AIR DISPERSION MODELLING REPORT OF RELEASES FROM AN ANIMAL RENDERING PROCESS, NOTTINGHAMSHIRE

Sarval Limited,
Stoke Lane,
Stoke Bardolph,
Nottinghamshire,
NG14 5HJ

ECL Ref: SARV.01.01/ADM
Date: May 2024
Issue: 1

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ACRONYMS / TERMS USED IN THIS REPORT

AAD	Ambient Air Directive
ADMS	Atmospheric Dispersion Modelling System
AQAL	Air Quality Assessment Level
AQA	Air Quality Assessment
AQMAs	Air Quality Management Areas
AQO	Air Quality Objective
AQS	Air Quality Standard
ASR	Annual Status Report
AW	Ancient Woodland
BAT	Best Available Techniques
BAT-AELs	Best Available Techniques Associated Emissions Levels
Bref	Best Available Techniques Reference Document
CERC	Cambridge Environmental Research Consultants
CO	Carbon monoxide
cSAC	Candidate Special Area of Conservation
DEFRA	Department for Environment, Food and Rural Affairs
DT	Diffusion Tube
EA	Environment Agency
EAL	Environmental Assessment Level
ECL	Environmental Compliance Ltd
EPUK	Environmental Protection UK
GLC	Ground Level Concentration
H_2S	Hydrogen Sulphide
IAQM	Institute of Air Quality Management
LNR	Local Nature Reserves
LWS	Local Wildlife Sites
MAGIC	Multi-Agency Geographic Information for the Countryside
MCPD	Medium Combustion Plant Directive
Met	Meteorological
Met data	Meteorological data
Met Office	Meteorological Office
Met station	Meteorological station
Met year	Meteorological year
N	Nitrogen
NCC	Nottingham City Council
NH_3	Ammonia
NNR	National Nature Reserves
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
O_2	Oxygen
PC	Process Contribution
PEC	Predicted Environmental Concentration
$PM_{2.5}$	Particulate matter with a diameter of 2.5µm or less
PM_{10}	Particulate matter with a diameter of 10µm or less
Ramsar	The Ramsar Convention on Wetlands of International Importance
S	Sulphur
SAC	Special Area of Conservation

ACRONYMS / TERMS USED IN THIS REPORT (cont.)

Sarval	Sarval Ltd
SO_2	Sulphur dioxide
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TCA	Tolerable Concentrations in Air
The Site	Sarval Ltd - Stoke Lane, Stoke Bardolph, Nottinghamshire, NG14 5HJ
TOx	Thermal Oxidiser
TPM	Total Particulate Matter
VOC	Volatile Organic Compounds
WHO	World Health Organisation

UNITS

g/s	Grams per second
K	Kelvin
km	Kilometre
m	Metre
mg/Nm^3	Milligram per normal cubic metre
m/s	Metres per second
MWth	Megawatt thermal
OU_E	Odour units
OU_E/s	Odour units per second
OU_E/m^3	Odour units per cubic metre
$\mu g/m^3$	Microgram per cubic metre
X	Easting coordinate
Y	Northing coordinate
Z_0	Surface roughness length (as defined by the modelling software)
%	Percent
%ile	Percentile
°	Degree
°C	Degree Celsius

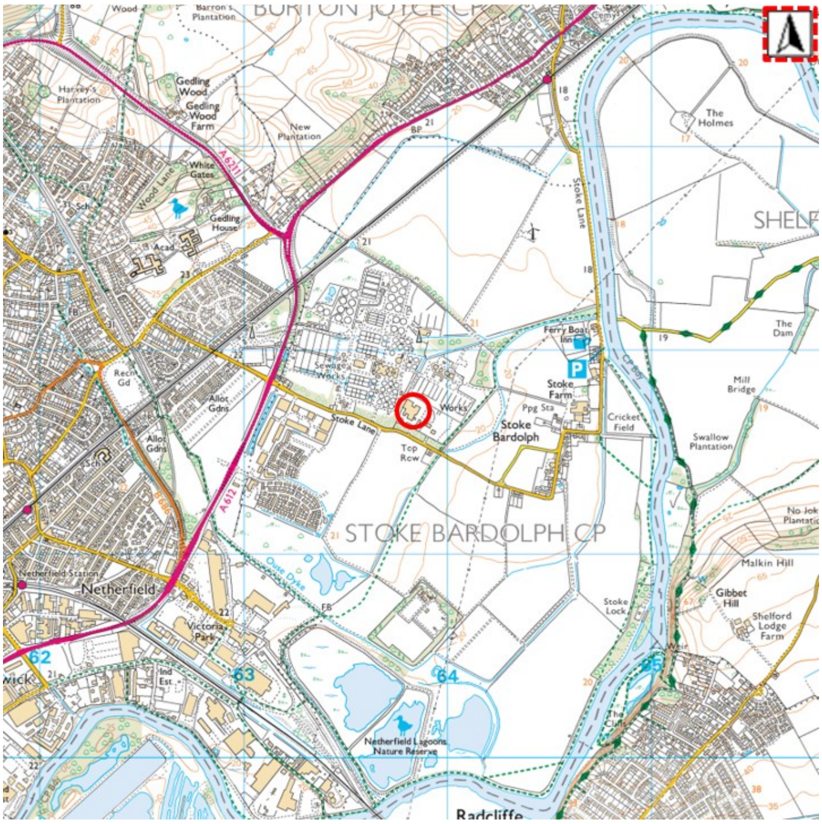
1. INTRODUCTION

1.1. The Study

1.1.1. Environmental Compliance Ltd ("ECL") were commissioned on behalf of Sarval Limited ("Sarval") to undertake an air quality assessment ("AQA") of releases from the emission points associated with their animal carcass and animal waste rendering plant at Stoke Lane, Stoke Bardolph, Nottinghamshire, NG14 5HJ ("the Site"). It is anticipated this AQA will form part of an Environmental Permit application to be submitted to the Environment Agency ("EA").

1.1.2. The emission points of interest for this assessment are two dual fuel boilers (which can burn either tallow fuel oil or natural gas), a thermal oxidiser ("TOx") and three scrubbers. The approximate location of the Site is circled in red on the site location map, which is presented as Figure 1.

Figure 1: Site Location Map



1.1.3. The study has been conducted to determine the impact of emissions to air on human health for receptors within a 2km radius of the Site. Specified environmental receptors within both a 10km and 2km radius of the discharge stacks have also been assessed.

1.1.4. The study was undertaken using the ADMS modelling package, which is one of the models recognised as being suitable for this type of study.

1.2. Objectives of the Study

1.2.1. The objectives of this study are as follows:

- to determine the maximum ground level concentrations (“GLCs”), arising from the Site; all pollutants are assumed to be released at their maximum permitted Emission Limit Values (“ELV”) or maximum expected concentrations (where applicable); and
- to assess the impact of emissions from the Site on existing local air quality in relation to human and environmental health at a range of potentially sensitive receptors by comparison with relevant Air Quality Standards (“AQSs”).

1.3. Scope of the Study

1.3.1. Modelling was carried out using a combination of the appropriate Best Available Technique (“BAT”) Associated Emission Levels (“BAT-AELs”) as specified in the BAT conclusions from the SA BAT Reference (“Bref”) document (*Slaughterhouses, Animal By-products and/or Edible Co-products Industries*[1]), the relevant Medium Combustion Plant Directive (“MCPD”) ELVs or an indicative maximum expected concentration provided by the Site.

1.3.2. For the purposes of this assessment, the following pollutants are assumed to be emitted to atmosphere from each of the following appliances (where applicable (i.e., for the boilers) the worst-case fuel source has been assessed):

- the two dual fuel boilers (when fuelled by tallow fuel oil) and the TOx:
  - oxides of nitrogen (“NO_x”) (as nitrogen dioxide (“NO_2”));
  - carbon monoxide (“CO”);
  - total particulate matter (“TPM”) (assessed as particulate matter with diameters of 2.5µm or less (“$PM_{2.5}$”) and 10µm or less (“PM_{10}”));
  - sulphur dioxide (“SO_2”);
  - volatile organic compounds (“VOCs”);
  - ammonia (“NH_3”);
  - hydrogen sulphide (“H_2S”); and
  - odour units (“OU_E”).
- the three scrubbers:
  - VOC;
  - NH_3;
  - H_2S; and
  - OU_E.

1.3.3. The effects of prevailing meteorological conditions, building downwash effects, local terrain and existing ambient air quality were also taken into account.

1.3.4. This report spans a number of guidance documents. The EA online guidance[2] was used for assessing if process contributions (“PCs”) are insignificant. The Environmental Protection

[1] Available via: https://eippcb.jrc.ec.europa.eu/reference/slaughterhouses-and-animals-products-industries
[2] Available via: https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

UK ("EPUK") and the Institute of Air Quality Management ("IAQM") guidance 2017[3] was used where applicable (i.e., where PCs exceeded the assessment criteria outlined in the EA online guidance). The EA's H4 Guidance Note on Odour[4] was used for assessing odour emissions.

1.3.5. The predicted environmental concentrations ("PECs") - the sum of the pollutant PC and the existing pollutant background concentration from other sources – were also compared to the relevant standards. Results are presented as the maximum predicted GLC and the maximum sensitive receptor GLC.

1.3.6. The maximum predicted pollutant GLCs at the specified human and ecological receptors were also compared to the relevant AQSs (refer to Tables 1 and 2 of Sections 2.3. and 2.4., respectively, for further details).

1.3.7. Gedling Borough Council ("GBC") currently has one active Air Quality Management Area ("AQMA") ('Gedling No 2 AQMA'), which was declared on the 1st of April 20011 for NO_2 emissions. In addition, the neighbouring Nottingham City Council ("NCC") currently has one active AQMA ('AQMA No.2'), which was declared for NO_2 emissions on the 1st of February 2002 (and last amended on the 9th of January 2019).

1.3.8. As GBC's Gedling No 2 AQMA and NCC's AQMA No.2 are considerable distances from the Site (approximately 6.3km west-northwest and 3.1km southwest, respectively), the impact of the Site's aerial emissions on these AQMAs will not need to be considered as part of this study.

[3] Available via: http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf
[4] Available via: https://assets.publishing.service.gov.uk/media/5a7ba9a2ed915d1311060b16/geho0411btqm-e-e.pdf

2. METHOD STATEMENT

2.1. Choice of Model

2.1.1. The UK-Atmospheric Dispersion Modelling system ("ADMS") model was developed jointly by Cambridge Environmental Research Consultants ("CERC"), Her Majesty's Inspectorate of Pollution (the EA's predecessor body), the Meteorological Office and National Power, with sponsorship from the UK Government and a number of commercial organisations. UK-ADMS is a computer-based model of dispersion from both point and non-point sources in the atmosphere and is one of the modelling packages that are suitable for this type of study. The current version is ADMS 6.0.1.0.

2.1.2. ADMS has been validated against a number of data sets in order to assess various configurations of the model such as flat or complex terrain, line/area/volume sources, buildings, dry deposition fluctuations and visible plumes. The model results have been compared to observational data or other model results if available.

2.1.3. ADMS is a new generation Gaussian plume air dispersion model, which means that the atmospheric boundary layer properties are characterised by two parameters:

- the boundary layer depth, and
- the Monin-Obukhov length,

rather than in terms of the single parameter Pasquill-Gifford class.

2.1.4. Dispersion under convective meteorological conditions uses a skewed Gaussian concentration distribution (shown by validation studies to be a better representation than a symmetrical Gaussian expression).

2.1.5. ADMS is therefore considered to be suitable for use in this assessment.

2.2. Key Assumptions

2.2.1. The study will be undertaken on the basis of a worst-case scenario. Consequently, the following assumptions have been made:

- the maximum anticipated emission concentrations will be released on a 24-hourly basis, 365 days of the year; in practice, when the plant is operating, the release concentrations will be below these maximum values; furthermore, taking shutdowns for planned maintenance into account, the plant will not operate for 365 days;
- the highest predicted pollutant GLCs for the five years of meteorological data for each averaging period (annual mean, hourly, etc.) have been used;
- concentrations of NO_2 in the emissions have been calculated assuming a long-term 70% NO_X to NO_2 conversion rate, and a short-term 35% NO_X to NO_2; and
- maximum predicted GLCs at any location, irrespective of whether a sensitive receptor is characteristic of public exposure, are compared against the relevant AQSs for each pollutant; in addition, the predicted maximum sensitive receptor GLC has also been assessed.

2.3. Sensitive Human Receptors

2.3.1. In addition to predicting concentrations over a 4km-by-4km grid, there are 10 specified potentially sensitive human receptor locations.

2.3.2. Details of the specified potentially sensitive human receptors are provided in Table 1 and a visual representation is provided as Figure 2.

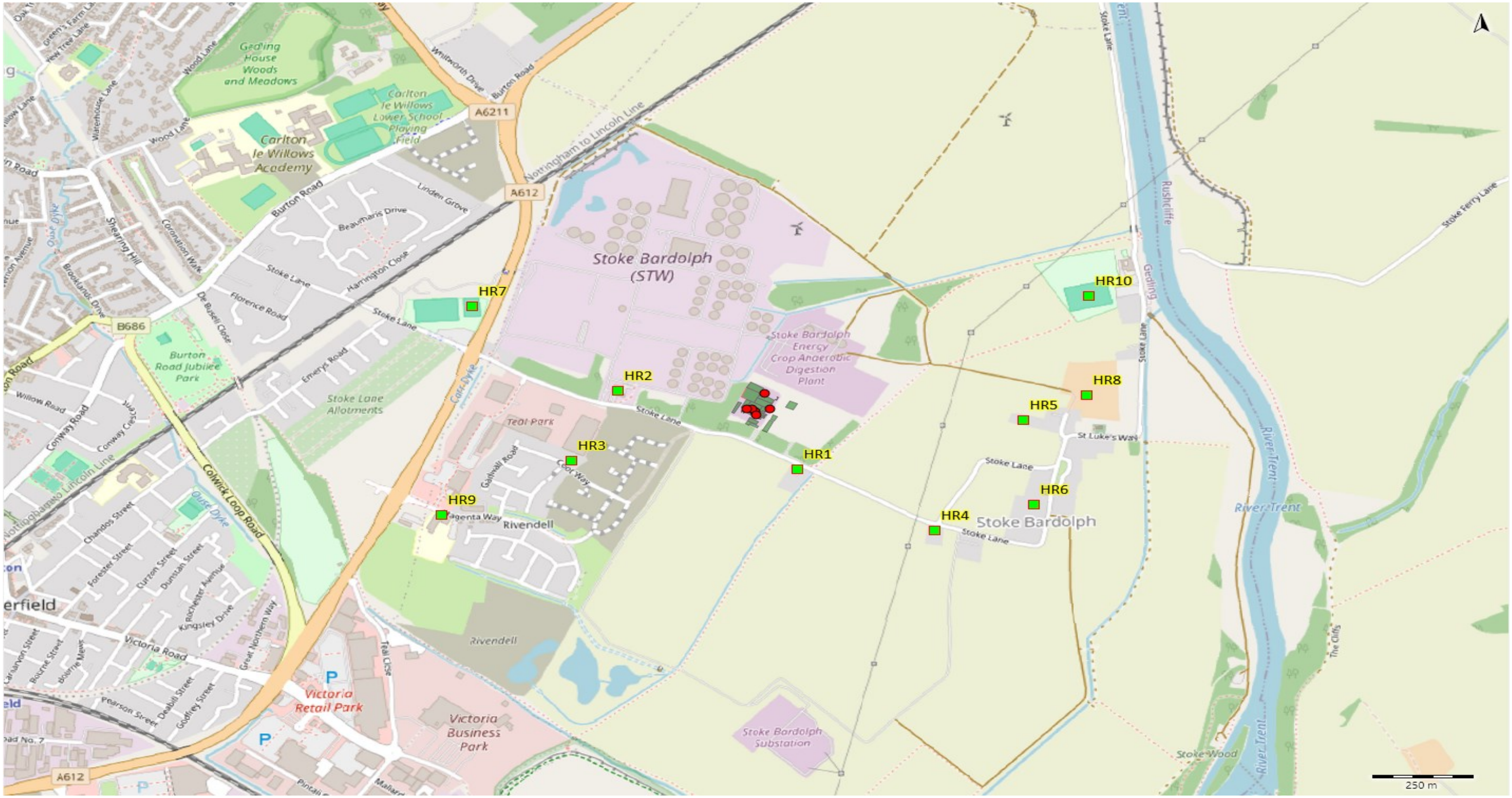
Table 1: Potentially Sensitive Human Receptors

ADMS Ref.	Name	Eastings (X)	Northings (Y)	Distance (m) [a]	Heading (°)
HR1	Top Row Cottages, Rivendell	463913	341502	215	155
HR2	Severn Trent Water	463479	341735	344	277
HR3	Residential properties off Coot Way, Rivendell	463366	341528	485	250
HR4	Residential properties off Stoke Lane, Rivendell (1)	464247	341321	568	131
HR5	Farm Row Cottages, Stoke Bardolph	464462	341649	643	94
HR6	Residential properties off Stoke Lane, Rivendell (2)	464488	341397	731	114
HR7	Carlton Town Football Club	463125	341987	754	293
HR8	Farm off St Luke's Way	464614	341723	793	88
HR9	Rivendell Flying High Academy	463052	341366	837	247
HR10	Gedling Football Club	464619	342017	860	68

Notes to Table 1

(a) Distances are measured as the crow flies from the defined receptor to on-site grid reference: SK 63821 41696.

Figure 2: Map Identifying the Locations of the Specified Potentially Sensitive Human Receptors



Notes to Figure 2

The red circles are the approximate locations of the emission points considered in the assessment (refer to Section 2.10., for further details);

The neon green squares with the red outline and yellow highlighted annotations are the locations of the potentially sensitive human receptor locations specified in Table 1; and

The darker green shapes (surrounding the emission points) represent the buildings layout considered in the model assessment (refer to Section 2.11., for further details).

2.4. Sensitive Ecological Receptors

2.4.1. The impact of emissions to air on vegetation and ecosystems has been assessed for the following sensitive environmental receptors within 10km of the discharge stacks:

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

2.4.2. In addition, the impact of emissions to air on vegetation and ecosystems has been assessed for the following sensitive environmental receptors within 2km of the discharge stacks:

- Sites of Special Scientific Interest ("SSSI") established by the 1981 Wildlife and Countryside Act; and
- local nature sites (ancient woodland ("AW"), local wildlife sites ("LWS") and national and local nature reserves ("NNR" and "LNR")).

2.4.3. The habitat receptor designations that have been identified based on the search radii outlined above, are presented in Table 2 and a visual representation is provided as Figure 3. The various ecological sites each cover a large area, consequently grid references for the ecological sites have been taken as the point of the ecological site approximately closest in distance to the Site.

Table 2: Ecological Receptors Considered for the Assessment

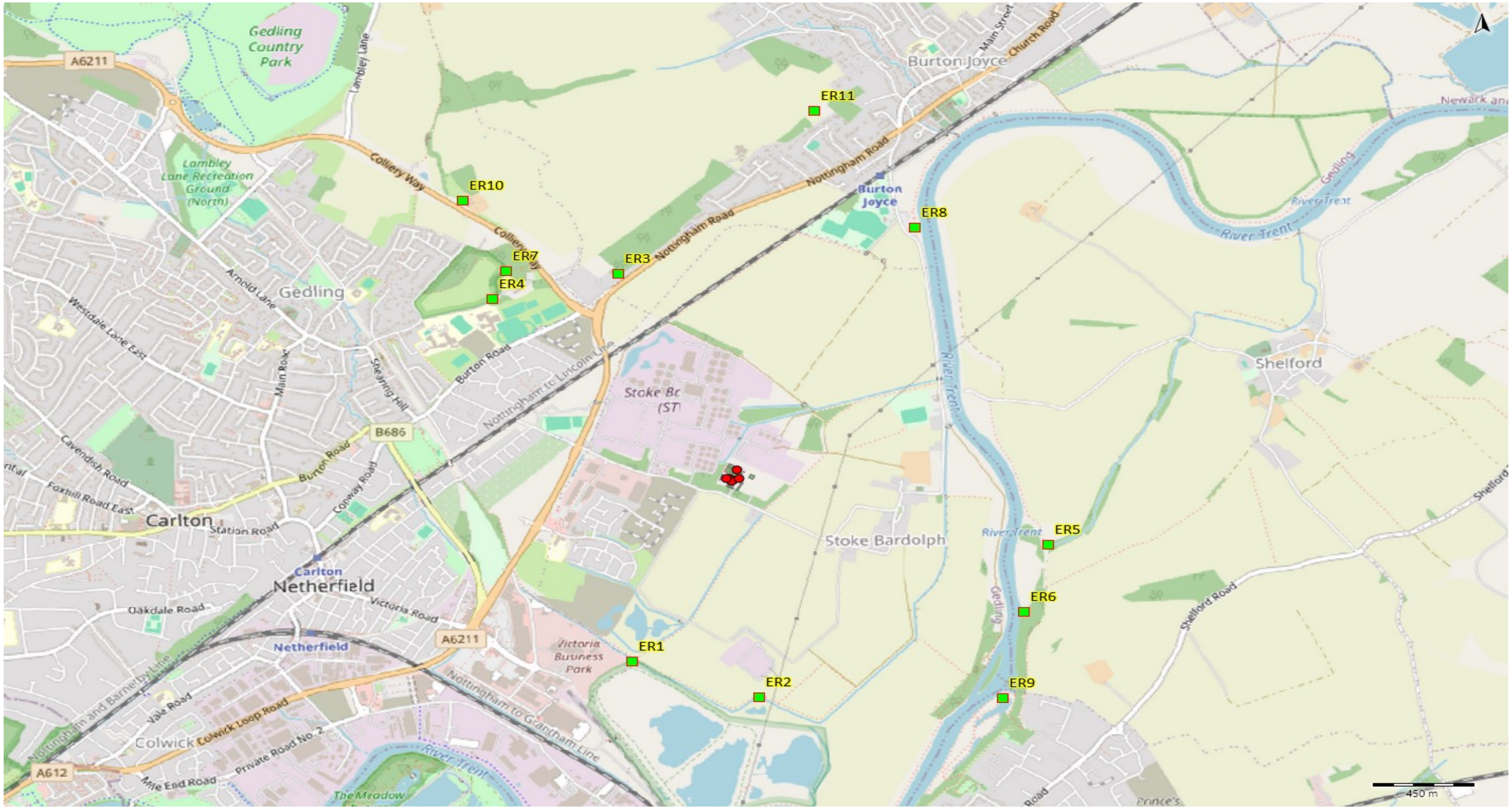
ADMS Ref.	Name and Designation [a]	Eastings (X)	Northings (Y)	Distance (m) [b]	Heading (°)
ER1	Netherfields Lagoons - LNR Netherfield Dismantled Railway Sidings - LWS	463370	340691	1,102	204
ER2	Netherfield Pits - LWS	463933	340502	1,199	175
ER3	New Plantation, Burton Joyce - LWS	463306	342783	1,203	335
ER4	Gedling House Meadow - LNR	462751	342649	1,433	312
ER5	Swallow Plantation - LWS	465216	341322	1,444	105
ER6	Trent Bluff Scrub, Radcliffe - LWS	465107	340963	1,480	120
ER7	Gedling House Woods - LNR	462808	342799	1,498	317
ER8	River Trent: Burton Joyce to Lowdham - LWS	464626	343034	1,561	31
ER9	The Avenue Pool - LWS	465014	340497	1,691	135
ER10	Gedling Wood (Ancient & Semi-Natural Woodland - ID: 1412309) - AW	462618	343179	1,910	321
ER11	Burton Joyce Grasslands - LWS	464178	343663	1,999	10

Notes to Table 2

(a) The ecological sites included were identified using the Multi-Agency Geographic Information for the Countryside ("MAGIC") portal and NCC's interactive mapping services (https://maps.nottinghamcity.gov.uk/insightmapping/#).

(b) Distances are measured as the crow flies from the approximate nearest point of the boundary of the designated habitat to on-site grid reference: SK 63821 41696.

Figure 3: Map Identifying Locations of Ecological Receptors Considered for the Assessment



<u>Notes to Figure 3</u>

The red circles represent the locations of the emission points considered in the assessment (refer to Section 2.10. for further details); and

The neon green squares with the red outline and yellow highlighted annotations represent the locations of the designated ecological sites detailed in Table 2.

2.5. Air Quality Standards for the Protection of Human Health

2.5.1. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007) details Air Quality Strategy Objectives for a range of pollutants, including a number that are directly relevant to this study. In addition, the Regulatory Authorities must ensure that the proposals do not exceed Ambient Air Directive ("AAD") limit values.

2.5.2. In this report, the generic term AQS is used to refer to any of the above values. The various AQSs are intended to be used as guidelines for the protection of human health and the management of local air quality. The values relevant to this study are detailed in Table 3.

Table 3: Air Quality Standards for the Protection of Human Health

Pollutant	Averaging Period	AQS ($\mu g/m^3$)	Comments
NO_X (as NO_2)	annual	40	UK Air Quality Objective ("AQO") and Ambient Air Directive ("AAD") Limit
	1-hour	200	UK AQO and AAD Limit, not to be exceeded more than 18 times per annum, equivalent to the 99.79th percentile of 1-hour means
CO	8-hour	10,000	UK AQO and AAD Limit
$PM_{2.5}$	annual	20	AAD Limit
PM_{10}	annual	40	AAD Limit
	24-hour	50	AAD Limit, not to be exceeded more than 35 times per annum, equivalent to the 90.41st percentile of 24-hour means
SO_2	24-hour	125	UK AQO, not be exceeded more than 3 times per annum, equivalent to the 99.18th percentile of 24-hour means
	1-hour	350	UK AQO, not be exceeded more than 24 times per annum, equivalent to the 99.73rd percentile of 1-hour means
	15-minute	266	UK AQO, not be exceeded more than 35 times per annum, equivalent to the 99.90th percentile of 15-minute means
VOC (as benzene [a])	annual	5	AAD Limit
	24-hour	30	EA hazard characterisation method for determining tolerable concentrations in air ("TCA")
NH_3	annual	180	Environmental Assessment Level ("EAL")
	1-hour	2,500	

Table 3: Air Quality Standards for the Protection of Human Health (cont.)

Pollutant	Averaging Period	AQS ($\mu g/m^3$)	Comments
H_2S	annual	140	EAL derived from long-term occupational exposure limits
	24-hour	150	WHO Air Quality Guidelines for Europe (2000)

Notes to Table 3
(a) In accordance with EA guidance (*Air emissions risk assessment for your environmental permit*), if you release VOCs and cannot identify what all the substances in them are, treat the unknowns as 100% benzene in your risk assessment.

2.6. Odour Assessment Criteria

2.6.1. When assessing odour, the following characteristics are taken into account (referred to by the acronym FIDOL):

- Frequency - how often the exposure occurs;
- Intensity - the perception of the strength of the odour;
- Duration – the length of time of the detectable odour episode;
- Offensiveness - the character of an odour as it relates to its hedonic tone (pleasant, neutral or unpleasant) at the given odour intensity; and
- Location - the type of receptors, e.g. housing, play areas, areas of particular sensitivity etc and also local meteorological conditions.

2.6.2. A number of odour impact criteria have been developed that enable the odour impact risk of proposed facilities to be predicted using dispersion modelling techniques. These criteria are generally defined in terms of a minimum concentration of odour (reflecting the intensity/strength element of FIDOL) that occurs for a defined minimum period of time (reflecting duration and frequency element of FIDOL) over a typical meteorological year.

2.6.3. There is no clear benchmark for assessing an odour for offensiveness, however, for the purposes of this report the impact of the release of a mixture of odours substances has been assessed against the benchmark levels as provided in the EA's H4 Guidance Note on Odour[5] and are based on the 98th percentile of hourly averages:

- 1.5 odour units for most offensive odours;
- 3 odour units for moderately offensive odours; and
- 6 odour units for less offensive odours.

2.6.4. Examples of these levels are provided in Table 4.

[5] Available via: https://assets.publishing.service.gov.uk/media/5a7ba9a2ed915d1311060b16/geho0411btqm-e-e.pdf

Table 4: Industrial Activities and Indicative Criteria of Significant Pollution

Relative Offensiveness of Odour	Typical Activities	Indicative Criterion of Significant Pollution[1]
More Offensive	Activities involving putrescible wastes Processes involving animal or fish remains Brickworks Creamery Fat and Grease Processing Waste Water Treatment Oil Refining Livestock Feed Factory	1.5 OU_E/m^3
Odours which do not obviously fall within a high or low category	Intensive Livestock Rearing Fat Frying (food processing) Sugar Beet Processing	3.0 OU_E/m^3
Less Offensive Odours	Chocolate Manufacture Brewery Confectionary Fragrance and Flavourings Coffee Roasting Bakery	6.0 OU_E/m^3

2.7. Air Quality Standards for the Protection of Sensitive Habitat Sites and Ecosystems

2.7.1. For dispersion modelling purposes, the specified habitat coordinates are a precautionary approach, and are those located at the boundary of the protected site approximately closest in distance to the Site. The maximum predicted impact for each of the habitat sites has been identified for comparison with relevant assessment criteria.

Critical Levels

2.7.2. Critical levels are thresholds of airborne pollutant concentrations above which damage may be sustained to sensitive plants and animals. High concentrations of pollutants in ambient air directly cause harm to leaves and needles of forests and other plant communities. Oxidised nitrogen can have both a toxic effect on vegetation and an impact on nutrient nitrogen.

2.7.3. The 2008 Air Quality Directive set limit values for the protection of vegetation and ecosystems and these have been adopted by the Air Quality Strategy, but are not currently set in regulations. The current objectives are summarised in Table 5.

Table 5: Assessment Criteria for the Protection of Sensitive Habitats and Ecosystems

Pollutant	Averaging Period	Critical Level ($\mu g/m^3$)	Comments
NO_X	annual	30	Air Quality Objective
	daily	75	(a)
SO_2	annual	10	Where lichens or bryophytes are present
	annual	20	Where lichens or bryophytes are not present
NH_3	annual	1	Where lichens or bryophytes (including mosses, liverworts and hornwarts) are present
	annual	3	Where lichens or bryophytes (including mosses, liverworts and hornwarts) are not present

Notes to Table 5

(a) World Health Organisation ("WHO") (2000) Air Quality Guidelines for Europe; 2nd Edition. WHO Regional Publications, European Series, No. 91.

Critical Loads

2.7.4. Critical Loads are defined as:

"a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"[6].

2.7.5. Critical loads for nutrient nitrogen are set under the Convention on Long-Range Transboundary Air Pollution based on empirical evidence, mainly observations from experiments and gradient studies. Critical loads [7] are assigned to habitat classes of the European Nature Information System [8] in units of kgN/ha/yr.

2.7.6. Predicted NO_x deposition rates in units of $\mu g\ m^{-2}\ s^{-1}$ are converted to units of kg/ha/yr as nitrogen for direct comparison with critical loads.

2.7.7. Exceedance of critical loads for nitrogen deposition can result in significant terrestrial and freshwater impacts due to changes in species composition, reduction in species richness, increase in nitrate leaching, increases in plant production, changes in algal productivity and increases in the rate of succession[9].

2.7.8. In the UK, an empirical approach is applied to critical loads for acidity for non-woodland habitats; and the simple mass balance equation is applied to both managed and unmanaged woodland habitats. For freshwater ecosystems, national critical load maps are currently based on the First-order Acidity Balance model. All these methods provide critical loads for systems at steady state[7] in units of keq/ha/yr.

[6] Available via: http://www.unece.org/env/lrtap/WorkingGroups/wge/definitions.htm
[7] Available via: http://www.apis.ac.uk/overview/issues/overview_Cloadslevels.htm
[8] Available via: http://eunis.eea.europa.eu/
[9] Available via: http://www.apis.ac.uk/overview/issues/overview_Cloadslevels.htm#_Toc279788052

2.7.9. The unit kiloequivalent (keq) is the molar equivalent of potential acidity resulting from sulphur or oxidised and reduced nitrogen. Predicted acid deposition rates in units of µg/m^2/s are converted to units of keq/ha/yr as hydrogen for direct comparison with critical loads.

2.7.10. Exceedance of the critical loads for acid deposition can result in significant terrestrial and freshwater impacts due to leaching and subsequent increase in availability of potentially toxic metal ions.

2.7.11. Table 6 lists the site-specific critical loads for nutrient nitrogen deposition and acid deposition respectively. Features are as indicated on the Air Pollution Information System ("APIS") website for SACs, SPAs and SSSIs. Where a primary feature identified in the citation was not listed on the APIS website, an equivalent feature was used to derive critical loads as indicated in the Habitats Table on the APIS website [(10)].

[10] http://www.apis.ac.uk/habitat_table.html

Table 6: Critical Loads for Deposition

ADMS Ref.	Site Name and Designation	Habitat Feature	Nutrient Nitrogen Deposition		Acid Deposition		
			Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	CL Min N (keq/ha/yr)	CL Max N (keq/ha/yr)	CL Max S (keq/ha/yr)
ER1	Netherfields Lagoons - LNR Netherfield Dismantled Railway Sidings - LWS	Neutral grassland N CL range: Low and medium altitude hay meadows Acid CL class: Calcareous grassland	10	20	0.856	4.856	4
ER2	Netherfield Pits - LWS				0.856	4.856	4
ER3	New Plantation, Burton Joyce - LWS	Broadleaved, mixed and yew woodland	10	15	0.142	1.706	1.564
ER4	Gedling House Meadow - LNR	Neutral grassland N CL range: Low and medium altitude hay meadows Acid CL class: Calcareous grassland	10	20	0.856	4.856	4
ER5	Swallow Plantation - LWS	Coastal and floodplain grazing marsh N CL range: Low and medium altitude hay meadows Acid CL class: Calcareous grassland	10	20	0.856	4.856	4
ER6	Trent Bluff Scrub, Radcliffe - LWS				0.856	4.856	4
ER7	Gedling House Woods - LNR	Broadleaved, mixed and yew woodland	10	15	0.142	1.708	1.566
ER8	River Trent: Burton Joyce to Lowdham - LWS	Coastal and floodplain grazing marsh N CL range: Low and medium altitude hay meadows Acid CL class: Calcareous grassland	10	20	0.856	4.856	4
ER9	The Avenue Pool - LWS				0.856	4.856	4
ER10	Gedling Wood (Ancient & Semi-Natural Woodland - ID: 1412309) - AW	Broadleaved, mixed and yew woodland	10	15	0.214	10.979	10.765
ER11	Burton Joyce Grasslands - LWS	Neutral grassland N CL range: Low and medium altitude hay meadows Acid CL class: Calcareous grassland	10	20	0.856	4.856	4

2.8. Habitat Site Specific Baseline Concentrations and Deposition Rates

Airborne NO_X, SO_2 and NH_3 Concentrations

2.8.1.1. A summary of site-specific baseline concentrations of NO_X, SO_2 and NH_3, as provided by APIS, is presented in Table 7.

Table 7: Baseline Concentrations of NO_X, SO_2 and NH_3

ADMS Receptor Reference	Name and Designation(s)	Background Concentration [(a)]			
		NO_X ($\mu g/m^3$)		SO_2 ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)
		Annual Mean	24 Hour Mean [(b)]	Annual Mean	Annual Mean
ER1	Netherfields Lagoons - LNR Netherfield Dismantled Railway Sidings - LWS	14.92	17.61	1.41	1.99
ER2	Netherfield Pits - LWS	14.92	17.61	1.41	1.99
ER3	New Plantation, Burton Joyce - LWS	15.76	18.60	1.46	1.97
ER4	Gedling House Meadow - LNR	16.13	19.03	1.71	1.97
ER5	Swallow Plantation - LWS	12.78	15.08	1.21	1.98
ER6	Trent Bluff Scrub, Radcliffe - LWS	12.68	14.96	1.29	1.99
ER7	Gedling House Woods - LNR	16.13	19.03	1.71	1.97
ER8	River Trent: Burton Joyce to Lowdham - LWS	14.67	17.31	1.44	1.96
ER9	The Avenue Pool - LWS	12.68	14.96	1.29	1.99
ER10	Gedling Wood (Ancient & Semi-Natural Woodland - ID: 1412309) - AW	13.93	16.44	1.47	1.94
ER11	Burton Joyce Grasslands - LWS	14.67	17.31	1.44	1.96

Notes to Table 7

(a) Background concentrations for the relevant ecological habitats have been taken from the APIS website for the closest grid square to the site (data year: 2019 – 2021).

(b) The 24-hour mean baseline concentration is twice the annual mean multiplied by a factor of 0.59, in accordance with the H1 guidance.

Nutrient Nitrogen and Acid Deposition

2.8.2. A summary of site-specific baseline nutrient nitrogen and acid deposition rates is presented in Table 8 for the relevant habitat sites.

Table 8: Background Nutrient Nitrogen and Acid Deposition Grid Averages

ADMS Receptor Reference	Name and Designation(s)	Nutrient Nitrogen Background (kgN/ha/yr) [(a)]	Acid Deposition Background (keq/ha/yr) [(a)]
ER1	Netherfields Lagoons - LNR Netherfield Dismantled Railway Sidings - LWS	16.94	1.2 (1.21 N, 0.15 S)
ER2	Netherfield Pits - LWS	16.94	1.2 (1.21 N, 0.15 S)
ER3	New Plantation, Burton Joyce - LWS	30.07	2.15 (2.15 N, 0.19 S)
ER4	Gedling House Meadow - LNR	17.1	1.21 (1.22 N, 0.15 S)
ER5	Swallow Plantation - LWS	17.16	1.21 (1.23 N, 0.15 S)
ER6	Trent Bluff Scrub, Radcliffe - LWS	17.15	1.21 (1.22 N, 0.15 S)
ER7	Gedling House Woods - LNR	30	2.15 (2.14 N, 0.19 S)
ER8	River Trent: Burton Joyce to Lowdham - LWS	17.17	1.21 (1.23 N, 0.15 S)
ER9	The Avenue Pool - LWS	17.15	1.21 (1.22 N, 0.15 S)
ER10	Gedling Wood (Ancient & Semi-Natural Woodland - ID: 1412309) - AW	29.98	2.14 (2.14 N, 0.19 S)
ER11	Burton Joyce Grasslands - LWS	17.17	1.21 (1.23 N, 0.15 S)

Notes to Table 8
(a) Taken from the APIS website for the closest grid square to the site (data year: 2019 – 2021).

2.9. Deposition Parameters - Sensitive Habitats

2.9.1. Deposition of nitrogen and acids was also included in the assessment. The pollutant deposition rates are presented in Table 9. These parameters are detailed in AQTAG06. Since woodland sites have a greater surface area, higher deposition velocities are adopted for these sites.

Table 9: Acid/Nitrogen Deposition Parameters [(11)]

Pollutant	Dry Deposition Velocity for Grassland (m/s)	Dry Deposition Velocity for Woodland (m/s)
NO_X (as NO_2)	0.0015	0.003
SO_2	0.012	0.024
NH_3	0.02	0.03

[11] As detailed in AQTAG06.

2.10. Background Air Quality

2.10.1. For the purposes of this assessment the most representative background concentration to the point being assessed (i.e., the maximum GLC or sensitive receptor location) will be used, where necessary, to calculate the PECs. The source, location and concentration of the background air quality data used will be specified in the appropriate results section of this report.

2.11. Stack Emission Parameters and Emission Limit Values

2.11.1. The stack emission parameters considered in this assessment are presented in Table 10.

Table 10: Stack Emission Parameters

Parameter	Boiler 1	Boiler 2	TOx	Scrubber 1	Scrubber 2	Scrubber 3
Rated Thermal Input (MWth)	15	15	N/A	N/A	N/A	N/A
Stack Height (m)	24.75	24.75	21	11	17.6	23.7
Flue Exit Diameter (m)	1	1	0.985	1	1	1.53
Volumetric Flow Rate (Actual) (m^3/s)	5	5	12.73	8.64	16.68	23.38
Stack Velocity (Actual) (m/s)	6.37	6.37	16.70	11.00	21.24	12.80
Stack Gas Temperature (°C)	200	119	226	32	28	22
Oxygen Concentration (%)	4.12	3.8	N/A	N/A	N/A	N/A
Moisture Concentration (%)	8.8	10.1	N/A	N/A	N/A	N/A
Normalised Volumetric Flow Rate (Nm^3/s) [(a)]	2.47	2.99	6.96	7.73	18.16	21.64
Stack Centre Coordinates (X, Y)	463810, 341673	463803, 341680	463813, 341664	463790, 341681	463846, 341681	463833, 341727

Notes to Table 10
(b) Referenced to 273K, 1atm for all emission points + dry and 3% O_2 for the boilers.

2.11.2. The emission concentration assumed for each pollutant and the pollutant mass emission rate for the study are presented in Table 11. These are the assumed daily concentrations used for the main modelling assessment.

Table 11: Pollutant Emission Rates

Pollutant	Emission Concentration (mg/Nm^3) (a)	B1	B2	TOx	S1	S2	S2
		g/s (OU_E/s for OU_E)					
NO_2	650 (b)	1.60	1.94	N/A	N/A	N/A	N/A
	350 (c)	N/A	N/A	2.44	N/A	N/A	N/A
CO	30 (d)	0.0740	0.0897	0.209	N/A	N/A	N/A
TPM	30 (b)	0.0740	0.0897	N/A	N/A	N/A	N/A
	5 (e)	N/A	N/A	0.0348	N/A	N/A	N/A
SO_2	350 (b)	0.864	1.05	N/A	N/A	N/A	N/A
	175 (c)	N/A	N/A	1.22	N/A	N/A	N/A
VOC	16 (f)	0.0395	0.0478	0.111	N/A	N/A	N/A
	1 (c)	N/A	N/A	N/A	0.00773	0.0151	0.0216
NH_3	7 (f)	0.0173	0.0209	0.0487	N/A	N/A	N/A
	1 (c)	N/A	N/A	N/A	0.00773	0.0151	0.0216
H_2S	1 (f)	0.00247	0.00299	0.00696	0.00773	0.0151	0.0216
OU_E	2,000 (c)	4,934	5,981	N/A	N/A	N/A	N/A
	3,000 (c)	N/A	N/A	20,887	N/A	N/A	N/A
	1,500 (c)	N/A	N/A	N/A	11,600	22,693	32,453

Notes to Table 11

B = Boiler, S = Scrubber

(a) Referenced to 273K, 1atm for all emission points + dry and 3% O_2 for the boilers.

(b) ELV taken from Table 2 of Part 1 of Annex II of the MCPD (for existing MCP with a rated thermal input greater than 5MW, other than engines and gas turbines - for liquid fuels other than gas oil).

(c) Confirmed by the Site.

(d) BAT-AEL (upper end) - Taken from Table 5.4 of the SA Bref.

(e) BAT-AEL (upper end) - Taken from Table 5.3 of the SA Bref.

(f) BAT-AEL (upper end) - Taken from Table 5.10 of the SA Bref (see note (3) of Table 5.10 for NH_3).

2.12. Building Parameters

2.12.1. The building parameters utilised for the study are detailed in Table 12 and a visual representation is provided as Figure 4. Please note that the building layout has been simplified due to modelling constraints.

Table 12: Building Parameters

Building	X [a]	Y [a]	Angle (°) [b]	Height (m) [c]	Length / Diameter (m) [c]	Width (m) [c]
Feather Raw Material Reception	463800	341723	118.41	14	37.19	30
Poultry Raw Material Reception	463812	341744	118.41	12.5	37.19	19.06
Poultry Grinding / Cooling	463831	341698	118.41	9	39.58	16.38
Process Area (1)	463811	341689	118.41	13	32.81	18.97
Process Area (2)	463790	341696	118.41	7	11.55	27.03
Stores (1)	463806	341645	119.75	9	23.09	10.24
Stores (2)	463794	341639	119.75	5.5	9.03	8.51
Stores (3)	463899	341691	118.41	10	20	20
Security	463809	341632	119.75	4	20.93	5.44
Office	463843	341631	120.48	5	10.09	33.74
Bagging (1)	463827	341670	118.41	5	12.89	37.54
Bagging (2)	463830	341671	118.41	14	6	6
TOx House	463814	341667	118.41	11.5	7.03	17.08
Boiler 1 House	463808	341670	118.41	9.5	5.45	17.08
Boiler 2 House	463802	341673	118.41	7	9.07	17.08
Tower 1	463835	341662	N/A	13	6	N/A
Tower 2	463832	341656	N/A	13	6	N/A
Tower 3	463779	341674	N/A	13	4	N/A
Tower 4	463784	341672	N/A	13	4	N/A
Tower 5	463863	341709	N/A	14	4	N/A
Tower 6	463866	341715	N/A	14	4	N/A
Workshop (1)	463765	341686	118.41	4	7	34
Workshop (2)	463856	341654	120.48	6	10.09	13.72
Lorry Loading	463838	341711	118.41	12	39.58	13.57

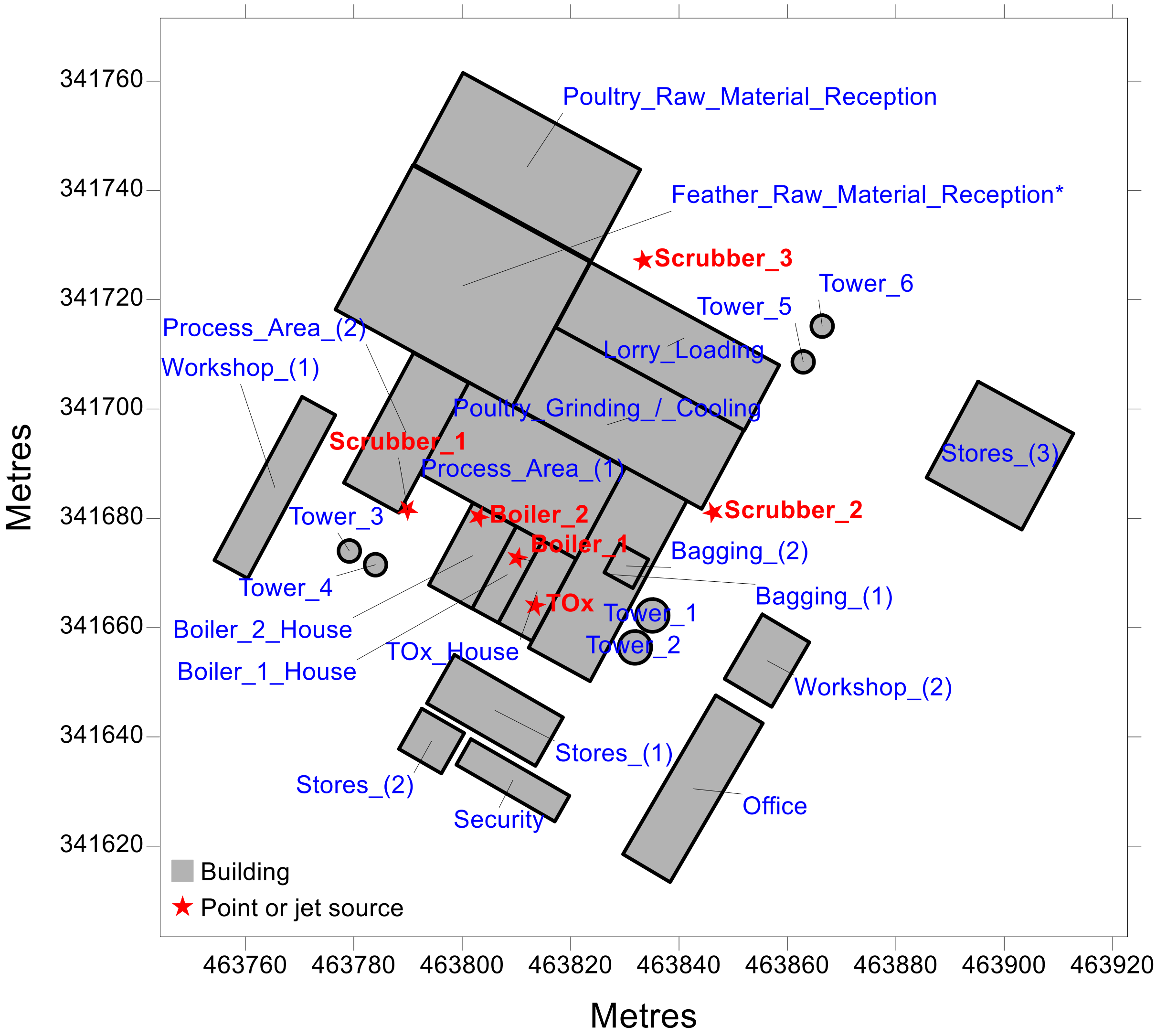
Notes to Table 12

(a) X(m), Y(m) denote the grid reference coordinates of the centre of the building.

(b) Angle denotes the angle between north and the side designated as length in the ADMS model.

(c) Building dimensions were obtained using a combination of the model's Mapper, LiDAR survey data and Google Earth.

Figure 4: Buildings Layout



2.13. Meteorological Data

2.13.1. ADMS has a meteorological pre-processing capability, which calculates the required boundary layer parameters from a variety of data. Meteorological data ("met data") can be utilised in its sequentially analysed form, which estimates the pattern of dispersion through 10° sectors from the source or as raw data.

2.13.2. The nearest suitable met data available from the Meteorological Office ("Met Office") is from Nottingham Watnall weather station. This site is located approximately 14 km west-northwest of the Site. Consequently, the assessment utilises five years (2019 – 2023) of hourly sequentially analysed data in sectors of 10° from this weather station.

2.13.3. Over the five years of meteorological data used (43,824 hours), ADMS reported that 314 hours contained inadequate data, 133 hours were calm and 675 hours were non-calm met data lines with a wind speed less than the minimum value (0.75 m/s). These represent 0.72%, 0.30% and 1.54% of the data, respectively.

2.13.4. Wind roses for the data are presented in Figure 5; these show that the prevailing winds are predominantly south-westerly with observable north-easterly components.

Figure 5: Wind Roses

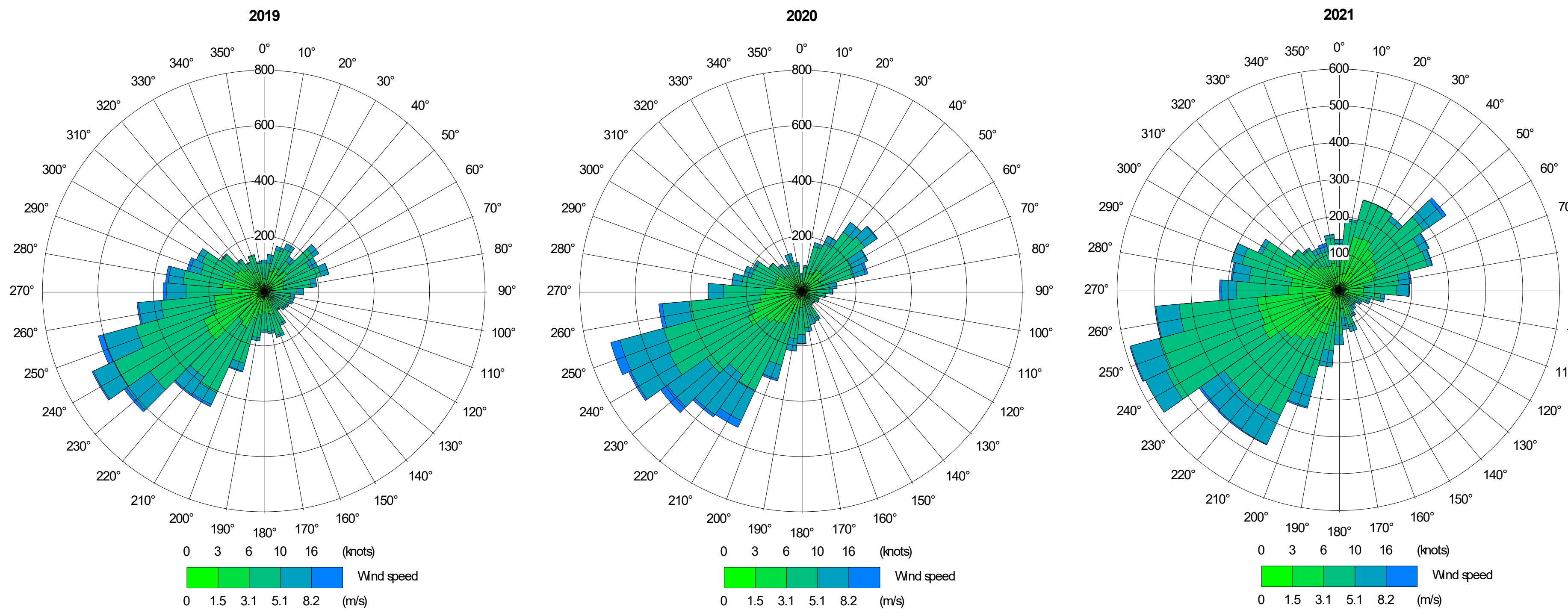
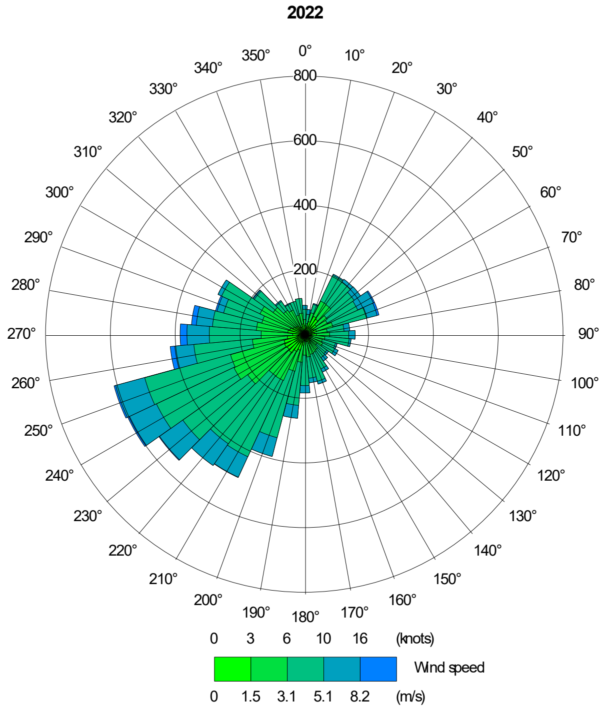
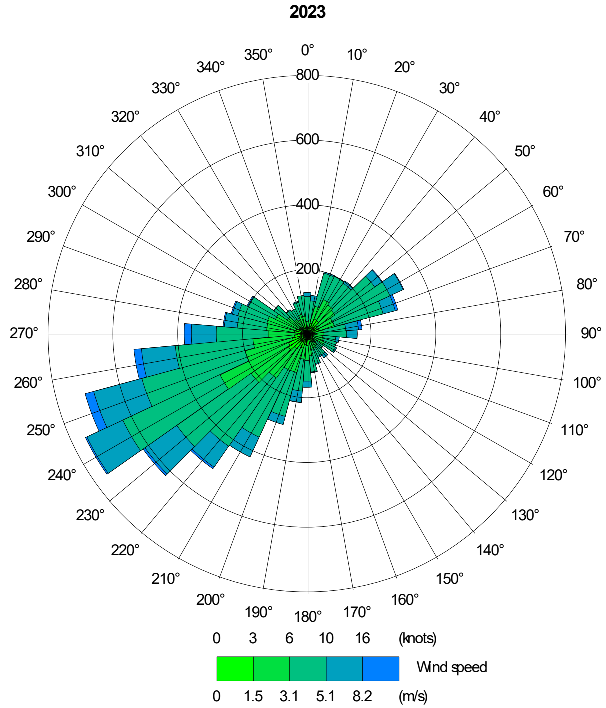


Figure 5: Wind Roses (cont.)





2.14. Surface Albedo

2.14.1. The surface albedo is the ratio of reflected to incident shortwave solar radiation at the surface of the earth[12]. ADMS allows the user to set this value between 0 and 1. A value of 0.40-0.95 would be considered representative of snow-covered ground where a large proportion of the light is reflected, soils from 0.05-0.40, agricultural crops 0.18-0.25, and grass would be 0.16 – 0.26 depending on length[13]. A value of 0.23 is an average value for non-snow-covered surfaces and is the default value used in the model. This value is considered appropriate for the setting of both the dispersion site and the met measurement sites.

2.15. Priestley-Taylor Parameter

2.15.1. The Priestly Taylor parameter is a parameter representing the surface moisture available for evaporation[14]. This parameter must be set between 0 and 3 where 0 would be classed as dry bare earth, 0.45 as dry grassland, 1 as moist grassland and a value of 3 is suggested for a saturated forest surrounded by forest[14]. The default value of 1 was considered to be appropriate for the setting of the dispersion and the met measurement sites and the surrounding areas.

2.16. Minimum Monin-Obukhov Length

2.16.1. The Monin-Obukhov length provides a measure of the stability of the atmosphere. For example, in urban areas the air is affected by heat generated from buildings and traffic which prevents the atmosphere from becoming stable. In rural areas the atmosphere would be more stable. The minimum Monin-Obukhov length can be set between 1 and 200m. Typical values would be[14]:

- large conurbations >1 million = 100m;
- cities and large towns = 30m;
- mixed urban/industrial = 30m;
- small towns <50,000 = 10m; and
- rural areas = 1m.

2.16.2. A value of 30m was considered appropriate for the dispersion site and the met measurement site.

2.17. Terrain Data

2.17.1. ADMS has a terrain pre-processing capability, which calculates the required boundary layer parameters from a variety of data. The terrain file was created by compiling the data from the relevant Ordnance Survey tiles and using an ADMS terrain grid resolution of 64 x 64.

2.17.2. Terrain data was used for an area 5 km by 5km. The terrain data used was of sufficient size to ensure that it would encompass all potentially sensitive human and ecological receptors.

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[12] ADMS 6 User Guide, CERC, V6.0, Mar 2023
[13] TR Oke, Buondary Layer Climates, 2nd Edition 1987
[14] J P Lhomme, A Theorestivl Basis for the Priestley-Taylor Coefficient, February 1997.

2.18. Roughness Length

2.18.1. The surface nature of the terrain is defined in terms of Roughness Length (Z_o). The roughness length is dependent on the type of terrain and its physical properties. The ADMS model gives values to various types of terrain, for example, agricultural areas are classed as 0.2-0.3m, parkland and open suburbia is classed as 0.5m and cities and woodlands are classed as 1.0m.

2.18.2. A surface roughness length of 0.5m was used for the dispersion site and the met measurement site.

2.19. Model Output Parameters

2.19.1. The ADMS model calculates the likely pollutant GLCs at locations within a definable grid system pre-determined by a user. Output grids may be determined in terms of a Cartesian or Polar co-ordinate system. For the purpose of this study the Cartesian system was used.

2.19.2. A Cartesian grid is constructed with reference to an initial origin, which is taken to be the bottom left corner of the grid. The lines of the grid are inserted at regular pre-defined increments in both northerly and easterly directions. Pollutant GLCs are calculated at the intersection of these grid lines; they are calculated in this manner primarily to aid in the generation of pollutant contours.

2.19.3. For assessing the maximum point of impact, a grid resolution of 4km x 4km was utilised in order to capture values of the predicted pollutant GLCs arising from the model. The grid coordinates were X = 461821 to 465821 and Y = 339696 to 343696, with 101 nodes along each axis i.e., a grid spacing of 40m.

2.19.4. For assessing the impact of emissions on human health and ecological sites the grid references of each were included as specified points within the ADMS model. This was carried out with a specified points file being created for the potentially sensitive human receptor and ecological locations (as outlined in Tables 1 and 2 of Sections 2.3. and 2.4., respectively).

2.20. Scenarios Modelled

2.20.1. The study has been undertaken on the basis of assessing the magnitude of impact of air emissions associated with the Site's operationally feasible worst-case scenario. It has been assumed this scenario would consist of the two dual fuel boilers (running on tallow fuel oil), the TOx and the three scrubbers operating concurrently 24-hours a day, 365 days of the year. Impact assessments have therefore been undertaken at the following:

- at the maximum point of impact;
- at potentially sensitive human receptor locations; and
- at potentially sensitive ecological sites (inclusive of deposition rates).

2.21. Assessment of Significance of Impact Guidelines – Maximum GLC and Human Receptors

2.21.1. Both the EA online guidance and IAQM guidance has been used for the purposes of significance assessment, and this guidance details the guidelines upon which the assessment of the significance of impact can be established.

2.21.2. In the first instance, the EA online guidance indicates that PCs can be considered insignificant if:

- the long-term PC is <1% of the long-term environmental standard; and
- the short-term PC is <10% of the short-term environmental standard.

2.21.3. As outlined in the EA online guidance, there are no criteria to determine whether:

- PCs are significant; and
- PECs are insignificant or significant.

Consequently, significance will be judged based on the site-specific circumstances and on the EPUK and IAQM methodology as described in Sections 2.21.4 – 2.21.10.

Long-Term Impacts

2.21.4. If the PCs exceed the long-term criteria outlined in the EA online guidance, the potential long-term effects on human receptors from the operation of the emission points will be assessed in accordance with the latest guidance produced by EPUK and IAQM in January 2017.

2.21.5. The guidance provides a basis for a consistent approach that could be used by all parties to professionally judge the overall significance of the air quality effects based on the severity of air quality impacts.

2.21.6. The following rationale is used in determining the severity of the air quality impacts at individual human receptors:

- the effects are provided as a percentage of the air quality acceptance level ("AQAL");
- the absolute concentrations are also considered in terms of the AQAL and are divided into categories for long-term concentrations. The categories are based on the sensitivity of the individual receptor in terms of harmful potential. The degree of potential to change increases as absolute concentrations are close to or above the AQAL;
- severity of the effect is described as qualitative descriptors; negligible, slight, moderate or substantial by taking into account in combination the harm potential and air quality effect. This means that a small increase at a receptor which is already close to or above the AQAL will have higher severity compared to a relatively large change at a receptor which is significantly below the AQAL, >75% AQAL;
- the effects can be adverse when the air quality concentration increases or beneficial when the concentration decreases as a result of development; and
- the judgement of overall significance of the effects is then based on severity of effects on all the individual receptors considered.

2.21.7. The impact descriptors for individual receptors are presented in Table 13.

Table 13: Impact Descriptors for Individual Receptors – Long-Term Concentrations

Long-term average concentration at receptor in assessment year	% Change in concentration relative to AQAL			
	1	2-5	6-10	>10
≤75% 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% of AQAL	Moderate	Substantial	Substantial	Substantial

Short-Term Impacts

2.21.8. As stated in EPUK / IAQM guidance, January 2017 (Land-Use Planning & Development Control: Planning for Air Quality') in Section 6.36, Page 27: *"For any point source, some consideration must also be given to the impacts resulting from short term, peak concentrations of those pollutants that can affect health through inhalation. The Environment Agency uses a threshold criterion of 10% of the short term AQAL as a screening criterion for the maximum short-term impact. This is a reasonable value to take and this guidance also adopts this as a basis for defining an impact that is sufficiently small in magnitude to be regarded as having an insignificant effect. Background concentrations are less important in determining the severity of impact for short term concentrations, not least because the peak concentrations attributable to the source and the background are not additive."*

2.21.9. Short-term concentrations in the context laid out in the IAQM guidance are those averaged over periods of an hour or less. These exposures would be regarded as acute and occur when a plume from an elevated source affects airborne concentrations experienced by a receptor over an hour or less.

2.21.10. The IAQM guidance offers the following severity of impact descriptors for peak short-term concentrations from an elevated source:

- 11-20% of the relevant AQAL – the magnitude can be regarded as 'small';
- 21-50% of the relevant AQAL – the magnitude can be regarded as 'medium'; and
- 51% or more of the relevant AQAL – the magnitude can be regarded as 'large'.

It is argued that this approach is intended to be a streamlined and pragmatic assessment procedure that avoids undue complexity.

2.22. Assessment of Significance of Impact Guidelines for Odour

2.22.1. The EA's H4 Guidance Note provides the criteria for which ground level concentrations of different odour types which have been reported as being acceptable in the long term. Odour from the installation will be considered significant if the predicted odour concentration at the site boundary (or the potentially sensitive human receptor locations) is greater than 1.5 OU_E/m^3.

2.23. Assessment of Significance of Impact Guidelines – Ecological Receptors

2.23.1. EA Operational Instruction 67_12[15] states that a detailed assessment is required where modelling predicts that the long-term PC is greater than:

- 1% for European sites and SSSIs; or
- 100% for NNR, LNR, LWS and AW.

And the PEC is greater than:

- 70% for European sites and SSSIs; or
- 100% for NNR, LNR, LWS and AW.

2.23.2. For short-term emissions, further assessment is required at European site and SSSI's where the PC is greater than 10% of the critical level.

2.23.3. Following detailed assessment, if the PEC is less than 100% of the appropriate environmental criterion, then it can be assumed there will be no adverse effect for European Sites and SSSI's.

2.23.4. For NNR, LNR, LWS or AW, if the PC is less than 100% of the appropriate environmental criterion, then it can be assumed there will be no significant pollution.

2.24. NO_x to NO_2 Conversion Rates

2.24.1. EA online guidance states that emissions of NO_x should be recorded as NO_2 as follows:

- for the long-term PCs and PECs, assume 100% of the emissions of NO_x convert to NO_2; and
- for the short-term PCs and PECs assume 50% of the emissions of NO_x convert to NO_2.

2.24.2. However, further to detailed discussion with the EA on previous studies, a long-term 70% NO to NO_2 conversion rate, and a short-term 35% NO to NO_2 as required by guidance on NO_x and NO_2 Conversion Ratios as referenced in AQTAG06 *Technical guidance on detailed modelling approach for an appropriate assessment* (April 2010) should be used in all detailed modelling assessments. The conversion rates as provided in section 2.24.1. should only be used for screening assessment.

[15] EA Operational Instruction 67_12 Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation, V2, 27.3.15

3. ASSESSMENT OF AIR QUALITY IMPACTS

3.1. Human Health Impacts

3.1.1. The predicted PCs for each of the pollutants considered in the assessment, at the maximum point of impact, have been extracted and are presented in Table 14 for all pollutants except odour and Table 15 for odour units. The maximum predicted PCs are also compared to their respective AQSs or odour assessment criteria.

3.1.2. Maximum concentrations are considered insignificant if the long-term prediction is less than 1% of the long-term AQS, and, for short-term predictions, a concentration less than 10% of the short-term AQS can be considered insignificant (see Section 2.20. of this document). Odour concentrations are considered significant if they are in excess of 1.5OU$_E$/m^3. In Tables 14 and 15, any PCs that are above these significance criteria are indicated in bold type.

Table 14: Comparison of Maximum PCs with Air Quality Standards

Pollutant	Worst Case Met Year (2019-2023)	Max PC (µg/m^3)	Location of Max PC		AQS (µg/m^3)	PC as % of AQS
			X Coord.	Y Coord.		
NO_2 (annual)	2020	**15.4**	463941	341776	40	**38.58%**
NO_2 (1 hour, 99.79th percentile)	2020	**67.6**	463821	341776	200	**33.78%**
CO (8 hour, 100th percentile)	2019	11.2	463741	341576	10,000	0.11%
$PM_{2.5}$ (annual)	2020	**0.800**	463941	341776	20	**4.00%**
PM_{10} (annual)	2020	**0.800**	463941	341776	40	**2.00%**
PM_{10} (24-hour, 90.41st percentile)	2020	2.37	463981	341776	50	4.74%
SO_2 (24-hour, 99.18th percentile)	2021	**75.1**	463701	341576	125	**60.06%**
SO_2 (1-hour, 99.73rd percentile)	2020	**99.0**	463741	341576	350	**28.29%**
SO_2 (15 minute, 99.90th percentile)	2021	**145**	463781	341776	266	**54.39%**
VOC (as benzene) (annual)	2020	**0.950**	463941	341776	5	**19.01%**
VOC (as benzene) (24-hour, 100th percentile)	2020	**6.22**	463741	341576	30	**20.75%**

Table 14: Comparison of Maximum PCs with Air Quality Standards (cont.)

Pollutant	Worst Case Met Year (2019-2023)	Max PC (µg/m³)	Location of Max PC		AQS (µg/m³)	PC as % of AQS
			X Coord.	Y Coord.		
NH_3 (annual)	2020	0.587	463941	341736	180	0.33%
NH_3 (1-hour, 100th percentile)	2021	8.37	463781	341776	2,500	0.33%
H_2S (annual)	2023	0.360	463941	341736	140	0.26%
H_2S (24-hour, 100th percentile)	2023	1.69	463701	341656	150	1.13%

Table 15: Comparison of Maximum Odour PCs with Odour Assessment Criteria

Pollutant	Worst Case Met Year (2019-2023)	Max PC (OU_E/m^3)	Location of Max PC		Odour Assessment Criteria (OU_E/m^3)	PC as % of Odour Criteria
			X Coord.	Y Coord.		
OU_E (1-hour, 98th percentile)	2023	**2.96**	463701	341616	1.5	**197.15%**

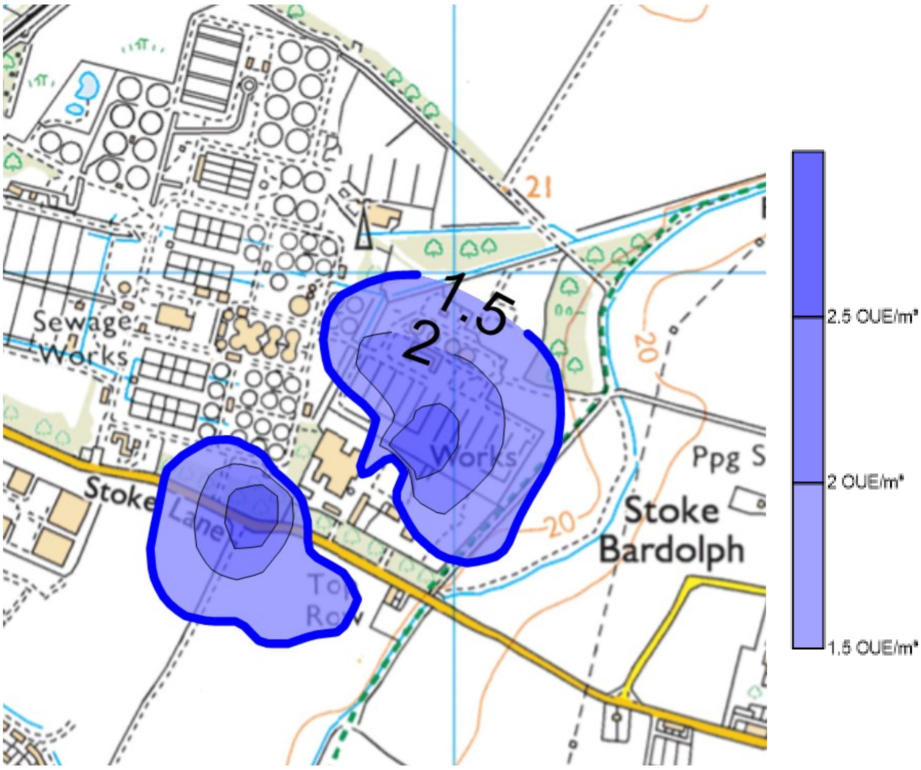
3.1.3. It can be seen from the data in Tables 14 and 15 that, with the exception of CO, short-term (i.e., 24-hour) PM_{10}, NH_3 and H_2S (both long-term and short-term) – which screen out as insignificant, the remaining pollutants have potentially significant impacts and therefore require further assessment.

3.1.4. For the short-term emissions with potentially significant impacts, as highlighted in bold in Table 14, these have been further assessed against the IAQM severity of impact descriptors detailed in Section 2.21.10. The impacts of the predicted PCs can be summarised as follows:

- 99.79th percentile NO_2 – the magnitude of impact can be regarded as 'medium';
- 99.18th percentile SO_2 – the magnitude of impact can be regarded as 'large';
- 99.73rd percentile SO_2 – the magnitude of impact can be regarded as 'medium';
- 99.90th percentile SO_2 – the magnitude of impact can be regarded as 'large'; and
- 100th percentile VOC – the magnitude of impact can be regarded as 'small'.

3.1.5. As displayed in Table 15, whilst the predicted worst-case PC exceeds the significance criteria for the most offensive odours (i.e., 1.5 OU_E/m^3), the highest odour concentrations largely occur in the adjacent areas immediately surrounding the Site's boundary, as shown in Figure 6 (refer to Figure 22 in Section 3.2 for the detailed pollutant contour plot).

Figure 6: Pollutant Contour Plot for 1-hour OU_E – 98th Percentile (Met Year 2023)



3.1.6. In Figure 6, areas that exceed the odour significance criteria are encapsulated by the blue contour line (which represents 1.5 OU_E/m^3). Consequently, whilst the predicted odour PCs within these areas are potentially significant, the land use is not considered to be representative of regular human exposure. Greater emphasis should therefore be placed on the surrounding potentially sensitive human receptor locations (for which the modelled results in Section 4.1. demonstrate that, for the vast majority of the time, no significant odour impact is predicted to occur).

3.1.7. For the potentially significant long-term PCs of NO_2, $PM_{2.5}$, PM_{10} and VOC shown in Table 13, PECs must be determined. PECs are calculated by adding the long-term process contribution to the long-term ambient background concentration.

3.1.8. GBC undertakes automatic monitoring at one site – however, as this is sited approximately 6.5km west-northwest of the Site, it has been discounted from consideration. In addition, GBC undertakes non-automatic (passive) diffusion tube ("DT") monitoring for NO_2 throughout the council. Table 16 displays the location of DTs within 1.5km of the Site and the 2022 annual NO_2 concentration at each source.

Table 16: Nearest Diffusion Tube Locations to Site for Nitrogen Dioxide

ID / Name [(a)]	2022 Annual NO_2 Concentration (µg/m^3) [(a)]	(X) [(a)]	(Y) [(a)]	Distance (m) [(b)]	Heading (°)
87999 New Works Cottages	21.6	463150	341842	687	282
88001 Nottingham Road, Burton Joyce	17	463226	342668	1,140	329
87406 Burton Rd/Shearing Hill	18.5	462422	341972	1,426	281
88000 Colwick Loop Rd /Nether Pasture	25.1	462615	340837	1,481	235

Notes to Table 16

(a) Information obtained online from GBC's 2023 Air Quality Annual Status Report (ASR). Available via: https://www.gedling.gov.uk/media/gedlingboroughcouncil/documents/environmentalhealth/GBC_ASR_2023red.pdf.

(b) Distances are measured as the crow flies from the background source to on-site grid reference: SK 63821 41696.

3.1.9. Background air quality data is also available from the Department for Environment, Food and Rural Affairs ("DEFRA"), with the nearest mapped modelled NO_2, $PM_{2.5}$, PM_{10} and VOC (as benzene) concentrations to Site displayed in Table 17 for the year 2022.

Table 17: Nearest DEFRA Modelled Data to Site

ECL Ref.	UK Grid Code	2022 Annual Mean Concentration (µg/m^3) [(a)]				Easting Coordinate (X) [(a)]	Northing Coordinate (Y) [(a)]	Distance (m) [(c)]	Heading (°)
		NO_2	$PM_{2.5}$	PM_{10}	VOC [(b)]				
DEFRA1	660804	11.21	8.17	15.74	0.439	463500	342500	866	338
DEFRA2	660805	10.16	7.92	15.63	0.429	464500	342500	1,052	40
DEFRA3	661494	13.60	7.81	12.98	0.454	463500	341500	376	239
DEFRA4	661495	9.99	7.72	13.31	0.425	464500	341500	707	106

Notes to Table 17

(a) Information obtained from DEFRA's background pollution maps, available from: https://uk-air.defra.gov.uk/data/pcm-data.

(b) Expressed as benzene.

(c) Distances are measured as the crow flies from the background source to on-site grid reference: SK 63821 41696.

3.1.10. When calculating PECs, it is important to consider the location of the maximum GLC in order to assign an appropriate background concentration. The location of the maximum GLCs (PCs) for long-term (i.e., annual) pollutants with potentially significant impacts (as indicated in bold in Table 14) are displayed in Table 18. Figure 7 demonstrates the location of the nearest background sources in relation to the relevant maximum long-term PCs.

Figure 7: Nearest Background Sources in Relation to the Maximum PC Locations

Notes to Figure 7
The red pin is the indicative location of the Site. Refer to Table 14 for the colour coded coordinates that correspond to the colour coded pins (that lack annotations). The annotated yellow icons are the nearest sources of local authority monitored background NO_2 (see Table 16) and the annotated pink icons are the nearest sources of DEFRA modelled background concentrations (see Table 17).

3.1.11. It can be seen from Figure 7 that the location of the maximum long-term PCs occur in closest proximity to DEFRA3. It should be noted that it is considered good practise to make use of observed (i.e., monitored) data where appropriate. However, although the nearest DT (ID 87999) is sited approximately 0.8km to the west of the maximum long-term NO_2 GLC, the DT is situated at a roadside junction controlled by traffic lights. The annual NO_2 concentration at DT 87999 is therefore likely to be elevated due to exhaust emissions from idling traffic and the location is not considered representative of the land use in the vicinity of the maximum long-term NO_2 GLC.

3.1.12. Consequently, for all long-term pollutants with potentially significant impacts, and in the interest of a conservative assessment, the DEFRA background location with the highest concentration for each pollutant will be used as the as the background source for the purposes of the PEC assessment. This should help to ensure the worst-case impact is assessed.

3.1.13. The PEC assessment is presented in Table 18, with the PECs compared with the relevant long-term AQS and the significance categorised adopting the IAQM guidance and impact descriptors shown in Table 13 of Section 2.21.

Table 18: Comparison of Maximum Long-term PCs and Maximum PECs with AQS

Pollutant	Worst Case Met Year (2019 – 2023)	Max PC (µg/m³)	AQS (µg/m³)	PC as % of AQS	Location of Max PC		2022 Annual Background Concentration (µg/m³)	Max PEC (µg/m³)	PEC as % of AQS	IAQM Significance
					X Coord.	Y Coord.				
NO_2 (annual)	2020	**15.4**	40	**38.58%**	463941	341776	13.60 [a]	29.0	73%	**Moderate**
$PM_{2.5}$ (annual)	2020	**0.800**	20	**4.00%**	463941	341776	8.17 [b]	8.97	45%	Negligible
PM_{10} (annual)	2020	**0.800**	40	**2.00%**	463941	341776	15.74 [b]	16.5	41%	Negligible
VOC (as benzene) (annual)	2020	**0.950**	5	**19.01%**	463941	341776	0.454 [a]	1.40	28%	**Moderate**

Notes to Table 18

(a) Background concentration taken from DEFRA3 – refer to Table 17 for details.
(b) Background concentration taken from DEFRA1 – refer to Table 17 for details.

3.1.14. It can be seen from the data in Table 18 that the PECs for the long-term pollutants assessed can be considered 'moderate' for NO_2 and VOC and 'negligible' for $PM_{2.5}$ and PM_{10}.

3.1.15. It should be noted that, even though the annual PCs have been calculated assuming the emission points assessed are releasing at the maximum relevant BAT-AELs (or worst-case emission concentrations), and are operational concurrently twenty-four hours a day, 365 days of the year, no exceedances of the AQSs are predicted for any of the pollutants assessed.

3.1.16. During normal day to day operation of the emission points, where they would not be emitting at their maximum assumed concentrations or all active simultaneously throughout the year – the impacts are therefore likely to be considerably less for all pollutants assessed.

3.2. Isopleths

3.2.1. The isopleths for the pollutants assessed are presented as Figures 8 to 22 for the worst case met year.

Figure 8: Isopleth for Long-Term NO_2 – Met Year 2020

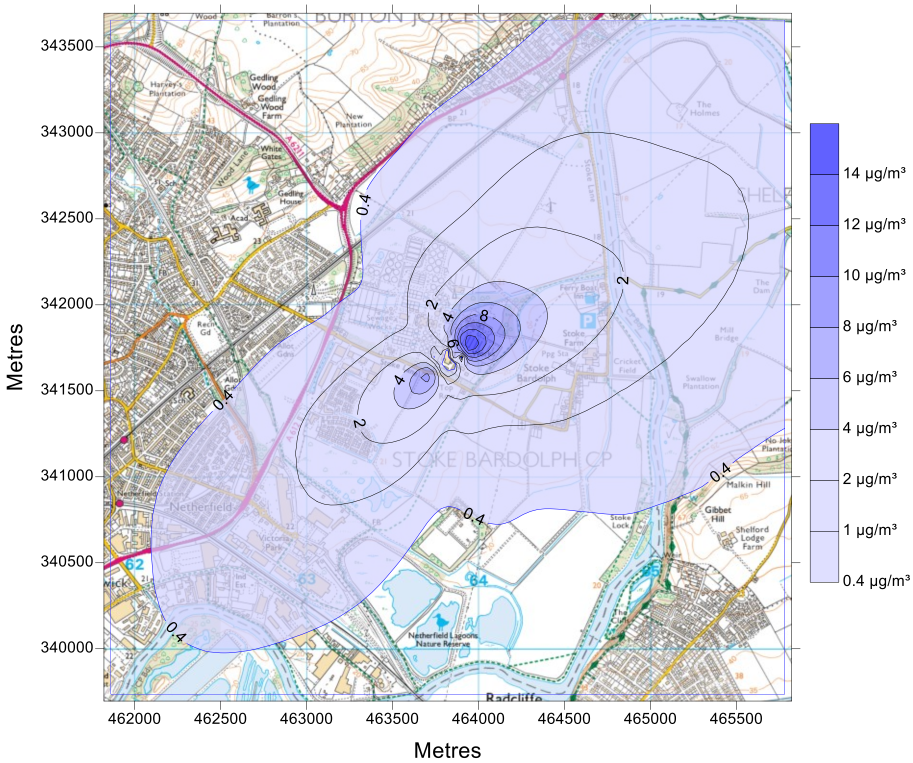


Figure 9: Isopleth for Short-Term NO_2 – Met Year 2020

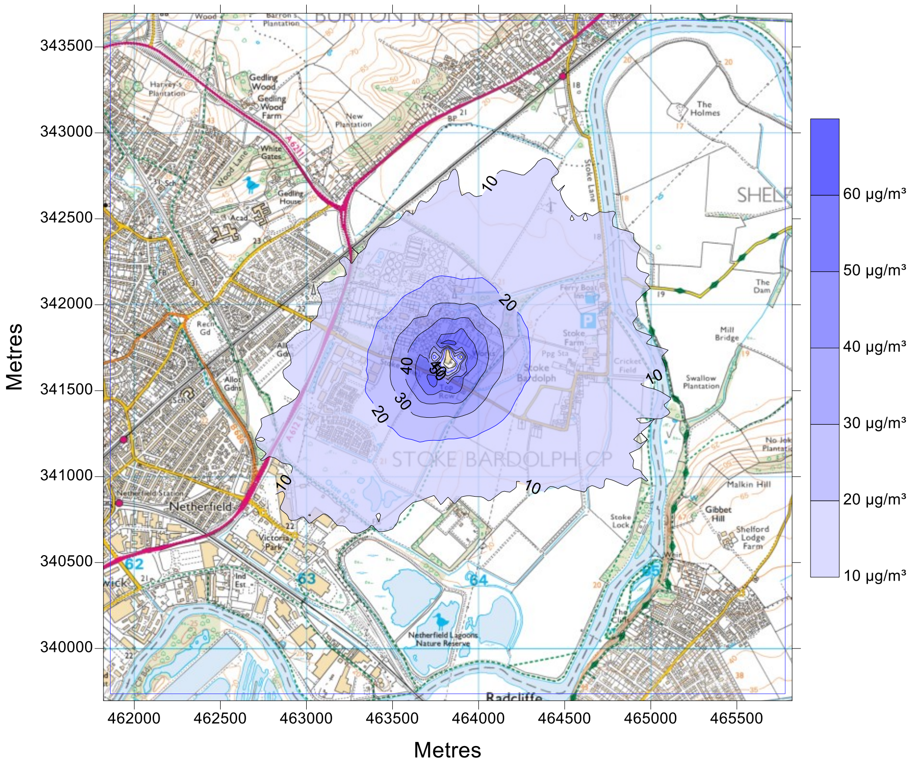


Figure 10: Isopleth for 8-hour CO – 100th Percentile – Met Year 2019

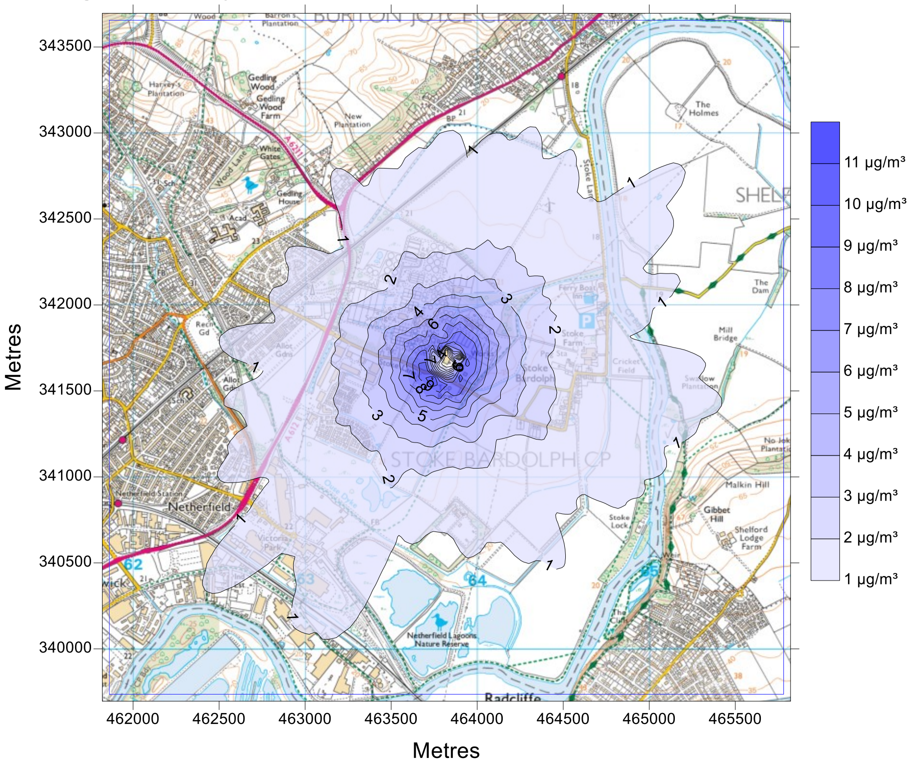


Figure 11: Isopleth for Annual $PM_{2.5}$ and PM_{10} – Met Year 2020

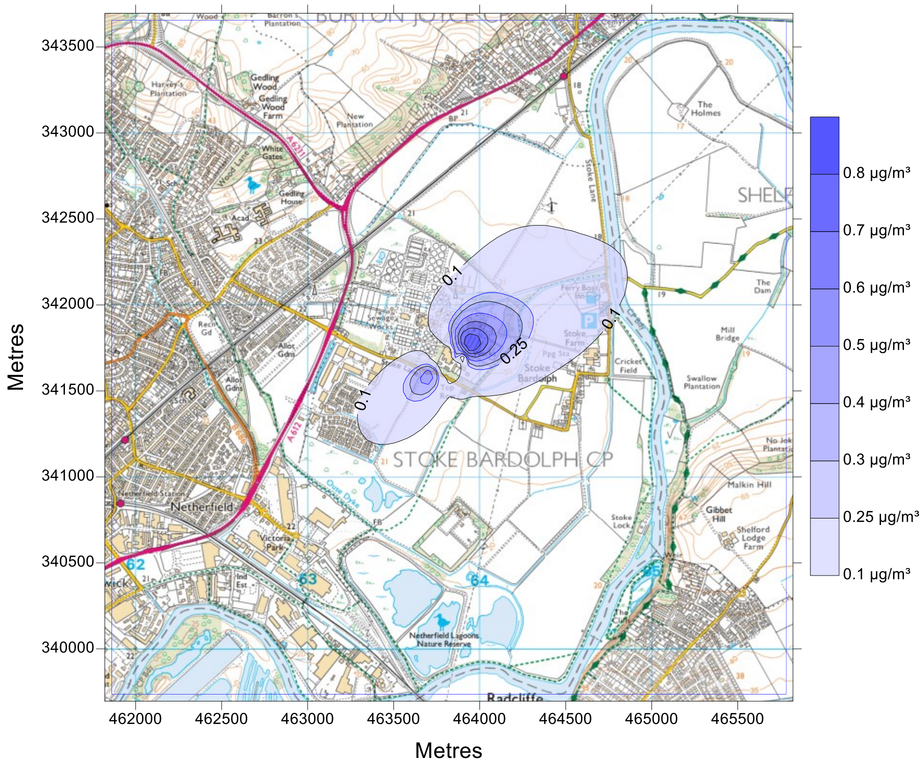


Figure 12: Isopleth for 24-hour PM_{10} – 90.41st Percentile – Met Year 2020

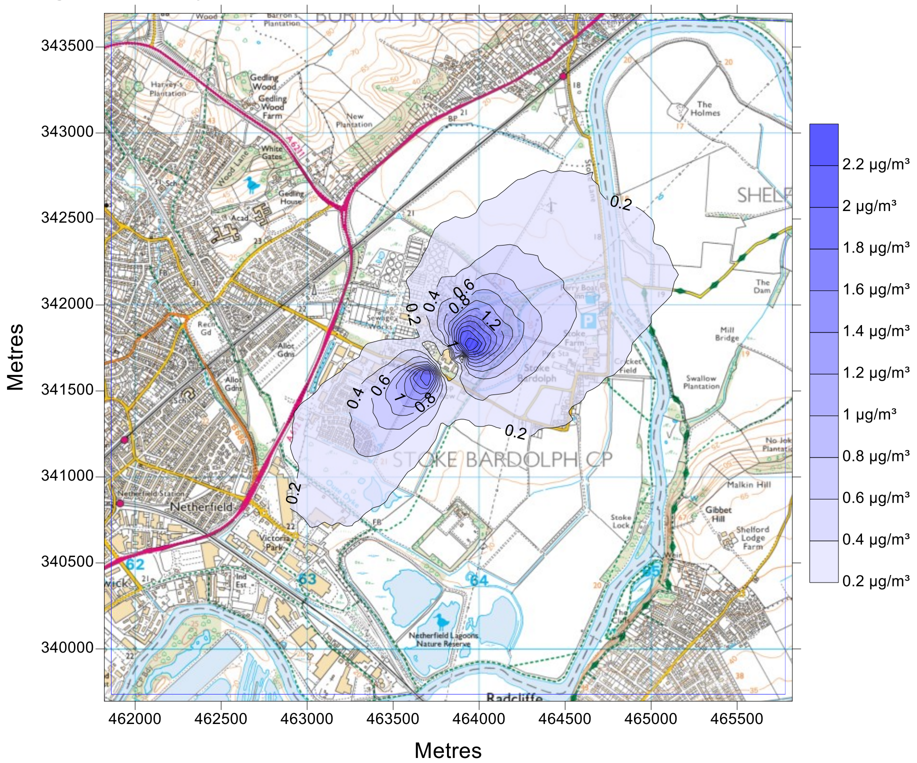


Figure 13: Isopleth for 24-hour SO_2 – 99.18th Percentile – Met Year 2021

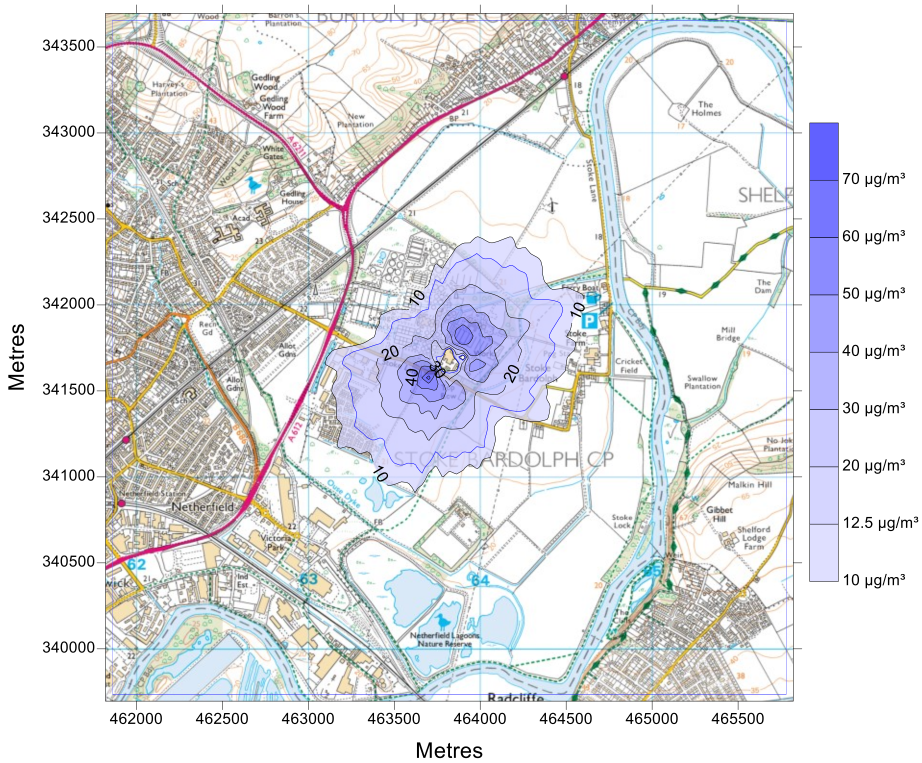


Figure 14: Isopleth for 1-hour SO_2 – 99.73rd Percentile – Met Year 2022

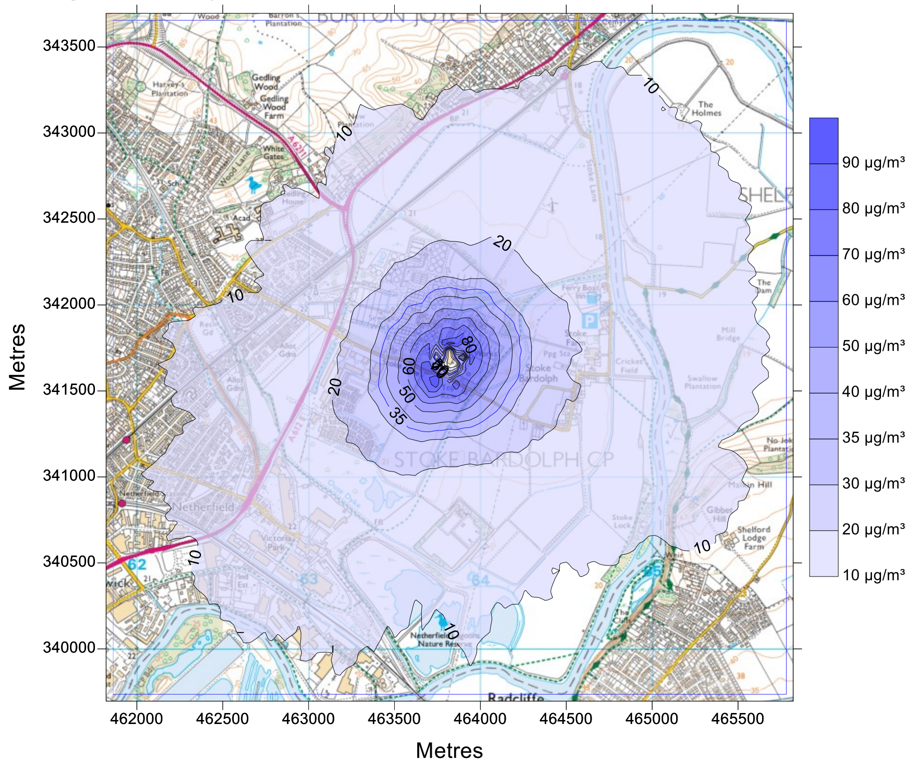


Figure 15: Isopleth for 15-minute SO_2 – 99.90th Percentile – Met Year 2021

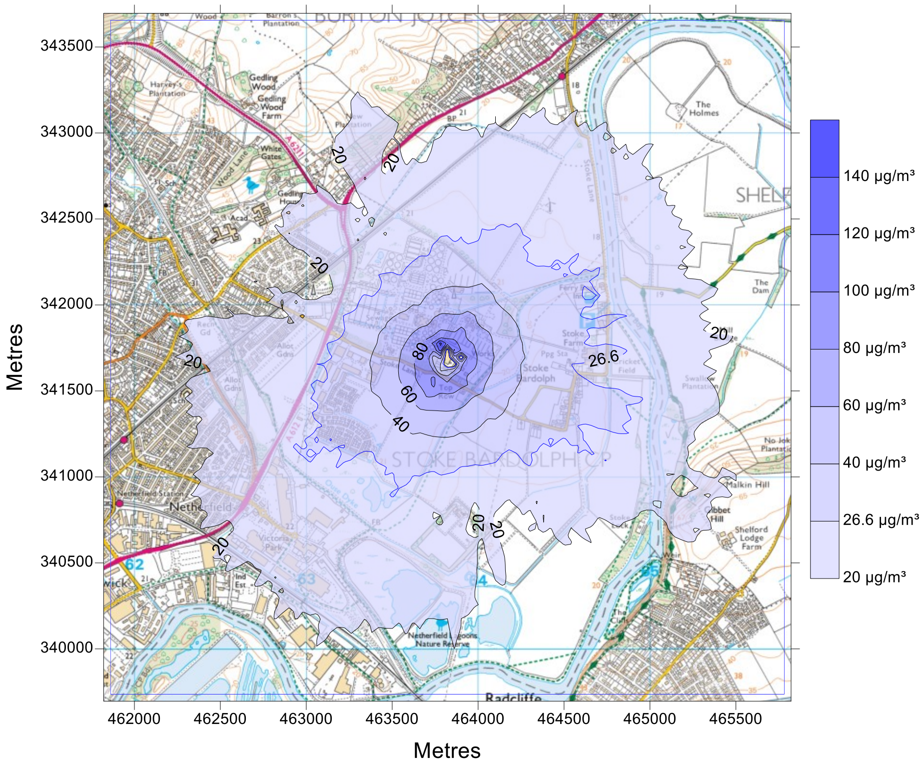


Figure 16: Isopleth for Annual VOC (as benzene) – Met Year 2020

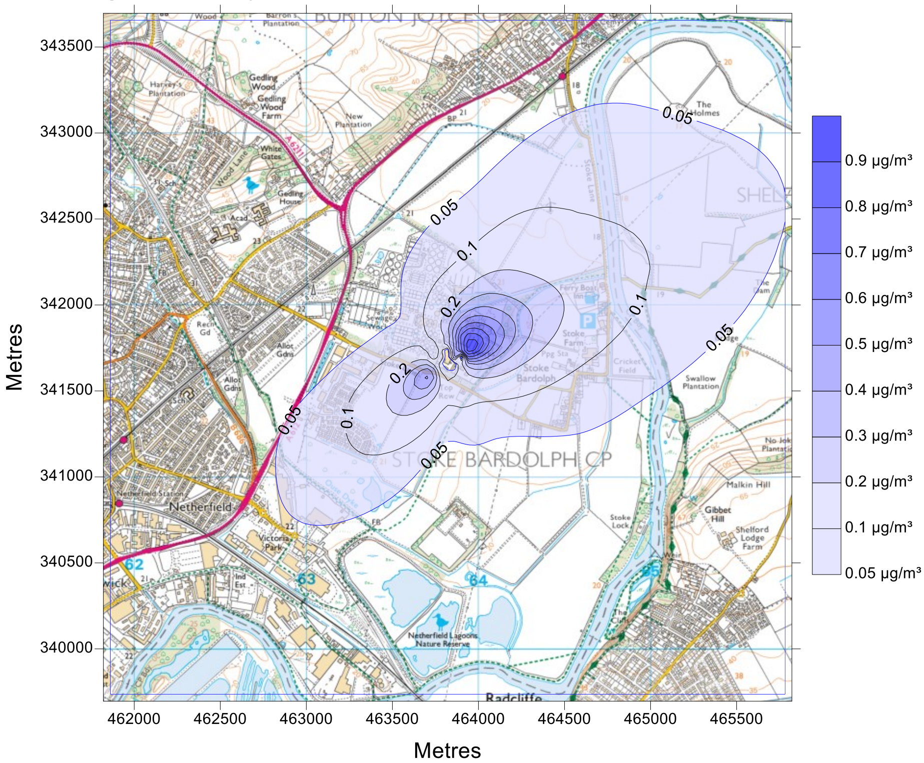


Figure 17: Isopleth for 24-hour VOC (as benzene) – 100th Percentile – Met Year 2020

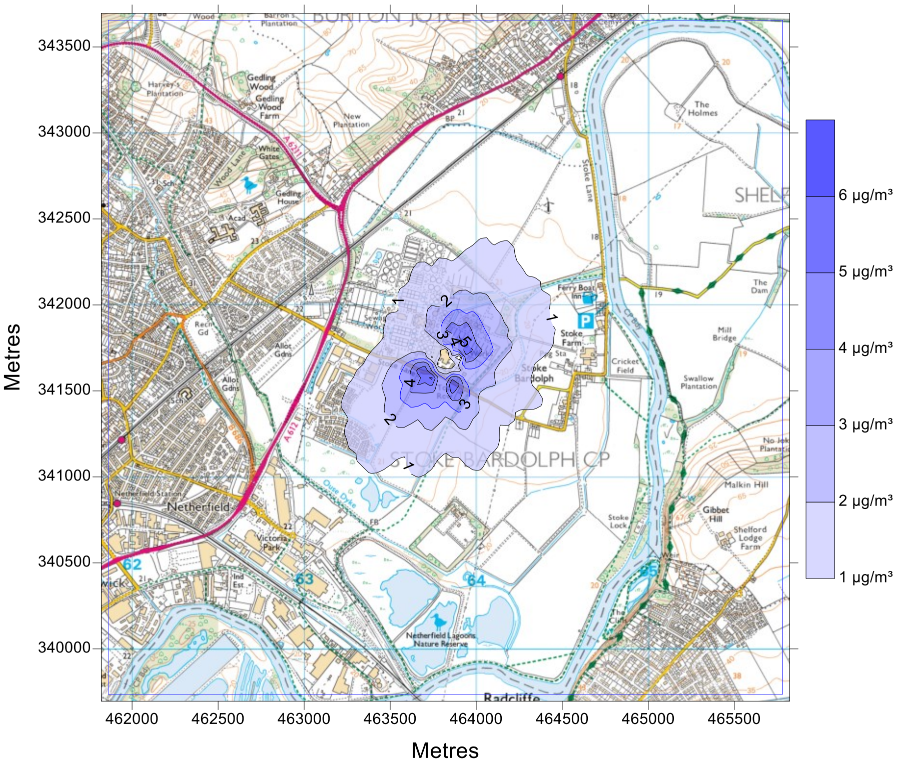


Figure 18: Isopleth for Annual NH_3 – Met Year 2020

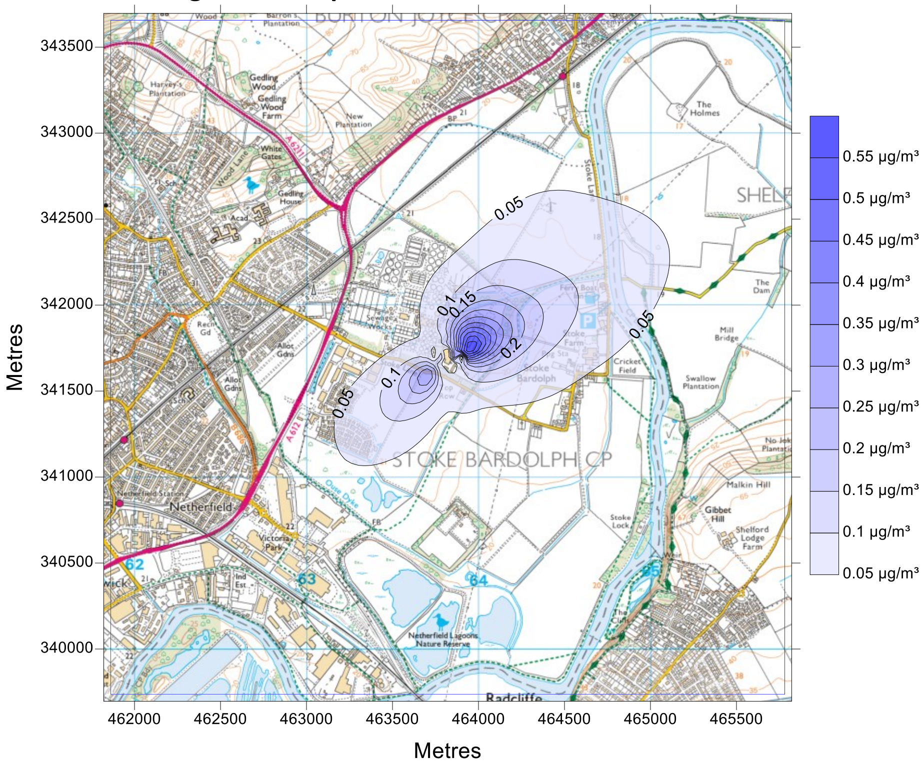


Figure 19: Isopleth for 1-hour NH_3 – 100th Percentile – Met Year 2021

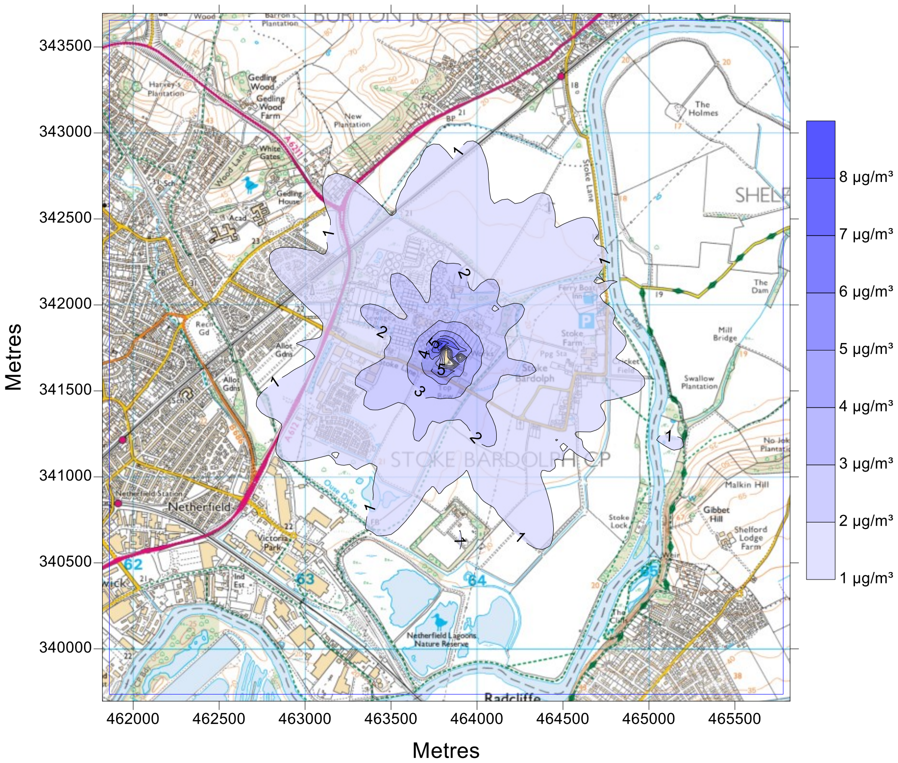


Figure 20: Isopleth for Annual H_2S – Met Year 2023

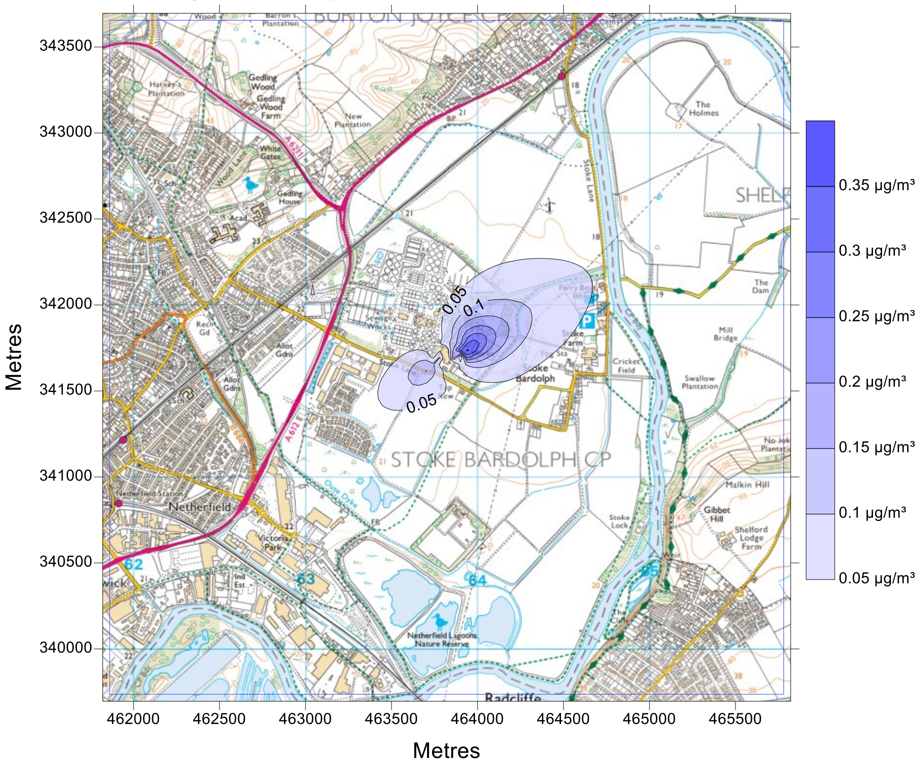


Figure 21: Isopleth for 24-hour H_2S – 100th Percentile – Met Year 2023

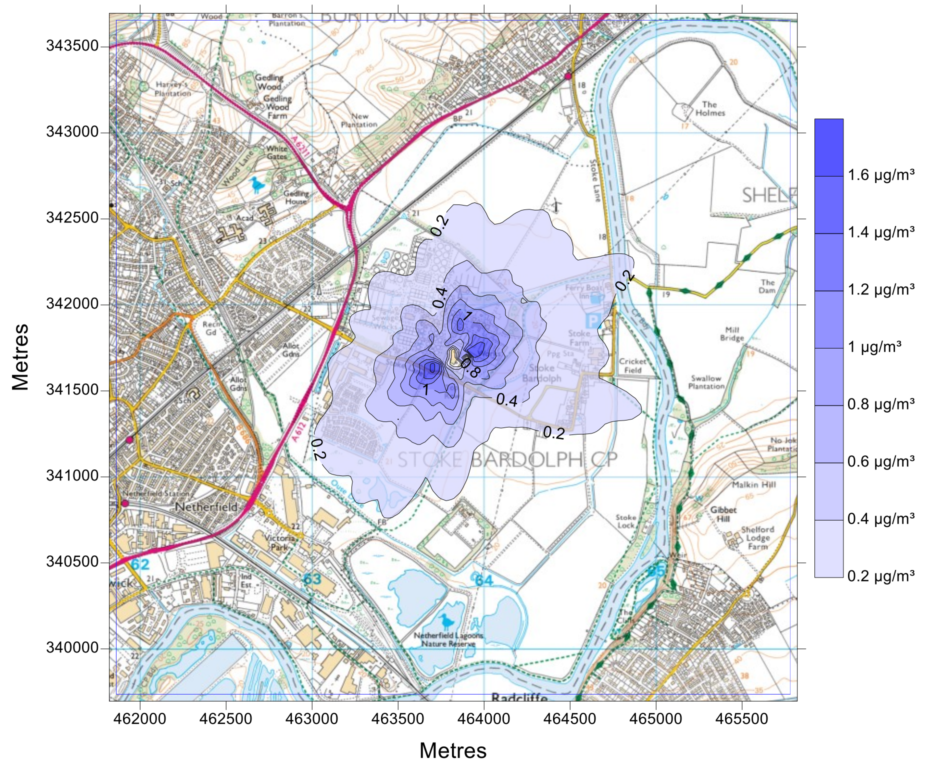
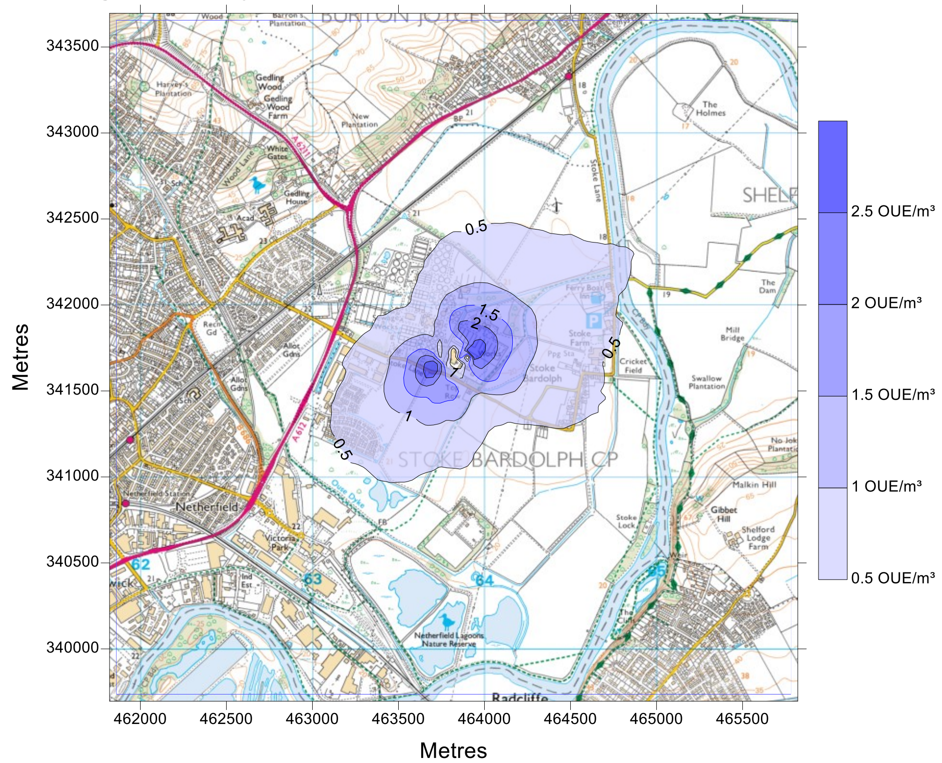


Figure 22: Isopleth for 1-hour OU_E – 98th Percentile – Met Year 2023



4. ASSESSMENT OF AIR QUALITY IMPACTS AT POTENTIALLY SENSITIVE HUMAN RECEPTOR LOCATIONS

4.1. Human Health Impacts

4.1.1. This part of the assessment considers emissions from the Site at potentially sensitive human receptor locations.

4.1.2. The PCs from the Site for each potentially sensitive receptor considered, for the worst case met year for each pollutant and averaging period, are presented in Table 19.

4.1.3. In Table 19, any PCs that are above the significance criteria (outlined in Section 2.21.) or exceed the significance criteria for OU_E (as outlined in Section 2.22.) are indicated in bold type.

Table 19: Comparison of Maximum PCs with AQS at Potentially Sensitive Receptor Locations

Pollutant	NO_2 (annual)	NO_2 (1-hour, 99.79th %ile)	CO (8-hour, 100th %ile)	$PM_{2.5}$ (annual)	PM_{10} (annual)	PM_{10} (24-hour, 90.41st %ile)	SO_2 (24-hour, 99.18th %ile)	SO_2 (1-hour, 99.73rd %ile)	SO_2 (15-minute, 99.90th %ile)
AQS (µg/m³)	40	200	10,000	20	40	50	125	350	266
Maximum PC (µg/m³)	2.92	46.7	8.41	0.149	0.149	0.527	43.0	68.1	79.6
Max PC as % of AQS	**7.29%**	**23.34%**	0.08%	0.60%	0.37%	1.05%	**34.42%**	**19.46%**	**29.91%**
HR1	**2.47**	**46.7**	8.41	0.126	0.126	0.436	**43.0**	**68.1**	**79.6**
HR2	**2.07**	**30.9**	4.73	0.107	0.107	0.402	**20.7**	**45.4**	**52.7**
HR3	**2.42**	**21.4**	3.31	0.124	0.124	0.527	**18.8**	31.9	**39.5**
HR4	**1.41**	17.1	2.75	0.0726	0.0726	0.308	12.0	25.0	**33.3**
HR5	**2.29**	15.7	1.99	0.116	0.116	0.384	11.0	23.2	**30.4**
HR6	**1.63**	14.2	2.13	0.0848	0.0848	0.315	9.37	21.2	**29.7**
HR7	**0.592**	12.2	1.63	0.0309	0.0309	0.124	6.78	17.9	23.7
HR8	**2.03**	13.1	1.79	0.1028	0.1028	0.327	8.59	19.6	**29.1**
HR9	**1.25**	12.3	1.82	0.0642	0.0642	0.267	8.41	18.1	**26.8**
HR10	**2.92**	12.8	1.72	0.149	0.149	0.403	9.62	19.3	**28.4**

Table 19: Comparison of Maximum PCs with AQS at Potentially Sensitive Receptor Locations (cont.)

Pollutant	VOC (as benzene) (annual)	VOC (as benzene) (24-hour, 100th %ile)	NH_3 (annual)	NH_3 (1-hour, 100th %ile)	H_2S (annual)	H_2S (24-hour, 100th %ile)	OU_E (1-hour, 98th %ile)
AQS (µg/m³) (OU_E/m³ for odour)	5	30	180	2,500	140	150	1.5
Maximum PC (µg/m³) (OU_E/m³ for odour)	0.176	4.43	0.102	3.19	0.0531	1.05	**1.57**
Max PC as % of AQS (or Odour Criteria)	**3.52%**	**14.77%**	0.06%	0.13%	0.04%	0.70%	**104.57%**
HR1	**0.151**	**4.43**	0.0892	3.19	0.0476	1.05	**1.57**
HR2	**0.123**	2.63	0.0714	2.93	0.0375	0.791	1.16
HR3	**0.144**	1.69	0.0835	2.18	0.0428	0.472	0.912
HR4	**0.0827**	1.05	0.0478	1.90	0.0244	0.277	0.616
HR5	**0.139**	1.06	0.0810	1.66	0.0425	0.296	0.681
HR6	**0.0994**	0.835	0.0589	1.30	0.0318	0.271	0.659
HR7	0.0361	0.606	0.0214	1.35	0.0115	0.177	0.361
HR8	**0.123**	0.806	0.0708	1.40	0.0362	0.241	0.590
HR9	**0.0746**	0.843	0.0431	1.28	0.0220	0.224	0.483
HR10	**0.176**	0.833	0.102	1.23	0.0531	0.255	0.616

4.1.4. It can be seen from the data in Table 19 that, with the exception of NO_2, SO_2, VOCs and OU_E (all relevant averaging periods), the remaining pollutants screen out and therefore require no further assessment. For the pollutants with potentially significant PCs, further assessment of the impact will be required.

4.1.5. When excluding odour (which has been assessed separately – see 4.1.6.), the remaining short-term emissions with potentially significant impacts (as highlighted in bold in Table 19) have been further assessed against the IAQM severity of impact descriptors detailed in Section 2.21.10. The impacts of the predicted PCs can be summarised as follows:

- 99.79th percentile NO_2 – the magnitude of impact can be regarded as 'medium';
- 99.18th percentile SO_2 – the magnitude of impact can be regarded as 'medium';
- 99.73rd percentile SO_2 – the magnitude of impact can be regarded as 'small';
- 99.90th percentile SO_2 – the magnitude of impact can be regarded as 'medium'; and
- 100th percentile VOC – the magnitude of impact can be regarded as 'small'.

4.1.6. For the potentially significant odour impacts at HR1, the worst-case PC is only just above the significance criteria for the most offensive odours (i.e., 1.5 OU_E/m^3). The predicted OU_E PCs for HR1, for all met years considered, are as follows:

- met year 2019 = 1.33 OU_E/m^3
- met year 2020 = 1.52 OU_E/m^3
- met year 2021 = 1.57 OU_E/m^3
- met year 2022 = 1.19 OU_E/m^3
- met year 2023 = 1.05 OU_E/m^3

Consequently, when looking at the average odour concentration at HR1, the PC is 1.33 OU_E/m^3 and therefore does not exceed the significance criteria.

4.1.7. For the purposes of calculating the PECs for long-term NO_2 and long-term VOC, the DEFRA background location with the highest concentration for each pollutant will be used as the as the background source (see Table 17 of Section 3.1).

4.1.8. The PEC assessment is presented in Table 20, with the PECs compared with the relevant long-term AQS and the significance categorised adopting the IAQM guidance and impact descriptors shown in Table 13 of Section 2.21.

Table 20: Comparison of Maximum PCs and Maximum PECs – Specified Potentially Sensitive Human Receptor Locations – Annual NO_2 and VOC

Pollutant	Receptor Reference	Worst Case Met Year (2019 – 2023)	Max PC (µg/m³)	AQS (µg/m³)	PC as % of AQS	Background (µg/m³)	Max PEC (µg/m³)	PEC as % of AQS	IAQM Significance
NO_2 (annual)	HR1	2021	**2.47**	40	**6.17%**	13.60 [(a)]	28.57	71%	Slight
	HR2	2019	**2.07**		**5.16%**		28.17	70%	Negligible
	HR3	2021	**2.42**		**6.04%**		28.52	71%	Slight
	HR4	2019	**1.41**		**3.51%**		27.51	69%	Negligible
	HR5	2019	**2.29**		**5.72%**		28.39	71%	Negligible
	HR6	2022	**1.63**		**4.07%**		27.73	69%	Negligible
	HR7	2022	**0.592**		**1.48%**		26.69	67%	Negligible
	HR8	2023	**2.03**		**5.08%**		28.13	70%	Negligible
	HR9	2021	**1.25**		**3.13%**		27.35	68%	Negligible
	HR10	2023	**2.92**		**7.29%**		29.02	73%	Slight
VOC (as benzene) (annual)	HR1	2021	**0.151**	5	**3.03%**	0.454 [(a)]	0.606	12%	Negligible
	HR2	2019	**0.123**		**2.46%**		0.578	12%	Negligible
	HR3	2021	**0.144**		**2.89%**		0.599	12%	Negligible
	HR4	2022	**0.0827**		**1.65%**		0.537	11%	Negligible
	HR5	2019	**0.139**		**2.78%**		0.594	12%	Negligible
	HR6	2022	**0.0994**		**1.99%**		0.554	11%	Negligible
	HR8	2023	**0.123**		**2.45%**		0.577	12%	Negligible
	HR9	2021	**0.0746**		**1.49%**		0.529	11%	Negligible
	HR10	2023	**0.176**		**3.52%**		0.631	13%	Negligible

Notes to Table 20

(a) Background concentration taken from DEFRA3 – refer to Table 17 in Section 3.1., for details.

4.1.9. As shown by the results in Table 20, the significance of the long-term NO_2 impact can be described as ‘slight’ for HR1, HR3 and HR10. For the remaining receptor locations for long-term NO_2 and for all receptor locations for long-term VOC (as benzene), the impact can be described as ‘negligible’.

4.1.10. As previously discussed, during normal day to day operation of the emission points, where they would not be emitting at their maximum assumed concentrations or all active simultaneously throughout the year – the impacts are likely to be considerably less for all pollutants assessed. Consequently, no further assessment is required.

5. ASSESSMENT OF AIR QUALITY IMPACTS AT POTENTIALLY SENSITIVE ECOLOGICAL RECEPTOR LOCATIONS – CRITICAL LEVELS

5.1.1. A summary of the results of the maximum predicted GLCs for NO_X, SO_2 and NH_3 at the identified sensitive ecological sites, are presented in Tables 21, 22 and 23, respectively. The assessment has been carried out in accordance with the guidance outlined in Section 2.23.

Table 21: Comparison of Maximum Predicted NO_x PCs with Critical Levels

ADMS Ref. & Designation(s)	Long Term PC (µg/m³)	Long Term Critical Level (µg/m³)	Long Term PC as a % of the Critical Level	Short Term PC (µg/m³)	Short Term Critical Level (µg/m³)	Short Term PC as a % of the Critical Level	Worst Case Met Year (2019 – 2023) Long-Term PC	Worst Case Met Year (2019 – 2023) Short-Term PC
ER1 – LNR & LWS	1.33	30	4.43%	14.2	75	18.95%	2021	2023
ER2 – LWS	0.649		2.16%	11.0		14.71%	2021	2022
ER3 – LWS	0.620		2.07%	8.92		11.89%	2019	2019
ER4 – LNR	0.367		1.22%	5.37		7.16%	2022	2023
ER5 – LWS	1.19		3.97%	12.1		16.07%	2022	2023
ER6 – LWS	0.968		3.23%	9.28		12.37%	2022	2023
ER7 – LNR	0.355		1.18%	5.38		7.18%	2022	2023
ER8 – LWS	1.44		4.80%	9.91		13.21%	2022	2023
ER9 – LWS	0.508		1.69%	7.74		10.32%	2022	2023
ER10 – AW	0.263		0.88%	4.61		6.15%	2022	2023
ER11 – LWS	0.573		1.91%	5.30		7.07%	2022	2023

5.1.2. It can be seen from the data in Table 21 that the NO_X PCs are all less than 100% of the long-term and short-term critical levels. Consequently, no further assessment is required.

Table 22: Comparison of Maximum Predicted SO_2 PCs with Critical Levels

ADMS Ref. & Designation(s)	Long Term PC (µg/m³)	Critical Level (µg/m³)	Long Term PC as a % of the Critical Level	Worst Case Met Year (2019 – 2023)
ER1 – LNR & LWS	0.702	10 [(a)]	7.02%	2021
ER2 – LWS	0.342		3.42%	2021
ER3 – LWS	0.327		3.27%	2019
ER4 – LNR	0.194		1.94%	2022
ER5 – LWS	0.629		6.29%	2022

Table 22: Comparison of Maximum Predicted SO_2 PCs with Critical Levels (cont.)

ADMS Ref. & Designation(s)	Long Term PC (µg/m³)	Critical Level (µg/m³)	Long Term PC as a % of the Critical Level	Worst Case Met Year (2019 – 2023)
ER6 – LWS	0.510	10 [(a)]	5.10%	2022
ER7 – LNR	0.187		1.87%	2022
ER8 – LWS	0.758		7.58%	2022
ER9 – LWS	0.268		2.68%	2022
ER10 – AW	0.138		1.38%	2022
ER11 – LWS	0.301		3.01%	2022

Notes to Table 22

(a) Without knowing whether lichens or bryophytes are present, the lower limit of 10 µg/m³ has been selected in the interest of being conservative (refer to Table 5 in Section 2.7., for more information).

5.1.3. It can be seen from the data in Table 22 that the SO_2 PCs are all less than 100% of the long-term critical level. Consequently, no further assessment is required.

Table 23: Comparison of Maximum Predicted NH_3 PCs with Critical Levels

ADMS Ref. & Designation(s)	Long Term PC (µg/m³)	Critical Level (µg/m³)	Long Term PC as a % of the Critical Level	Worst Case Met Year (2019 – 2023)
ER1 – LNR & LWS	0.0318	1 [(a)]	3.18%	2021
ER2 – LWS	0.0157		1.57%	2021
ER3 – LWS	0.0147		1.47%	2019
ER4 – LNR	0.00872		0.87%	2022
ER5 – LWS	0.0288		2.88%	2022
ER6 – LWS	0.0230		2.30%	2022
ER7 – LNR	0.00837		0.84%	2022
ER8 – LWS	0.0342		3.42%	2022
ER9 – LWS	0.0118		1.18%	2022
ER10 – AW	0.00606		0.61%	2022
ER11 – LWS	0.0133		1.33%	2022

Notes to Table 23

(a) Without knowing whether lichens or bryophytes (including mosses, liverworts and hornwarts) are present, the lower limit of 1 µg/m³ has been selected in the interest of being conservative (refer to Table 5 in Section 2.7., for more information).

5.1.4. It can be seen from the data in Table 23 that the NH_3 PCs are all less than 100% of the long-term critical level. Consequently, no further assessment is required.

6. ASSESSMENT OF AIR QUALITY IMPACTS - IMPACT ON HABITAT SITES – DEPOSITION

6.1. Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads

6.1.1. A summary of maximum predicted nutrient nitrogen deposition rates at the relevant identified habitat sites are presented in Table 24.

6.1.2. Where the nitrogen deposition rate is potentially significant (i.e., greater than 100% of the maximum critical load – see Section 2.23), it is highlighted in bold.

Table 24: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites

ADMS Reference	Site Details [(a)]	Deposition Rate Used	Critical Load (kgN/Ha/yr)		Nutrient Nitrogen Deposition Rate (kgN/Ha/yr) [(b)]	PC as % of Critical Load	
			Lower	Upper		Lower	Upper
ER1	Netherfields Lagoons - LNR Netherfield Dismantled Railway Sidings - LWS	Grassland	10	20	0.245	2.45%	1.22%
ER2	Netherfield Pits - LWS	Grassland	10	20	0.122	1.22%	0.61%
ER3	New Plantation, Burton Joyce - LWS	Woodland	10	15	0.193	1.93%	1.29%
ER4	Gedling House Meadow - LNR	Grassland	10	15	0.0663	0.66%	0.44%
ER5	Swallow Plantation - LWS	Grassland	10	20	0.216	2.16%	1.08%
ER6	Trent Bluff Scrub, Radcliffe - LWS	Grassland	10	20	0.171	1.71%	0.86%
ER7	Gedling House Woods - LNR	Woodland	10	15	0.106	1.06%	0.71%
ER8	River Trent: Burton Joyce to Lowdham - LWS	Grassland	10	20	0.265	2.65%	1.33%
ER9	The Avenue Pool - LWS	Grassland	10	20	0.0870	0.87%	0.43%
ER10	Gedling Wood (Ancient & Semi-Natural Woodland - ID: 1412309) - AW	Woodland	10	15	0.0757	0.76%	0.50%
ER11	Burton Joyce Grasslands - LWS	Grassland	10	20	0.102	1.02%	0.51%

Note to Table 24
(a) Refer to Section 2.7., for further details regarding the assigned habitat feature for these ecological sites.
(b) Total PC is derived from the sum of the contribution from nitrogen and ammonia (dry deposition only).

6.1.3. It can be seen from the data in Table 24 that the maximum nutrient nitrogen deposition rates due to process emissions do not exceed 100% of the lower or upper critical load for the ecological site considered. Consequently, no further assessment is required.

6.2. Comparison of Maximum Predicted Acid Deposition Rates with Critical Loads

6.2.1. A summary of maximum predicted acid deposition rates at the relevant identified habitat sites are presented in Table 25.

6.2.2. Where the acid deposition rate is potentially significant (i.e., greater than 100% of the maximum critical load – see Section 2.23) it is highlighted in bold.

Table 25: Comparison of Maximum Predicted Acid Deposition Rates with the Maximum Critical Load at Sensitive Habitat Sites

ECL Habitat Ref.	Designation(s) [(a)]	Deposition Rate Used	Acid Deposition (kEq/ha/yr) [(b) (c)]	CL Min N (kEq/ha/yr)	CL Max N (kEq/ha/yr)	CL Max S (kEq/ha/yr)	Total PEC (kEq/ha/yr) [(d)]	PC as % of the Critical Load
ER1	LNR / LWS	Grassland	0.0814	0.856	4.856	4.000	1.44	1.68%
ER2	LWS	Grassland	0.0405	0.856	4.856	4.000	1.40	0.84%
ER3	LWS	Woodland	0.0686	0.142	1.706	1.564	2.41	4.02%
ER4	LNR	Grassland	0.0219	0.856	4.856	4.000	1.39	0.45%
ER5	LWS	Grassland	0.0714	0.856	4.856	4.000	1.45	1.47%
ER6	LWS	Grassland	0.0568	0.856	4.856	4.000	1.43	1.17%
ER7	LNR	Woodland	0.0370	0.142	1.708	1.566	2.37	2.17%
ER8	LWS	Grassland	0.0885	0.856	4.856	4.000	1.47	1.82%
ER9	LWS	Grassland	0.0286	0.856	4.856	4.000	1.40	0.59%
ER10	AW	Woodland	0.0262	0.214	10.979	10.765	2.36	0.24%
ER11	LWS	Grassland	0.0342	0.856	4.856	4.000	1.41	0.70%

Note to Table 25
(a) Refer to Table 6 of Section 2.7. and Sections 2.7.11. – 2.7.12., for further details regarding the assigned habitat feature for these ecological sites.
(b) Total PC is derived from the sum of the contribution from nitrogen, ammonia and sulphur deposition (dry deposition only).
(c) Woodland deposition rate used for all receptors. Refer to Table 9 in Section 2.9. for deposition parameters.
(d) Refer to Section 2.8., for the site-specific acid background concentrations.

6.2.3. The data in Table 25 shows that the maximum predicted acid deposition rate as a result of emissions from the Site does not exceed the critical load function. Consequently, no further assessment is required.

7. CONCLUSIONS

7.1.1. Detailed air quality modelling, using the ADMS dispersion model, has been undertaken to predict the impacts associated with stack emissions arising from Sarval's rendering process at their site at Stoke Bardolph.

7.1.2. As a worst-case, emissions have been assumed to be at the maximum emission concentrations assumed for the assessment. This represents a conservative assessment of the impact since the actual emissions from the Site are likely to be considerably lower during normal operation.

7.1.3. At the point of maximum GLC, with the exception of CO, short-term PM_{10}, NH_3 and H_2S (both long-term and short-term) which screen out as insignificant, the remaining pollutants have potentially significant impacts and therefore required further assessment. Following further assessment, VOC (as benzene) PCs can be regarded as 'small', short-term NO_2 and 99.73rd percentile SO_2 can be regarded as 'medium' and 99.18th and 99.90th percentile SO_2 can be regarded as 'large'. The PECs for the long-term pollutants assessed can be considered 'moderate' for NO_2 and VOC and 'negligible' for $PM_{2.5}$ and PM_{10}. Following further assessment for OU_E, the areas which exceed the odour significance criteria are not considered to be representative of regular human exposure.

7.1.4. At the potentially sensitive human receptor locations, all pollutants except NO_2, SO_2, VOCs and OU_E screen out as insignificant. Following further assessment, 99.73rd percentile SO_2 and VOC (as benzene) PCs can be regarded as 'small', short-term NO_2, 99.18th percentile SO_2 and 99.90th percentile can be regarded as 'medium' and the vast majority of the impacts for long-term NO_2 and VOC (as benzene) can be considered 'negligible'. Following further assessment for OU_E at HR1, for the majority of the time the predicted PCs do not exceed the most stringent odour significance criteria.

7.1.5. For the habitat sites considered, it has been demonstrated that the NO_X, SO_2 and NH_3 emissions from the Site are unlikely to result in a breach of the relevant Critical Levels or Critical Loads or are unlikely to have an adverse effect on local habitat sites – with all predicted PCs well within the acceptable limits.

7.1.6. In summary, therefore, it can be concluded that emissions arising from Sarval's Stoke Bardolph site will not have a detrimental impact on local air quality, human health or the sensitive habitat sites considered as part of this assessment.