BIO DYNAMIC (UK) AD PLANT

COLWICK INDUSTRIAL ESTATE, NOTTINGHAM

AIR QUALITY ASSESSMENT

February 2022

Report Ref: 01.0130.004 v1

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CONTENTS

1.0 INTRODUCTION

1.1 Background

This air quality assessment has been undertaken by Isopleth Ltd on behalf of Bio Dynamic (UK) Ltd. The assessment considers air quality impacts associated with the installation of new biogas combustion units at the existing Bio Dynamic (UK) Limited anaerobic digestion (AD) facility. This site is located on land at Private Road No 4, Colwick Industrial Estate, NG4 2JT (Figure 1). The site lies within the administrative area of Gedling Borough Council (GBC) and Nottinghamshire County Council (NCC).

The air quality impact of the proposed development has been assessed. The type, source and significance of potential impacts are identified and any additional measures that should be employed to minimise these impacts are described.

The key pollutant associated with operation of the spark ignition engines considered in this assessment is nitrogen dioxide (NO_x as NO_2). Other pollutants associated with the operation of spark ignition engines when run on biogas include the following, the impacts of which have also been predicted:

- sulphur dioxide (SO_2);
- carbon monoxide (CO); and
- volatile organic compounds (VOCs)

Predicted ground level concentrations of these pollutants are compared with relevant air quality standards and guidelines for the protection of human health and sensitive habitats.

The assessment also considers the operation of a backup diesel fuelled boiler unit, which could operate when the CHP engines are not operational (during start-up of the AD process, for example). The on site flares are for emergencies only and according to EA Guidance there is no requirement to assess these.

1.2 Planning History

The site benefits from an existing permission granted 8th August 2018, Application Number: 2018/0737NCC:

> *Retrospective planning permission to retain fencing, gates and concrete aprons and new planning permission to install twin CHP generation plant, boiler unit and flue, yard office and admin office.*

The permission required preparation of an air quality assessment. This was completed by Isopleth Ltd in April 2019.

1.3 Permitting Status

The Bio Dynamic UK Limited site operates under an environmental permit reference DP3935ER.

1.4 Scope

This detailed assessment report relates to the impact of air pollutants from the operation of the proposed facility. Results of the dispersion modelling for emissions to air are presented in terms of impact concentrations, with a description of significance in line with the requirements of the MCPD permitting guidance.

1.5 Experience of Assessor

According to guidance issued by the IAQM, air quality and odour assessments must only be completed by a qualified specialist if they are to be considered robust. This assessment has been completed by Matt Stoaling of Isopleth ltd and Fellow of the IAQM. Matt has provided air quality and odour advice and services to a range of industry sectors and clients, including solid waste, wastewater and agriculture. Matt has worked on behalf of local authority and government agencies advising on odour issues, including documents relating to air quality and odour assessment published by the Environment Agency, Sniffer and the IAQM.

2.0 SITE DESCRIPTION

2.1 Location

The Biodynamic UK Anaerobic Digestion (AD) site is located on land at Private Road No 4, Colwick Industrial Estate, NG4 2JT. The approximate National Grid Reference for the site is 463405, 339790. A location plan of the site has been included in Appendix A.

The application site is located within Colwick Industrial Estate approximately 5.5km east of Nottingham City Centre. The site is at the eastern extremity of the industrial estate near to the River Trent crossing of the Radcliffe on Trent – Nottingham railway line and is located on the northern side of Private Road No. 4. Access to the site is obtained from the A612 via the private industrial access roads.

The area surrounding the application site is industrial in character. To the south (front) of the site is an inert waste transfer, crushing and screening facility operated by Enva England Ltd who also operate a waste transfer station to the west (side). To the east is a river dredging storage facility operated by the Canal and Rivers Trust. To the rear of the site is the Nottingham to Grantham railway line.

The nearest residential properties are located within Holme Pierrepont village and Radcliffe on Trent approximately 700m from the application site. The application is separated from these properties by industrial land, the River Trent and agricultural land.

The closest ecological receptor includes the Netherfield Lagoons Local Nature Reserve (LNR).

2.2 Site Description

The existing facility consists of two spark ignition engines, fuelled on biogas from the anaerobic digestion plant and enabled for combined heat and power (CHP):

- CHP Engine 1: 500 KWe GE Jenbacher J312GS; and
- CHP Engine 2: 1950 KWe Caterpillar G3520C.

This facility combusts natural gas and produces electricity which is sold onto the National Grid as well as heat for the AD process. The engines are containerised and fitted with individual stacks. The site is also equipped with a BD Permits Biogas Upgrading Facility (i.e. gas to grid) however this is not a source of combustion pollutants and therefore does not fall within the scope of this assessment. The permit number is EPR/KP3707LX for the gas to grid operation.

The proposal relates to the installation of two new FINNING Caterpillar 1250KWe spark ignition engines, fuelled on biogas from the anaerobic digestion plant and enabled for combined heat and power (CHP). The NOx emission concentration of the new engines is **250 mg/Nm^3 at 5% O_2**, 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/Nm^3 at 15% O_2**, 0 degC, 1atm, dry.

This air quality assessment assumes that the facility will operate for all hours of the 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 (SO_2), nitrogen dioxide (NO_2), particulate matter of less than 10 micrometres (µm) in aerodynamic diameter (PM_{10}), particulate matter of less than 2.5 µm in aerodynamic diameter lead ($PM_{2.5}$), lead (Pb), carbon monoxide (CO), benzene (C_6H_6), ozone (O_3), 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 came into force on exit day. The Regulations ensure that the Environmental Permitting (EP) regime in England and Wales continued 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 NO_2, the short-term standard is for a 1-hour averaging period, whereas for SO_2 the 15 minute, 1 hour and 24-hour averaging periods are relevant. These periods reflect the varying impacts on health of differing exposures to pollutants.

Table 3-1
Air Quality Strategy Objectives (England)

Pollutant	Concentration	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
Sulphur dioxide (SO_2)	125 µg/m^3 not to be exceeded more than 3 times a year	24-hour mean
	350 µg/m^3 not to be exceeded more than 24 times a year	1 hour mean
	266 µg/m^3 not to be exceeded more than 35 times a year	15-minute mean
Carbon monoxide (CO)	10000 µg/m^3	8-hour

The limits for Volatile organic compounds (VOCs) are discussed in section 4.5.3 of this report.

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 report[1] *Relationship between the UK Air Quality Objectives and Occupational Air Quality Standards* (November

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

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'*.

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.

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 Limits for the Protection of Ecosystems and Vegetation

In addition to the critical levels defined in the AQS for NO_x and SO_2 the following EALs for the protection of ecosystems and vegetation are also defined in EPR as critical levels.

Table 3-3
Critical Levels For The Protection Of Vegetation And Ecosystems

Pollutant	Concentration (µg/m³)	Habitats
Sulphur dioxide	10	Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the ecosystem's integrity
	20	For all higher plants (all other ecosystems)
Nitrogen Oxides	30	All ecosystems. Annual Average.
	75	Daily Mean (24hr average)

3.4 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.

3.5 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, SO_2, and particulate matter (PM_{10}) 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/Nm^3 (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/Nm^3, with aggregated thermal inputs greater than 1 MW_{th} and operating more than 50 hours per year where there is a higher risk of NOX impacts. For example, where the facility is located in or near an Air Quality Management Area (AQMA) declared for NO_2, 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/Nm^3 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.

3.6 National Planning Policy

The most recent version of the National Planning Policy Framework (NPPF) was published in 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 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 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.

4.0 ASSESSMENT METHODOLOGY

The impact assessment approach 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.

4.1 Scenarios

2 No. model scenarios have been assessed:

- **Scenario 1**: This scenario represents the typical operational status of the site, with 4 No. spark ignition engines operational (2 existing, 2 proposed). The boiler and flares would not be required under these circumstances.
- **Scenario 2**: This scenario represents the potential operation of the site during start-up, with 4 No. spark ignition engines operational (2 existing, 2 proposed) for 9 months of the year and the boiler operational for 3 months (March, April and May). The flares would not be required under these circumstances.

The results of these scenarios have been presented in Section 9.0.

4.2 Local Meteorological Data

The dispersion modelling has been carried out using five years (2015-2019) of hourly sequential meteorological data in order to take account of inter-annual variability and reduce the effect of any atypical conditions. Data from Nottingham Watnall 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) and was the data set accepted for use in support of Application Number: 2018/0737NCC.

The meteorological data has been prepared based on a surface roughness of 0.2m with the Albedo / Bowen is characterised as grassland (30%), water (20%), deciduous forest 20% and urban (30%).

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

4.3 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.

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.

The generation facility lies at a basal elevation of around 21.5m AoD. Topography has been incorporated within the dispersion model.

4.4 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 geometry of the relevant buildings and tanks have been included in Appendix C. All other buildings / structures within 5 stack heights are lower than 40% of the stack and are therefore not relevant to the model.

4.5 Pollutant Specific Approaches

4.5.1 Nitrogen Oxides to NO_2 Conversion

Oxides of nitrogen (NOx) 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 NO_2. The proportion of NO converted to NO_2 depends on a number of factors including wind speed, distance from the source, solar irradiation and the availability of oxidants, such as ozone (O_3).

A conversion ratio of 70% NOx:NO_2 has been assumed for comparison of predicted concentrations with the long-term objectives for NO_2. A conversion ratio of 35% has been utilised for the assessment of short-term impacts, as recommended by Environment Agency guidance[2].

[2] AQMAU, Conversion Rates for NOx and NO_2.

4.5.2 SO_2: Averaging Period Conversion

Most long-term standards are expressed as an annual average (mean). Most short term standards as an hourly average. But sometimes the short-term environmental standard is measured using a different time period (for example 15 minutes). EA Guidance[3] advises that the calculation of averaging periods for pollutants, in particular for SO_2 should be completed using the following factors when the process contribution has been calculated on an hourly basis:

- 1.34 to convert it into a 15 minute average;
- 0.7 to convert it into an 8 hour average; and
- 0.59 to convert it to a 24 hour average.

This approach has been taken to the assessment of SO_2 for the different averaging periods in this case.

4.5.3 Non-Methane VOCs

Volatile organic compounds (VOCs) are a group of carbon-based substances rather than an individual pollutant (with a defined limit). For example, VOCs from biogas engines will include any methane slip (i.e. methane not fully combusted) and although this may account for a large proportion of total VOC methane is not toxic (although is hazardous for other reasons including asphyxiation or explosion at high enough levels). For this reason, non-methane VOC are often considered more representative when considering appropriate limits.

When determining the Bio Dynamic (UK) Environmental Permit (EPR/DP3935ER/V005) the Environment Agency confirmed that NMVOCs should be assessed against the limit for ethyl benzene (rather than benzene, for example) as it better represents biogas from source-segregated biodegradable waste.

The limits for Ethyl Benzene are:

- Annual: 4410 µg/m^3; and
- 1-hour: 55200 µg/m^3.

These limits are therefore used as a surrogate for the NMVOC group in accordance with the Environment Agency guidance for this site.

[3] EA Guidance: Air emissions risk assessment for your environmental permit: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

5.0 SENSITIVE 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.

5.1 Human Receptors

5.1.1 Residential

A selection of the closest receptors to the development which have been used for modelling purposes are shown in Table 5-1 and are also shown on Drawing AQ1 (Appendix A).

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 operational facility site. As described in section 3.2 of this report, annual objectives only apply at residences.

Table 5-1
Modelled Receptors: Human

Reference	Description	OS GR Xm	OS GR Ym	Height (m AoD)
D1	The Firs	463023.2	339270.8	20.0
D2	Meadow View Brook	463092.9	339148.8	20.0
D3	Jubilee Cottage	463121.7	339104.6	19.6
D4	Granfield	462972.9	339114.7	21.4
D5	Lee Holme	462956.9	339193.0	20.9
D6	Homestead	462945.5	339266.1	20.1
D7	Meadow Lane	462903.9	339279.5	20.4
D8	2 The Hall	462857.0	339327.0	20.0
D9	The Hall	462667.4	339272.1	21.9
D10	Oakfield	463987.5	339423.2	19.9
D11	1a Holme Lane	463990.2	339291.7	20.8
D12	38 Radcliffe Park	464276.0	339557.7	19.5
D13	47a Radcliffe Park	464300.5	339617.8	19.7
D14	61 Nether Pasture	462500.7	340734.3	22.7
D15	15 Nether Pasture	462613.1	340843.4	22.0

Impacts have also been assessed by use of a receptor grid at 30m resolution across the 1.2km model domain. These results have been presented as impact isopleths and this allows the concentration at all locations to be determined. These predicted ground level concentrations may then be compared with relevant long term air quality standards and guidelines for the protection of health.

5.1.2 Workplaces

As discussed in Section 3.4.1 above, workplaces are not covered under the air quality objectives. They are instead regulated under the health and safety executive occupational exposure levels. For this reason, the employees and visitors to the industrial estate are not regarded as sensitive receptors for purposes of planning and environmental permitting. They will however be protected by Health and Safety Executive legislation.

5.2 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 Directive[4];
- Special Protection Areas (SPAs) and potential SPAs designated under the EC Birds Directive[5];
- Ramsar Sites designated under the Convention on Wetlands of International Importance[6].
- 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 NOx are compared with relevant critical levels, thresholds of airborne pollutant concentrations above which damage may be sustained to sensitive plants and animals. 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 D. It can be seen that there are no sites of international ecological interest within 5km. There are also no SSSI within 2km.

As such, according to the EA the only ecological site of interest is the Netherfield Lagoons LNR within 2km of the facility. Impacts at all sites can be seen from the impact isopleths provided in Appendix E, however in addition to this, 777 discrete points have also been modelled at 25m spacings within the Netherfield Lagoons LNR.

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

[5] Council Directive 79/409/EEC on the conservation of wild birds.

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

6.0 SIGNIFICANCE OF IMPACT

The significance of impact from the generation plant at the Bio Dynamic AD plant has been considered against criteria for both planning criteria from EPUK / the IAQM and also Permitting criteria issued by the Environment Agency.

6.1.1 Planning

The IAQM / 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 6-1: 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'.

6.1.2 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.

7.0 EMISSIONS

MCPD emission limits have been assumed for the purposes of the modelling assessment and the facility is assumed to be operating at full load for the entire year (8760 hours per year) for both short term and long term impacts.

The normalised emission concentrations used in the assessment are as shown below.

Table 7-1
Emissions Concentrations (µg/m^3)

Pollutant	Engine 1 (existing)	Engine 2 (existing)	Engine 3 (proposed)	Engine 4 (proposed)	Boiler
NO_x	500	500	250	250	250
SO_2	350	350	107	107	407
CO	1400	1400	1400	1400	30
NMVOC	75	75	75	75	0

The full input parameters used in the assessment are detailed in Appendix E.

8.0 BASELINE CONDITIONS

8.1 Council Review and Assessment of Air Quality

The Gedling Borough Council 2020 Air Quality Annual Status Report (ASR), dated July 2020, is the latest version published by Gedling BC at the time of writing. This report states that:

> *'The main pollutants of concern in the Borough relate to the tail pipe emissions from motor vehicles. As such the main commuter routes into Nottingham, through the Borough, are the main areas of concern: the A60 Mansfield Road, A612 Colwick Loop Road and B684 Mapperley Plains/Woodborough Road. Ambient background levels are affected by emissions from domestic heating: NOx from domestic gas boilers and PM from wood/coal burners.*
>
> *…*
>
> *Nitrogen Dioxide is the primary pollutant of concern in the Borough; Gedling Borough has an Air Quality Management Area (AQMA) along the A60 Mansfield Road. Nitrogen Dioxide monitoring results for the last year (2019) show no exceedances within the AQMA, but continue to be of concern in the AQMA and along the Colwick Loop Road.'*

The closest AQMA to the site is Nottingham City Council AQMA No:2

> *'01/02/2002, A horseshoe shaped area from Broadmarsh to the bus depot and along the A6008 to Upper Parliament Street.'*

This AQMA lies approximately 2km to the west of the Bio Dynamic UK site at its closest point at the Colnwick Country Park.

8.2 Local Monitoring Data

GBC undertook automatic (continuous) monitoring at one site during 2019. This site, reference GBC1, is located at Daybrook Square (Roadside) OS GR 457944, 344596.

GBC also undertook non- automatic (passive) monitoring of NO_2 at 31 sites during 2019. There are no sites directly relevant to the Biodynamic UK facility, with the closest being shown in Table 5-1, below.

Table 5-1
Modelled Receptors: GBC DTs

Reference	Description	OS GR Xm	OS GR Ym	Height (m AoD)	2019 NO_2 Result ($\mu g/m^3$)
DT1	19 Victoria Road ID 87401	461995.0	341175.0	27.6	24
DT2	36 Victoria Road ID 87402	462002.0	341097.0	26.9	28
DT3	Mile End Road ID 87461	461196.0	340108.0	24.0	31

There are no GBC monitoring sites for NO_2 which are directly relevant to the facility, the closest being nearly 2km from the site. There is no council monitoring for SO_2, CO or VOC relevant to the site.

8.3 DEFRA Background Maps

Additional information on background concentrations in the vicinity of the development site has been obtained from the DEFRA background pollutant maps. The highest 2021 background concentrations from the 9 grid squares which represents the closest to the operational site are:

- NO_x: 19.7 µg/m^3;
- NO_2: 14.3 µg/m^3;
- SO_2: 5.1 µg/m^3;
- CO: 380 µg/m^3.

The estimated DEFRA background NO_2 concentration is therefore 'well below' the relevant objective for this pollutant.

9.0 PREDICTED IMPACTS

The assessment results are presented in the tables below for the detailed modelling scenarios described in section 4.1.

9.1 Scenario 1

This scenario represents the typical operational status of the site, with 4 No. spark ignition engines operational (2 existing, 2 proposed). The boiler and flares would not be required under these circumstances.

9.1.1 All Locations

The predicted process contribution (PC) at the maximum point of impact (outside the Bio Dynamic UK site red line boundary) is presented in Table 9.1 for short term limits. These values represent the average of the 5 year data set. The impact at all locations is also presented as impact isopleths in Appendix D.

Table 9-1
Maximum Predicted GLC (µg/m^3)

Pollutant	Averaging Period	EAL (µg/m^3)	PC (µg/m^3)	PC (%age of EAL)
NO_2	1-hour	200	56.1	28%
CO	8-hour	10000	60.4	1%
SO_2	24-hour	125	67.1	54%
SO_2	1-hour	350	101.0	29%
SO_2	15-min	266	135.3	51%
NMVOC	1-hour	55200	39.6	0.1%

The relevant percentiles for the pollutants are:

- 99.79 percentile for 1-hour NO_2
- 99.73 percentile for 1-hour SO_2
- 99.178 percentile for 24-hour SO_2.

No further consideration of the impact is required such as comparison with the baseline concentrations (i.e. PC + Baseline, or Predicted Environmental Concentration, 'PEC') for the facility with the exception of NO_2 and SO_2.

As can be seen in the isopleth plots (Appendix F) the point of maximum impact is not defined as a location '*where members of the public have regular access*', i.e. for 1-hour NO_2 it is not likely that they would be at this location for 18 hours or more per year.

Table 9-2
Comparison of Predictions with Baseline Concentrations (µg/m^3)

Pollutant	EAL	Baseline	PEC	PEC (as a %age of EAL)
NO_2 Hourly	200	28.7	84.8	42.4%
SO_2 24-hour	125	10.2	77.3	61.9%
SO_2 1-hour	350	10.2	111.2	31.8%
SO_2 15-min	266	10.2	145.6	54.7%

In terms of impact at the point of maximum Ground Level Concentration (GLC), the process contribution impacts cannot be regarded as insignificant (as above 1% of the limit) but as the PEC is below 70% the overall impact (when the background is taken into account) is insignificant.

9.1.2 Discrete Receptors: Human

The predicted NO_2 process contribution (PC) and predicted environmental concentration (PEC) at the assessed receptor locations is presented in Table 9.3.

Table 9-3
NO_2: Receptor Impact Concentrations (µg/m^3)

Receptor	PC Annual NO_2	PEC Annual NO_2	PC 1-hr NO_2	PEC 1-hr NO_2
D1	0.5	14.8	6.2	34.8
D2	0.4	14.7	5.5	34.2
D3	0.4	14.7	5.3	33.9
D4	0.4	14.7	4.9	33.6
D5	0.4	14.7	5.3	33.9
D6	0.4	14.8	5.6	34.3
D7	0.4	14.8	5.5	34.2
D8	0.4	14.8	5.5	34.1
D9	0.3	14.7	4.4	33.0
D10	0.4	14.7	5.3	33.9
D11	0.3	14.6	4.8	33.4
D12	0.4	14.7	4.4	33.0
D13	0.4	14.8	4.3	33.0
D14	0.1	14.4	3.1	31.8
D15	0.1	14.4	3.2	31.8

Maximum predicted impacts can be seen in Appendix F. The highest long term NO_2 impact at an assessed receptor is predicted to fall at receptor D1 (at 'The Firs') which represents 1.2% of the annual objective with the PEC being 37% of the annual objective. According to the IAQM significance criteria this impact is 'negligible'. The highest hourly NO_2 impact at an assessed receptor is also predicted to fall at the same property which is 3% of the short term objective with the PEC being 17.3% of the hourly objective and therefore insignificant.

The predicted SO_2 process contribution (PC) and predicted environmental concentration (PEC) at the assessed receptor locations is presented in Table 9-4.

Table 9-4
SO_2: Receptor Impact Concentrations (µg/m³)

Receptor	PC 24-hr SO_2	PEC 24-hr SO_2	PC 1-hr SO_2	PEC 1-hr SO_2	PC 15-min SO_2	PEC 15-min SO_2
D1	4.5	14.8	10.2	20.4	13.7	23.9
D2	3.9	14.1	9.1	19.4	12.2	22.5
D3	3.6	13.9	8.7	19.0	11.7	21.9
D4	3.5	13.7	8.1	18.4	10.9	21.1
D5	3.9	14.1	8.9	19.1	11.9	22.2
D6	4.4	14.6	9.4	19.7	12.6	22.9
D7	4.0	14.2	9.2	19.4	12.3	22.6
D8	3.9	14.1	9.2	19.4	12.3	22.5
D9	2.8	13.1	7.3	17.5	9.8	20.0
D10	2.7	13.0	8.5	18.7	11.4	21.6
D11	2.5	12.7	7.7	18.0	10.3	20.6
D12	2.3	12.5	7.1	17.4	9.6	19.8
D13	2.3	12.5	7.1	17.3	9.5	19.8
D14	1.3	11.5	5.1	15.3	6.8	17.0
D15	1.3	11.6	5.2	15.4	7.0	17.2

Maximum predicted impacts at receptor locations are (at worst) within 70% of the objective limits for protection of human health as can be seen in Table 9-4 and Appendix F.

The predicted CO and NMVOC process contribution (PC) and predicted environmental concentration (PEC) at the assessed receptor locations is presented in Table 9-4. As described in Section 4.5.3 the impacts for NMVOC are compared with the EALs for Ethyl Benzene as previously agreed with the Environment Agency for this site.

Table 9-5
CO and VOC: Receptor Impact Concentrations (µg/m³)

Receptor	PC CO 8-hour	PC CO 8-hour	PC Annual VOC	PEC Annual VOC	PC 1-hr VOC	PEC 1-hr VOC
D1	60.4	440.4	0.1	0.6	4.1	5.0
D2	52.0	432.0	0.1	0.6	3.6	4.5
D3	55.2	435.2	0.1	0.5	3.5	4.3
D4	50.1	430.1	0.1	0.5	3.3	4.2
D5	52.3	432.3	0.1	0.6	3.5	4.4
D6	58.1	438.1	0.1	0.6	3.7	4.6
D7	59.9	439.9	0.1	0.6	3.6	4.5
D8	57.0	437.0	0.1	0.6	3.6	4.4
D9	41.8	421.8	0.1	0.5	3.3	4.2

Receptor	PC CO 8-hour	PC CO 8-hour	PC Annual VOC	PEC Annual VOC	PC 1-hr VOC	PEC 1-hr VOC
D10	55.5	435.5	0.1	0.5	4.0	4.9
D11	47.0	427.0	0.1	0.5	3.6	4.4
D12	40.5	420.5	0.1	0.6	3.1	4.0
D13	43.5	423.5	0.1	0.6	2.9	3.8
D14	29.8	409.8	0.0	0.5	2.5	3.4
D15	24.1	404.1	0.0	0.5	2.7	3.5

Maximum predicted impacts at receptor locations are (at worst) within 70% of the objective limits for protection of human health and annual impacts are dominated by the existing background, as can be seen in Table 9.5 and Appendix F.

9.1.3 Discrete Receptors: Ecological

The maximum process contributions at the Netherfield Lagoons receptor locations is shown below. Table 9-6 shows impacts against annual and 24-hour NOx (as NO_2) critical levels.

Table 9-6
Ecology: NO_x Critical Levels (µg/m^3)

PC Annual NO_x	% of critical level	PC 24-h NO_x	% of critical level
8.5	28.3%	71.1	94.8%

When there are local nature sites or ancient woodlands within the specified distance (2km) impacts are insignificant if:

- the short-term PC is less than 100% of the short-term environmental standard
- the long-term PC is less than 100% of the long-term environmental standard

All NOx impacts are therefore 'insignificant' at the LNR.

9.1.4 Critical Load: Nutrient N Deposition

The maximum Nutrient Nitrogen critical load impacts are presented in the table below.

Table 9-7
Nutrient Nitrogen Deposition (kgN/ha/yr)

Critical Load	Baseline N Deposition	PC N Deposition	% of Critical Load
15	11.4	1.223	8.2%

9.2 Scenario 2

This scenario represents the potential operation of the site during start-up, with 4 No. spark ignition engines operational (2 existing, 2 proposed) for 9 months of the year and the boiler operational for 3 months (March, April and May). The flares would not be required under these circumstances.

9.2.1 All Locations

The predicted process contribution (PC) at the maximum point of impact (outside the Bio Dynamic site red line boundary) is presented in Table 6.1 for short term limits.

The predicted process contribution (PC) at the maximum point of impact is presented in Table 9-8. These values represent the average of the 5 year data set. The impact at all locations is also presented as impact isopleths in Appendix D.

Table 9-8
Maximum Predicted GLC (µg/m³)

Pollutant	Averaging Period	EAL (µg/m³)	PC (µg/m³)	PC (%age of EAL)
NO_2	1-hour	200	56.0	28.0%
CO	8-hour	10000	567.1	5.7%
SO_2	24-hour	125	66.9	53.5%
SO_2	1-hour	350	100.7	28.8%
SO_2	15-min	266	134.9	50.7%
NMVOC	1-hour	55200	40.4	0.1%

It should be noted that these impacts are not necessarily at locations where the objective would apply.

No further consideration of the impact is required such as comparison with the baseline concentrations (i.e. PC + Baseline, or Predicted Environmental Concentration, 'PEC') for the facility with the exception of NO_2 and SO_2.

Table 9-9
Comparison of Predictions with Baseline Concentrations (µg/m³)

Pollutant	EAL	Baseline	PEC	PEC (as a %age of EAL)
NO_2 Hourly	200	28.7	84.7	42.3%
SO_2 24-hour	125	10.2	77.2	61.7%
SO_2 1-hour	350	10.2	110.9	31.7%
SO_2 15-min	266	10.2	145.2	54.6%

In terms of impact at the point of maximum Ground Level Concentration (GLC), the process contribution impacts cannot be regarded as insignificant (as above 1% of the limit) but as the

PEC is below 70% the overall impact (when the background is taken into account) is insignificant.

9.2.2 Discrete Receptors: Human

The predicted NO_2 process contribution (PC) and predicted environmental concentration (PEC) at the assessed receptor locations is presented in Table 9-10.

Table 9-10
NO_2: Receptor Impact Concentrations (µg/m^3)

Receptor	PC Annual NO_2	PEC Annual NO_2	PC 1-hr NO_2	PEC 1-hr NO_2
D1	0.3	14.6	5.6	34.2
D2	0.3	14.6	5.1	33.7
D3	0.2	14.6	4.8	33.5
D4	0.2	14.6	4.7	33.3
D5	0.3	14.6	4.9	33.6
D6	0.3	14.6	5.3	34.0
D7	0.3	14.6	5.2	33.9
D8	0.3	14.6	5.2	33.8
D9	0.2	14.6	4.3	32.9
D10	0.3	14.6	5.2	33.8
D11	0.2	14.6	4.7	33.3
D12	0.3	14.7	4.3	32.9
D13	0.4	14.7	4.3	33.0
D14	0.1	14.4	3.0	31.7
D15	0.1	14.4	3.1	31.7

Maximum predicted impacts can be seen in Appendix F. The highest long term NO_2 impact at an assessed receptor is predicted to fall at receptor D1 (at 'The Firs') which represents 0.8% of the annual objective with the PEC being 37% of the annual objective. According to the IAQM significance criteria this impact is 'negligible'. The highest hourly NO_2 impact at an assessed receptor is also predicted to fall at the same property which is 2.7% of the short term objective with the PEC being 17.1% of the hourly objective and therefore insignificant.

The predicted SO_2 process contribution (PC) and predicted environmental concentration (PEC) at the assessed receptor locations is presented in Table 9-11.

Table 9-11
SO_2: Receptor Impact Concentrations (µg/m^3)

Receptor	PC 24-hr SO_2	PEC 24-hr SO_2	PC 1-hr SO_2	PEC 1-hr SO_2	PC 15-min SO_2	PEC 15-min SO_2
D1	3.9	14.1	9.0	19.2	12.0	22.3
D2	3.0	13.3	8.2	18.4	11.0	21.2
D3	3.1	13.4	7.9	18.1	10.6	20.8
D4	2.9	13.1	7.7	17.9	10.3	20.5
D5	3.4	13.7	8.0	18.2	10.7	20.9
D6	3.7	13.9	8.7	19.0	11.7	21.9
D7	3.4	13.7	8.4	18.7	11.3	21.5
D8	3.1	13.4	8.5	18.7	11.3	21.6
D9	2.6	12.9	7.0	17.3	9.4	19.7
D10	2.5	12.8	8.3	18.6	11.2	21.4
D11	2.4	12.6	7.5	17.7	10.0	20.3
D12	2.2	12.4	7.0	17.2	9.4	19.6
D13	2.2	12.5	7.1	17.3	9.5	19.8
D14	1.2	11.5	4.9	15.1	6.5	16.8
D15	1.3	11.6	5.1	15.3	6.8	17.0

Maximum predicted impacts at receptor locations are (at worst) within 70% of the objective limits for protection of human health and annual impacts are dominated by the existing background, as can be seen in Table 9-11 and Appendix F.

Table 9-12
CO and VOC: Receptor Impact Concentrations (µg/m^3)

Receptor	PC CO 8-hour	PC CO 8-hour	PC Annual VOC	PEC Annual VOC	PC 1-hr VOC	PEC 1-hr VOC
D1	60.4	440.4	0.1	0.5	4.1	5.0
D2	51.8	431.8	0.1	0.5	3.6	4.5
D3	55.2	435.2	0.1	0.5	3.5	4.3
D4	50.1	430.1	0.1	0.5	3.3	4.2
D5	52.3	432.3	0.1	0.5	3.5	4.4
D6	58.1	438.1	0.1	0.5	3.7	4.6
D7	59.9	439.9	0.1	0.5	3.6	4.5
D8	55.2	435.2	0.1	0.5	3.6	4.4
D9	41.8	421.8	0.1	0.5	3.3	4.2
D10	55.5	435.5	0.1	0.5	4.0	4.9
D11	47.0	427.0	0.1	0.5	3.5	4.4
D12	40.5	420.5	0.1	0.5	3.1	4.0

Receptor	PC CO 8-hour	PC CO 8-hour	PC Annual VOC	PEC Annual VOC	PC 1-hr VOC	PEC 1-hr VOC
D13	43.5	423.5	0.1	0.5	2.9	3.8
D14	29.8	409.8	<0.1	0.5	2.5	3.4
D15	24.1	404.1	<0.1	0.5	2.5	3.3

Maximum predicted impacts at receptor locations are (at worst) within 70% of the objective limits for protection of human health and annual impacts are dominated by the existing background, as can be seen in Table 9-12 and Appendix F.

9.2.3 Discrete Receptors: Ecological

The maximum process contributions at the Netherfield Lagoons receptor locations is shown below. Table 9-13 shows impacts against annual and 24-hour NOx (as NO_2) critical levels.

Table 9-13
Ecology: NO_x Critical Levels (µg/m^3)

PC Annual NO_x	% of critical level	PC 24-h NO_x	% of critical level
6.4	21.5%	60.5	80.7%

When there are local nature sites or ancient woodlands within the specified distance (2km) impacts are insignificant if:

- the short-term PC is less than 100% of the short-term environmental standard
- the long-term PC is less than 100% of the long-term environmental standard

All NOx impacts are therefore 'insignificant' at the LNR.

9.2.4 Critical Load: Nutrient N Deposition

The maximum Nutrient Nitrogen critical load impacts are presented in the table below. An ecosystem specific critical load of 15 kgN/ha/yr has been applied in the absence of site specific critical loads for local sites.

Table 9-14
Nutrient Nitrogen Deposition (kgN/ha/yr)

Critical Load	Baseline N Deposition	PC N Deposition	% of Critical Load
15	11.4	0.926	6.2%

9.3 Summary

As would be expected, the air quality impact is highest at locations adjacent to the generators, within the industrial estate when the EA limit values are applied. This is not a location where the hourly or annual objectives would apply. However, at locations where the hourly and / or annual objectives must be applied, levels are well below the relevant objectives and EAL's.

9.4 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 NO_2 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.

10.0 CONCLUSIONS

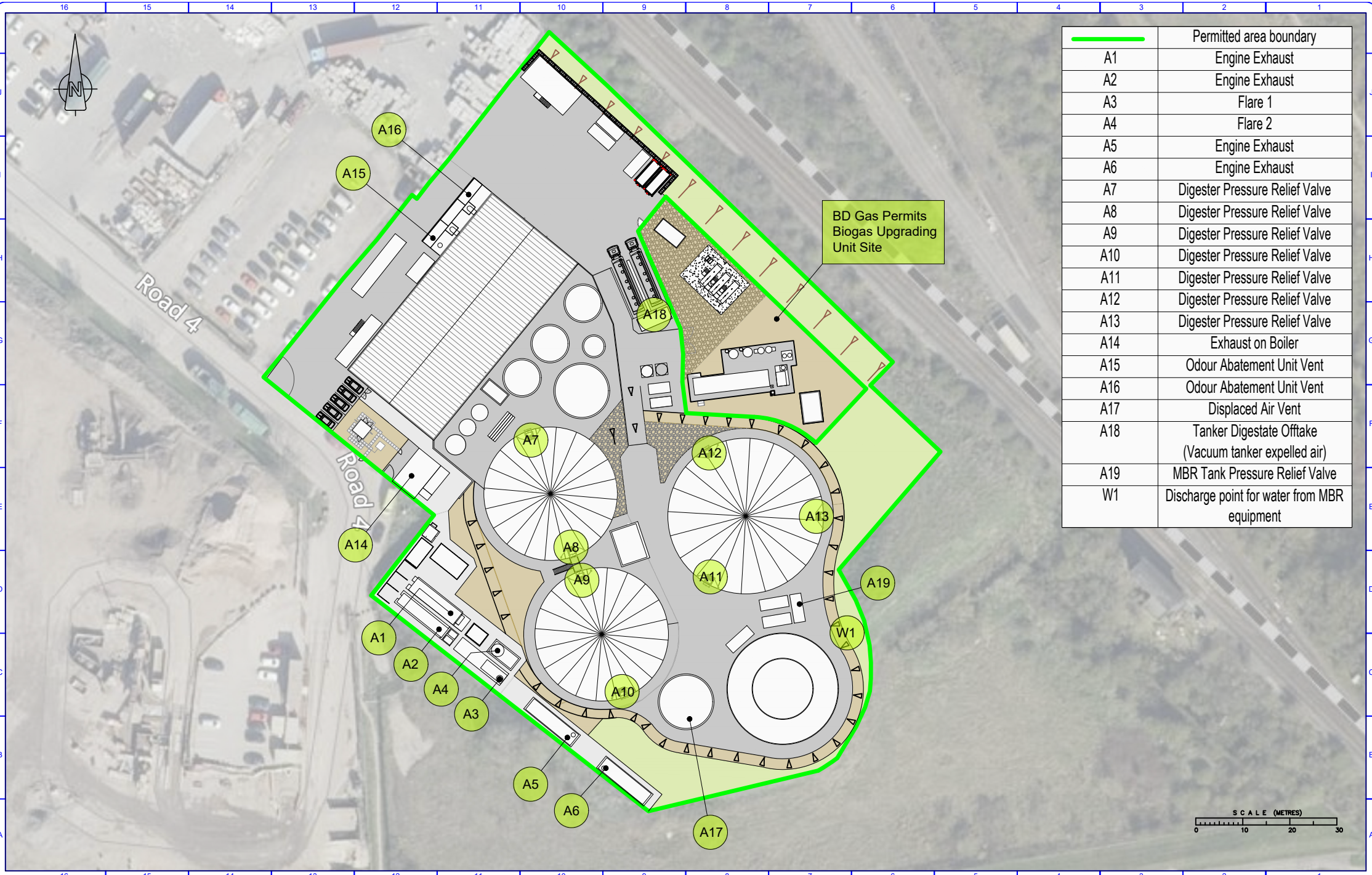
An assessment has been carried out to determine the local air quality impacts associated with the installation of new biogas combustion units at the existing Bio Dynamic (UK) Limited anaerobic digestion (AD) facility. This site is located on land at Private Road No 4, Colwick Industrial Estate, NG4 2JT. The site lies within the administrative area of Gedling Borough Council (GBC) and Nottinghamshire County Council (NCC).

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 and backup boiler at the Site. As a worst-case, emissions from each of the stacks have been assumed to occur for 8760 hours per year when comparing against short and long term air quality limits.

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 it can be seen that there is no realistic potential for a breach of the air quality objectives (or Environmental Assessment Limits) 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 'not significant'. The site is therefore unlikely to be a significant contributor to or 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.

APPENDIX A



———	Permitted area boundary
A1	Engine Exhaust
A2	Engine Exhaust
A3	Flare 1
A4	Flare 2
A5	Engine Exhaust
A6	Engine Exhaust
A7	Digester Pressure Relief Valve
A8	Digester Pressure Relief Valve
A9	Digester Pressure Relief Valve
A10	Digester Pressure Relief Valve
A11	Digester Pressure Relief Valve
A12	Digester Pressure Relief Valve
A13	Digester Pressure Relief Valve
A14	Exhaust on Boiler
A15	Odour Abatement Unit Vent
A16	Odour Abatement Unit Vent
A17	Displaced Air Vent
A18	Tanker Digestate Offtake (Vacuum tanker expelled air)
A19	MBR Tank Pressure Relief Valve
W1	Discharge point for water from MBR equipment

REV NUM	DESCRIPTION	DRWN BY	CHK'D BY	APR'D BY	DATE
01	Pasteurisation tank removed	SC	--	AC	13-08-21
02	Updated to latest layout	SC	SG	SS	09-12-21

ORIGINATOR LOGO

Anaergia
Breaking Barriers to Sustainability

EngStmp

DRAWN:	SC
CHECKED:	**
APPROVED:	**
DATE:	09-04-2021
PROJECT NO.:	125
SCALE:	1:1000

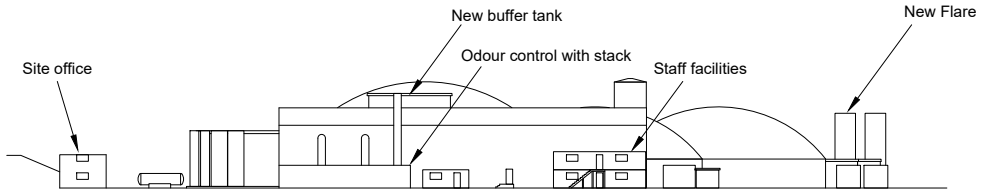
Bio Dynamic

Permit Boundary and Emissions Points Plan

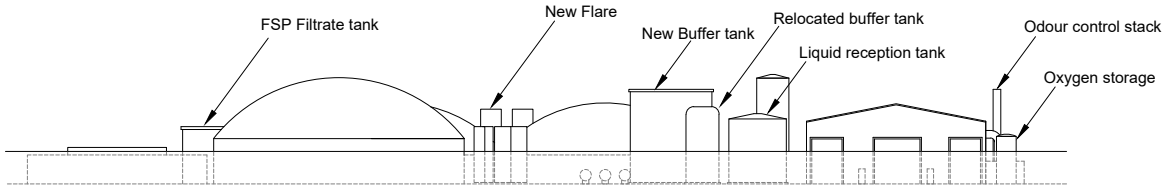
DRAWING NUMBER

125-08

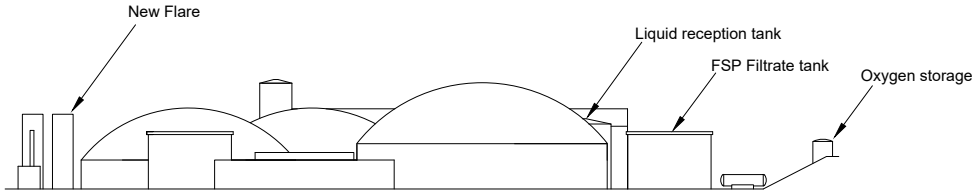
Status 02



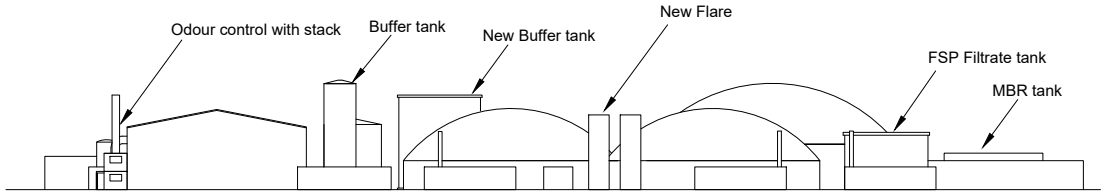
North West Elevation



North East Elevation



South East Elevation



South West Elevation

REV NUM	DESCRIPTION	DRWN BY	CHK'D BY	APR'D BY	DATE
01	Updated to latest layout	SC	SG	SS	01/12/21

ORIGINATOR LOGO

Anaergia
Breaking Barriers to Sustainability

EngStmp

DRAWN:	SC
CHECKED:	**
APPROVED:	**
DATE:	11-05-2021
PROJECT NO.:	125
SCALE:	1:1000

Bio Dynamic

Stage 2 Upgrade Elevations to existing AD Facility

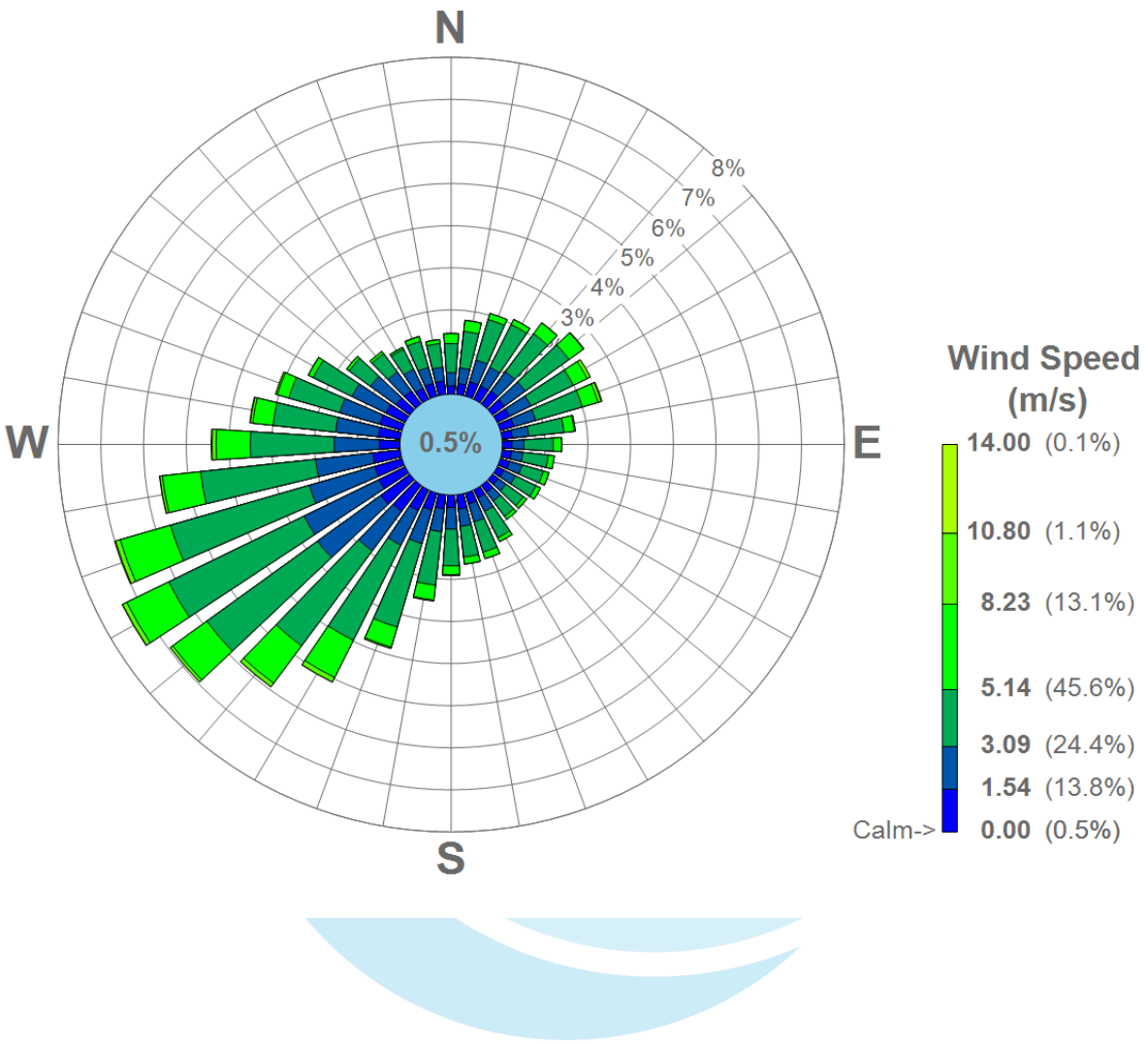
DRAWING NUMBER

125-07

Status 01

APPENDIX B: WIND DATA

Figure B-1
Wind Data: Nottingham Watnall (2015 – 2019)



APPENDIX C: BUILDING GEOMETRY

Buildings have been included in the dispersion model to account for potential downwash effects.

Table C-1
Building Geometry (Rectangular)

Building	X	Y	Z	Height	X length	Y length	Angle
CHP1	463394.1	339798.1	21.5	3.5	2.5	12.1	128.5
CHP2	463396.9	339801.4	21.5	4.5	3.1	12.1	128.5
Building 1	463409.1	339791.7	21.5	3.5	3.1	4.1	129.3
Building 2	463401.7	339808.7	21.5	4	3.9	7.6	129.8
Building 3	463382.6	339845.7	21.5	8	23.3	48.7	39.5
CHP3 (new)	463422.1	339775.6	21.5	4.5	3.3	12.1	128.5
CHP4 (new)	463437.5	339763.2	21.5	4.5	3.3	12.1	128.5

The geometry for the tanks is as follows:

Table C-2
Building Geometry (Circular)

Building	X	Y	Z	Height	Radius
Tank 1	463425.2	339819.5	21.5	6	14.25
Tank 2	463436.2	339789.5	21.5	6	14.25
Tank 3	463467.1	339814.5	21.5	8	16.7

APPENDIX D: ECOLOGICAL SEARCHES


A614
Papplewick
Linby
B6011
River Leen
(disused)
M1
HUCKNALL
P&R
Bestwood Village
A611
Nuthall
Bulwell
Oxton
Halloughton
Morton
Farndon
Fiskerton
Thurgarton
Bleasby
East Stoke
Thorpe
1487
Elston
ROSSE WAY
Calverton
Epperstone
Gonalston
Maid Marian Services
Woodborough
Lowdham
Hoveringham
Syerston
Flintham
Sibthorpe
Shelton
A46
Lambley
ARNOLD
Kneeton
Caythorpe
Gunthorpe
East Bridgford
Screveton
Hawksworth
Burton Joyce
A6097
Car Colston
Thoroton
A610
A60
CARLTON
Shelford
River Trent
A6002
NOTTINGHAM
Newton
Scarrington
Bilborough Services
Stoke Bardolph
Radcliffe on Trent
BINGHAM
Orston
Aslockton
A6514
A609
A612
Wollaton Hall
Holme Pierrepont
Whatton
A52
University
Lenton
Cropwell Butler
Elton
Bramcote
Services
Sutton
Granby
Wilford
Gamston
Bassingfield
LEFORD
BEESTON
WEST BRIDGFORD
Tithby
Barnstone
Edwalton
Cotgrave
Cropwell Bishop
Langar
Toton
Clifton
Tollerton
Owthorpe
Attenborough
Clipston
Barton in Fabis
Plumtree
Normanton-on-the-Wolds
Colston Bassett
Plungar
A453
Fairham Brook
Ruddington
Canal
Bradmore
Kinoulton
Thrumpton
Gotham
A606
Harby
Keyworth
Stanton-on-the-Wolds
Bunny
Hose
Ratcliffe on Soar
Hickling
Widmerpool
Hickling Pastures
Kingston
VALE OF B


STOKE BARDOLPH CP
Netherfield Lagoons (LNR)
Netherfield
Colwick
Radcliffe on Trent
HOLME PIERREPONT CP
RADCLIFFE ON TRENT CP
Holme Pierrepont
Holme Lane
Trent Valley Way
Grantham Road
Stoke Lane
Shelford Road
Holme Lane
Radcliffe Road
Stragglethorpe

APPENDIX E: INPUT DATA

Table E-1
Modelling Inputs

Parameter	Modelled Value				
Model	CHP 1 - Jenbacher	CHP 2 - Caterpillar	CHP3 - J616	CHP4 - J616	Boiler
Rating (kWe)	500	1950	1250	1250	---
Stack Height (m)	6.4	7.54	5	5	10
Stack Diameter (m)	0.23	0.45	0.40	0.40	0.40
Exhaust Temp (K)	723.0	806.0	703.0	703.0	514.0
Actual Flow (Am^3/s per unit)	1.53	6.63	3.71	3.71	1.35
Velocity of release (m/s)	36.73	41.71	29.52	29.52	10.74
Oxygen (% v/v)	7.68	8	8	8	0
Moisture (% v/v)	10.4	10	10	10	0
Normalised Flow (Nm^3/s per unit @5%O_2)	0.43	1.64	1.05	1.05	0.72
NO_x emission (g/s) per unit	0.215	0.820	0.263	0.263	0.180
SO_2 emission (g/s) per unit	0.150	0.574	0.113	0.113	0.293
CO emission (g/s) per unit	0.601	2.297	1.473	1.473	0.022
NMVOC emission (g/s) per unit	0.032	0.123	0.079	0.079	0.000

[at 5% O_2, 0 degC, 1atm, dry]

Modelled NO mass emissions differ from those in the table above for the reasons given in section 4.5.1 of this report, in that they have been adjusted for NO_X:NO_2 proportion in accordance with EA guidance and also hours of operation in the case of long term emissions.

Table E-2
Stack Locations

Stack	OS Xm	OS Ym
CHP 1 - Jenbacher 500kw	463400.7	339790.8
CHP 2 - Caterpillar 1950kw	463403.3	339793.7
CHP3 - J616 1250kW	463430.3	339768
CHP4 - J616 1250kW	463436.8	339760.8
Boiler	463402.3	339824.7

APPENDIX F: IMPACT PLOTS

Figure F1: Scenario 1 Annual Average NO_2 impact

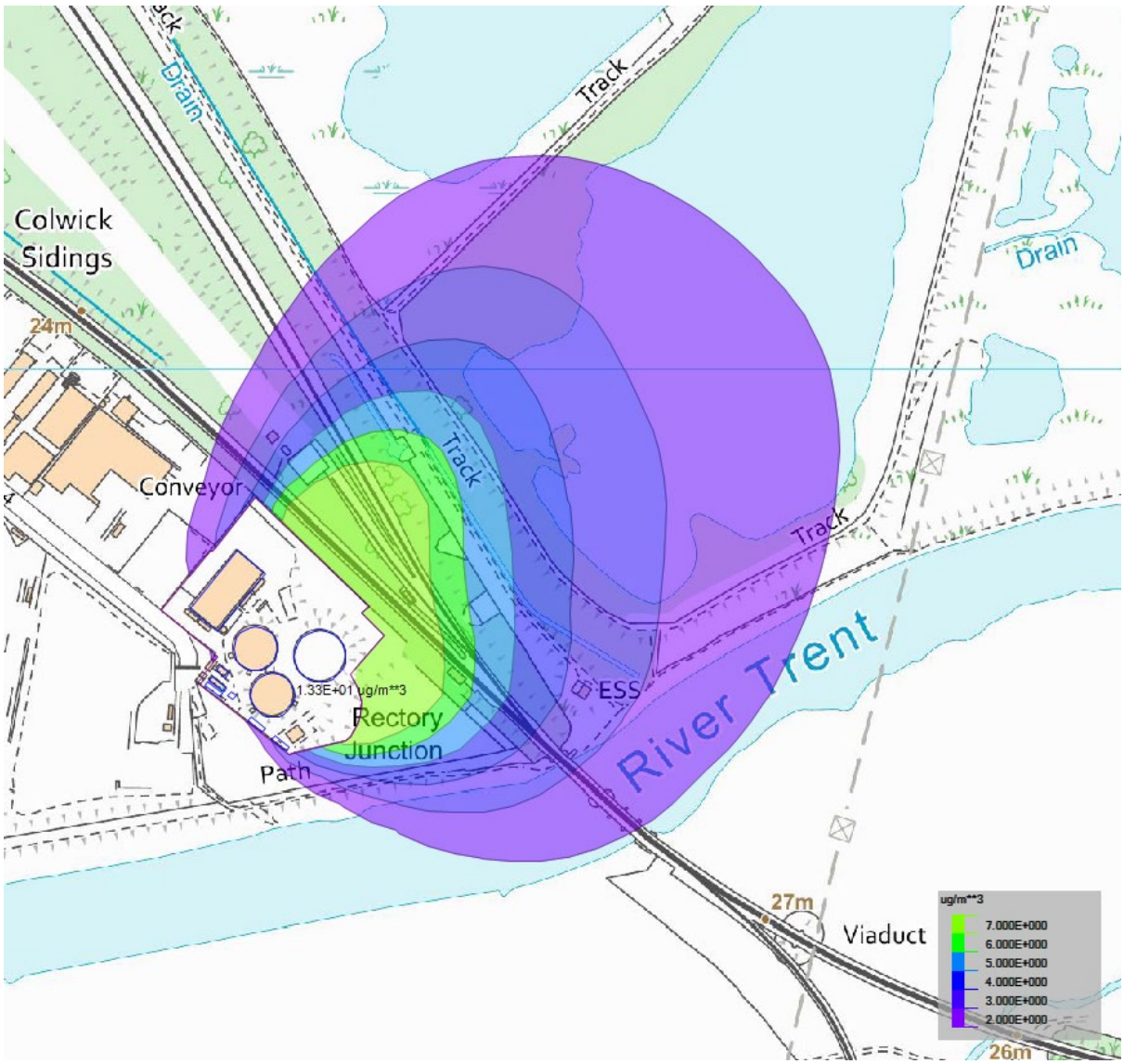


Figure F2: Scenario 1 1hr (99.79th percentile) NO_2 impact

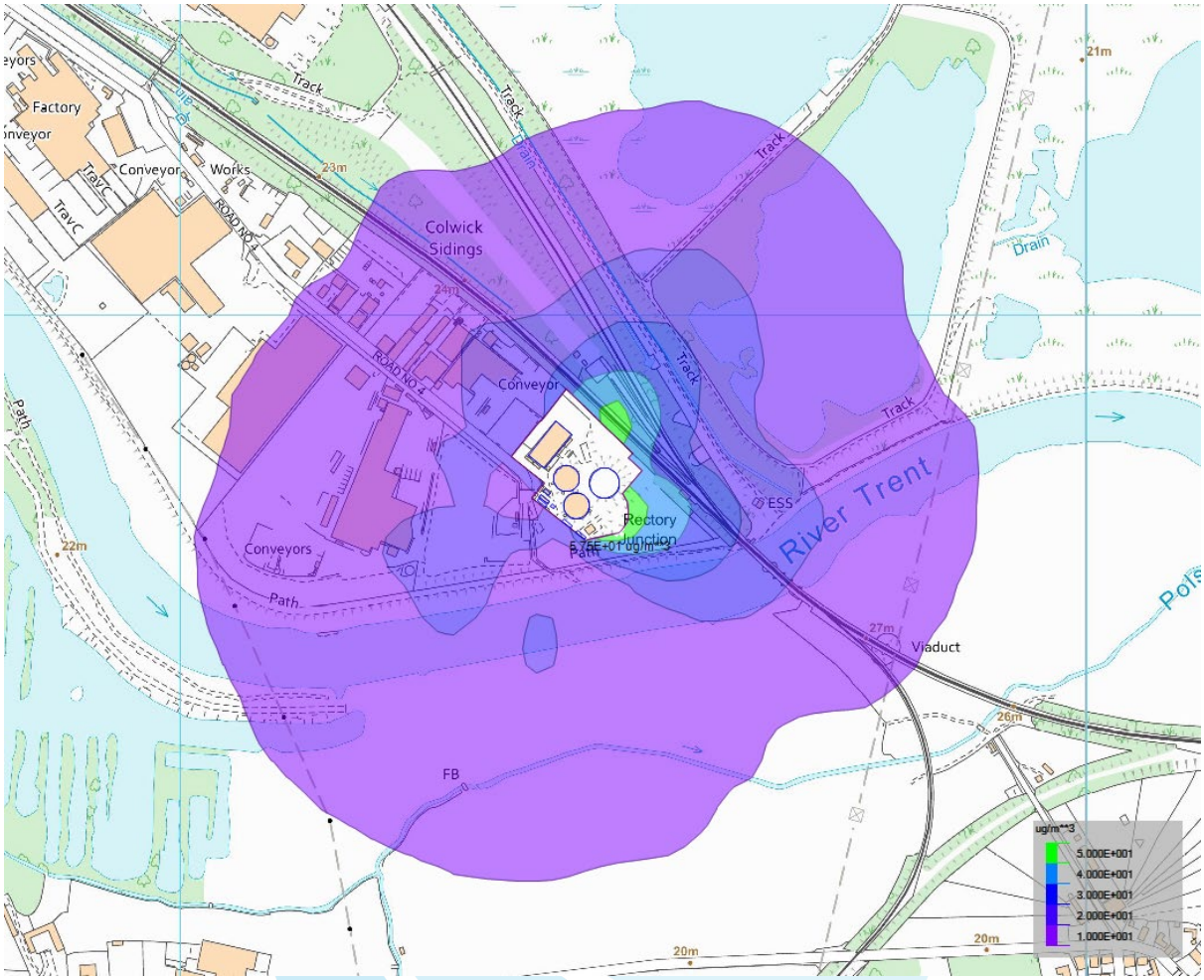


Figure F3 Scenario 1 1hr (99.73rd percentile) SO_2 impact

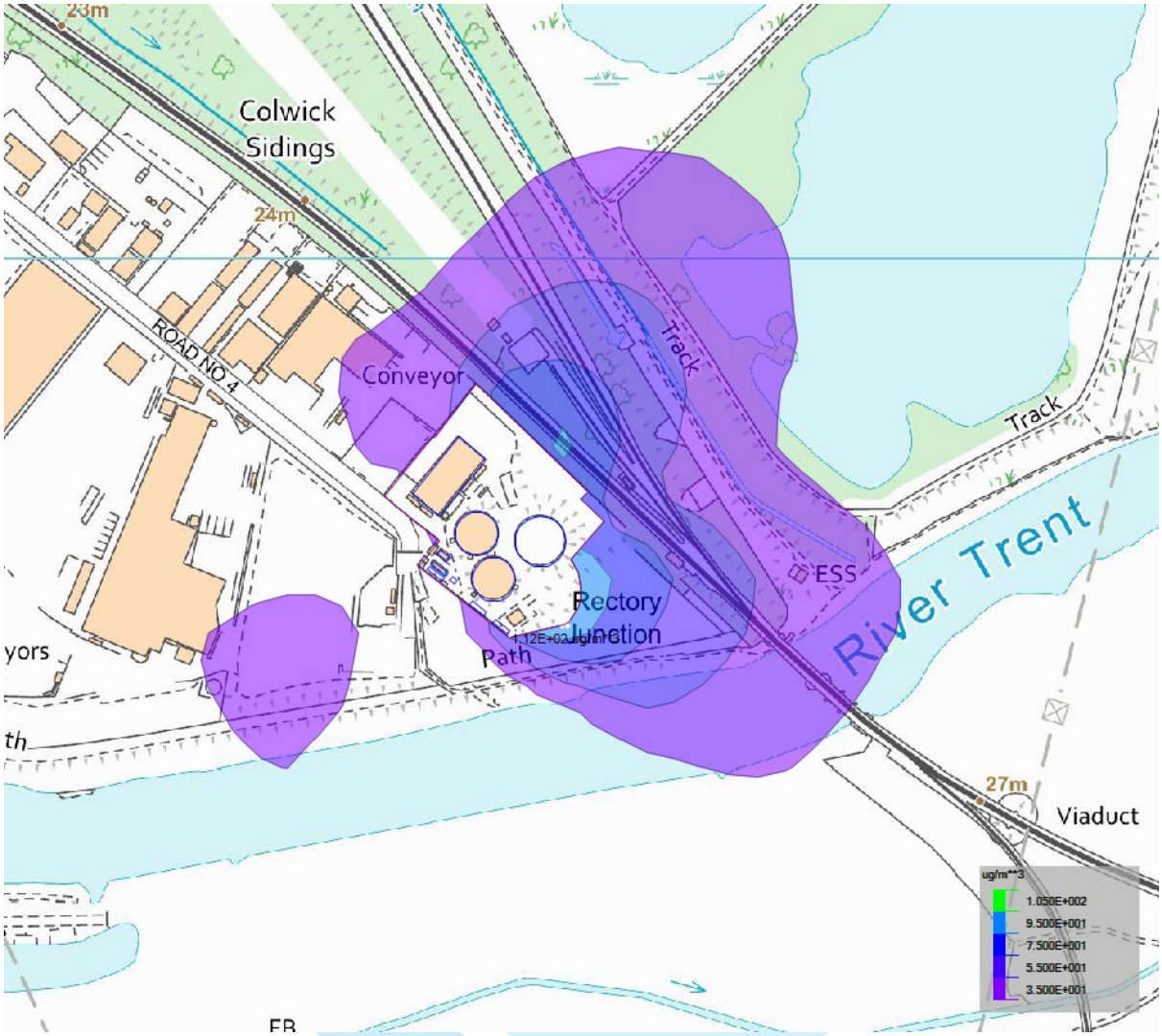


Figure F1: Scenario 2 Annual Average NO_2 impact

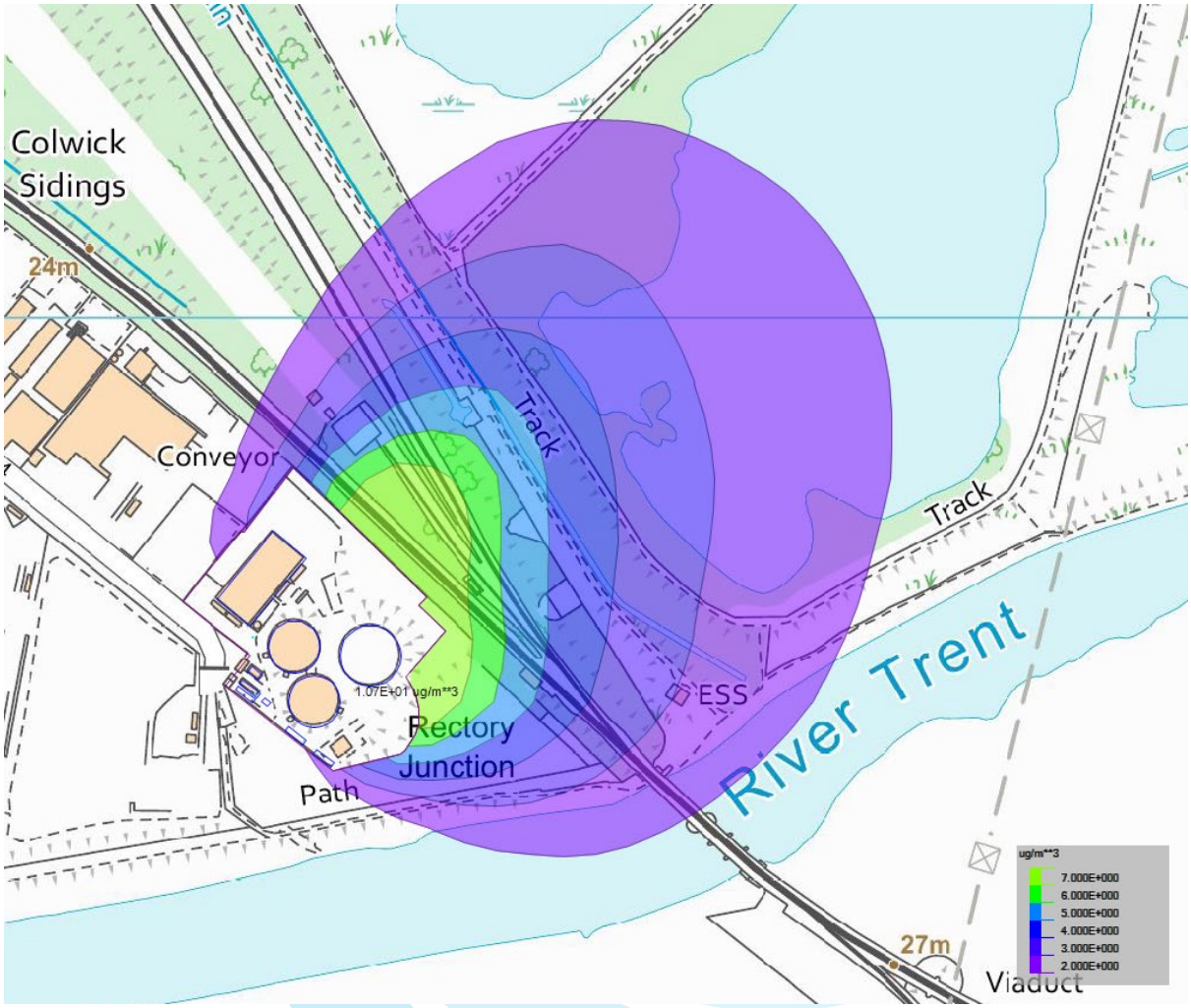


Figure F2: Scenario 2 1hr (99.79th percentile) NO_2 impact

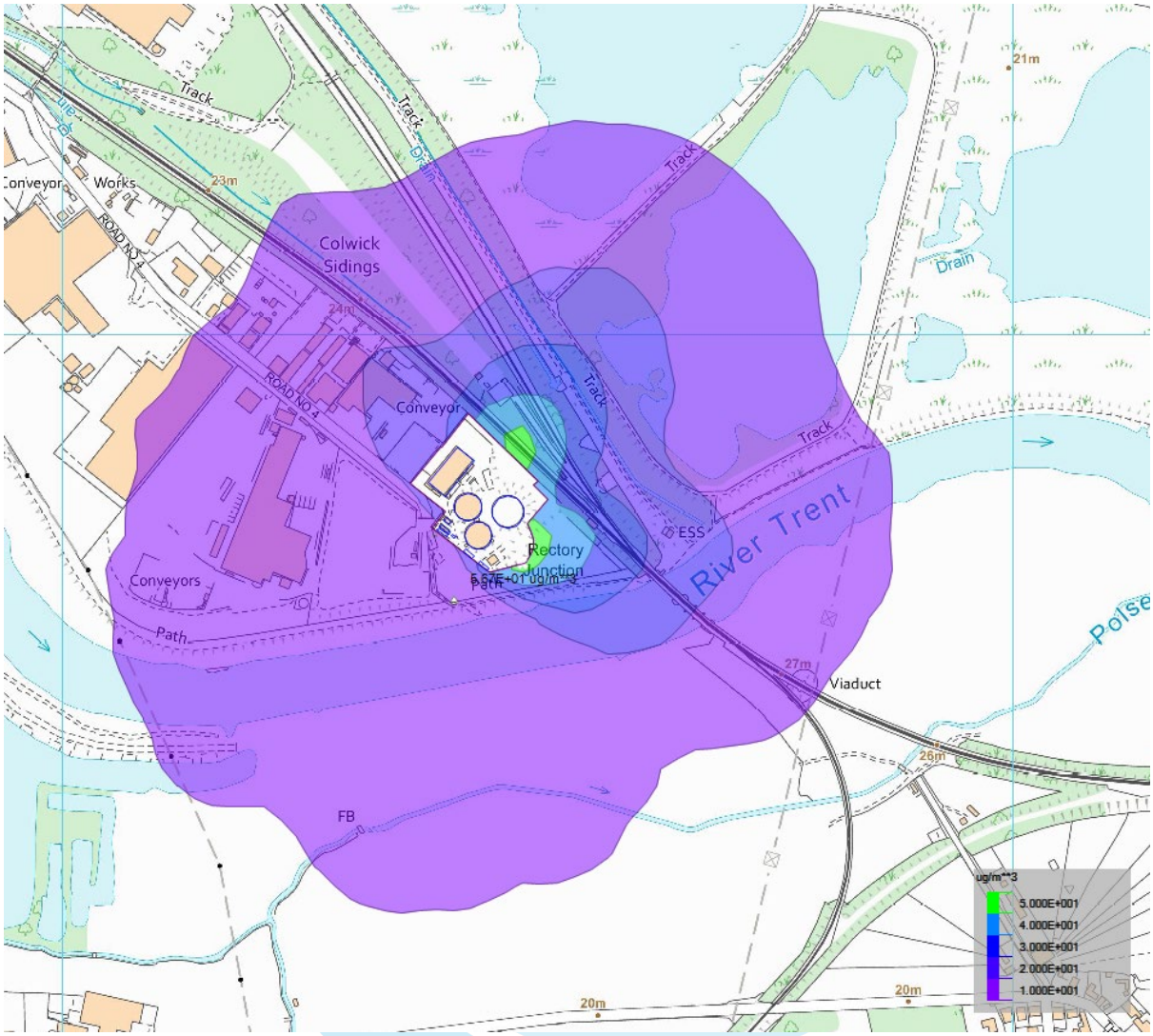
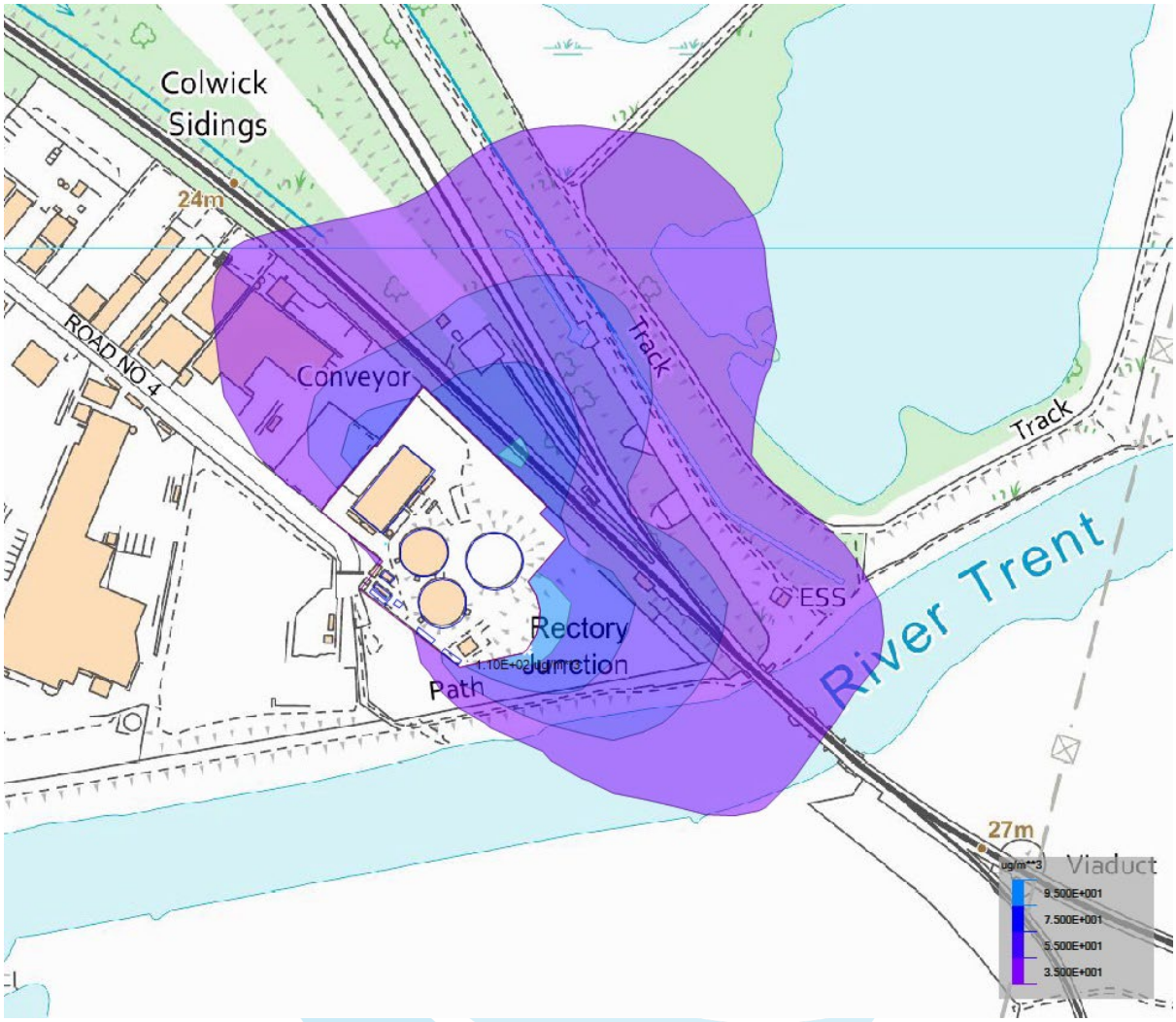


Figure F3 Scenario 2 1hr (99.73rd percentile) SO_2 impact



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