

GAS-FIRED STANDBY ELECTRICITY GENERATION FACILITY
MARL ROAD, KNOWSLEY, KIRKBY
AIR QUALITY ASSESSMENT

August 2021

Report Ref: 01.0197.006 v2

CONTENTS

1.0	INTRODUCTION	4
1.1	Background.....	4
1.2	Planning History	4
1.3	Scope	5
2.0	SITE DESCRIPTION	6
2.1	Location	6
2.2	Development Description.....	6
3.0	REGULATORY STANDARDS AND GUIDELINES	7
3.1	International Legislation and Policy	7
3.2	Air Quality Strategy for England, Scotland, Wales & Northern Ireland.....	7
3.3	Local Air Quality Management (LAQM).....	9
3.4	Medium Combustion Plant Directive (MCPD).....	10
3.5	National Planning Policy	11
3.6	Knowsley Metropolitan Borough Council Policies	12
4.0	ASSESSMENT METHODOLOGY	13
4.1	Local Meteorological Data.....	13
4.2	Topography.....	13
4.3	Building Downwash / Entrainment	14
4.4	Nitrogen Oxides to NO ₂ Conversion	14
4.5	Sensitive Human Health Receptors	14
4.6	Sensitive Habitats and Ecosystems	15
4.7	Significance of Impact	16
4.7.1	Planning.....	16
4.7.2	Permitting.....	18
5.0	BASELINE CONDITIONS	20
5.1	Council Review and Assessment of Air Quality	20
5.2	Local Monitoring Data	20
5.3	DEFRA Background Maps	20
6.0	PREDICTED IMPACTS.....	21
6.1	All Locations	21
6.2	Discrete Receptors: Human.....	21
6.3	Discrete Receptors: Ecological	22
6.3.1	Critical Levels.....	22

6.3.2	Critical Loads	23
6.4	Summary.....	23
6.5	Suitability for Permitting	23
7.0	CONCLUSIONS	25
	DRAWING AQ1	26
	APPENDIX A: INPUT DATA.....	28
	APPENDIX B: WIND DATA	29
	APPENDIX C: AIR QUALITY LIMITS.....	30
	APPENDIX D: IMPACT PLOTS.....	31
	APPENDIX E: ECOLOGICAL SEARCHES	34



[Copyright notice: Unless otherwise noted, all OS drawings used in this report are subject to Crown copyright and database rights 2021 Ordnance Survey 0100031673]

1.0 INTRODUCTION

1.1 Background

This air quality assessment has been undertaken by Isopleth Ltd further to instruction by Forsa Energy Gas Holdings Ltd (hereafter referred to as 'Forsa').

The assessment considers air quality impacts associated with the proposed development of a small scale standby electricity generation plant (SSSEGP) peaking power plant at their site on land at Land At Marl Road, Knowsley Industrial Park, Kirkby, Knowsley (Drawing AQ1). The site lies within the administrative area of Knowsley Metropolitan Borough Council (KMBC).

The impacts of the proposed electricity generation facility on local air quality has been assessed. The type, source and significance of potential impacts are identified and the measures employed to minimise these impacts are described.

The key pollutant associated with operation of the spark ignition engines considered in this assessment are oxides of nitrogen (NO_x as NO_2), identified in the Medium Combustion Plant Directive (MCPD) as the primary pollutants arising from the combustion of natural gas, for which there is a quantitative limit. Other pollutants, such as sulphur dioxide (SO_2), sometimes associated with the operation of spark ignition engines (when run on biogas) are generated in negligible levels when using this fuel type and there is no MCPD limit for carbon monoxide (CO). Predicted ground level concentrations of NO_2 are compared with relevant air quality standards and guidelines for the protection of human health and sensitive habitats.

1.2 Planning History

Permission was granted for a similar scheme on 6th November 2015, Application Reference Number: 15/00595/FUL:

'Construction of an Electricity Generation Plant Comprising of a Maximum of 14no. Generators Sited Within Individual Sound Proof Containers Together With Associated Development. Land At Marl Road, Knowsley Industrial Park, Kirkby Knowsley.'

The application for the approved scheme was supported by an air quality assessment completed by Isopleth Ltd:

'Isopleth Ltd (2015). Short-Term Operating Reserve (STOR) Power Plant. Marl Road, Knowsley. Air Quality Assessment. September 2015 Report Ref: 01.0024.003/15066'

The November 2015 air quality assessment considered a scheme which included 10 No. 2.0MWe spark ignition engines, fuelled by natural gas, for electricity generation that together will generate a total of 20.0 MWe.

The planning approval for application 15/00595/FUL was not commenced and has since lapsed.

1.3 Scope

This detailed assessment report relates to the impact of air pollutants from the operation of the proposed electricity generation facility. Results of the dispersion modelling for engine exhaust emissions are presented in terms of concentrations, with a description of magnitude and also determination of significance where relevant.



2.0 SITE DESCRIPTION

2.1 Location

The site is located at Marl Road, Knowsley. The approximate National Grid Reference for the site is 343275, 399494. A layout and location plan of the site is presented as Drawing AQ1.

The site lies within the Knowsley Industrial Park. The closest residential receptors are at Dale Lane / North Perimeter Road approximately 450m to the north west of the site.

2.2 Development Description

The site will operate on a largely unmanned basis and will be remotely operated by Forsa. The standby, natural gas fuelled spark ignition engines provide balance to the National Grid during unexpected periods of high demand for electricity or where there are constraints on electricity available in England and Wales.

The proposed facility will comprise 10 No. 2.0 MWe Cummins C2000 N5CD (HSK78G) spark ignition engines, fuelled by natural gas, for electricity generation that together will generate a total of 20 MWe. Emissions to air are via 10 No. engine exhausts of 8.0m in height, each serving a single engine.

The NO_x emission concentration of the engines is **250 mg/Nm³ at 5% O₂**, 0 degC, 1atm, dry. This may be converted to differing oxygen concentrations using the equation in MCERTS monitoring Guidance M2 Box 3.5. In this case, the concentration may also be expressed as **93.75 mg/Nm³ at 15% O₂**, 0 degC, 1atm, dry.

This air quality assessment assumes that each of the engines within the power plant will operate for a maximum of 2500 hours per year.

3.0 REGULATORY STANDARDS AND GUIDELINES

3.1 International Legislation and Policy

European Directive 2008/50/EC of the European Parliament and of the Council of 21st May 2008, sets legally-binding Europe-wide limit values for the protection of public health and sensitive habitats. The Directive streamlines the European Union's air quality legislation by replacing four of the five existing Air Quality Directives within a single, integrated instrument.

The pollutants included are sulphur dioxide (SO₂), nitrogen dioxide (NO₂), particulate matter of less than 10 micrometres (µm) in aerodynamic diameter (PM₁₀), particulate matter of less than 2.5 µm in aerodynamic diameter (PM_{2.5}), lead (Pb), carbon monoxide (CO), benzene (C₆H₆), ozone (O₃), polycyclic aromatic hydrocarbons (PAHs), cadmium (Cd), arsenic (As), nickel (Ni) and mercury (Hg).

Directive 2008/50/EC makes it clear that the ambient air quality standards shall not be enforced where there is no regular public access and fixed habitation:

'2. Compliance with the limit values directed at the protection of human health shall not be assessed at the following locations:

(a) any locations situated within areas where members of the public do not have access and there is no fixed habitation;

(b) in accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply;

(c) on the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access to the central reservation.'

The Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019 (SI 2019/39) were made on 8 January 2019 and come into force on exit day. The Regulations ensure that the Environmental Permitting (EP) regime in England and Wales can continue to function after Brexit.

3.2 Air Quality Strategy for England, Scotland, Wales & Northern Ireland

The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007, pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems.

The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence

reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedences of the standard over a given period.

For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of NO₂, the short-term standard is for a 1-hour averaging period, whereas for CO it is the 8-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants.

Table 3-1
Air Quality Strategy Objectives

Pollutant	Concentrations	Measured As
Nitrogen Dioxide (NO ₂)	200 µg/m ³ not to be exceeded more than 18 times per year	1 hour mean
	40 µg/m ³	Annual mean

The health studies which provide the basis for the air quality standards are based on data for individuals within a population, and therefore the exposure should relate to that of an individual.

For the purposes of LAQM, regulations state that exceedances of the objectives should be assessed in relation to 'the quality of the air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present'.

Examples of where the objectives should, and should not apply, are summarised in Table 3-2 below, as taken from DEFRA Guidance LAQM TG(16). This table should be considered in the context of the conclusions of various review documents such as The AQC report¹ *Relationship between the UK Air Quality Objectives and Occupational Air Quality Standards* (November 2016). In particular it is important that, when setting the objective, DEFRA took account of EPAQS's recommendations. It was also influenced by the limit value set in European Commission's First Air Quality Daughter Directive which made it clear that it only applied to 'outdoor air in the troposphere, excluding work places'. The Ambient air quality Directive is consistent with this, stating that 'Compliance with the limit values directed at the protection of human health shall not be assessed... on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply'.

¹<http://www.aqconsultants.co.uk/AQC/media/Reports/Relationship-between-the-UK-Air-Quality-Objectives-and-Occupational-Air-Quality-Standards.pdf>

As such, commercial / industrial occupiers of industrial units would therefore be outside the requirements of the air quality objectives. Occupiers of industrial units where members of the public would 'regularly be present' are however within the requirements, such as some of those mentioned in section 2.1 above.

Table 3-2
Air Quality Strategy Objectives

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 façades 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 objective would apply, together with hotels. 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.
1-hour mean	All locations where the annual mean, 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations 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 where members of the public might reasonably expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.3 Local Air Quality Management (LAQM)

Part IV of the Environment Act 1995 also requires local authorities to periodically Review and Assess the quality of air within their administrative area. The Reviews have to consider the present and future air quality and whether any air quality objectives prescribed in Regulations are being achieved or are likely to be achieved in the future.

Where any of the prescribed air quality objectives are not likely to be achieved the authority concerned must designate that part an Air Quality Management Area (AQMA).

For each AQMA, the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local

air quality in pursuit of the air quality objectives. Local authorities are not statutorily obliged to meet the objectives, but they must show that they are working towards them.

The Department of Environment, Food and Rural Affairs (DEFRA) has published technical guidance for use by local authorities in their Review and Assessment work. This guidance is commonly referred to as LAQM.TG(16). Full details are available on the DEFRA website.

3.4 Medium Combustion Plant Directive (MCPD)

Directive (EU) 2015/2193 of the European Parliament and the Council of 25th November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion facilities (Medium Combustion Plant (MCP) Directive) regulates pollutant emissions from the combustion of fuels in facilities with a rated thermal input equal to or greater than 1 megawatt (MW_{th}) and less than 50 MW_{th}.

The MCPD entered into force on 18th December 2015 and has been transposed into the Environmental Permitting Regulations, most recently through The Environmental Permitting (England and Wales) (Amendment) Regulations 2018 No. 110. The MCPD regulates emissions of NO_x, SO₂, and particulate matter (PM₁₀) into the air with the aim of reducing those emissions and the risks to human health and the environment they may cause. It also lays down rules to monitor emissions of carbon monoxide (CO).

Environment Agency has issued guidance relating to MCPD regulation and assessment, including:

'Emissions from specified generators (Version 1). Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators.'

This EA guidance states that it is intended for use with:

- Tranche A generators that have NO_x emissions greater than 500 mg/Nm³ (at 273.15 K, 101.3 kPa, 0% moisture and 15% oxygen), with aggregated rated thermal inputs of greater than 5 MW_{th} and operating more than 50 hours per year;
- Tranche B generators with NO_x emissions less than 190 mg/Nm³, with aggregated thermal inputs greater than 1 MW_{th} and operating more than 50 hours per year where there is a higher risk of NO_x impacts. For example, where the facility is located in or near an Air Quality Management Area (AQMA) declared for NO₂, or operates for more than 500 hours per year.

These include former Tranche A generators with transitional arrangements of:

- NO_x emissions less than 500 mg/Nm³ with aggregated rated thermal inputs greater than 5 MW_{th}; and aggregated rated thermal inputs less than 5 MW_{th}.

This detailed air quality assessment is compliant with the requirements of the EA guidance.

3.5 National Planning Policy

The latest revision of the National Planning Policy Framework (NPPF) was published in July 2021 and sets out the Government's planning policies for England and how these are expected to be applied.

The purpose of the planning system is to contribute to the achievement of sustainable development. In order to ensure this, this NPPF recognises three overarching objectives, including the following of relevance to air quality:

"c) An environment objective - to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigation and adapting to climate change, including moving to a low carbon economy."

Chapter 15 (paragraph 174) of the NPPF details objectives in relation to conserving and enhancing the natural environment. It states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

[...]

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality [...]"

The NPPF (paragraph 186) specifically recognises air quality as part of delivering sustainable development and states 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 Air Quality Management Areas and Clean Air Zones, 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 the 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 Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

The implications of the NPPF have been considered throughout this assessment.

3.6 Knowsley Metropolitan Borough Council Policies

The Knowsley Local Plan Core Strategy was adopted in January 2016. The core strategy contains Policies with direct relevance to air quality, including:

Policy CS2: Development Principles

'1) New development in Knowsley and the preparation of subsequent stages of the Local Plan will be expected to support the following development principles:

Principle 4: Recognise environmental limits, protect and enhance environmental assets, enhance local character and promote quality of place by:

....

j) Minimising negative impact upon flood risk, air quality, water quality, land quality, soil quality, and noise or vibration levels and ensuring any negative impacts are appropriately mitigated.

.....

Development that will have an unacceptable impact upon any of the above will only be permitted where the benefits of the proposal clearly outweigh the harm.'

Also:

'Policy CS23: Renewable and Low Carbon Infrastructure

1) The Council will support proposals that will produce and distribute decentralised, low carbon and renewable energy, provided that they do not cause significant harm (in terms of their number, scale, siting or cumulative impacts) to:

a) Natural resources, biodiversity, geodiversity, water and air quality and, landscape character;

....'

A detailed review of the KMBC planning policies is outside the scope of this report.

4.0 ASSESSMENT METHODOLOGY

The scope of the impact assessment for stack emissions from the proposed plant has been determined in the following way:

- review of air quality data for the area surrounding the Site, including data from the Defra Air Quality Information Resource (UK-AIR) and the Air Pollution Information System (APIS);
- desk study to confirm the location of nearby areas that may be sensitive to changes in local air quality; and
- review of emission parameters for the power plant and dispersion modelling using the Breeze AERMOD 9 dispersion model (version 19191) to predict ground-level concentrations of pollutants at sensitive human and habitat receptor locations.

Manufacturer emission limits have been assumed for the purposes of the modelling assessment and each engine is assumed to be operating at full load for 2500 hours in the year.

The input parameters used in the assessment are identified in Appendix A.

4.1 Local Meteorological Data

The dispersion modelling has been carried out using six years (2014-2019) of hourly sequential meteorological data in order to take account of inter-annual variability and reduce the effect of any atypical conditions. Data from the Crosby meteorological station has been used for the assessment. This site is the most representative data currently available for the area which provides the level of completeness required for dispersion modelling (i.e. minimal missing data).

The meteorological data has been prepared based on a surface roughness of 0.5m with the Albedo / Bowen is characterised as grassland (30%), cultivated land (30%), deciduous forest (10%) and urban (30%).

A windrose for all years of meteorological data are presented in Appendix B.

4.2 Topography

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

The power plant containers are sites on concrete plinths and lie at a basal elevation of around 39m AoD. Topography has been incorporated within the dispersion model.

AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source. Topographical data for the site has been obtained in OS digital (.ntf) format.

Data was processed by the AERMAP function within AERMOD to calculate terrain heights, and interpolate data to calculate terrain heights for sources, buildings etc.

4.3 Building Downwash / Entrainment

The presence of buildings close to emission sources can significantly affect the dispersion of pollutants by leading to downwash. This occurs when a building distorts the wind flow, creating zones of increased turbulence. Increased turbulence causes the plume to come to ground earlier than otherwise would be the case and result in higher ground level concentrations closer to the stack.

Downwash effects are only significant where building heights are greater than 40% of the emission release height. The downwash structures also need to be sufficiently close for their influence to be significant.

The engine containers are a maximum of 4.5m in height and have been included in the dispersion model to account for potential downwash effects and allow for stack height determination. All other buildings / structures within 5 stack heights are lower than 40% of the stack and are therefore not relevant to the model.

4.4 Nitrogen Oxides to NO₂ Conversion

Oxides of nitrogen (NO_x) emitted to atmosphere as a result of combustion will consist largely of nitric oxide (NO), a relatively innocuous substance. Once released into the atmosphere, NO is oxidised to NO₂. The proportion of NO converted to NO₂ depends on a number of factors including wind speed, distance from the source, solar irradiation and the availability of oxidants, such as ozone (O₃).

A conversion ratio of 70% NO_x:NO₂ has been assumed for comparison of predicted concentrations with the long-term objectives for NO₂. A conversion ratio of 35% has been utilised for the assessment of short-term impacts, as recommended by Environment Agency guidance².

4.5 Sensitive Human Health Receptors

The term 'sensitive receptors' includes any persons, locations or systems that may be susceptible to changes as a consequence of the proposed power plant. As described in section 3.2 of this report, annual objectives only apply at residences.

A selection of the closest receptors to the development which have been used for modelling purposes are shown in Table 4.1 and are also shown on Drawing AQ1.

² AQMAU, Conversion Rates for NO_x and NO₂.

Table 4-1
Modelled Receptors: Human

Reference	Description	OS GR Xm	OS GR Ym
D1	Warrenhouse Road 1	342604.0	399618.7
D2	Warrenhouse Road 2	342583.8	399569.7
D3	Simonswood Lane 1	342550.2	399527.5
D4	Simonswood Lane 2	342515.7	399458.4
D5	Simonswood Lane 3	342496.5	399388.4
D6	Simonswood Lane 4	342477.3	399286.7
D7	Simonswood Lane 5	342447.6	399163.8
D8	Brook Hey Drive 1	342482.1	399343.3
D9	Brook Hey Drive 2	342435.1	399367.3
D10	Dale Lane 1	342891.3	399767.5
D11	Dale Lane 2	342835.0	399805.8
D12	Mintor Road 1	342374.6	398847.9
D13	Eddie McArdle Playing Fields 1	342872.2	399508.7
D14	Eddie McArdle Playing Fields 2	342800.7	399389.1
D15	North Mersey Business centre	343574.3	399516.5

It is recognised that this list is not exhaustive, however these receptors have been selected in order to provide an indication of impacts in all directions from the proposed plant.

For impacts at this site, a receptor grid at 30m resolution across the model domain has been used. These results have been presented as impact isopleths and this allows the concentration at all locations. These predicted ground level concentrations may then be compared with relevant long term and short term air quality standards and guidelines for the protection of health. This approach enables the concentration of a pollutant to be determined at all locations, including those sites which have yet to be built.

4.6 Sensitive Habitats and Ecosystems

The presence of the following habitat sites have been assessed:

- Special Areas of Conservation (SACs) and candidate SACs (cSACs) designated under the EC Habitats Directive³;
- Special Protection Areas (SPAs) and potential SPAs designated under the EC Birds Directive⁴;
- Ramsar Sites designated under the Convention on Wetlands of International Importance⁵.

³ Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

⁴ Council Directive 79/409/EEC on the conservation of wild birds.

⁵ Ramsar (1971), The Convention of Wetlands of International Importance especially as Waterfowl Habitat.

- Sites of Special Scientific Interest (SSSI);
- National Nature Reserves (NNR);
- Local Nature Reserves (LNR); and
- ancient woodland.

Where sensitive ecological receptors are present, maximum predicted ground level concentrations of NO_x are compared with relevant critical levels, thresholds of airborne pollutant concentrations above which damage may be sustained to sensitive plants and animals. The development is not a significant source of SO₂ or HCL / HF.

Environment Agency guidance states that *“the critical levels should be applied at all locations as a matter of policy, as they represent a standard against which to judge ecological harm”*.

Critical loads refer to the threshold beyond which deposition of pollutants to water or land results in measurable damage to vegetation and habitats. The maximum predicted deposition rates are compared with site specific critical loads obtained from APIS.

MAGIC searches for areas 5km (European sites) and 2km from the site (SSSI, AW) are included in Appendix E. These distances are consistent with Environment Agency Guidance for standby generation. The receptors modelled are shown in table 4-2 below.

Table 4-2
Modelled Receptors: Ecological

Reference	Description	OS GR Xm	OS GR Ym
ER1	Acornfield Plantation LNR	343551.8	398020.1

The isopleths included in the appendices to this report allow the impact to be seen in relation to any ecological sites of local interest which have not been specifically mentioned in this report.

A summary of critical levels for the protection of sensitive ecosystems and vegetation is presented in Appendix C.

4.7 Significance of Impact

The significance of impact from the generation plant at the Marl Road facility has been considered against criteria for both planning and also permitting criteria issued by the Environment Agency.

4.7.1 Planning

The EPUK Guidance describes that:

‘Impacts on air quality, whether adverse or beneficial, will have an effect on human health that can be judged as ‘significant’ or ‘not significant’. This is the primary requirement of the EIA regulations, but is also relevant to other air quality assessments.

It is important to distinguish between the meaning of ‘impact’ and ‘effect’ in this context. An impact is the change in the concentration of an air pollutant, as experienced by a receptor.

This may have an effect on the health of a human receptor, depending on the severity of the impact and other factors that may need to be taken into account. Judging the severity of an impact is generally easier than judging the significance of an effect.’

In determining impact significance from the pollutants discharged to air, specific reference has been made to Table 6.3 of “Development Control: Planning for Air Quality”, which presents descriptors for impact magnitude and impact significance. These descriptors are reproduced below and relate to annual average impacts.

Figure 4-1: EPUK Impact descriptors for individual receptors

Long term average Concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

The following standard terminology has been applied:

- Substantial beneficial;
- Moderate beneficial;
- Minor beneficial;
- Neutral/negligible;
- Minor adverse;
- Moderate adverse; and
- Substantial adverse.

In relation to short-term impacts, the EPUK guidance states:

‘6.38 Where such peak short term concentrations from an elevated source are in the range 10-20% of the relevant AQAL, then their magnitude can be described as small, those in the range 20-50% medium and those above 50% as large. These are the maximum concentrations experienced in any year and the severity of this impact can be described as slight, moderate and substantial respectively, without the need to reference background or baseline concentrations. That is not to say that background concentrations are unimportant, but they will, on an annual average basis, be a much smaller quantity than the peak concentration caused by a substantial plume and it is the contribution that is used as a measure of the impact, not the overall concentration

at a receptor. This approach is intended to be a streamlined and pragmatic assessment procedure that avoids undue complexity.'

Therefore, the following descriptors for impact magnitude resulting from short term impacts are applied in this assessment:

- <10%: Negligible;
- 10-20%: Small;
- 20-50%: Medium; and
- >50 Large.

The EPUK guidance also states that:

'judgement of the significance should be made by a competent professional who is suitably qualified. The reasons for reaching the conclusions should be transparent and set out logically.'

An impact which results in an exceedance of an air quality objective will normally be regarded as 'significant'.

4.7.2 Permitting

The EA impact, effect and significance criteria are as detailed below.

Stage 1

The EA Guidance describes that, to screen out a PC for any substance so that no further assessment is needed for that pollutant, the PC must meet both of the following criteria:

- the short-term PC is less than 10% of the short-term environmental standard;
- the long-term PC is less than 1% of the long-term environmental standard

If both of these criteria are met no further assessment of the substance is required. There will be a need to carry out a second stage of screening to determine the impact of the PEC if the criteria are not met.

Stage 2

The EA Guidance describes that, in the second stage of screening if both of the following requirements are met there is no requirement for any further assessment of that substance. Detailed modelling will be required for emissions that don't meet both of the following requirements:

- the short-term PC is less than 20% of the short-term environmental standards minus twice the long-term background concentration; and
- the long-term PEC is less than 70% of the long-term environmental standards

The guidance then states that no further action is needed if the assessment has shown that both of the following apply:

- emissions comply with BAT associated emission levels (AELs) or the equivalent requirements where there is no BAT AEL; and
- the resulting PECs are not predicted to exceed environmental standards

A cost benefit analysis is required if any of the following apply:

- PCs could cause a PEC to exceed an environmental standard (unless the PC is very small compared to other contributors);
- the PEC is already exceeding an environmental standard;
- the activity or part of it isn't covered by a 'BAT reference document' (BREF);
- the emissions from the facility don't comply with BAT AELs; or
- a BAT assessment has been requested.

If the emissions from the facility that affect ecological sites meet both of the following criteria, they are insignificant:

- the short-term PC is less than 10% of the short-term environmental standard for protected conservation areas; and
- the long-term PC is less than 1% of the long-term environmental standard for protected conservation areas

If these requirements are not met there is a need to calculate the PEC and check the PEC against the standard for protected conservation areas.

- If your long-term PC is greater than 1% and the PEC is less than 70% of the long-term environmental standard, the emissions are insignificant and there is no requirement to assess them any further; however
- If the PEC is greater than 70% of the long-term environmental standard, detailed modelling is required.

5.0 BASELINE CONDITIONS

5.1 Council Review and Assessment of Air Quality

The 2020 Air Quality Annual Status Report (ASR) for KMBC dated November 2020 confirms that the council currently has no AQMAs. The proposed development site is therefore not located within an AQMA.

5.2 Local Monitoring Data

KMBC has continuous monitors

- Halewood;
- Huyton; and
- Kirby.

The closest site to the proposed development is the roadside Kirby AQMS, located at Old Rough Lane, Kirkby (OS GR 341414, 398991). This is approximately 2km west of the Marl Road site. The results at all of the 3 continuous monitors showed that 2019 levels were below the annual average limit for nitrogen dioxide.

KMBC also monitored NO₂ concentrations at 32 diffusion tube locations in 2019. None of these diffusion tube sites are of direct relevance to the proposed development site.

5.3 DEFRA Background Maps

Additional information on background concentrations in the vicinity of the development site has been obtained from the DEFRA background pollutant maps. Background concentrations from the two grid squares which represent the site for the current year of 2021 are given as follows.

Table 5-1
DEFRA Backgrounds (µg/m³)

OS GR	Total_NOx_21	Total_NO2_21
341500, 399500	17.08	12.73
341500, 398500	19.08	14.06

Estimated DEFRA background concentrations are therefore 'well below' the relevant objectives. For purposes of this assessment the highest values have been used to represent the background (OS GR 341500, 398500).

6.0 PREDICTED IMPACTS

The assessment results are presented in the tables below.

6.1 All Locations

The predicted process contribution (PC) at the maximum point of impact (offsite) is presented in Table 6.1 for short term limits. The annual objective does not apply at the point of maximum ground level concentration except where a residence is present.

Table 6-1
Maximum Predicted Ground Level Concentrations ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Period	EAL ($\mu\text{g}/\text{m}^3$)	PC ($\mu\text{g}/\text{m}^3$)	PC (%age of EAL)
NO ₂	1-hour	200	110.2	55%

[*18th Highest value of operational period, equating to 99.79th percentile of entire year.]

The results show that the process contribution for short term NO₂ is below the relevant objective at this point of maximum impact.

The potentially significant long-term and short-term impacts are compared with the baseline concentrations (i.e. PC + Baseline, or Predicted Environmental Concentration, 'PEC') for the power generation plant in Table 6.2.

Table 6-2
Comparison of Predictions with Baseline Concentrations ($\mu\text{g}/\text{m}^3$)

Pollutant	EAL	Baseline	PEC	PEC (as a %age of EAL)
NO ₂	200	28.1	138.3	69%

In terms of impact at the point of maximum Ground Level Concentration (GLC) the magnitude of change in 1-hour NO₂ impact is 'large'. This location is not defined as a location '*where members of the public have regular access*', i.e. it is not likely that they would be at this location for 18 hours or more per year.

6.2 Discrete Receptors: Human

The predicted process contribution (PC) and predicted environmental concentration (PEC) at the assessed receptor locations, where members of the public would reasonably be expected to spend time, is presented in Table 6.3. Annual average concentrations do not apply at receptors HR13 and HR14 (amenity) or HR15 (workplace).

Table 6-3
Receptor Impact Concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	PC Annual NO_2	PEC Annual NO_2	PC 1-hr NO_2	PEC 1-hr NO_2
HR1	0.27	14.3	12.2	40.4
HR2	0.25	14.3	11.8	39.9
HR3	0.23	14.3	11.2	39.3
HR4	0.21	14.3	10.6	38.8
HR5	0.19	14.3	10.4	38.5
HR6	0.17	14.2	9.7	37.9
HR7	0.15	14.2	8.7	36.8
HR8	0.18	14.2	10.1	38.2
HR9	0.17	14.2	9.6	37.7
HR10	0.62	14.7	19.7	47.8
HR11	0.52	14.6	16.9	45.0
HR12	0.11	14.2	7.6	35.7
HR13	---	---	21.9	50.0
HR14	---	---	17.7	45.8
HR15	---	---	28.6	56.8

Maximum predicted impacts can be seen in Appendix D. The highest long term NO_2 impact at an assessed receptor is predicted to fall at HR10 Dale Lane which represents 1.6% of the annual objective. The highest hourly NO_2 impact at an assessed discrete receptor is predicted to fall at HR15 which is 14.3% of the short term objective.

6.3 Discrete Receptors: Ecological

6.3.1 Critical Levels

The NO_x critical level impacts at all locations (annual and 24-hour) can be seen in Table 6-4, below.

Table 6-4
Ecological Receptors: Critical Levels ($\mu\text{g}/\text{m}^3$)

Receptor	PC Annual NO_x	Annual NO_x % of limit	PC 24-hr NO_x	24-hr NO_x % of limit
Acornfield Plantation LNR	0.069	0.2%	1.3	1.8%

As the process contribution at Acornfield Plantation LNR is less than 100% of the NO_x critical levels, impacts are insignificant according to Environment Agency guidance.

6.3.2 Critical Loads

In relation to critical loads, the Nutrient N impacts at all locations can be seen in Table 6-5, below.

Table 6-5
Ecological Receptors: Critical Loads

Receptor	PC	lower critical load Kg N/ha/yr	PC (% of lower critical load)
Acornfield Plantation LNR	0.020	15.00	0.13%

As the process contribution at Acornfield Plantation LNR is less than 100% of the nutrient N critical load, impacts are insignificant according to Environment Agency guidance.

6.4 Summary

In relation to all impact screening:

- The highest short term PC at any location outside the site boundary is 110.2 $\mu\text{g}/\text{m}^3$ which is 55% of the EAL (200 $\mu\text{g}/\text{m}^3$). As this is above the 10% threshold, this short term prediction at the point of maximum GLC cannot be considered 'insignificant';
- The highest long term NO_2 PC at an assessed receptor location is 0.62 $\mu\text{g}/\text{m}^3$ which is 1.6% of the EAL (40 $\mu\text{g}/\text{m}^3$). As this is above the 1% threshold, this long term prediction cannot be considered 'insignificant'.

The short term PCs at the point of maximum GLC have not screened out, but the PEC is less than 70% of the associated EAL. At locations where the hourly and / or annual objectives must be applied, levels are well below the relevant NO_2 objectives.

Therefore it can be concluded that the predicted short term and long term PECs at the sensitive human receptors are 'not significant', and are therefore unlikely to be a significant contributor to or cause an exceedance of an EAL. No further mitigation is required, beyond that already in place (i.e. stack height and use of lean burn engines) and in relation to AQ there is no reason why planning consent should not be granted.

6.5 Suitability for Permitting

EA Guidance 'Environmental permitting: air dispersion modelling reports' (24th May 2019) states that:

'You must include a discussion of results (what they mean and their significance) before you make your final conclusions.'

However:

'At the detailed modelling stage there are no criteria to determine whether:

- *PCs are significant*
- *PECs are insignificant or significant'*

In addition, Environment Agency Guidance 'Air emissions risk assessment for your environmental permit' states the following in relation to the requirements for further action, based on the results of the detailed modelling.

When you don't need to take further action

'You don't need to take further action if your assessment has shown that both of the following apply:

- your proposed emissions comply with BAT associated emission levels (AELs) or the equivalent requirements where there is no BAT AEL*
- the resulting PECs won't exceed environmental standards'*

However:

When you need to take further action. You'll need to do a cost benefit analysis if any of the following apply:

- your PCs could cause a PEC to exceed an environmental standard (unless the PC is very small compared to other contributors – if you think this is the case contact the Environment Agency)*
- the PEC is already exceeding an environmental standard*
- your activity or part of it isn't covered by a 'BAT reference document' (BREF)*
- your proposals don't comply with BAT AELs - in this case you'll need to make a request for an exception ('derogation') that includes a cost benefit analysis of your proposals*
- you've been asked to do a BAT assessment*

At locations where the hourly and / or annual objectives must be applied, levels are below the relevant NO₂ objectives. Therefore:

1. Emissions from the generators comply with BAT associated emission levels (AELs); and
2. the PCs will not cause a PEC to exceed an environmental standard at locations where the hourly and / or annual objectives must be applied; and
3. the PEC is not already exceeding an environmental standard at locations where the hourly and / or annual objectives must be applied.

For these reasons, it is acceptable for the EA to issue a Permit for this site when comparing the impacts against their assessment criteria.

7.0 CONCLUSIONS

An assessment has been carried out to determine the local air quality impacts associated with the operation of a proposed power plant on land at Marl Road, Knowsley.

Detailed air quality modelling using the AERMOD 9 dispersion model has been undertaken to predict the impacts associated with stack emissions from the gas engines at the Site. As a worst-case, emissions from each of the stacks have been assumed to occur for 2500 hours per year when comparing against long term air quality limits and the entire year when comparing against short term limits. Actual operational hours are likely to be significantly lower.

All impacts, human and ecological, are predicted to be below limit values at locations where the Air Quality Directive states that they must be applied. When applying the theoretical worst case assumptions above (i.e. that each of the engines is operating for 2500 hours per year) it can be seen that there is no realistic potential for a breach of the air quality objectives at any location.

In summary, it can be concluded that the predicted short term and long term PECs at the sensitive human and ecological receptors are within acceptable limits. The site is therefore unlikely to cause an exceedance of an EAL (or upper critical load / level). For these reasons, it is acceptable for the EA to issue a Permit for this site when comparing the impacts against their assessment criteria and in relation to air quality there is no reason why planning consent should not be granted. These findings are broadly consistent with those for the previously approved scheme, granted 6th November 2015 (Application Number: 15/00595/FUL).

Notice:

This report was produced by Isopleth Ltd to present the results of an air quality constraints assessment for a proposed power plant at a site on land at Marl Road, Knowsley.

This report may not be used by any person (or organisation) other than Forsa Energy Gas Holdings Ltd without express permission. In any event, Isopleth Ltd accepts no liability for any costs, liabilities or losses arising as a result of the use of or reliance upon the contents of this report by any person (or organisation) other than Forsa Energy Gas Holdings Ltd.

DRAWING AQ1







APPENDIX A: INPUT DATA

Table A-1
Modelling Inputs

Parameter	Modelled Value
No. of engines	10
Engine rating (kW _e)	2.0
NO _x concentration (mg/Nm ³)*	250
Exhaust Temp (K)	665
Actual Flow (Am ³ /s per engine)	6.21
H ₂ O (%)	10.0%
Oxygen (%)	10.0%
Normalised Flow (Nm ³ /s per engine)	1.58
NO _x mass emission (g/s) per engine	0.39
Stack Diameter (m)	0.55
Velocity of release (m/s)	26.14
Height of Stack (m)	8.0

[at 5% O₂, 0 degC, 1atm, dry]

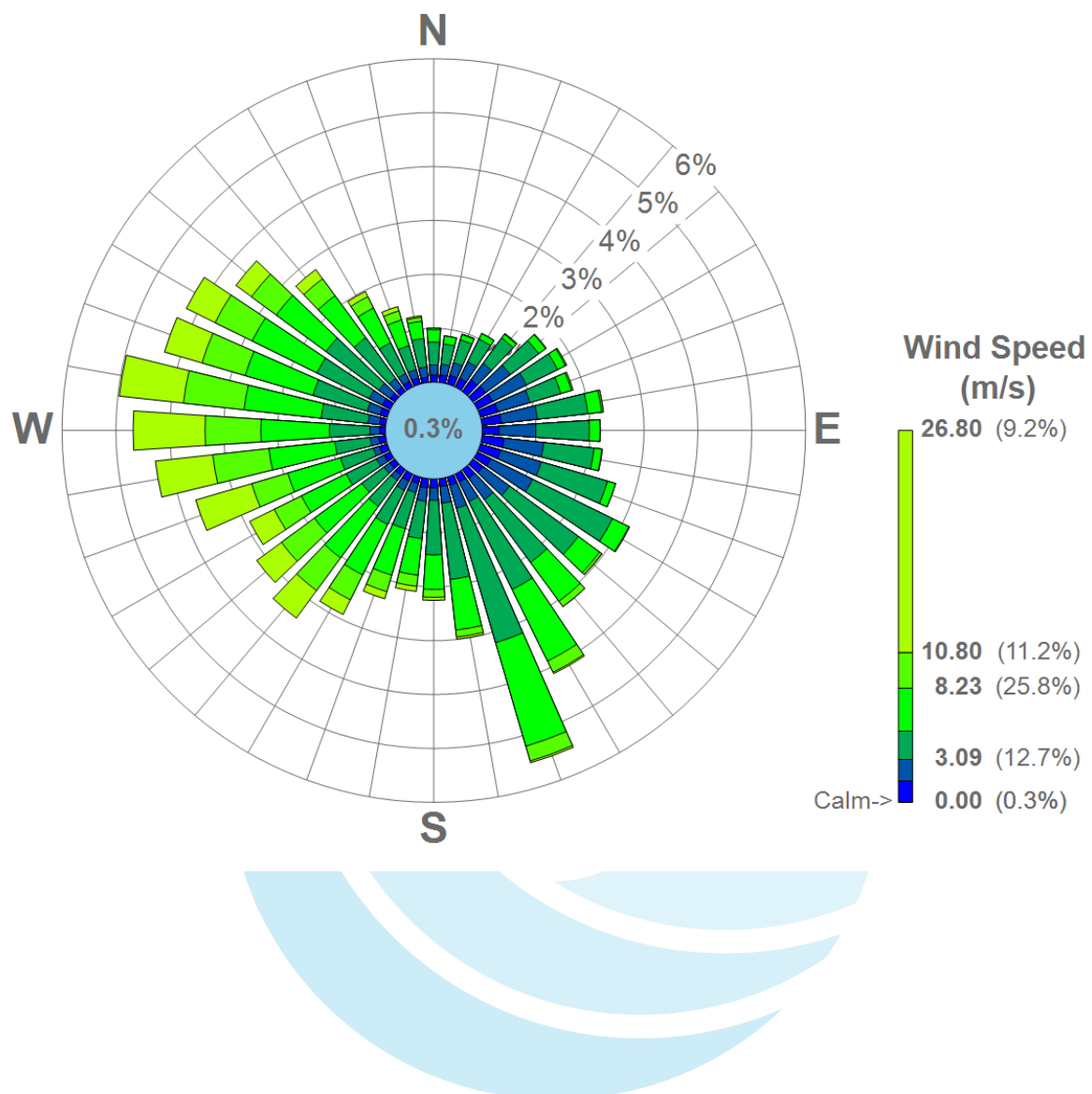
Modelled mass emissions differ from those in the table above for the reasons given in this report, in that they have been adjusted for NO_x:NO₂ proportion in accordance with EA guidance and also hours of operation in the case of long term emissions. For example:

- NO_x mass emission per engine = 0.39 g/s;
- Multiplied by 0.7 for NO_x:NO₂ = 0.276 g/s;
- Multiplied by (2500 / 8760) hours = 0.079 (modelling input).

Table A-2
Stack Locations

Stack	OS Xm	OS Ym
Engine 1	343279.2	399514.4
Engine 2	343278.1	399509.5
Engine 3	343277.1	399504.7
Engine 4	343276.1	399499.7
Engine 5	343275.0	399494.8
Engine 6	343270.9	399475.7
Engine 7	343269.8	399470.8
Engine 8	343268.8	399466.0
Engine 9	343267.7	399461.1
Engine 10	343266.8	399456.3

APPENDIX B: WIND DATA



APPENDIX C: AIR QUALITY LIMITS

Table C-1
Air Quality Strategy Objectives

Pollutant	Concentrations	Measured As
Nitrogen Dioxide (NO ₂)	200 µg/m ³ not to be exceeded more than 18 times per year	1 hour mean
	40 µg/m ³	Annual mean
Nitrogen Dioxide (NO _x)	30 µg/m ³	Annual mean : Protection of Vegetation
	75 µg/m ³	24h: Protection of Vegetation



APPENDIX D: IMPACT PLOTS

Figure D1: Annual Average NO₂ impact

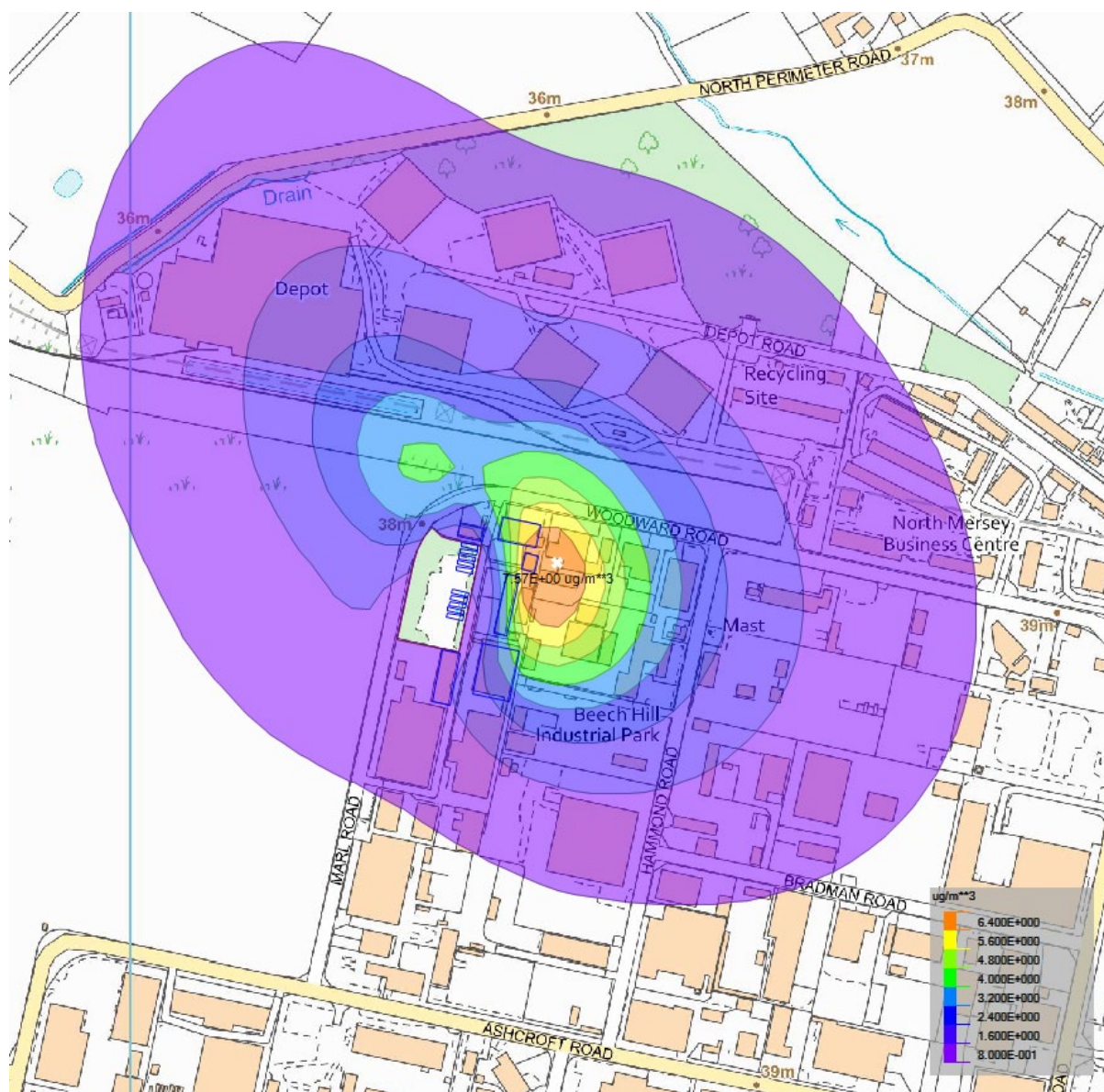


Figure D2: 1hr (99.79th percentile) NO₂ impact

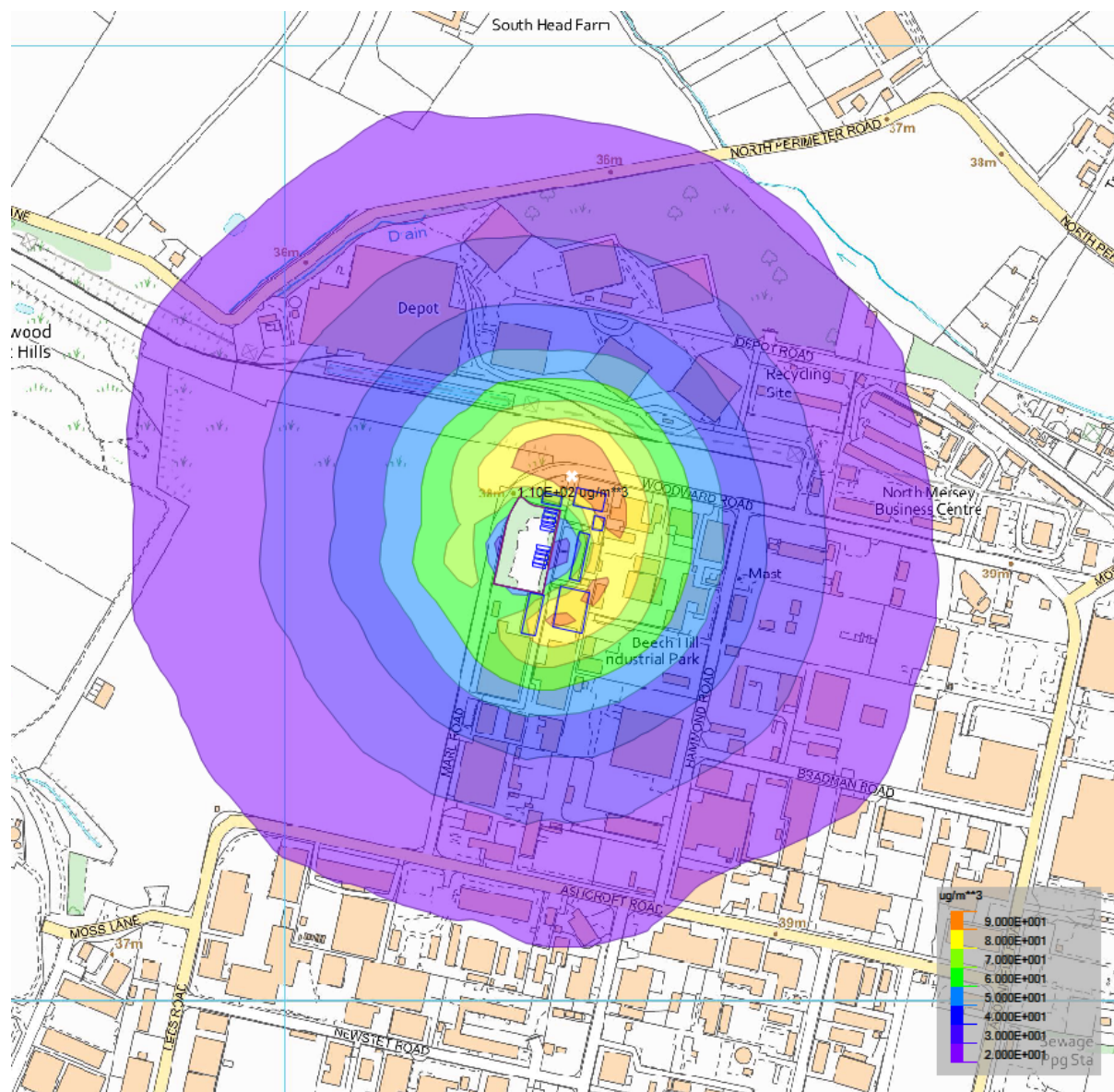
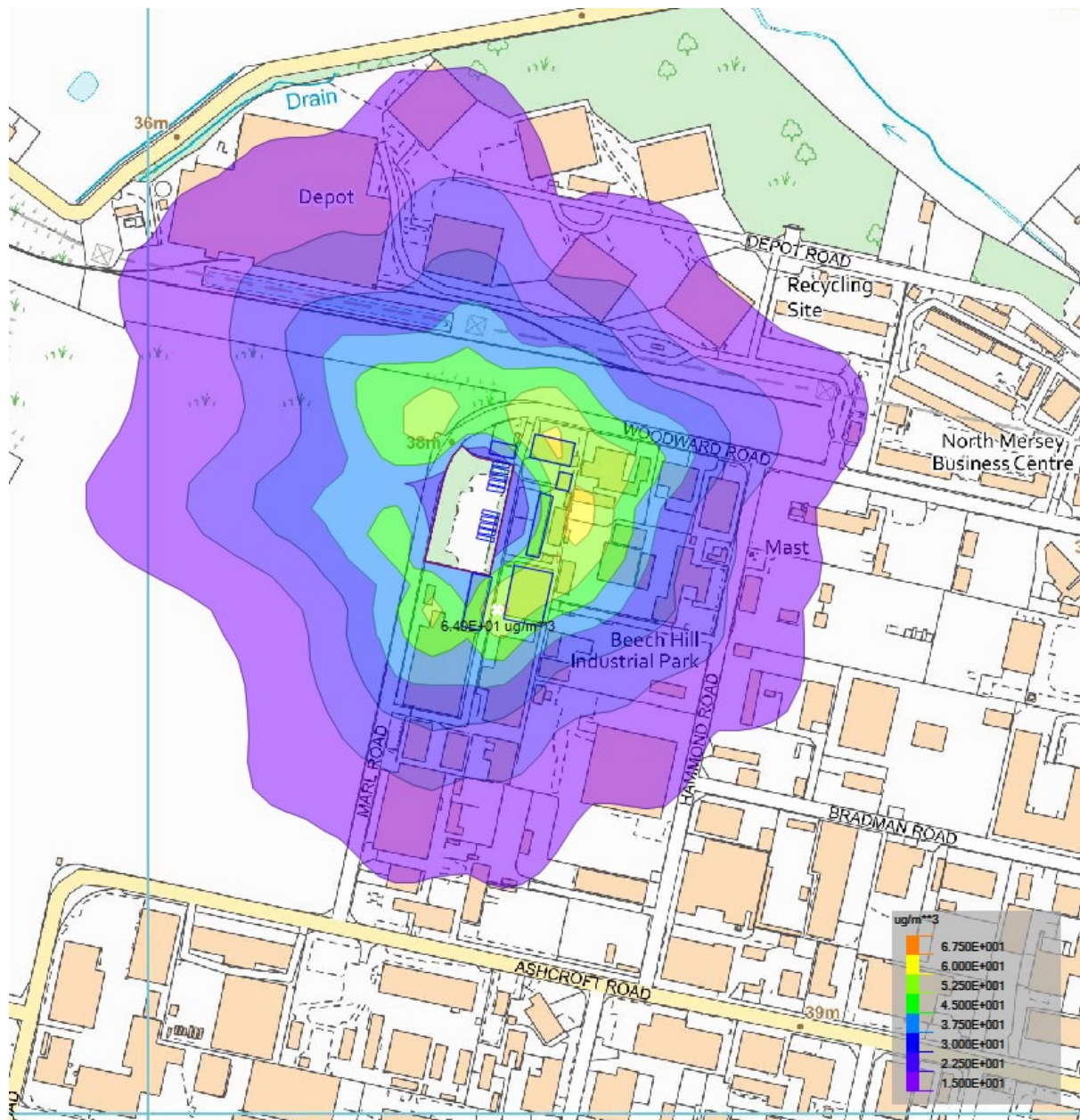


Figure D3: 24 hour Average NO_x impact



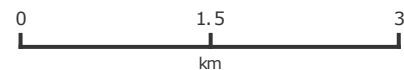
APPENDIX E: ECOLOGICAL SEARCHES





Legend

-  Ramsar Sites (England)
-  Proposed Ramsar Sites (England)
-  Special Areas of Conservation (England)
-  Possible Special Areas of Conservation (England)
-  Special Protection Areas (England)
-  Potential Special Protection Areas (England)



Projection = OSGB36

xmin = 328000

ymin = 392100

xmax = 358200

ymax = 407000

Map produced by MAGIC on 3 August, 2021.

Copyright resides with the data suppliers and the map must not be reproduced without their permission. Some information in MAGIC is a snapshot of the information that is being maintained or continually updated by the originating organisation. Please refer to the metadata for details as information may be illustrative or representative rather than definitive at this stage.

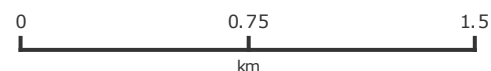


Legend

-  Local Nature Reserves (England)
-  Sites of Special Scientific Interest (England)

Ancient Woodland (England)

-  Ancient and Semi-Natural Woodland
-  Ancient Replanted Woodland



Projection = OSGB36

xmin = 336900

ymin = 396700

xmax = 349500

ymax = 402500

Map produced by MAGIC on 3 August, 2021.

Copyright resides with the data suppliers and the map must not be reproduced without their permission. Some information in MAGIC is a snapshot of the information that is being maintained or continually updated by the originating organisation. Please refer to the metadata for details as information may be illustrative or representative rather than definitive at this stage.



Isopleth Ltd
Ulverston,
53 Englishcombe Lane,
Bath
BA2 2EE
www.isopleth.co.uk

Registered in England and Wales No. 9150373