that is based upon the Gaussian theory of plume dispersion.

3.1.2 The model uses all input data, including the characteristics of the releases (e.g. rate, temperature, velocity, height, location, etc.), the terrain, meteorological data and the locations of the buildings adjacent to the proposed emission points, to predict the concentration of the substance of interest at a specified point.

3.1.3 The model uses sequential hourly meteorological data and the locations of the buildings, to predict the concentration of PM_{10} and TVOC at each point for each hour over the course of a year. This allows the long-term mean and short-term peak ground level concentrations to be estimated over the modelled area as required.

3.1.4 The dispersion modelling has been carried out in accordance with the EA guidance on carrying out risk assessments for environmental permits.

3.2 Prediction of Pollutant Concentrations

3.2.1 The assessment has considered the following pollutants from the three proposed and one existing stack sources:

- PM_{10} concentrations (in micrograms per cubic metre, µg/m^3); and
- TVOC concentrations (in micrograms per cubic metre, µg/m^3).

3.2.2 TVOC emissions have been modelled from the proposed stacks associated with the Shredder Scrubber (Unit 4) and Process Scrubber (Unit 6) only as TVOC will not be emitted from the existing stack or the Kiln Scrubber (Unit 7) stack.

3.2.3 The AERMOD model produces computed concentrations which are known as the Process Contribution (PC). This represents the emissions from the process being modelled.

3.2.4 For human receptors, the PC is added to the relevant ambient background concentration to provide a total Predicted Environmental Concentration (PEC) at the existing receptors assessed. The PC and PEC values are then compared with the relevant air quality objectives (as detailed in Table 1) and the likelihood of exceedance is determined.

3.2.5 Further details of the modelling methodology are provided in **Appendix B**.

3.3 Existing Sensitive Human Receptors

3.3.1 A number of existing sensitive human receptors (referred to as ESR 1 to ESR 10) have been selected for consideration in the air quality assessment.

3.3.2 Details of these receptors are provided in Table 2, and their locations are shown on drawing ST20838-001. With the exception of Adderley Primary School, the ESR's are the nearest residential dwellings to the proposed and existing stacks.

Table 2: Existing Sensitive Human Receptors Considered in Air Quality Assessment

Receptor	Address	Location		Bearing from Site	Approx. Distance to Stack (m)
		Easting	Northing		
ESR 1	Adderley Primary School, Adderley Road	409465.6	287332.2	South east	297
ESR 2	Adderley Road, Saltley	409443.7	287555.7	East	143
ESR 3		409448.3	287613.5	East	148
ESR 4		409466	287644.9	East	175
ESR 5	Ash Road, Saltley	409497.5	287733.5	North east	246
ESR 6	Hams Road, Saltley	409568.5	287600.6	East	264
ESR 7	Ash Road, Saltley	409597.7	287684.2	North east	311
ESR 8		409498.9	287769.8	North east	272
ESR 9	Hall Road, Saltley	409633.6	287697.1	North east	350
ESR 10	Hams Road, Saltley	409706.5	287473.5	East	417

3.3.3 In addition to selected existing sensitive receptors, a uniform Cartesian grid has also been modelled. The parameters of the modelled Cartesian grid are included in Table 3.

Table 3: Uniform Cartesian Grid Parameters		
Parameter	**X**	**Y**
South West Grid Coordinates	409074.82	287150.60
Number of Points	60	70
Spacing (m)	15	15
Length (m)	885	1,035
Total Number of Grid Receptors	4,200	

3.4 Limitations and Uncertainties

3.4.1 The air quality assessment has adopted a conservative approach to try to address the uncertainties involved with atmospheric dispersion modelling.

3.4.2 The maximum emission limit value for the proposed and existing stacks have been used in the assessment to calculate the emission rates. In reality it is likely that the emissions from the stacks will be lower than this.

3.4.3 To reduce uncertainty of the modelled results, the stacks have been modelled as running 24 hours a day for 365 days a year. It is understood that the stacks will not operate continuously in this manner so the results of the assessment can be considered to be robust.

3.4.4 In accordance with EA guidance, the model has included the latest 5 years of meteorological data, with the worst case results presented.

3.4.5 As a result of these conservative inputs, the model is considered more likely to provide an overestimation of the potential air quality effects, associated with the proposed and existing stacks, than an underestimation.

4 BASELINE SITUATION

4.1 Birmingham City Council Local Air Quality Management

4.1.1 The site is located within the administrative area of Birmingham City Council (BCC), which is responsible for the management of local air quality.

4.1.2 At present, there is one Air Quality Management Areas (AQMA) declared by BCC, the city-wide Birmingham AQMA. This was declared in 2003 for exceedance of the annual mean air quality objective for NO_2 and the 24-hour mean objective for PM_{10}. However, this was amended in 2010 to just include the annual mean NO_2 exceedance, and the exceedance of PM_{10} objective was removed.

4.1.3 BCC undertakes PM_{10} air quality monitoring at three monitoring locations across their jurisdiction, however, none of these are in close proximity to the site. The closest monitoring location to the site (REF: BAU2), is located approximately 1.7km south west. A review of the 2024 Annual Status Report (ASR) for BCC shows that this automatic roadside monitoring location recorded a concentration of 15µg/m^3 in 2023.

4.2 Background Air Pollutant Concentrations at Existing Sensitive Human Receptors

4.2.1 The air quality assessment needs to take into account background concentrations upon which the predicted pollutant concentrations from the proposed stack are superimposed.

4.2.2 There are no representative background pollutant monitoring locations in the vicinity of the site. Background PM_{10} concentrations for use in the air quality assessment have therefore been obtained from 2021-based default concentration maps available on the Department for Environment, Food and Rural Affairs (Defra) Local Air Quality Management webpages[1].

4.2.3 The background pollutant concentrations used in the air quality assessment are detailed in Table 4.

Table 4: Background Air Pollutant Concentrations Used in the Air Quality Assessment

Receptor	2024 Backgrounds for PM_{10} (µg/m^3)[a]	2024 Backgrounds for Benzene (µg/m^3)[ab]
ESR 1	14.58525	0.6512
ESR 2		

[1] Department for Environment, Food and Rural Affairs Local Air Quality Management webpages [Accessed at: http://uk-air.defra.gov.uk/data/laqm-background-home]

Table 4: Background Air Pollutant Concentrations Used in the Air Quality Assessment

Receptor	2024 Backgrounds for PM_{10} (µg/m³)[a]	2024 Backgrounds for Benzene (µg/m³)[ab]
ESR 3		
ESR 4		
ESR 5		
ESR 6		
ESR 7		
ESR 8		
ESR 9		
ESR 10		

[a] *Obtained from the 2021-based maps on the Defra Local Air Quality Management webpages.*

[b] *Benzene backgrounds obtained from 2001 maps are no longer valid for use and no factor is given for future year conversion. The new 2021-based background mapping guidance states that benzene backgrounds should be taken from the Modelled Background Pollutiuon data available at https://uk-air.defra.gov.uk/data/pcm-data*

5 IMPACT ASSESSMENT

5.1 Assessment of Pollutant Concentrations

PM_{10} Concentrations

5.1.1 The background concentrations of PM_{10} as detailed in Table 4, have been used to determine the PEC concentrations at each human receptor, for each year of meteorological data. The PC and PEC concentrations as a percentage of the relevant air quality objective have then been determined for each receptor, for each year of meteorological data.

5.1.2 The highest concentrations/percentages, for the considered existing sensitive human receptors, are summarised in Table 5.

Table 5: Maximum Modelled PM_{10} Concentrations for Existing Sensitive Human Receptors

Pollutant	AQO	ESR	PC	PEC	PC/AQO	PEC/AQO
PM_{10} Annual Mean	40µg/m^3	ESR 3	0.87µg/m^3	15.45µg/m^3	2.17%	38.63%
PM_{10} 24-hour Mean (90.4th Percentile)	50µg/m^3, not to be exceeded more than 35 times a year	ESR 3	1.88µg/m^3	16.47µg/m^3	3.76%	32.93%

TVOC Concentrations

5.1.3 The background concentrations of TVOC (benzene) as detailed in Table 4, have been used to determine the PEC concentrations at each human receptor, for each year of meteorological data. The PC and PEC concentrations as a percentage of the relevant air quality objective have then been determined for each receptor, for each year of meteorological data.

5.1.4 The highest concentrations/percentages, for the considered existing sensitive human receptors, are summarised in Table 5.

Table 5: Maximum Modelled TVOC Concentrations for Existing Sensitive Human Receptors

Pollutant	AQO	ESR	PC	PEC	PC/AQO	PEC/AQO
TVOC Annual Mean	5µg/m^3	ESR 2	0.99µg/m^3	1.64µg/m^3	2.47%	32.79%

Summary

5.1.5 The results confirm that the maximum modelled PCs and PECs do not exceed the relevant air quality objectives for the existing human receptor locations considered in the assessment (i.e. ESR 1 to ESR 10).

5.1.6 On this basis, it is therefore considered that the proposed exhaust heights for the proposed stacks are sufficient to ensure the adequate dispersion of PM_{10} and TVOC emissions, and therefore further mitigation will not be required.

5.1.7 The modelled PM_{10} and TVOC concentrations for the considered receptors, along with the Cartesian grid points experiencing the maximum modelled concentrations, are detailed in **Appendix C**.

6 CONCLUSIONS

6.1.1 Atmospheric dispersion modelling has been undertaken using AERMOD to consider emissions associated with three proposed and one existing stack emission sources at the existing site in Duddeston Mill Trading Estate.

6.1.2 The potential air quality effects have been considered at a number of existing sensitive human receptor points.

6.1.3 With regard to existing sensitive human receptors, the maximum modelled PCs and PECs have been compared against the relevant air quality objectives, to determine the risk of exceedance. The results confirm there will be no exceedances of the relevant air quality objectives for the receptors considered.

6.1.4 Based on this, it is considered that the proposed exhaust heights for the proposed stacks are sufficient to ensure the adequate dispersion of PM_{10} and TVOC emissions, and therefore further mitigation will not be required.

APPENDICES

APPENDIX A: AIR QUALITY LEGISLATION AND GUIDANCE

National Air Quality Strategy

A.1 The Environment Act 1995, as amended 2021, requires the UK government to prepare a national Air Quality Strategy. The first UK strategy was published in March 1997, setting out policies for the management of ambient air quality. This was subsequently updated in 2007[1].

A.2 The 2007 strategy establishes the framework for air quality management in England, Scotland, Wales and Northern Ireland. Air quality standards and objectives are set out for eight pollutants which may potentially occur at levels that give cause for concern. The strategy also provides details of the role that local authorities are required to take in working towards improvements in air quality, known as the Local Air Quality Management (LAQM) regime.

Air Quality Standards and Objectives

A.3 Air quality standards and objectives are set out in the strategy for the following pollutants: nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), lead (Pb), fine particulate matter (PM_{10}), benzene (C_6H_6), 1, 3–butadiene (C_4H_6) and ozone (O_3).

A.4 Objectives for each pollutant, except O3, were first given statutory status in the Air Quality (England) Regulations 2000[2] and Air Quality (England) (Amendment) Regulations 2002[3]. These objectives are defined in the strategy as:

> *"the maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale."*

A.5 EU limit values, set out within the Ambient Air Quality Directive 2008/50/EC[4] (i.e. the CAFE Directive), were transposed into UK legislation on 11th June 2011 as The Air Quality Standards Regulations 2010. These are mostly the same as the air quality objectives in terms of concentrations; however, there are differences in determining how compliance is achieved. Although the UK is no longer part of the EU, no changes have yet been made to the objectives and limit values used in the management and assessment of air quality.

A.6 Whilst there is no specific objective for $PM_{2.5}$ in England, a limit value of $20\mu g/m^3$ is referred

[1] Department of Environment, Food and Rural Affairs, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2007
[2] The Air Quality (England) Regulations 2000. SI No 928
[3] The Air Quality (Amendment) Regulations 2002
[4] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

to in the regulations, which has been adopted for use in this assessment (as recommended by the LAQM Helpdesk). An objective has been set for $PM_{2.5}$ in Scotland since early 2016. The Environment Act 2021 sets out a requirement to establish a target objective for $PM_{2.5}$, and this has now been set through the Environmental Targets (Fine Particulate Matter) (England) Regulations 2023. Annual mean concentrations of $PM_{2.5}$ must now meet a target of 10 µg/m^3 across England by 2040.

A.7 Examples of where these objectives and limit values apply are detailed in the Defra LAQM Technical Guidance document LAQM.TG(22)[5] and are included in Table A1.

Table A1: Examples of Where the Air Quality Objectives Should Apply

Averaging Period	Objectives Should Apply at:	Objectives Should Generally Not Apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes, etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels. Gardens of residential properties [a]	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 and 8-hour objectives apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the	Kerbside sites where public would not be expected to have regular access

[5] Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance LAQM.TG(22), August 2022

Table A1: Examples of Where the Air Quality Objectives Should Apply		
Averaging Period	**Objectives Should Apply at:**	**Objectives Should Generally Not Apply at:**
	public might reasonably be expected to spend one hour or longer	
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer	
[a] Such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure to pollutants would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied		

Local Air Quality Management

A.8 LAQM legislation in the Environment Act 1995 requires local authorities to conduct the periodic review and assessments of air quality. These aim to identify all those areas where the objectives are being, or are likely to be, exceeded. Where exceedances are likely to occur, local authorities are required to declare an Air Quality Management Area (AQMA).

A.9 LAQM.TG(22) presents a streamlined approach for LAQM in England and Scotland; however, Northern Ireland is still considering changes to LAQM and therefore works according to the previous regime.

A.10 The Welsh Government amended the LAQM regime in Wales in 2017 by issuing new statutory policy guidance in order to bring the system into line with the Well-being of Future Generations (Wales) Act 2015[6]. This aims to achieve compliance with the national air quality objectives in specific hotspots and to reduce exposure to pollution more widely, so as to achieve the greatest public health benefit.

A.11 Local authorities in England are required to produce Annual Status Reports (ASRs), and in Scotland, Annual Progress Reports (APRs). These replace all other reports which previously had to be submitted including Updating and Screening Assessments, Progress Reports and Detailed Assessments (which would be produced to assist with an AQMA declaration).

A.12 Local authorities now have the option of a fast-track AQMA declaration option. This allows more expert judgement to be used and removes the need for a Detailed Assessment where a local authority is confident of the outcome. Detailed Assessments

[6] Well-being of Future Generations (Wales) Act 2015 (anaw 2)

should however still be used if there is any doubt.

A.13 As part of the UK Government's requirement to improve air quality, selected local authorities in England are also currently investigating the feasibility of setting up Clean Air Zones (CAZs). These are areas where targeted action and co-ordinated resources aim to improve air quality within an urban setting, in order to achieve compliance with the EU Limit Values within the shortest possible time.

A.14 The first CAZs were implemented in Bath in March 2021, and in Birmingham in June 2021. Since then, CAZ's have also been declared in Bradford, Bristol, Portsmouth, Sheffield and Tyneside (Newcastle and Gateshead). In addition, the London Ultra Low Emission Zone (ULEZ) has now been expanded to incorporate all London Boroughs. The Greater Manchester CAZ, due to be introduced from 30 May 2022, has been delayed and is currently under review.

National Planning Policy Framework

A.15 The National Planning Policy Framework (NPPF)[7], introduced in March 2012, and then most recently updated in December 2023 requires that:

"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of AQMAs and CAZs, and the cumulative impacts from individual sites in local areas.

Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications.

Planning decisions should ensure that any new development in AQMAs and CAZs is consistent with the local air quality action plan."

Planning Practice Guidance

A.16 The Planning Practice Guidance (PPG)[8], updated in November 2019, states that whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impacts in an area where air quality is known to be poor.

[7] Ministry of Housing, Communities and Local Government, National Planning Policy Framework, July 2021
[8] Department for Communities and Local Government. Planning Practice Guidance: Air Quality, November 2019

They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).

A.17 Where a proposed development is anticipated to give rise to concerns about air quality, an appropriate assessment needs to be carried out. Where the assessment concludes that the proposed development (including mitigation) will not lead to an unacceptable risk from air pollution, prevent sustained compliance with national objectives or fail to comply with the requirements of the Habitats Regulations, then the local authority should proceed to decision with appropriate planning conditions and/or obligations.

Environment Agency Guidance on Air Emissions Risk Assessments

A.18 The Environment Agency (EA) has produced guidance to support the completion of an air emissions risk assessment as part of Environmental Permit applications[9]. This sets out steps to be followed when carrying out a risk assessment, including defining when detailed atmospheric dispersion modelling is required as part of an Environmental Permit application. The document also sets out environmental benchmarks for a range of pollutants and the required contents of air dispersion modelling reports.

AQTAG06 – Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air

A.19 Guidance has been produced[10] to provide an overview of how a quantitative assessment (Stage 3 appropriate assessment) should be carried out, using short range modelling to consider emissions to air arising from an Environmental Permitting Regulations (EPR) process, to fulfil the requirements of the Habitats Regulations.

A.20 The guidance provides details of the different inputs required for a dispersion modelling exercise. In addition, it sets out recommended deposition velocities for both grassland and forest habitats, which are used in an assessment of nutrient nitrogen and acid deposition.

[9] Environment Agency, Air emissions risk assessment for your environmental permit, May 2024 [Accessed at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit]

[10] Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air, AQTAG06, March 2014

APPENDIX B: METHODOLOGY FOR OPERATIONAL PHASE ASSESSMENTS

Atmospheric Dispersion Modelling

B.1 The atmospheric dispersion model AERMOD (Lakes Environmental, Version 12.0) has been used to assess the potential air quality impacts associated with the operation of the three proposed and one existing stacks. This dispersion model is widely used and accepted for the purpose of undertaking assessments to support both planning and Environmental Permit applications.

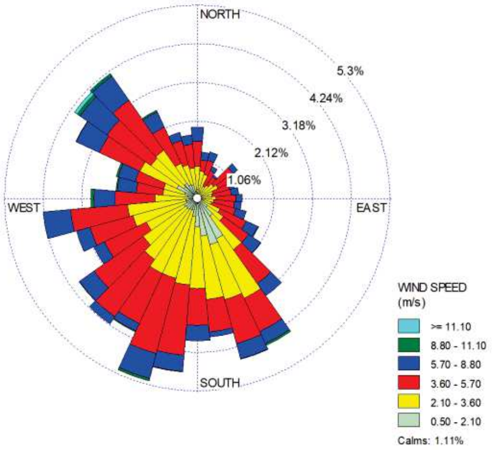
Meteorological Data

B.2 The meteorological data used in the air quality modelling has been obtained from ADM Limited and is from the Birmingham Meteorological Recording Station, covering the period between 1st January 2019 and 31st December 2023. For all years, the data is complete.

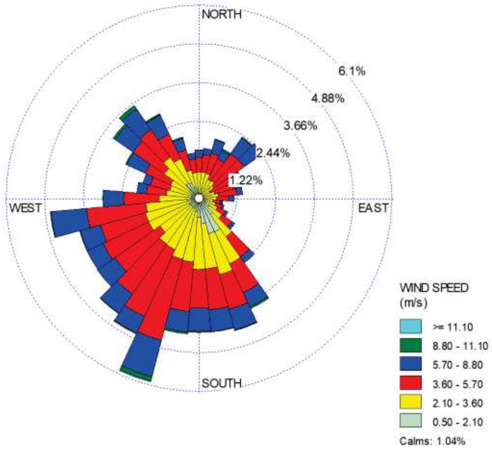
B.3 The site is located at an altitude of approximately 98m AOD. The Birmingham Meteorological Recording Station is located approximately 8.6km to the north-west, at an altitude of 100m AOD, and is therefore considered to be most representative of the conditions at the site.

B.4 The 2019 to 2023 wind roses for the Birmingham Meteorological Recording Station, are shown in Figure B1. Each year has been run separately in the model.

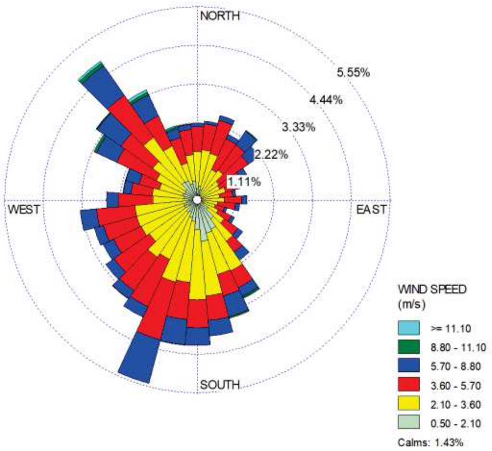
2019



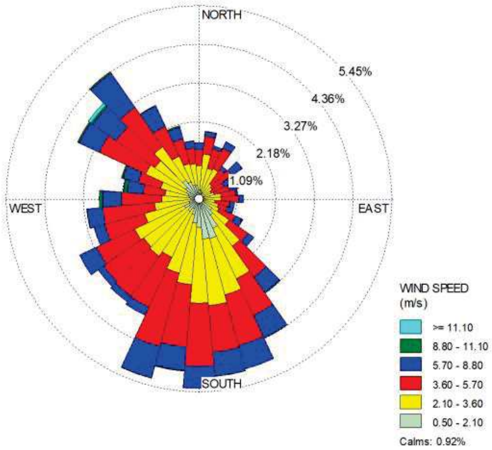
2020



2021



2022



2023

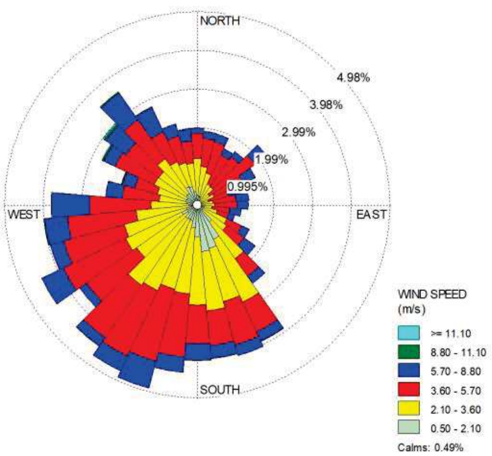


Figure B1: 2019 to 2023 Wind Roses for Birmingham Meteorological Recording Station

Surface Characteristics

B.5 The predominant characteristics of land use in an area provides a measure of the vertical mixing and dilution that takes place in the atmosphere due to factors such as surface roughness and albedo.

B.6 The meteorological data has been processed using AERMET, the supporting meteorological pre-processing software (Lakes Environmental, Version 12.0), to enable the surface characteristics to be set in the model.

B.7 The values set within the model are included in Table B1.

Table B1: Surface Characteristics Included in Model	
Setting	**Urban**
Albedo	0.2075
Bowen ratio	1.625
Surface roughness	1m

B.8 Buildings can also have a significant influence on the behaviour of the local airflow and 'downwash' can occur, where an emission plume can be drawn down in the vicinity of buildings. There are a number of existing buildings near to the source of the emissions, and therefore building effects have been included within the model.

B.9 Further details of the buildings included in the model are provided later in this appendix.

Terrain

B.10 To consider the impact of terrain surrounding the Proposed Development, on the dispersion of pollutants, OS Terrain 5 data has been used in the model (in x.y.z format). This has been processed using the in-built AERMAP terrain processor.

Emission Parameters

B.11 Information regarding the proposed stack has been provided by EMR. The parameters included in the model are shown in Table B2.

Table B2: Model Parameters for Sources Included in Model								
Parameter	Input in Model							
	Existing Stack		Shredder Scrubber (Unit 4)		Process Scrubber (Unit 6)		Kiln Scrubber (Unit 7)	
Stack location (X,Y)	409302.44	287579.92	409291.42	287477.79	409294.25	287509.98	409295.55	287523.78
Base elevation (m)	98.0		98.0		98.0		98.0	
Stack height (m)	8.6		10		10		10	
Stack diameter (m)	0.71		0.60		0.20		0.10	
Stack gas flow at exit (Am³/hr)	20077		34380		6600		708.0	
Stack gas flow at exit (Am³/s)	5.577		9.550		1.833		0.197	
Stack gas flow at exit (Nm³/hr)	19031		26588		5578		537	
Stack gas flow at exit (Nm³/s)	5.286		7.386		1.550		0.149	
Stack efflux velocity (m/s)	14.09		33.78		58.35		25.08	
Stack gas exit temp. (°C)	15		80		50		87	

B.12 The locations of the proposed and existing stacks in the model are shown in Figure B2, overleaf.

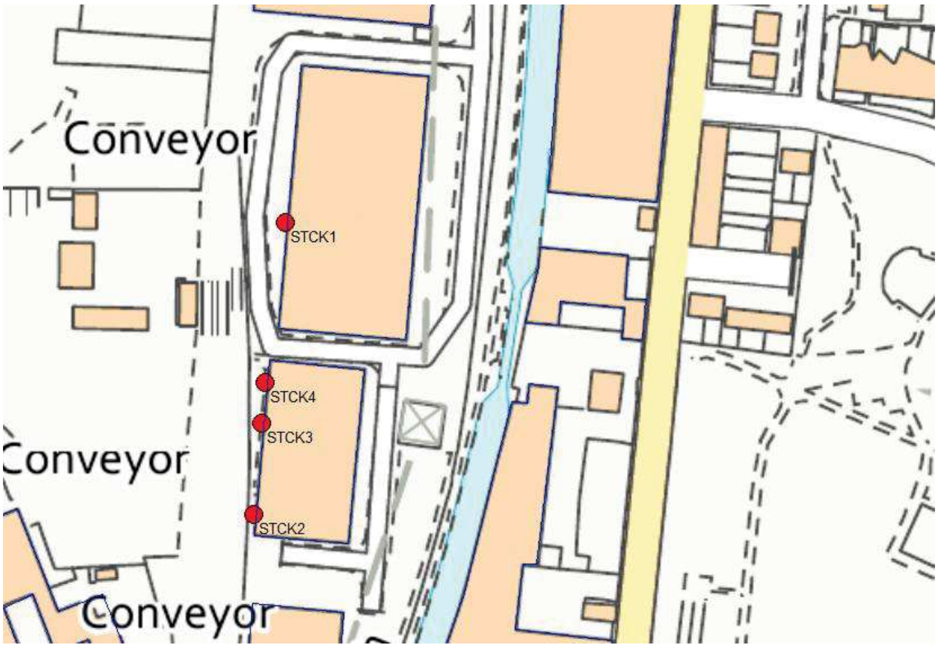


Figure B2: Location of the Stacks in Model

B.13 The emission concentrations for each substance, as well as the calculated emission rates, are shown in Table B3 overleaf.

Table B3: Emission rates from the Proposed Stack				
Input in Model				
Emitted Substance	Existing Stack	Shredder Scrubber (Unit 4)	Process Scrubber (Unit 6)	Kiln Scrubber (Unit 7)
	Emission Concentration (mg/Nm^3)			
PM_{10}[a]	5	5	5	5
TVOC[a]	N/A	20	20	N/A
	Emission Rate (g/s)			
PM_{10}	0.0264	0.0369	0.0077	0.0007
TVOC	N/A	0.1477	0.0310	N/A

[a] *ELV provided by client as maximum concentration as the manufacturers guaranteed limit.*

Treatment of Buildings

B.14 There are a number of existing buildings located within the site, and near to the proposed stack. The buildings included within the model are detailed in Table B4, and their locations are shown in Figure B3.

Table B4: Onsite Buildings Included in Model						
Building Number	Building Name in Model	Building Description	Base Elevation (m)	Height of Building (m)	Grid Reference of SW Corner/ Centre of Circle	
					X	Y
1	BLD_1	Unit 8, 9 and 10 (and rest of building not owned by EMR)	98	7.6	409308	287634.69
2	BLD_2	Units 4, 5 6 & 7	98	7.38	409297.11	287531.78
3	BLD_3	Storage and Office	98	8	409281.84	287345.59
4	BLD_4	On site building (not owned by EMR)	98.96	8	409296.93	287719.42
5	BLD_5	Off site building 2	96.57	15	409416.84	287731.64
6	BLD_6	Off site building 3	98.08	5	409391.42	287571.07
7	BLD_7	Off site building 4	98.91	18	409381.73	287517.33
8	BLD_8	Off site building 5	101.05	18	409299.81	287265.06
9	BLD_9	Off site building 6	99.07	11	409173.47	287465.87

B.15 The locations of the buildings are shown in Figure B3, overleaf.

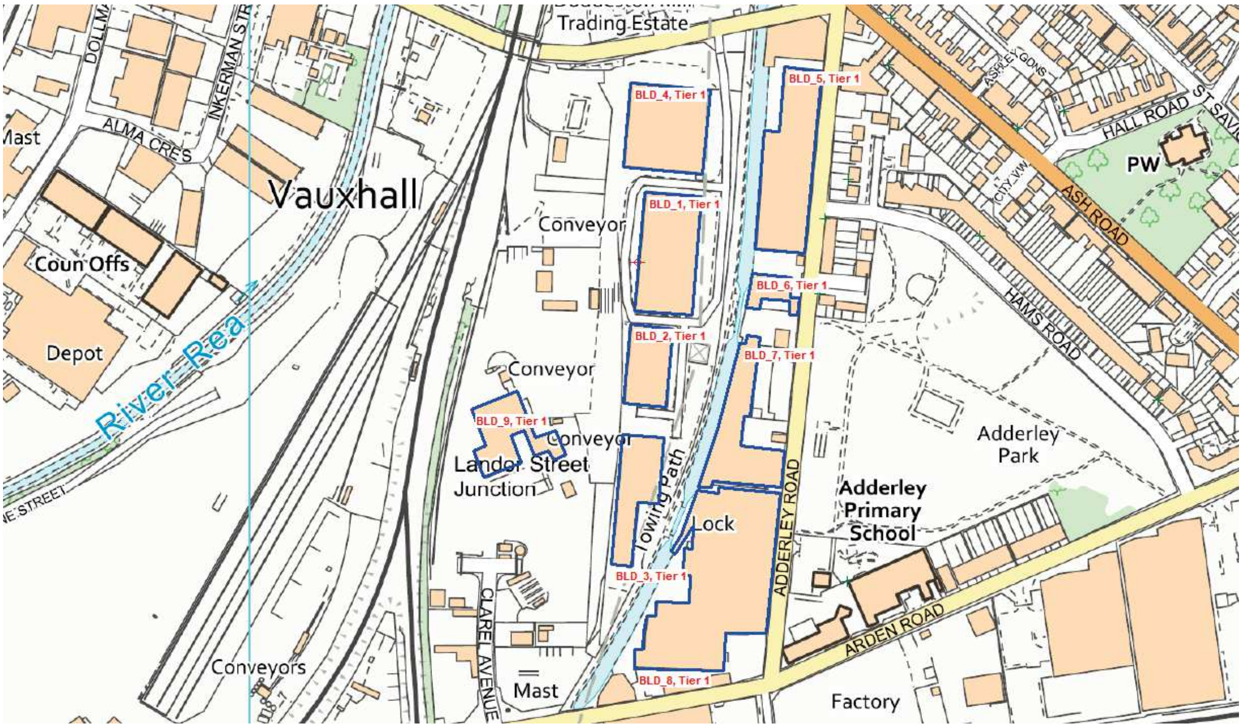


Figure B3: Location of Buildings in Model

Appendix C: Predicted PM_{10} Concentrations for Existing Sensitive Human Receptors

Predicted PM_{10} Concentrations

C.1 The predicted PM_{10} concentrations for the existing sensitive receptors and points across the receptor grid, for each year of meteorological data, are shown in Figures C1 to C5. The highest results for the receptors considered are highlighted in red.

Figure C1: 2019 Meteorological Data

				SHORT TERM 90.4th PERCENTILE				LONG TERM ANNUAL MEAN			
				PC 90.4th%ile	PEC	PC/AQO	PEC/AQO	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%	µg/m^3	µg/m^3	%	%
ESR 1		409465.57	287332.18	0.86	15.45	1.73	30.90	0.32	14.91	0.81	37.27
ESR 2		409443.68	287555.74	1.59	16.17	3.18	32.35	0.82	15.41	2.06	38.52
ESR 3		409448.32	287613.53	1.67	16.25	3.34	32.51	0.82	15.41	2.06	38.52
ESR 4		409466.02	287644.91	1.40	15.98	2.79	31.96	0.69	15.28	1.73	38.19
ESR 5		409497.45	287733.48	0.94	15.52	1.88	31.05	0.42	15.00	1.04	37.50
ESR 6		409568.54	287600.64	0.74	15.32	1.47	30.64	0.31	14.89	0.77	37.24
ESR 7		409597.66	287684.15	0.60	15.19	1.20	30.37	0.24	14.83	0.60	37.07
ESR 8		409498.85	287769.76	0.85	15.44	1.71	30.88	0.38	14.97	0.95	37.41
ESR 9		409633.55	287697.11	0.52	15.11	1.04	30.21	0.20	14.78	0.50	36.96
ESR 10		409706.51	287473.49	0.35	14.93	0.69	29.86	0.13	14.72	0.32	36.79

Figure C2: 2020 Meteorological Data

				SHORT TERM 90.4th PERCENTILE				LONG TERM ANNUAL MEAN			
				PC 90.4th%ile	PEC	PC/AQO	PEC/AQO	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	$\mu g/m^3$	$\mu g/m^3$	%	%	$\mu g/m^3$	$\mu g/m^3$	%	%
ESR 1		409465.57	287332.18	0.81	15.39	1.61	30.78	0.31	14.89	0.76	37.23
ESR 2		409443.68	287555.74	1.65	16.24	3.30	32.47	0.82	15.40	2.04	38.50
ESR 3		409448.32	287613.53	**1.88**	**16.47**	**3.76**	**32.93**	**0.87**	**15.45**	**2.17**	**38.63**
ESR 4		409466.02	287644.91	1.48	16.07	2.96	32.13	0.72	15.30	1.79	38.26
ESR 5		409497.45	287733.48	0.88	15.47	1.76	30.93	0.42	15.00	1.04	37.51
ESR 6		409568.54	287600.64	0.81	15.40	1.63	30.80	0.33	14.91	0.82	37.28
ESR 7		409597.66	287684.15	0.64	15.23	1.29	30.46	0.26	14.84	0.64	37.10
ESR 8		409498.85	287769.76	0.80	15.39	1.60	30.77	0.38	14.96	0.95	37.41
ESR 9		409633.55	287697.11	0.53	15.12	1.06	30.23	0.21	14.80	0.53	36.99
ESR 10		409706.51	287473.49	0.33	14.92	0.66	29.83	0.12	14.70	0.30	36.76

Figure C3: 2021 Meteorological Data

				SHORT TERM 90.4th PERCENTILE				LONG TERM ANNUAL MEAN			
				PC 90.4th%ile	PEC	PC/AQO	PEC/AQO	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	$\mu g/m^3$	$\mu g/m^3$	%	%	$\mu g/m^3$	$\mu g/m^3$	%	%
ESR 1		409465.57	287332.18	0.93	15.51	1.85	31.02	0.35	14.94	0.88	37.34
ESR 2		409443.68	287555.74	1.64	16.23	3.28	32.45	0.83	15.41	2.07	38.53
ESR 3		409448.32	287613.53	1.66	16.25	3.33	32.50	0.81	15.40	2.03	38.49
ESR 4		409466.02	287644.91	1.47	16.06	2.94	32.11	0.69	15.27	1.72	38.19
ESR 5		409497.45	287733.48	0.93	15.51	1.85	31.02	0.40	14.98	1.00	37.46
ESR 6		409568.54	287600.64	0.74	15.32	1.47	30.64	0.30	14.88	0.75	37.21
ESR 7		409597.66	287684.15	0.63	15.22	1.27	30.44	0.24	14.83	0.60	37.07
ESR 8		409498.85	287769.76	0.82	15.40	1.64	30.81	0.36	14.95	0.90	37.37
ESR 9		409633.55	287697.11	0.54	15.13	1.08	30.25	0.20	14.79	0.50	36.96
ESR 10		409706.51	287473.49	0.36	14.95	0.72	29.89	0.14	14.72	0.34	36.80

Figure C4: 2022 Meteorological Data

				SHORT TERM 90.4th PERCENTILE				LONG TERM ANNUAL MEAN			
				PC 90.4th%ile	PEC	PC/AQO	PEC/AQO	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	$\mu g/m^3$	$\mu g/m^3$	%	%	$\mu g/m^3$	$\mu g/m^3$	%	%
ESR 1		409465.57	287332.18	0.90	15.49	1.81	30.98	0.33	14.92	0.83	37.29
ESR 2		409443.68	287555.74	1.73	16.32	3.46	32.63	0.80	15.39	2.01	38.47
ESR 3		409448.32	287613.53	1.65	16.24	3.31	32.48	0.77	15.36	1.93	38.39
ESR 4		409466.02	287644.91	1.51	16.09	3.01	32.18	0.66	15.25	1.66	38.13
ESR 5		409497.45	287733.48	0.95	15.53	1.89	31.06	0.40	14.99	1.01	37.47
ESR 6		409568.54	287600.64	0.71	15.29	1.41	30.58	0.28	14.86	0.69	37.15
ESR 7		409597.66	287684.15	0.59	15.18	1.18	30.35	0.23	14.81	0.57	37.03
ESR 8		409498.85	287769.76	0.85	15.44	1.70	30.88	0.36	14.95	0.91	37.38
ESR 9		409633.55	287697.11	0.50	15.09	1.00	30.17	0.19	14.77	0.46	36.93
ESR 10		409706.51	287473.49	0.35	14.94	0.71	29.88	0.13	14.71	0.32	36.78

Figure C5: 2023 Meteorological Data

				SHORT TERM 90.4th PERCENTILE				LONG TERM ANNUAL MEAN			
				PC 90.4th%ile	PEC	PC/AQO	PEC/AQO	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	PM_{10} 24 HOUR	ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	$\mu g/m^3$	$\mu g/m^3$	%	%	$\mu g/m^3$	$\mu g/m^3$	%	%
ESR 1		409465.57	287332.18	0.72	15.31	1.45	30.62	0.29	14.88	0.73	37.19
ESR 2		409443.68	287555.74	1.82	16.41	3.65	32.82	0.84	15.43	2.11	38.57
ESR 3		409448.32	287613.53	1.87	16.46	3.74	32.91	0.86	15.44	2.15	38.61
ESR 4		409466.02	287644.91	1.55	16.13	3.09	32.26	0.72	15.31	1.81	38.27
ESR 5		409497.45	287733.48	1.01	15.60	2.02	31.19	0.43	15.02	1.08	37.54
ESR 6		409568.54	287600.64	0.84	15.42	1.68	30.85	0.32	14.90	0.80	37.26
ESR 7		409597.66	287684.15	0.69	15.28	1.38	30.55	0.26	14.85	0.65	37.11
ESR 8		409498.85	287769.76	0.90	15.49	1.81	30.98	0.39	14.97	0.97	37.43
ESR 9		409633.55	287697.11	0.57	15.16	1.15	30.32	0.21	14.80	0.53	37.00
ESR 10		409706.51	287473.49	0.38	14.97	0.76	29.93	0.13	14.71	0.32	36.79

Appendix D: Predicted TVOC Concentrations for Existing Sensitive Human Receptors

Predicted TVOC Concentrations

C.2 The predicted TVOC concentrations for the existing sensitive receptors and points across the receptor grid, for each year of meteorological data, are shown in Figures C6 to C10. The highest results for the receptors considered are highlighted in red.

Figure C6: 2019 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1		409465.57	287332.18	0.49	1.14	1.22	22.82
ESR 2		409443.68	287555.74	0.89	1.54	2.23	30.83
ESR 3		409448.32	287613.53	0.77	1.42	1.92	28.39
ESR 4		409466.02	287644.91	0.64	1.29	1.60	25.81
ESR 5		409497.45	287733.48	0.42	1.07	1.04	21.38
ESR 6		409568.54	287600.64	0.38	1.03	0.95	20.60
ESR 7		409597.66	287684.15	0.30	0.95	0.74	18.97
ESR 8		409498.85	287769.76	0.38	1.03	0.94	20.56
ESR 9		409633.55	287697.11	0.26	0.91	0.64	18.13
ESR 10		409706.51	287473.49	0.18	0.83	0.46	16.67

Figure C7: 2020 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	μg/m³	μg/m³	%	%
ESR 1		409465.57	287332.18	0.43	1.08	1.08	21.64
ESR 2		409443.68	287555.74	0.98	1.63	2.44	32.58
ESR 3		409448.32	287613.53	0.83	1.48	2.07	29.61
ESR 4		409466.02	287644.91	0.68	1.33	1.70	26.61
ESR 5		409497.45	287733.48	0.44	1.09	1.09	21.76
ESR 6		409568.54	287600.64	0.41	1.06	1.03	21.28
ESR 7		409597.66	287684.15	0.32	0.97	0.80	19.40
ESR 8		409498.85	287769.76	0.39	1.04	0.97	20.80
ESR 9		409633.55	287697.11	0.27	0.92	0.68	18.49
ESR 10		409706.51	287473.49	0.19	0.84	0.48	16.86

Figure C8: 2021 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	μg/m³	μg/m³	%	%
ESR 1		409465.57	287332.18	0.49	1.14	1.23	22.85
ESR 2		409443.68	287555.74	0.81	1.46	2.01	29.13
ESR 3		409448.32	287613.53	0.69	1.34	1.72	26.81
ESR 4		409466.02	287644.91	0.57	1.22	1.43	24.47
ESR 5		409497.45	287733.48	0.37	1.02	0.93	20.46
ESR 6		409568.54	287600.64	0.35	1.00	0.87	19.95
ESR 7		409597.66	287684.15	0.27	0.92	0.68	18.44
ESR 8		409498.85	287769.76	0.34	0.99	0.84	19.73
ESR 9		409633.55	287697.11	0.23	0.89	0.59	17.71
ESR 10		409706.51	287473.49	0.18	0.83	0.44	16.53

Figure C9: 2022 Meteorological Data

RECEPTOR	ADDRESS	GRID REFERENCE		LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
				ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m³	µg/m³	%	%
ESR 1		409465.57	287332.18	0.49	1.14	1.22	22.75
ESR 2		409443.68	287555.74	0.83	1.48	2.08	29.69
ESR 3		409448.32	287613.53	0.72	1.37	1.80	27.42
ESR 4		409466.02	287644.91	0.60	1.25	1.50	25.01
ESR 5		409497.45	287733.48	0.39	1.04	0.98	20.83
ESR 6		409568.54	287600.64	0.35	1.00	0.88	20.06
ESR 7		409597.66	287684.15	0.28	0.93	0.69	18.58
ESR 8		409498.85	287769.76	0.35	1.00	0.88	20.07
ESR 9		409633.55	287697.11	0.24	0.89	0.60	17.81
ESR 10		409706.51	287473.49	0.17	0.83	0.44	16.52

Figure C10: 2023 Meteorological Data

RECEPTOR	ADDRESS	GRID REFERENCE		LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
				ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m³	µg/m³	%	%
ESR 1		409465.57	287332.18	0.42	1.08	1.06	21.51
ESR 2		409443.68	287555.74	**0.99**	**1.64**	**2.47**	**32.79**
ESR 3		409448.32	287613.53	0.84	1.49	2.10	29.79
ESR 4		409466.02	287644.91	0.69	1.34	1.73	26.86
ESR 5		409497.45	287733.48	0.44	1.09	1.11	21.89
ESR 6		409568.54	287600.64	0.43	1.08	1.07	21.60
ESR 7		409597.66	287684.15	0.34	0.99	0.84	19.77
ESR 8		409498.85	287769.76	0.39	1.04	0.98	20.86
ESR 9		409633.55	287697.11	0.29	0.94	0.73	18.84
ESR 10		409706.51	287473.49	0.20	0.86	0.51	17.11

Appendix E: Professional Experience

E1 Details of the experience of the personnel involved with the project are provided below:

Paul Threlfall **Associate Director (Air Quality)**
BSc (Hons), MSc, MIEnvSc, MIAQM

Paul joined Wardell Armstrong in October 2017 as an Air Quality Scientist, after completing his MSc Water, Energy and the Environment at Liverpool John Moores University. The majority of his work is carried out in support of planning applications and, therefore, he has experience of undertaking air quality assessments for a wide range of projects including residential developments, commercial developments, and mixed-use developments. Paul also has extensive experience of undertaking detailed air quality assessments for large industrial developments for both planning and permit applications.

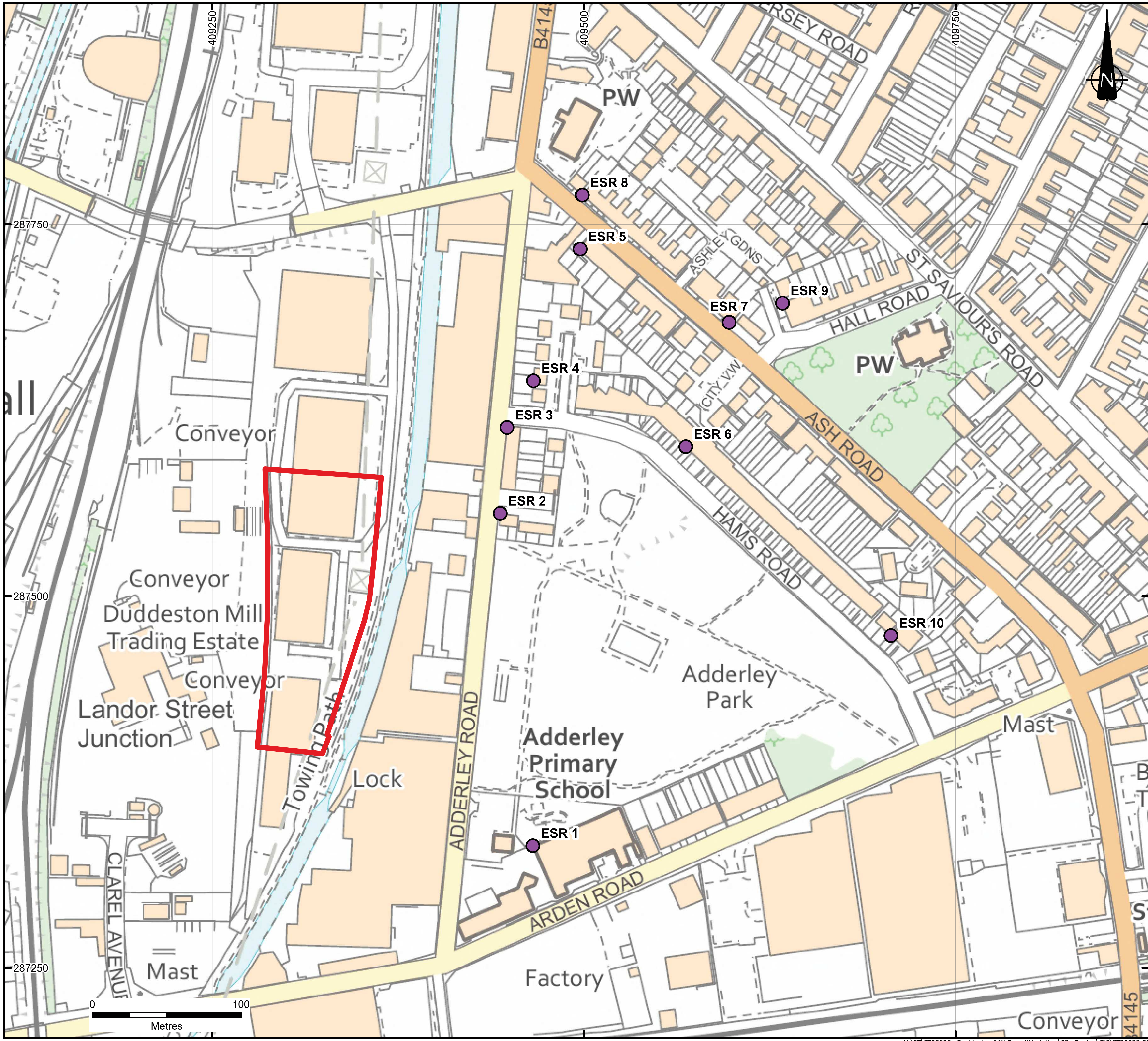
Paul has a broad range of skills and knowledge of air quality modelling and monitoring through his involvement in air quality projects, both as individual commissions and as part of Environmental Impact Assessments (EIAs). Paul also has extensive knowledge and experience of undertaking odour assessments, ranging from qualitative desk-based assessments to more detailed odour dispersion modelling assessments using AERMOD, as well as extensive experience of undertaking odour 'sniff test' observations.

Malcolm Walton **Technical Director**
BSc (Env Health) Dip (Acoustics & Noise Control) MCIEH AMIOA

Malcolm holds a Bachelor of Science degree in Environmental Health and the Diploma in Acoustics and Noise Control. Malcolm is a Member of the Chartered Institute of Environmental Health and an Associate Member of the Institute of Acoustics.

Malcolm joined Wardell Armstrong in September 2001 following 12 years working as an Environmental Health Officer in several local authorities, responsible for the enforcement of environmental legislation and, in particular, air pollution and noise nuisance. Malcolm has experience in the technical co-ordination of environmental appraisal of large schemes to UK and international standards. Malcolm regularly carries out and co-ordinates noise and air quality assessment work associated with planning applications including EIA work and PPC permit application/compliance. He also regularly acts as expert witness in planning inquiries in respect of noise, air quality and odour.

DRAWINGS



KEY

- Site Boundary Application
- Existing Sensitive Human Receptors

Notes:

Boundaries are indicative.

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
A	FIRST ISSUE	10/12/24	CP	PT	MTW

CLIENT

EUROPEAN METAL RECYCLING LTD

PROJECT

DUDDESTON MILL PERMIT VARIATION

DRAWING TITLE

EXISTING SENSITIVE HUMAN RECEPTORS

DRG No.	REV	SUIT. CODE
ST20838-001	A	--

DRG SIZE	SCALE	DATE
A3	1:2,500	10/12/2024

DRAWN BY	CHECKED BY	APPROVED BY
CP	PT	MTW

wardell armstrong PART OF SLR

N:\ST\ST20838 - Duddeston Mill PermitVariation\03 - Design\GIS\ST20838-001 Existing Sensitive Human Receptors Plan\ST20838-001 Existing Sensitive Human Receptors Plan.aprx

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