HIVE AGGREGATES

Retford Circular Economy Project Environmental Statement Addendum – Volume 3 Technical Appendices

Technical Appendix 13.8: Air Emissions Risk Assessment

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ERM

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Lound Hive Air Emissions Risk Assessment (AERA)

Lound PFA Processing Facility

Lound Hive Limited

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Executive Summary

SLR Consulting Limited has been instructed by Lound Hive Limited to prepare an Air Emissions Risk Assessment (AERA) in support of an Environmental Permit application for the following plant at the proposed Pulverised Fuel Ash (PFA) facility on agricultural land to the north of Retford (the 'Site'):

- A Specified Generator (SG) comprising a single 6.1 MW_{th} natural gas fired combined heat and power engine; and
- A drying plant, comprising of 8No. Coomtech SMR Kinetic Energy Dryers.

In consideration of the proposed combined heat and power engine the AERA has concluded that:

- The process contributions do not lead to any exceedances of the standards (long-term or short-term) for the protection of human health at any location outside of the Site; and
- The process contributions are considered to cause 'no significant pollution' at the Sutton and Lound Gravel Pits Site of Special Scientific Interest (SSSI).

In consideration of the proposed drying plant, the AERA has concluded that the process contributions do not lead to any exceedances of the standards (long-term or short-term) for the protection of human health at any location outside of the Site.

Table of Contents

Tables in Text

Figures in Text

Appendices

1.0 Introduction

SLR Consulting Limited (SLR) has been instructed by Lound Hive Limited (hereinafter referred to as 'the Client') to prepare an Air Emissions Risk Assessment (AERA) in support of an Environmental Permit (EP) application for the Specified Generator (SG) plant and drying plant modules at the proposed Pulverised Fuel Ash (PFA) facility on agricultural land and an existing industrial estate to the north of Retford, hereafter referred to as the 'Site'.

The SG would comprise a single 6.1 MW_{th} Natural Gas (NG) fired Combined Heat and Power (CHP)engine. The drying plant would comprise a total of 8No. Coomtech SMR Kinetic Energy modules. Each module would have a single stack whereby exhaust air, filtered to remove particulates, would be emitted to atmosphere via 8 individual stacks.

2.0 Scope and Objective

The objective of the study is to assess the impact of potentially significant emissions on local air quality as a result of the proposed installation of the CHP engine and the Coomtech drying modules and to compare against the relevant Air Quality Standards and Environmental Assessment Levels (EALs).

The AERA has considered the potential risk of short-term and long-term impacts on both human and ecological receptors. Impacts have been assessed against relevant EALs for the protection of human health and against Critical Loads (C_{Lo}) and Critical Levels (C_{Le}) for the protection of vegetation and ecosystems. This assessment has been carried out using the Environment Agency's (EA) 'Air emissions risk assessment for your environmental permit' guidance[1] (termed the 'AERA guidance' herein), with additional reference to the emission limit values (ELVs) outlined within the Medium Combustion Plant Directive[2] (MCPD).

In reference to the MCPD, dispersion modelling has been undertaken to assess the impact of oxides of nitrogen (NO_x) as appropriate for medium combustion plant fuelled on NG. The dispersion modelling has included the impact of particulate matter (PM_{10}) from the drying plant emission points.

[1] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

[2] European Union Directive 2015/2193/EU, Medium Combustion Plant Directive.

3.0 Legislation and Relevant Guidance

3.1 Environmental Permitting Regulations

The Site is regulated under the Environmental Permitting (England and Wales) Regulations 2018 (as amended) (EPR) which implement the MCPD in Schedule 25A, alongside additional controls introduced by the Department for Environment, Food and Rural Affairs (Defra) relating to SG's through the SG Regulations (the SGR) in Schedule 25B.

3.2 Medium Combustion Plant

The CHP engine would comprise medium combustion plant, as defined by Schedule 25A of the EPR 2018. The CHP engine would be classed as 'new' medium combustion plant.

For new medium combustion plant fuelled on NG the MCPD presents ELVs for NO_x only.

3.3 Permitting Guidance

Guidance Notes produced by the Department for Environment, Food and Rural Affairs (Defra) provide a framework for regulation of installations and additional technical guidance produced by the EA are used to provide the basis for permit conditions.

In relation to SG, the EA have produced specific guidance[3] for the assessment of emissions to air from SG to supplement their existing '*Air emissions risk assessment for your environmental permit*'[4] (the AERA guidance) to clarify their exact requirements for SG's, as opposed to the more generic AERA guidance requirements.

The purpose of the AERA guidance is to assist operators to assess risks to the environment and human health when applying for a permit under the EPR.

The EA also provides specific guidance for assessing impacts on ecological sites known as AQTAG.06[5].

3.4 National Air Quality Legislation and Guidance

3.4.1 Air Quality Standards Regulations

The Air Quality Standards Regulations 2010[6] transpose both the European Union (EU) Ambient Air Quality Directive (2008/50/EC), and the Fourth Daughter Directive (2004/107/EC) within United Kingdom (UK) legislation. The regulations set Limit Values, Target Values, and Objectives for the protection of human health and the environment. Following the UK's withdrawal from the EU, the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[7] was introduced to mirror revisions to supporting EU legislation.

3.4.2 Air Quality Strategy

The Air Quality Strategy (AQS) for England was published in 2023[8]. The AQS provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the UK Government and Devolved Administrations for the protection of public health and the environment.

[3] Specified generators: dispersion modelling assessment. https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

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

[5] AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. Environment Agency, March 2014.

[6] The Air Quality Standards Regulations (England) 2010, Statutory Instrument 1001.

[7] The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, Statutory Instrument No. 1313, The Stationary Office Limited.

[8] Air Quality Strategy: Framework for Local Authority Delivery, Defra. April 2023.

The ambient air quality objectives of relevance to human receptors in this assessment (collectively termed Air Quality Assessment Levels (AQALs) throughout this report) are provided in Table 3-1.

Table 3-1 Applied Assessment Levels

Pollutant		Standard (µg/m³)	Averaging Period	Exceedances	Source
Nitrogen dioxide	NO_2	40	Annual mean	None	AQS
		200	1-hour mean	No more than 18 times over the calendar year	AQS
Particulate Matter	PM_{10}	40	Annual mean	None	AQS
		50	24-hour mean	No more than 35 times over the calendar year	AQS

The AQS objectives apply at locations where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period – herein referred to as 'relevant exposure'. Table 3-2 provides an indication of those locations.

Table 3-2 Human Health Relevant Exposure

AQAL Averaging Period	AQALs Should Apply At	AQALs Should Not Apply At
Annual mean	Building facades of residential properties, schools, hospitals etc.	Facades of offices or other places of work Hotels Gardens of residences Kerbside sites
24-hour mean	As above together with hotels and gardens of residential properties	Kerbside sites or any other location where public exposure is expected to be short-term
1-hour mean	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access

3.4.3 Local Air Quality Management

Part IV of the Environment Act 1995 requires local authorities to undergo a process of Local Air Quality Management (LAQM). This requires local authorities to Review and Assess air quality within their boundaries to determine the likeliness of compliance, regularly and systematically.

Where any of the prescribed AQS objectives are not likely to be achieved, the authority must designate an Air Quality Management Area (AQMA). For each AQMA, the local authority is required to prepare an Air Quality Action Plan (AQAP), which details measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the objective. Local authorities therefore have formal powers to control air quality through a combination of LAQM and through application of wider planning policies.

Defra has published technical guidance for use by local authorities in their LAQM work[9]. This guidance, referred to in this report as LAQM.TG(22), has been used where appropriate in the assessment presented here.

The EA's role in relation to LAQM is as follows[10]:

[9] Local Air Quality Management Technical Guidance (TG22), Published by Defra in partnership with the Scottish Government, Welsh Government and Department of Agriculture, Environment and Rural Affairs. August 2022.

[10] Regulating to Improve Air Quality. AQPG3, version 1, Environment Agency, 14 July 2008.

"The Environment Agency is committed to ensuring that any industrial installation or waste operation we regulate will not contribute significantly to breaches of an AQS objective.

It is a mandatory requirement of EPR legislation that we ensure that no single industrial installation or waste operation we regulate will be the sole cause of a breach of an EU air quality limit value. Additionally we have committed that no installation or waste operation will contribute significantly to a breach of an EU air quality limit value."

3.5 Protection of Nature Conservation Sites

Sites of nature conservation importance are provided environmental protection from developments, including from atmospheric emissions. AQALs for the protection of ecological receptors are known as Critical Levels (C_{Le}) for airborne concentrations and Critical Loads (C_{Lo}) for deposition to land from air.

The SG guidance requires that designated ecological sites should be screened against relevant AQALs if they are located within the following set distances from the Site:

- 2 km for a designated Site of Special Scientific Interest (SSSI); and
- 5 km for designated Special Protection Areas (SPA), Special Areas of Conservation (SAC) or Ramsar sites (as appropriate for SG fuelled on NG or low sulphur diesel).

On the basis that the relevant critical levels or critical loads are in respect to NO_2 and NO_x emissions, the assessment of impact on ecological sites is limited to the assessment of the CHP Plant alone.

3.5.1 Critical Levels

C_{Le} are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The relevant C_{Le} for the protection of vegetation and ecosystems are specified within the UK air quality regulations and AERA guidance, as transposed in Table 3-3.

Table 3-3 Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Critical Level (µg/m³)	Habitat and Averaging Period
Nitrogen oxides (NO_X)	30	Annual mean (all ecosystems)
	75	24-hour mean (all ecosystems)

3.5.2 Critical Loads

C_{Lo} are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. C_{Lo} are set for the deposition of various substances to sensitive ecosystems. In relation to combustion emissions, C_{Lo} for eutrophication and acidification are relevant which can occur via both wet and dry deposition; however, on a local scale only dry (direct deposition) is considered significant.

4.0 ASSESSMENT METHODOLOGY

The atmospheric dispersion modelling has been undertaken with due consideration to the EA's AERA and SG guidance. The modelling approach is based upon the following stages:

- Review of installation specification and operational envelope to define emission sources, pollutant emission rates and characteristics;
- Identification of sensitive receptors, both human and ecological;
- Compilation of the existing air quality baseline and review of LAQM status; and
- Calculation of process contribution to ground level concentrations and evaluation against relevant AQALs for both human and ecological receptors.

4.1 Modelled Pollutants

In reference to the MCPD and AERA guidance, the following key pollutants in Table 4-1 have been considered.

Table 4-1 Modelled Pollutants

Pollutant	Modelled As	
	Short-term	Long-term
NO_2	99.79 percentile of 1-hour means	Annual mean
NO_x	24-hour mean (1st high)	Annual mean
PM_{10}	90.41 percentile of 24-hour means	Annual mean

4.2 Modelled Scenario

Whilst operated at full load, the CHP engine has a maximum thermal input of 6.1 MW_{th}. For the purposes of this assessment it has been assumed that the CHP engine would be constantly operated at maximum load, representing a precautionary approach. The dryers would also run on a continuous basis.

As such, a single scenario has been investigated to represent continuous operation at maximum load.

4.3 Quantification of Emissions

The emission parameters for the CHP engine and the dryer plant have been defined on the basis of manufacturer's design and specifications. With regard to the CHP, this is in consideration of the steam boiler operating at maximum load (6.1 MW_{th}). The emission concentrations are compliant with the MCPD.

The emission parameters applied within the assessment are presented in Table 4-2 and Table 4-3 below.

Table 4-2 Emission Parameters: CHP Emission Source

Emission Parameter	CHP Engine
Anticipated make / model	**Jenbacher JGS 616 GS**
Number of stacks	**1**
Exhaust stack location (x,y)	**468675, 383250**
Maximum load (MW_{th})	**6.1**
Fuel type	**Natural Gas**
Proposed release height (m)	**15.0**
Stack orientation	**Vertical**
Stack diameter at release point (m)	**0.6**

Emission Parameter	CHP Engine
Efflux velocity (m/s)	**15.2**
Emission temperature (°C)	**172** [a]
Actual flow (Am^3/s)	**3.1**
Normalised flow (Nm^3/s)	**4.0** [b]
NO_x concentration (mg/Nm^3)	**95**
NO_x emission (g/s)	**0.38**

Table notes:

a) The exhaust heat from the engine is utilised within the drying plant, reducing the emission temperature to 172°C.
b) Normalised to 273K, dry, 101.3 kPa, 6.9% oxygen, assuming in-stack water content of 5.9%.

Table 4-3 Emission Parameters: Drying Plant Emission Source

Emission Parameter	Drying Plant
Anticipated make / model	**Coomtech SMR Kinetic Energy Dryers**
Number of stacks	**8**
Exhaust stack location (x,y)	**Various**
Proposed release height (m)	**14.0 m**
Stack orientation	**Vertical**
Stack diameter at release point (m)	**0.56**
Efflux velocity (m/s)	**14.5**
Emission temperature (°C)	**40**
Actual flow (Am^3/s)	**3.6**
Normalised flow (Nm^3/s)	**2.9** [c]
PM_{10} concentration (mg/Nm^3)	**5.0**
PM_{10} emission (g/s)	**1.45e-04**

Table notes:

a) Normalised to 273K, dry, 101.3 kPa, 21.0% oxygen, assuming in-stack water content of 6.5%.

4.4 Model Setup

For this assessment the AERMOD View model[11] (AERMOD) has been applied; this model is widely used and accepted by the EA for undertaking such assessments and its predictions have been validated against real-time monitoring data by the United States (US) Environmental Protection Agency (EPA). It is therefore considered a suitable model for this assessment.

[11] Software used: Lakes AERMOD View.

4.4.1 Model Domain / Receptors

The modelling has been undertaken using a receptor grid across a map of the study area. Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the maximum ground level concentration outside the Site boundary to be assessed.

A nested receptor grid extending 5 km from the Site was applied as follows:

- 200 m x 200 m at 20 m grid resolution;
- 500 m x 500 m at 50 m grid resolution;
- 1000 m x 1000 m at 100 m grid resolution;
- 2000 m x 2000 m at 200 m grid resolution; and
- 5000 m x 5000 m at 500 m grid resolution.

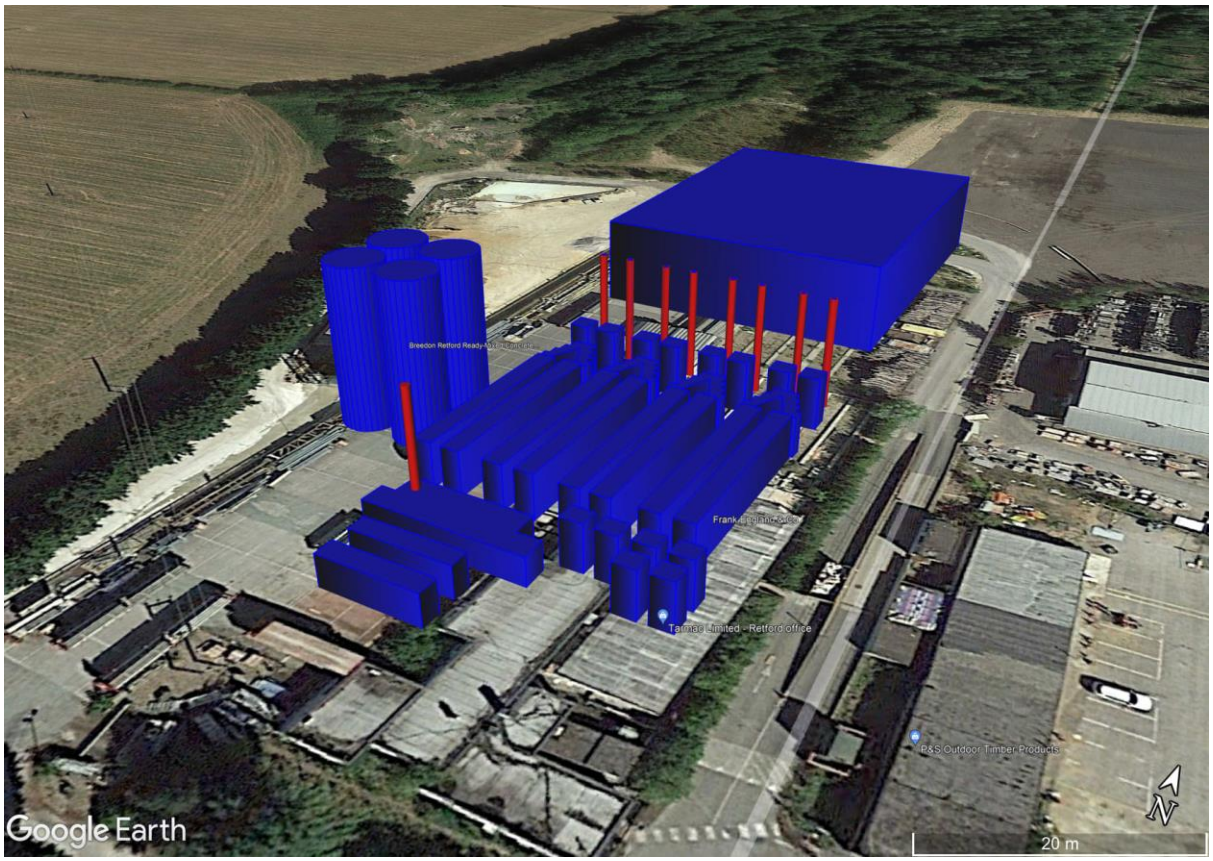
In addition, the modelling of discrete sensitive receptor locations as described in Section 6.1 was undertaken to assess the impact at relevant exposure locations and to facilitate the discussion of results.

4.4.2 Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. Building downwash has been considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which are within a distance defined as five times the lesser of the height or maximum projected width of the building.

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Structures input to the model are presented (in blue) in relation to the chimney stack (in red) in Figure 4-1.

Figure 4-1 Modelled Buildings and Structures



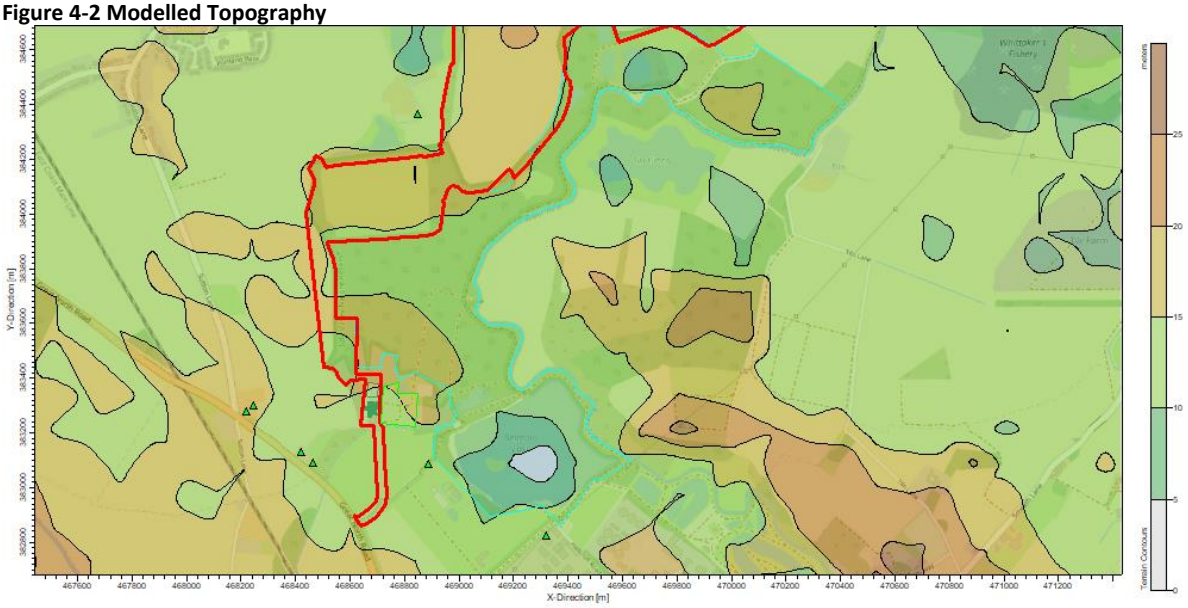
4.4.3 Topography

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. Topography was incorporated within the modelling using 30 m resolution Shuttle Radar Topography Mission (SRTM) terrain data files. Data was processed by the AERMAP function within AERMOD to calculate terrain heights as presented in Figure 4-2 below.

The Site is situated at an elevation of approximately 15 m AOD and surrounded by relatively flat land in all directions. Topography has been incorporated within the dispersion modelling.

Figure 4-2 Modelled Topography



4.4.4 Meteorological Data Preparation

The most important climatic parameters governing the release and dispersal of fugitive emissions from the Site are:

- Wind direction which determines the broad direction of dispersal;
- Wind speed will affect ground level emissions by increasing the initial dilution of pollutants in the emission; and
- Rainfall naturally supresses dust release (>0.2mm/day considered sufficient to suppress dust).

The nearest meteorological recording station to the Site is at Robin Hood Airport (formerly known as Doncaster Sheffield Airport), located approximately 13.5 km north of the Site. In consideration of the close proximity of the Robin Hood Airport recording station to the Site, as well as the similar elevation and surrounding land use, this recording station was determined to be representative of the Site locale and has been utilised within this study.

Recent meteorological data (covering the period 2018 to 2022, inclusive) was obtained in '.met' format from the data supplier. The data was converted to the required surface and profile formats for use in AERMOD, in accordance with the latest guidance[12].

The surface roughness, albedo and bowen ratios applied are presented in Table 4-4 below.

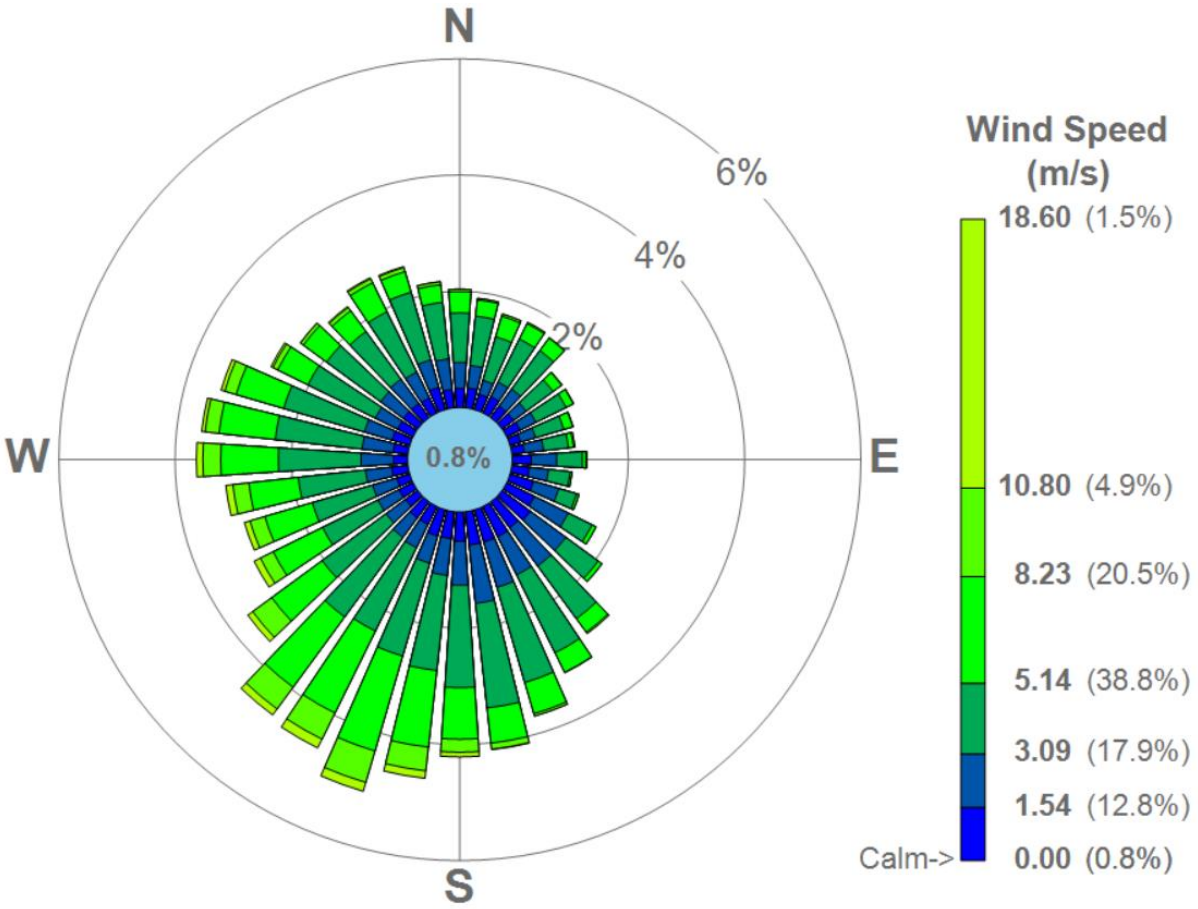
[12] AERMOD Implementation guide. AERMOD implementation workgroup, USEPA. Last revised July 2021.

Table 4-4 Applied Surface Characteristics

Zone (Start)	Zone (End)	Albedo	Bowen Ratio	Surface Roughness (m)
30	90	0.18	0.64	0.126
90	150	0.18	0.64	0.160
150	240	0.18	0.64	0.069
240	270	0.18	0.64	0.081
270	300	0.18	0.64	0.111
300	30	0.18	0.64	0.070

A windrose presenting the frequency of wind speed and direction, as applied within the assessment is presented in Figure 4-3 below. Prevailing winds are from the south and southwest.

Figure 4-3 Robin Hood Airport Wind Rose (2018-2022 average)



4.4.5 Dispersion Model Uncertainty

Model validation studies[13] for AERMOD generally suggest that these dispersion models are for the vast majority of cases able to predict maximum short term high percentiles concentrations well within a factor of two and the latest evaluation studies for AERMOD show the composite (geometric mean) ratio of predicted to observed short-term averages from 'test sites' (where real-time monitoring data is available to validate model performance), to be between 0.96 and 1.2.

[13] AERMOD: Latest Features and Evaluation Results, EPA-454/R-03-003, June 2003 (United States Environmental Protection Agency).

5.0 Approach to Assessment of Impact

5.1 Operational Envelope

For the purposes of this assessment, it has been assumed that the CHP engine would be operated at maximum load (6.1 MW_{th}) continuously for 24-hours-per-day and 365-days-per-year.

5.2 Treatment of Model Output

The assessment of impacts against the standards (as outlined in Section 3.4 and 3.5) was undertaken utilising the model outputs as described in Table 5-1 below.

As per the SG Guidance and EA AQMAU guidance[14] on conversion ratio for NO_x and NO_2 it has been assumed that 70% of NO_x is present as NO_2 in relation to long term impacts and 35% of NO_x is present as NO_2 in relation to short-term impacts.

Table 5-1 Model Outputs

Averaging Period	Model Output – Process Contribution (PC)	Predicted Environmental Concentration (PEC)
1-hour	1-hour mean (for NO_2 only) 99.79 percentile of 1-hour means (for NO_2 only)	PC + 2x annual mean background
24-hour	24-hour mean 90.41 percentile of 24-hour means (for PM_{10} only)	PC + 2x annual mean background
Annual	Annual mean	PC + annual mean background

5.3 Assessment of Impact and Significance

5.3.1 Human Receptors

To assess the potential impact on air quality, the predicted exposure is compared to the AQALs, and the results of the dispersion modelling have been presented in the form of:

- Tabulated concentrations at discrete receptor locations to facilitate the discussion of results; and
- Illustrations of the impact as isopleths (contours of concentration) for the criteria selected enabling determination of impact at any locations within the study area.

In accordance with the EA's AERA guidance, the impact is considered to be insignificant or negligible if:

- The long-term process contribution is <1% of the long term AQAL; and
- The short-term process contribution is <10% of the short term AQAL.

For process contributions that cannot be considered insignificant further assessment has been undertaken and the Predicted Environmental Concentration (PEC: PC + existing background pollutant concentration) determined for comparison as a percentage of the relevant AQAL.

5.3.2 Ecological Receptors

5.3.2.1 Calculation of Contribution to Critical Levels

Modelled PCs have been directly assessed as a percentage of the C_{Le} relevant to this assessment, which are set out in Section 3.5.

[14] Environment Agency, Air Quality Modelling and Assessment Unit, 'Conversion Ratios for NO_x and NO_2' (no date)

5.3.2.2 Calculation of Contribution to Critical Loads

On review of the APIS resource database, there is no available data on critical loads with regards to the ecological designations within the Site locale to allow an assessment of critical loads to be undertaken.

5.3.2.3 Significance of Effect on Ecological Receptors

In addition to the AERA guidance, the EA's Operational Instruction 66_12[15] details how the air quality impacts on ecological sites should be assessed. This guidance provides risk-based screening criteria to determine whether impacts would have 'no likely significant effects' for European sites, 'no likely damage' for SSSIs, or 'no significant pollution' for other sites, as follows:

- PC does not exceed 1% long-term C_{Le} and/or C_{Lo} for European sites and SSSIs;
- PC does not exceed 10% short-term C_{Le} (for NO_x) for European sites and SSSIs; and
- PC does not exceed 100% of the short-term or long-term C_{Le} and/or C_{Lo} at other sites.

Where the PC exceeds the above requirements, the Predicted Environmental Concentration is calculated (for long term targets only) and assessed against the relevant standard. If the PEC is less than 70% of the long-term environmental standard, the emissions are considered insignificant.

[15] EA Working Instruction 66_12 – Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation.

6.0 Baseline Environment

6.1 Site Setting and Sensitive Receptors

The Site is located approximately 500 m south of the village of Lound and 400 m southeast of the village of Sutton-cum-Lound. The Site is located at the approximate National Grid Reference (NGR): x468650, y383300.

The Site is located within the administrative area of Bassetlaw District Council (BDC) in a rural and flat setting.

The Site is bounded by:

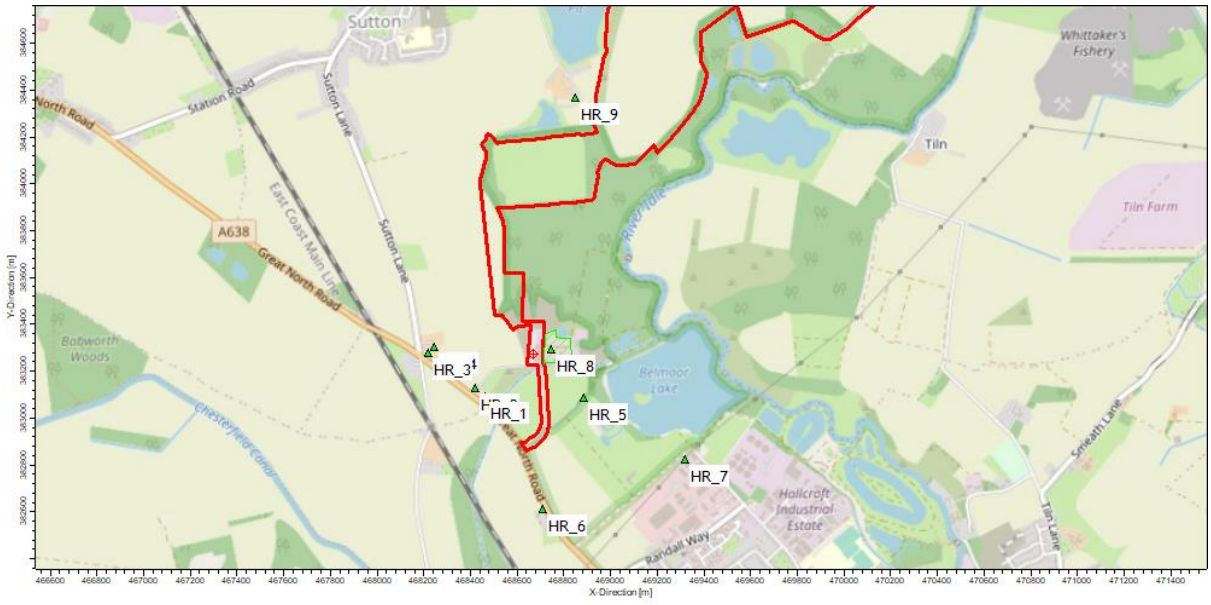
- The Wetlands Fishery immediately to the north of the Site among agricultural land the Idle Valley Nature Reserve is located to the northeast as well as a collection of commercial properties;
- The River Idle runs to the east of the Site, with a number of large surface water features associated with former minerals workings alongside, as well as the Sutton & Lound Gravel Pits SSSI;
- South of the Site is predominantly bounded by the Sutton & Lound Gravel Pits SSSI as well as agricultural fields; and
- A collection of residential dwellings among agricultural land lies to the west as well as Sutton-Cum-Lound

Further details on the identified sensitive human and ecological receptors are presented below.

6.1.1 Human Receptors

According to LAQM.TG(22), AQALs should only apply to locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant AQAL. As such, nine locations surrounding the CHP engine have been selected to inform the risk assessment, as presented in Figure 6-1 below.

Figure 6-1 Site Setting and Modelled Receptors



Further details on the human receptors identified are presented in Table 6-1. The assessment has also been undertaken utilising a nested receptor grid (as presented in Section 4.4.1) to allow potential short-term exposure to be assessed at all locations surrounding the Site.

Table 6-1 Modelled Discrete Receptors – Human Receptors

Reference	Receptor Type	Receptor Location		Flagpole Height (m)
		X	Y	
HR1	Residential	468462	383090	1.5

Reference	Receptor Type	Receptor Location		Flagpole Height (m)
		X	Y	
HR2	Residential	468422	383129	1.5
HR3	Residential	468221	383280	1.5
HR4	Residential	468245	383303	1.5
HR5	Educational facility	468887	383089	1.5
HR6	Residential	468711	382610	1.5
HR7	Recycling centre	469320	382823	1.5
HR8	Commercial / industrial	Multiple, See Figure 6-1		1.5
HR9	Residential	468849	384368	1.5

6.1.2 Ecological Receptors

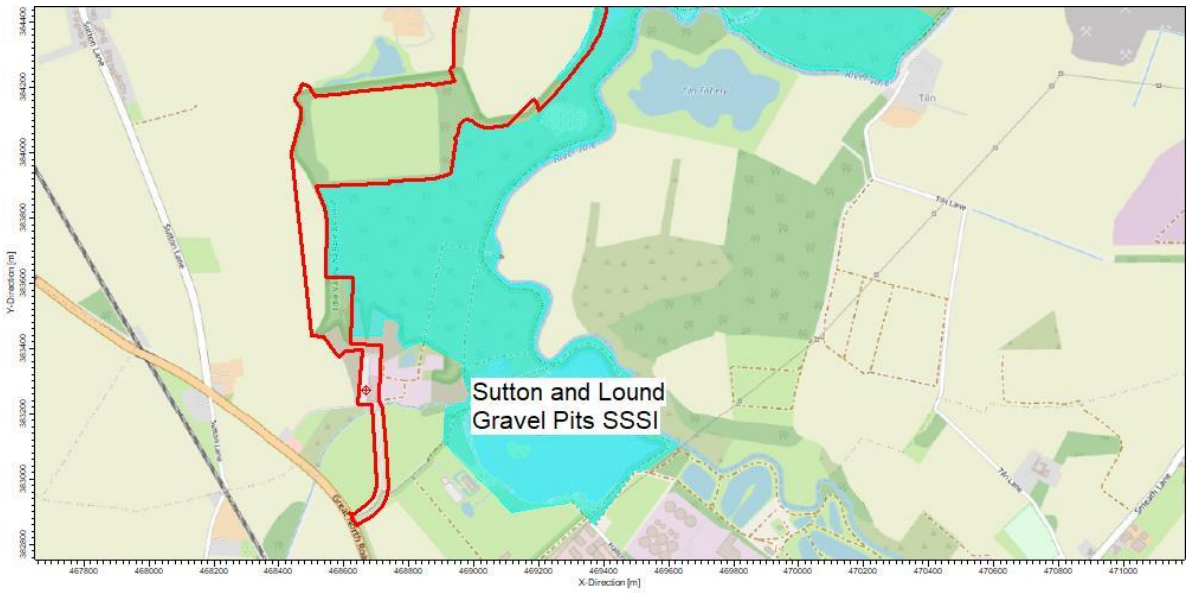
The designated ecological sites identified within the relevant screening distances of the Site (as outlined in Section 3.5) and the sensitive habitat(s) identified at those sites, are presented in Table 6-2 below.

Table 6-2 Designated Ecological Sites

Site	Designation	Sensitive Interest Features	Approximate Distance from the CHP Engine
Sutton and Lound Gravel Pits	SSSI	Lowland open waters and their margins	180 m

The location of the Sutton and Lound Gravel Pits SSSI is presented in blue in Figure 6-2 below.

Figure 6-2 Modelled Designated Ecological Site Locations



6.2 Ambient Air Quality

6.2.1 Local Air Quality Management

The Site is located within the administrative area of BDC. BDC have not declared any AQMAs and the nearest AQMA to the Site is located within Doncaster Council's administrative boundary at a distance of more than 16 km.

AQMAs have therefore not been considered further within this assessment.

6.2.2 Local Monitoring Data

BDC undertake non-automatic (passive) monitoring of NO_2 using diffusion tubes[16]. The nearest monitoring locations are situated within Retford. The nearest monitoring location to the Site is on Hospital Road (A620), located approximately 8 km southeast of the Site in a roadside setting.

Monitoring data collected prior to the COVID-19 pandemic (i.e. pre-2020) has been presented, as pollutant concentrations monitored after this date are expected to be atypical, and not representative of the local environment. This approach is in line with the IAQM position statement.

Monitoring data from the monitoring locations in Retford (prior to 2020) are presented in Table 6-3 below. Annual mean NO_2 concentrations were below the AQAL between 2017-2019, even at these roadside locations.

Table 6-3 Local Air Quality Monitoring

Monitoring Location	Site Classification	Distance and Direction from the Site	Annual Mean NO_2 Concentration (µg/m³)		
			2017	2018	2019
London Road Junction, Retford (#25)	Roadside	10.8 km / southeast	26.4	25.7	24.7
Hospital Road, Retford (#26)	Roadside	8 km / southeast	30.5	31.1	30.1
Arlington Way / Grove Street, Retford (#27)	Roadside	9.9 km / southeast	27.3	28.2	28.7

6.2.3 Automatic Air Quality Monitoring

BDC does not operate automatic (continuous) monitoring sites within its administrative area.

NO_2 concentrations are monitored nationally through the 'Automatic Urban and Rural Network' (AURN). The AURN networks are used to quantify temporal and spatial changes in concentrations of these pollutants on a long-term basis.

The closest monitoring stations within the AURN are located within Doncaster and Lincoln, however these are situated within an 'urban traffic' setting and therefore not considered representative of the Site locale. The nearest monitoring station in a 'urban background' location (considered more representative of the Site locale) is the 'Sheffield Tinsley' monitor, however this is located at a distance of more than 100 km from the Site and is therefore not considered representative of the Site locale.

6.2.4 Defra Modelled Background and Projections

Background pollutant concentration data on a 1 km x 1 km spatial resolution is provided by Defra through the UK Air Information Resource (AIR) website and is routinely used to support LAQM and Air Quality Assessments.

Mapped background concentrations for NO_2 are based upon the 2018 base year.

The background concentrations were downloaded for the grid square containing the Site (x468500, y383500), as well as the surrounding grid squares. Table 6-4 presents the maximum predicted concentration.

Table 6-4 Defra Background Maps

Grid Square		Annual Mean NO_2 Concentration (µg/m³)	Annual Mean PM_{10} Concentration (µg/m³)
X	y		
467500	384500	7.7	15.2
468500	384500	8.1	15.0
469500	384500	7.1	14.3

[16] BDC 2022 Air Quality Annual Status Report.

Grid Square		Annual Mean NO_2 Concentration ($\mu g/m^3$)	Annual Mean PM_{10} Concentration ($\mu g/m^3$)
X	y		
467500	383500	7.7	15.2
468500	383500	7.9	15.0
469500	383500	7.3	14.7
467500	382500	7.4	15.1
468500	382500	7.9	15.2
469500	382500	8.6	13.7
Maximum		**8.6**	**15.2**

6.3 Baseline Conditions

The background concentrations at receptors applied within this assessment have been determined in consideration of the measured (local or automatic) and predicted (Defra or APIS[17] modelled) data available. These are presented within Table 6-5.

Table 6-5 Baseline Conditions at Human Receptors

Pollutant	Averaging Period	Concentration ($\mu g/m^3$)	Data Source
NO_2	Long-term (annual average)	30.1	NO_2 concentration measured by BDC on Hospital Road, Retford, in 2019
PM_{10}	Long-term (annual average)	15.2	PM_{10} concentration for 2023 from Defra Background Maps (2018 base year, see Table 6-4)
NO_x	Long-term (annual average)	11.9	NOx Concentration from APIS (1 km resolution pollutant maps 2019-2021)

Where required, short-term background concentrations are determined in reference to the method outlined within the AERA guidance (short-term background concentration of a substance is twice its long-term concentration, as detailed in Table 5-1).

[17] http://www.apis.ac.uk/, accessed June 2023. The APIS website is a support tool used in the assessment of potential effects of air pollutants upon habitats and species - developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology

7.0 Assessment Results

The average predicted concentrations across the 5 years of meteorological data applied have been presented.

Contour plots are presented in Appendix B.

7.1 Human Receptors

7.1.1 NO_2

Predicted annual mean NO_2 impacts at the modelled receptor locations are summarised in Table 7-1. The impacts are described as insignificant at all receptors as the predicted PC is less than 1% of the AQAL.

Table 7-1 Predicted NO_2 Annual Mean Impacts

Receptor [a]	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL
HR1	0.2	0.4%	30.3	75.7%
HR2	0.1	0.4%	30.2	75.6%
HR3	<0.1	0.2%	30.2	75.4%
HR4	<0.1	0.2%	30.2	75.4%
HR6	0.1	0.3%	30.2	75.5%
HR9	0.1	0.3%	30.2	75.5%

Table notes:

a) Receptor HR5, HR7 and HR8 are not locations of relevant long-term exposure, therefore presentation of annual mean concentrations at these locations is not required.

Predicted short-term (1-hour 99.79%ile) NO_2 impacts at the modelled receptor locations are summarised in Table 7-2.

The impacts at the discrete receptors are described as insignificant at all receptors as the predicted PC is less than 10% of the AQAL.

The maximum predicted off-Site Ground Level Concentration (GLC) is below the short-term AQAL.

Table 7-2 Predicted NO_2 1-hour Mean (99.79%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³) [a]	PEC as % of AQAL
Max. GLC	59.4	29.7%	119.6	59.8%
HR1	1.1	0.6%	61.3	30.7%
HR2	1.0	0.5%	61.2	30.6%
HR3	0.6	0.3%	60.8	30.4%
HR4	0.6	0.3%	60.8	30.4%
HR5	5.4	2.7%	65.6	32.8%
HR6	1.0	0.5%	61.2	30.6%
HR7	1.4	0.7%	61.6	30.8%
HR8	4.0	2.0%	64.2	32.1%
HR9	0.6	0.3%	60.8	30.4%

7.1.2 PM_{10}

Predicted annual mean PM_{10} impacts at the modelled receptor locations are summarised in Table 7-3. The impacts are described as insignificant at all receptors as the predicted PC is less than 1% of the AQAL.

Table 7-3 Predicted PM_{10} Annual Mean Impacts

Receptor [a]	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL
HR1	<0.01	<0.01	15.2	38.0%
HR2	<0.01	<0.01	15.2	38.0%
HR3	<0.01	<0.01	15.2	38.0%
HR4	<0.01	<0.01	15.2	38.0%
HR6	<0.01	<0.01	15.2	38.0%
HR9	<0.01	<0.01	15.2	38.0%

Table notes:

a) Receptor HR5, HR7 and HR8 are not locations of relevant long-term exposure, therefore presentation of annual mean concentrations at these locations is not required.

Predicted short-term PM_{10} (24-hour mean 90.41 percentile) impacts at the modelled receptor locations are summarised in Table 7-4 below.

The impacts are described as insignificant at all receptors as the predicted PC is less than 10% of the AQAL.

The maximum predicted off-Site GLC is below the short-term AQAL.

Table 7-4 Predicted PM_{10} 24-hour Mean (90.41%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL
Max. GLC	0.13	0.02%	30.4	60.8%
HR1	0.01	0.02%	30.4	60.8%
HR2	0.01	<0.01%	30.4	60.8%
HR3	<0.01	<0.01%	30.4	60.8%
HR4	<0.01	<0.01%	30.4	60.8%
HR5	0.01	0.02%	30.4	60.8%
HR6	<0.01	0.01%	30.4	60.8%
HR7	<0.01	0.01%	30.4	60.8%
HR8	0.03	0.05%	30.4	60.9%
HR9	0.01	<0.01%	30.4	60.8%

7.2 Ecological Receptors

The results of the assessment of impacts on C_{Le} are presented in Table 7-5 below. The findings are as follows:

- The PEC does not exceed 70% of the long-term C_{Le} at the SSSI; and
- Whilst the PC exceeds 10% of the short-term (NO_X) C_{Le} at the SSSI, the resulting PEC would not exceed the short term C_{Le}.

Therefore, it is concluded that no further action is required.

Table 7-5 Predicted Critical Levels

Site	Averaging Period	Applied C_{Le} (µg/m^3)	PC (µg/m^3)	PC as % of C_{Le}	PEC (µg/m^3)	PEC as % of C_{Le}
Sutton and Lound Gravel Pits SSSI	NO_x Annual	30	1.8	6.1%	13.7	45.8%
	NO_x 24-hour	75	17.3	23.1%	41.1	54.8%

8.0 Conclusions

This AERA has quantified and assessed the potential air quality impacts associated with combustion emissions from the CHP engine and the particulate emissions from the dryer plant at the proposed Pulverised Fuel Ash (PFA) facility on agricultural land and an existing industrial estate to the north of Retford. The study has been undertaken using Environment Agency approved techniques and assessed against published AQALs for the protection of human health and designated ecological sites.

In consideration of the proposed CHP engine the AERA has concluded that:

- The process contributions do not lead to any exceedances of the standards (long-term or short-term) for the protection of human health at any location outside of the Site; and
- The process contributions are considered to cause 'no significant pollution' at the Sutton and Lound Gravel Pits SSSI in relation to Critical Levels.

In consideration of the proposed drying plant the AERA has concluded that:

- The process contributions do not lead to any exceedances of the standards (long-term or short-term) for the protection of human health at any location outside of the Site.

Appendix A Modelling Checklist

Lound Hive Air Emissions Risk Assessment (AERA)

Lound PFA Processing Facility

SLR Project No.: 416.V63926.00001

Table A-1 Modelling Checklist

Item	Yes/No	Details / Reason for Omission
Location map	Yes	Figure 6-1 and Figure 6-2
Site plan	Yes	Figure 4-1
Pollutants modelled and relevant EALs	Yes	Section 3.4.2 and 3.5
Details of modelled scenarios	Yes	Section 4.2
Details of relevant ambient concentrations	Yes	Section 6.2, 6.3 and 6.4
Model description and justification	Yes	Section 4.4
Special model treatment used	Yes	Section 5.2
Table of emission parameters used	Yes	Table 4-2
Details of modelled domain and receptors	Yes	Section 4.4.1, 6.1.1 and 6.1.2
Details of meteorological data used	Yes	Section 4.4.4
Details of terrain treatment	Yes	Section 4.4.3
Details of building treatment	Yes	Section 4.4.2
Details of modelling deposition	Yes	Section 5.3.2
Model uncertainty and sensitivity	Yes	Section 4.4.5
Assessment of impacts	Yes	Section 7.0
Contour plots	Yes	Appendix B
Model input files	Yes	Appendix C

Appendix B Contour Plots

Lound Hive Air Emissions Risk Assessment (AERA)

Lound PFA Processing Facility

SLR Project No.: 416.V63926.00001

Figure B-1 Annual Mean Nitrogen Dioxide Process Contribution (2018-2022)

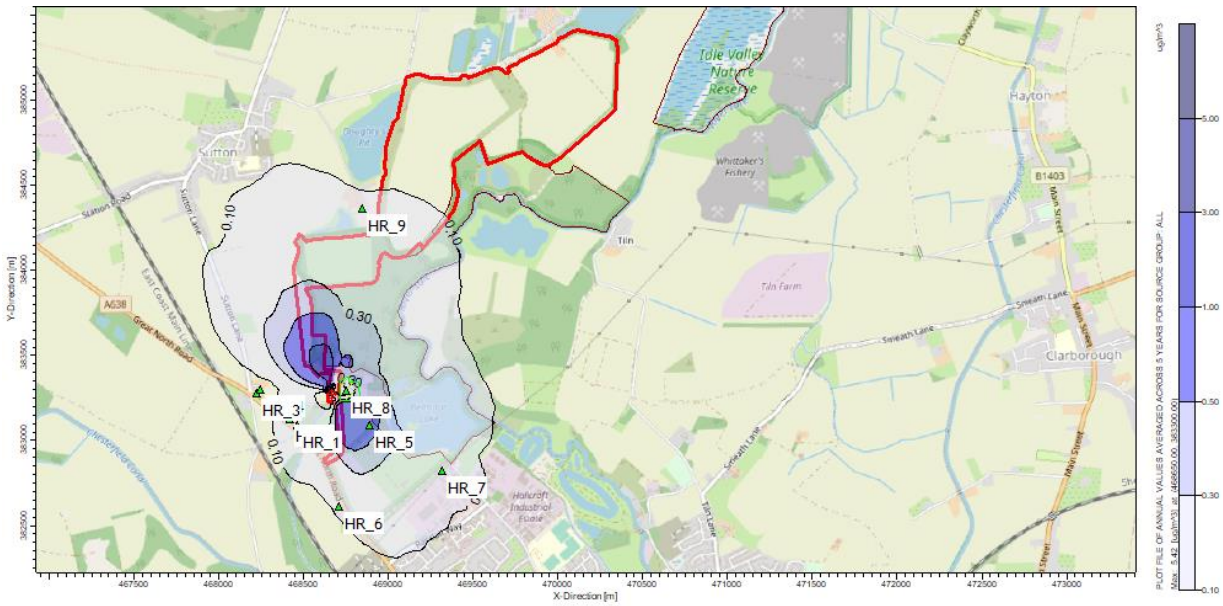


Figure B-2 1-hour Mean (99.79%ile) Nitrogen Dioxide Process Contribution (2018-2022)

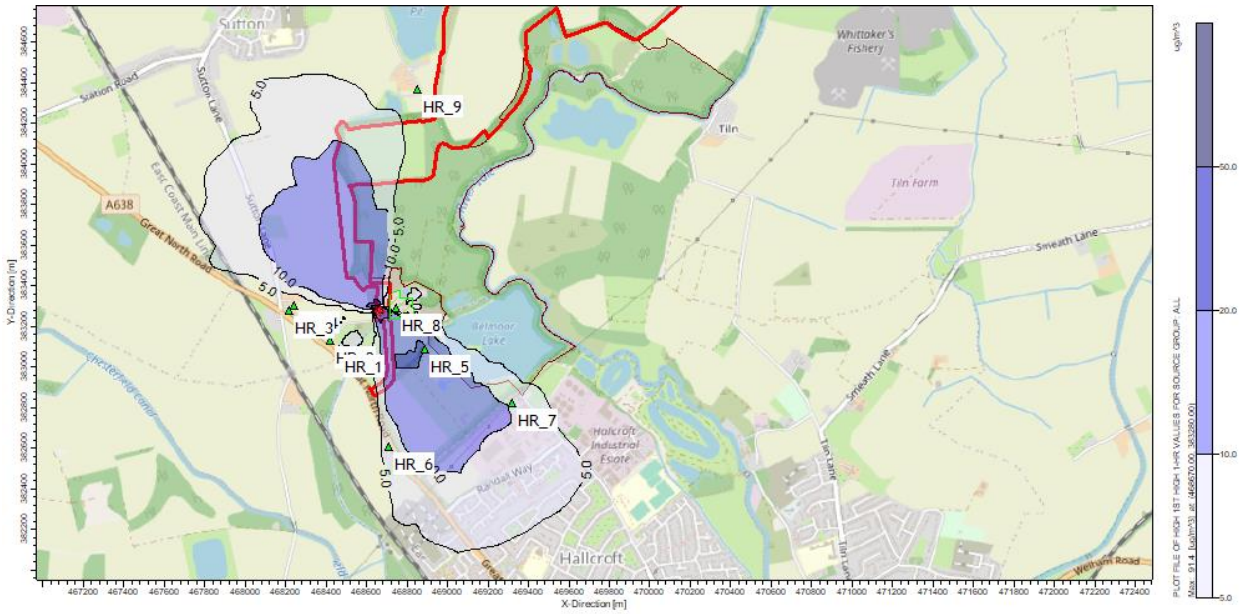
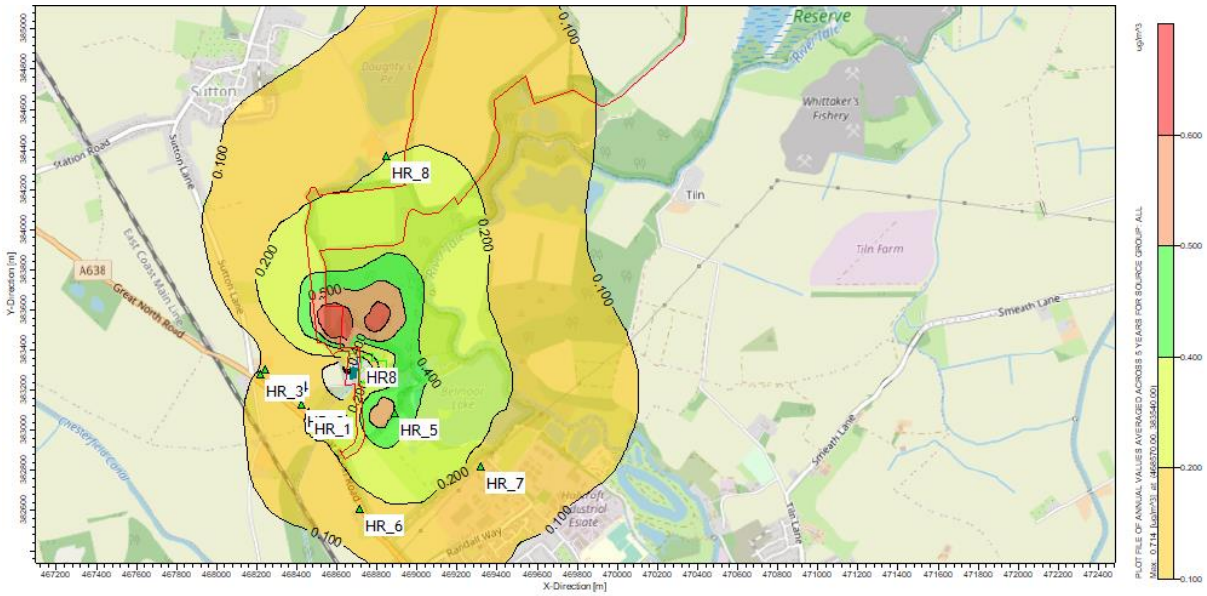


Figure B-3 Annual Mean PM_{10} Process Contribution (2018-2022)



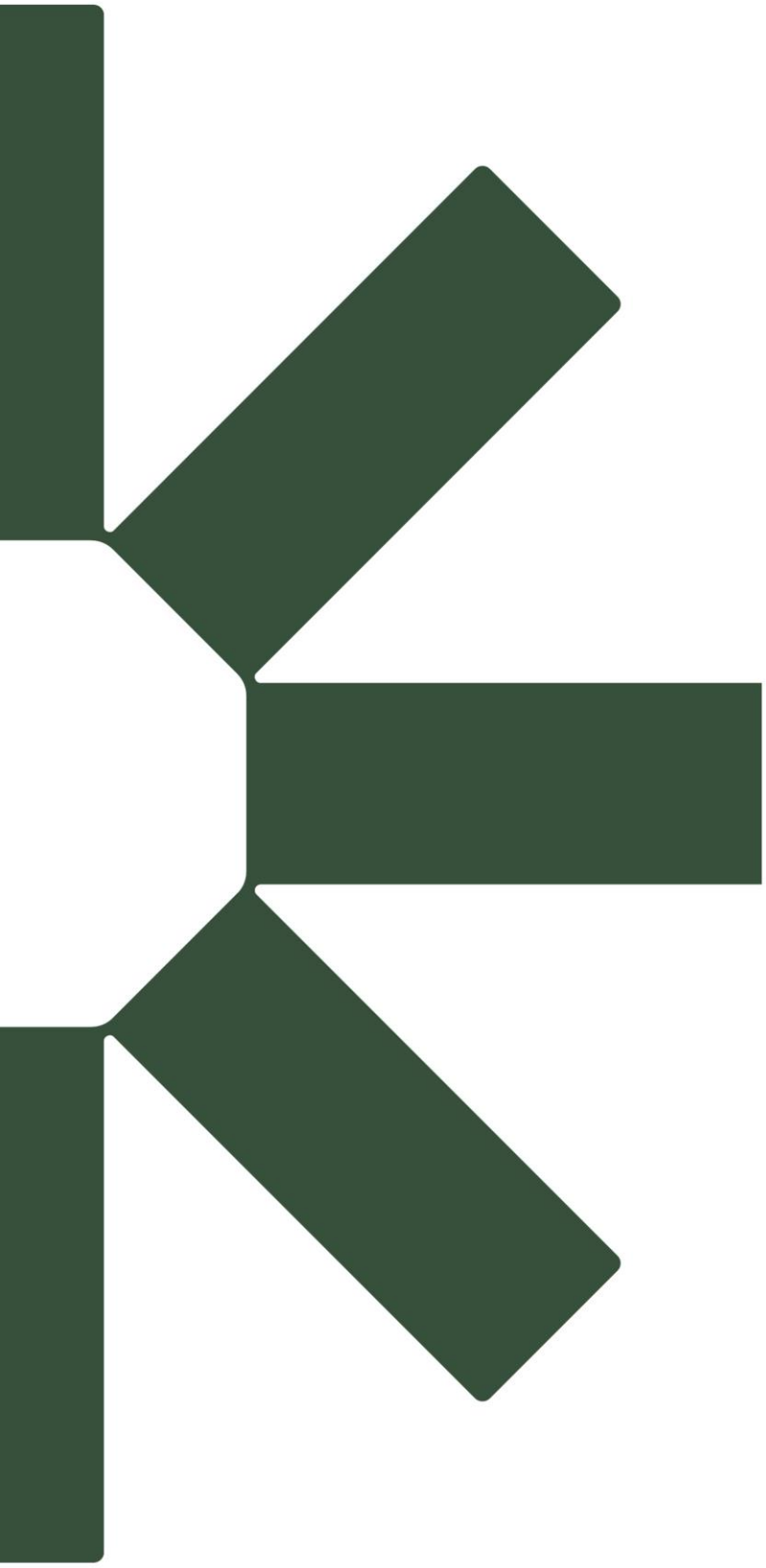
Appendix C Model Input Files

Lound Hive Air Emissions Risk Assessment (AERA)

Lound PFA Processing Facility

SLR Project No.: 416.V63926.00001

Provided electronically as attached compressed (.zip) files



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