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Covanta Energy Limited

Dispersion Modelling Assessment

ENGINEERING CONSULTING

Document approval

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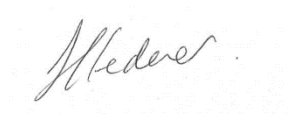
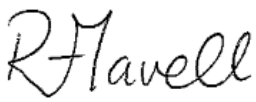
Prepared by:	Hannah Lederer		Environmental Scientist	08/08/2022
Checked by:	Rosalind Flavell		Senior Consultant	08/08/2022

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Management Summary

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged by Covanta Energy Limited to undertake a Dispersion Modelling Assessment to support the application for a variation to the Environmental Permit (EP) for the Newhurst Energy Recovery Facility (the Facility). The proposed changes are to increase the processing capacity of the Facility from 350,000 tonnes per annum to 455,000 tonnes per annum of waste, based on operation at the 102% MCR point on the firing diagram and an availability of 8,760 hours per annum. Full details of the proposed changes being applied for can be found in the Supporting Information of the EP application.

This assessment has considered the following scenarios:

- the "Permitted Facility" – using the model inputs from the AQA submitted with the previous EP variation in 2018 (referred to as the 2018 AQA); and
- the "Proposed Facility" – using the dispersion model inputs provided by the technology supplier based on the increased hourly throughput as proposed as part of this variation.

Dispersion Modelling of Emissions

The ADMS dispersion model is routinely used for air quality assessments to the satisfaction of the Environment Agency (EA). The model uses weather data from the local area to predict the spread and movement of the exhaust gases from the stack for each hour over a five-year period. The model takes account of wind speed, wind direction, temperature, humidity and the amount of cloud cover, as all of these factors influence the dispersion of emissions. The model also takes account of the effects of buildings and terrain on the movement of air. To set up the model, it has been assumed that the Facility operates for the whole year and releases emissions at the emission limits set in the existing EP continuously. The model has been used to predict the ground level concentration of pollutants on a long-term and short-term basis across a grid of points. In addition, concentrations have been predicted at the identified sensitive receptors.

Approach and Assessment of Impact on Air Quality

The impact on air quality has been assessed using a standard approach based on guidance provided by the EA. Using this approach, in relation to the AQALs set for the protection of human health the following can be concluded from the assessment.

1. The predicted impact of the Proposed Facility is lower than the predicted impact of the Permitted Facility.
2. Emissions from the operation of the Proposed Facility will not cause a breach of any AQAL.
3. The impacts of the Proposed Facility are assessed as not significant.
4. There is no risk of exceeding an AQAL for any metal either on a long or short-term basis.

Approach and Assessment of Impact on Ecology

The impact of air quality on ecology has been assessed using a standard approach based on guidance provided by the EA. Using this approach, in relation to the Critical Level and Critical Loads set for the protection of ecology the following can be concluded from the assessment.

At European and UK designated sites impacts can be screened out as 'insignificant' if the process contribution is less than 1% of the long term or less than 10% of the short-term Critical Level or Critical Load.

At local wildlife sites impacts can be screened out as 'insignificant' if the process contribution is less than 100% of the Critical Level or Critical Load.

The following can be concluded from the assessment:

1. The predicted impact of the Proposed Facility is lower than the predicted impact of the Permitted Facility.
2. At all local wildlife sites, the contribution from the Proposed Facility can be screened out as 'insignificant'.
3. One UK designated site has been identified within the screening distance, although this is within the screening distance from the installation boundary it is more than 2 km from the stack. At this site the Proposed Facility cannot be screened out as insignificant. However, the predicted impact is lower than the Permitted Facility, and where the PEC is predicted to exceed the Critical Level or Load, this is exceeded due to the baseline.

Summary and Conclusions

In summary, the assessment has shown that the predicted impact of the Proposed Facility is lower than the Permitted Facility. With reference to the AQALs for the protection of human health the total impact of the Proposed Facility is not significant. With reference to the Critical Level and Critical Loads for the protection of ecosystems the impact at all local wildlife sites can be screened out as 'insignificant'. Whilst the total impact at the local SSSI cannot be screened out as 'insignificant' the predicted impact is lower than the Permitted Facility. As such there should be no air quality constraint in granting a variation to the existing EP for the increased throughput as proposed.

Contents

1 Introduction

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged by Covanta Energy Limited to undertake a Dispersion Modelling Assessment to support the application for a variation to the Environmental Permit (EP) for the Newhurst Energy Recovery Facility (the Facility). The proposed changes are to increase the processing capacity of the Facility from 350,000 tonnes per annum to 455,000 tonnes per annum of waste, based on operation at the 102% MCR point on the firing diagram and an availability of 8,760 hours per annum. Full details of the proposed changes being applied for can be found in the Supporting Information of the EP application.

The existing EP includes emission limits for emissions to air based on the Industrial Emissions Directive (IED) (Directive 2010/75/EU). This includes limits on emissions of oxides of nitrogen, sulphur dioxide, heavy metals and dioxins and furans, as well as other substances. For the purpose of this assessment, it has been assumed that the same emission limits will apply – i.e. no allowance has been made to the future reduction in emission limits which will need to come through as part of the implementation of the Waste Incineration BREF[1]. This means that the results presented are conservative as actual impacts in future will be lower. However, this does mean a direct comparison can be made with the impact of the Facility as currently permitted.

This assessment has considered the following scenarios:

- the "Permitted Facility" – based on a comparison model, which has used the model inputs from the AQA submitted with the previous EP variation in 2018 (referred to as the 2018 AQA), using the latest version of ADMS and meteorological data; and
- the "Proposed Facility" – using the dispersion model inputs provided by the technology supplier based on the increased hourly throughput as proposed as part of this variation.

When considering the impact on human health, the predicted atmospheric concentrations have been compared to the Air Quality Assessment Levels (AQALs) for the protection of human health. It is noted that for dioxins the AQAL is a Tolerable Daily Intake (TDI) which considered the combination of the intake from inhalation and ingestion. As such it is not possible to demonstrate compliance with the assessment level with just reference to the air concentration. As such, a separate Dioxin Pathway Intake Assessment has been undertaken to assess the pathway intake of these pollutants and impacts compared to the TDI.

When considering the impact on ecosystems the predicted atmospheric concentrations have been compared to the Critical Levels for the protection of ecosystems. It is noted that deposition of emissions over a prolonged period can have nutrification and acidification impacts. An assessment of the long-term deposition of pollutants has been undertaken and the results compared to the habitat specific Critical Loads.

1.1 Structure of the report

This report has the following structure.

- National and international air quality legislation and guidance are considered in section 2.
- The background levels of ambient air quality are described in section 3.
- The residential properties and ecological receptors which are sensitive to changes in air quality associated with the Facility and identified in section 4.
- The inputs used for the dispersion model are contained in section 5.

[1] Best Available Techniques (BAT) Reference Document for Waste Incineration - 2019

- Details of the sensitivity analysis carried out is presented in section 6.
- The assessment methodology and results of the assessment of the impact of emissions on human health is presented in section 7.
- The assessment methodology and results of the assessment of the impact of emissions at ecological sites is presented in section 8.
- The conclusions of the assessment are set out in section 9.
- The Appendices include illustrative figures and detailed results tables.

2 Air Quality Standards, Objectives and Guidelines

European air quality legislation is consolidated under the Ambient Air Quality Directive (Directive 2008/50/EC), which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides Ambient Air Directive (AAD) Limit Values for sulphur dioxide, nitrogen dioxide, benzene, carbon monoxide, lead and particulate matter with a diameter of less than 10µm (PM_{10}) and a new AAD Target Value and Limit Value for fine particulates (those with a diameter of less than 2.5µm ($PM_{2.5}$). The fourth daughter Directive - 2004/107/EC - was not included within the consolidation. It sets health-based Target Values for polycyclic aromatic hydrocarbons (PAHs), cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable. Directives 2008/50/EC and 2004/107/EC are transposed under UK Law into the Air Quality Standards Regulations (2010). The regulations also extend powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to local authorities for the implementation of these Directives.

The UK Government and the devolved administrations are required under the Environment Act (1995) to produce a national air quality strategy. This was last reviewed and published in 2007. The Air Quality Strategy (AQS) sets out the UK's air quality objectives and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. This is the method of the implementation of the AADT Limits and Targets. This includes additional targets and limits for 15-minute sulphur dioxide and 1,3-butadiene and more stringent requirements for benzene and PAHs, known as AQS Objectives.

The Air Quality Strategy defines “standards” and “objectives” in paragraph 17:

“For the purposes of the strategy:

- *standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups or on ecosystems; and*
- *objectives are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale.”*

The status of the objectives is clarified in paragraph 22, which also emphasises the importance of European Directives:

“The air quality objectives in the Air Quality Strategy are a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except in as far as these mirror any equivalent legally binding limit values in EU legislation. Where UK standards or objectives are the sole consideration, there is no legal obligation upon regulators, to set Emission Limit Values (ELVs) any more stringent than the emission levels associated with the use of Best Available Techniques (BAT) in issuing permits under the PPC Regulations. This aspect is dealt with fully in the PPC Practical Guides.”

In 2019 the UK Government published the Clean Air Strategy (CAS). This sets out methods by which air pollution from all sectors will be reduced. The CAS has not introduced any new air quality limits. However, the CAS sets out the actions required across all parks of the government to meet legally binding targets to reduce five key pollutants (fine particulate matter (PM2.5s), ammonia, oxides of nitrogen, sulphur dioxide and non-methane volatile organic compounds (NMVOCs)) by 2020 and

2030 and secure health public heath benefits. The CAS also makes a commitment to bring forward primary legislation on clean air as outlined in the Environment Act.

The Environment Act (2021) introduces a duty on the government to set a legally binding target for $PM_{2.5}$s. To date this has not yet been set. The Department for the Environment Food and Rural Affairs (DEFRA) fact sheet[2] sets out that:

"The government is committed to evidence-based policy making and will consider the WHO's annual mean guideline level for $PM_{2.5}$ when setting the target, alongside independent expert advice, evidence and analysis on a diversity of factors – from the health benefits of reducing $PM_{2.5}$, to the practical feasibility and economic viability of taking different actions.

It would be irresponsible to set a target without giving consideration to its achievability and the measures required to deliver on that target.

The target level and achievement date will be developed during the target setting process and will follow in secondary legislation."

The WHO annual mean PM guidelines values are as follows:

- Fine particulate matter ($PM_{2.5}$) – 10 µg/m^3 as an annual mean, and 25 µg/m^3 as a daily mean.
- Course particulate matter (PM_{10}) – 20 µg/m^3 as an annual mean, and 50 µg/m^3 as a daily mean.

For other pollutants the EA set Environmental Assessment Levels (EALs) in the environmental management guidance document 'Air Emissions Risk Assessment for your Environmental Permit'[3] (Air Emissions Guidance). The long-term and short-term EALs from this document have been used when the AQS does not contain relevant objectives. Standards and objectives for the protection of sensitive ecosystems and habitats are also contained within the Air Emissions Guidance and the Air Pollution Information System (APIS[4]).

AAD Target and Limit Values, AQS Objectives, and EALs are set at levels well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups. For the remainder of this report these are collectively referred to as Air Quality Assessment Levels (AQALs). Table 1, Table 3 and Table 2 summarise the air quality objectives and guidelines used in this assessment.

[2] DEEFRA Policy paper 10 March 2020: Air quality factsheet (part 4) - https://www.gov.uk/government/publications/environment-bill-2020/10-march-2020-air-quality-factsheet-part-4

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

[4] http://www.apis.ac.uk

Table 1: Air Quality Assessment Levels (AQALs)

Pollutant	Limit Value (µg/m³)	Averaging Period	Frequency of Exceedances	Source
Nitrogen dioxide	200	1 hour	18 times per year (99.79th percentile)	AQS Objective
	40	Annual	-	AQS Objective
Sulphur dioxide	266	15 minutes	35 times per year (99.9th percentile)	AQS Objective
	350	1 hour	24 times per year (99.73rd percentile)	AQS Objective
	125	24 hours	3 times per year (99.18th percentile)	AQS Objective
Particulate matter (PM_{10})	50	24 hours	35 times per year (90.41st percentile)	AQS Objective
	50	24 hours	-	WHO Guideline
	40	Annual	-	AQS Objective
	20	Annual		WHO Guideline
Particulate matter ($PM_{2.5}$)	20	Annual	-	AQS Target Value
	25	24 hours	-	WHO Guideline
	10	Annual	-	WHO Guideline
Carbon monoxide	10,000	8 hours, running	-	AQS Objective
	30,000	1 hour		Air Emissions Guidance
Hydrogen chloride	750	1 hour	-	Air Emissions Guidance
Hydrogen fluoride	160	1 hour	-	Air Emissions Guidance
	16	Annual	-	Air Emissions Guidance
Ammonia	2,500	1 hour	-	Air Emissions Guidance
	180	Annual	-	Air Emissions Guidance
Lead	0.25	Annual	-	AQS Objective
Benzene	5.00	Annual	-	AQS Objective
	30	24 hour	-	Air Emissions Guidance
1,3-butadiene	2.25	Annual, running	-	AQS Objective
PCBs	6	1-hour	-	Air Emissions Guidance
	0.2	Annual	-	Air Emissions Guidance
PAHs	0.0025	Annual	-	AQS Objective

As shown in Table 1, lead is the only metal included in the AQS. The AQS includes objectives to limit the annual mean to 0.5 µg/m³ by the end of 2004 and to 0.25 µg/m³ by the end of 2008. Only the first objective is included in the Air Quality Directive.

The fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes target values for arsenic, cadmium and nickel. However, these values are the same as, or lower than, those included in the Air Emissions Guidance. Therefore, the Environmental Assessment Levels (EALs) from the Air Emissions Guidance shown in Table 2 have been used in this assessment.

Table 2: Environmental Assessment Levels (EALs) for Metals

Metal	Daughter Directive Target Level (µg/m³)	EALs (µg/m³)	
		Annual mean	1-hour mean
Arsenic	0.006	0.006	-
Antimony	-	5	150
Cadmium	0.005	0.005	-
Chromium (II & III)	-	5	150
Chromium (VI)	-	0.00025	-
Cobalt	-	-	-
Copper	-	10	200
Lead	-	0.25	-
Manganese	-	0.15	1500
Mercury	-	0.25	7.5
Nickel	0.020	0.020	-
Thallium	-	-	-
Vanadium	-	-	1 *

Notes:
* EAL for Vanadium is a 24-hour mean.

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

Pollutant	Concentration (µg/m³)	Measured as	Source
Nitrogen oxides (as nitrogen dioxide)	75 / 200*	Daily mean	Air Emissions Guidance
	30	Annual mean	AQS Objective
Sulphur dioxide	10	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity	Air Emissions Guidance
	20	Annual mean for all higher plants	AQS Objective
Hydrogen fluoride	5	Daily mean	Air Emissions Guidance
	0.5	Weekly mean	Air Emissions Guidance
Ammonia	1	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity	Air Emissions Guidance
	3	Annual mean For all higher plants	Air Emissions Guidance
NOTE: **only for detailed assessments where the ozone is below the AOT40 critical level and sulphur dioxide is below the lower critical level of 10 µg/m³* The *AOT40 for ozone is 6,000 µg/m³ calculated from accumulated hourly ozone concentrations – AOT40 means the sum of the difference between each hourly daytime (08:00 to 20:00 Central European Time) ozone concentration greater than 80 µg/m³ (40 ppb) and 80 µg/m³, for the period between 01 May and 31 July.*			

In addition to the Critical Levels set out in the table above, APIS provides habitat specific Critical Loads for nitrogen and acid deposition. Full details of the habitat specific critical loads can be found in Annex C.

2.1 Areas of relevant exposure

The AQALs apply only at areas of exposure relevant to the assessment level. The following table extracted from Local Authority Air Quality Technical Guidance (2021) (LAQM.TG(16))[5] explains where the AQALs apply.

[5] Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance (TG16), February 2018, available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-April-21-v1.pdf

Table 4: Guidance on Where AQALs Apply

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

Source: Box 1.1 LAQM.TG(16)

2.2 Industrial pollution regulation

Atmospheric emissions from industrial processes are controlled in England through the Environmental Permitting Regulations (2012) (and subsequent amendments). The Facility currently has an EP to operate. The EP includes conditions to ensure that the environmental impact of the operations is minimised. This includes conditions to prevent fugitive emissions of dust and odour beyond the boundary of the permitted activity, and limits on emissions to air.

The Industrial Emissions Directive (IED) (Directive 2010/75/EU), was adopted on 07 January 2013, and is the key European Directive which covers almost all regulation of industrial processes in the

European Union (EU). Within the IED, the requirements of the relevant sector BREF (Best Available Techniques Reference documents) become binding as BAT (Best Available Techniques) guidance, as follows.

- Article 15, paragraph 2, of the IED requires that Emission Limit Values (ELVs) are based on best available techniques, referred to as BAT.
- Article 13 of the IED, requires that 'the Commission' develops BAT guidance documents (referred to as BREFs).
- Article 21, paragraph 3, of the IED, requires that when updated BAT conclusions are published, the Competent Authority (in England this is the EA) has up to four years to revise permits for facilities covered by that activity to comply with the requirements of the sector specific BREF.

The EA explain that 'BAT' means the available techniques which are the best for preventing or minimising emissions and impacts on the environment where 'techniques' include both the technology used and the way the installation is designed, built, maintained, operated and decommissioned.

The Waste Incineration BREF was published by the European Integrated Pollution Prevention and Control (IPPC) Bureau in December 2019. The Waste Incineration BREF has introduced BAT-AELs (BAT Associated Emission Levels) which are more stringent than those currently set out in the existing EP for some pollutants. However, for the purpose of this assessment no allowance has been made to the future reduction in emission limits which will need to be adopted by the Facility to implement the requirements of the Waste Incineration BREF. This means that the results presented are conservative as actual impacts in future will be lower. However, this does mean a direct comparison can be made with the impact of the Permitted Facility.

2.3 Local air quality management

In accordance with Section 82 of the Environment Act (1995) (Part IV), local authorities are required to periodically review and assess air quality within their area of jurisdiction, under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves assessing present and likely future ambient pollutant concentrations against AQALs. If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) are likely to be exceeded, then the local authority is required to declare an Air Quality Management Area (AQMA). For each AQMA, the local authority is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant levels in pursuit of the relevant AQALs.

3 Baseline Air Quality

In this section, we have reviewed the baseline air quality and defined appropriate background concentrations to be used within this assessment.

3.1 Air quality review and assessment

Under Section 82 of the Environment Act (1995) (Part IV), local authorities are required to undertake an ongoing exercise to review air quality within their area of jurisdiction. The Facility is located within Charnwood Borough Council (CBC) area.

There are some sections of Loughborough Air Quality Management Area (AQMA) within 5 km of the Facility, as shown on Figure 1 (Appendix A).

3.2 National modelling – mapped background data

In order to assist local authorities with their responsibilities under LAQM, Defra provides modelled background concentrations of pollutants across the UK on a 1 km by 1 km grid. This model is based on known pollution sources and background measurements and is used by local authorities in lieu of suitable monitoring data. Mapped background concentrations have been downloaded for the grid squares containing the Facility and immediate surroundings. In addition, mapped atmospheric concentrations of ammonia are available from the Centre for Ecology and Hydrology (CEH) throughout the UK on a 5 km by 5 km grid.

The mapped background data is calibrated against monitoring data. For instance, the 2018 mapped background concentrations are based on 2018 meteorological data and are calibrated against monitoring undertaken in 2018. As a conservative approach where mapped background data is used the concentration for the year against which the data was validated has been used. This eliminates any potential uncertainties over anticipated trends in future background concentrations.

Concentrations will vary over the modelling domain area. Therefore, the maximum mapped background concentration from within 5 km of the Facility has been calculated, as presented in Table 5, together with the concentration at the Facility.

Table 5: Mapped Background Data

Pollutant	Annual mean concentration (µg/m³)		Dataset
	At Site	Max within 5 km of Facility	
Nitrogen dioxide	11.59	18.54	DEFRA 2018 Dataset
Oxides of nitrogen	15.41	26.68	DEFRA 2018 Dataset
Sulphur dioxide	4.14	5.61	DEFRA 2001 Dataset
Particulate matter (as PM_{10})	18.83	18.83	DEFRA 2018 Dataset
Particulate matter (as $PM_{2.5}$)	9.73	11.80	DEFRA 2018 Dataset
Carbon monoxide	369	390	DEFRA 2001 Dataset
Benzene	0.57	0.67	DEFRA 2001 Dataset
1,3-butadiene	0.25	0.27	DEFRA 2001 Dataset
Ammonia	1.86	2.58	DEFRA (CEH) 2014

Source: © Crown 2022copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

3.3 AURN monitoring data

The UK Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of Defra. This includes automatic monitoring of oxides of nitrogen, nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide and fine particulate matter. In addition, as part of their commitment local authorities undertake monitoring of nitrogen dioxide, particulate matter, carbon monoxide and sulphur dioxide if deemed necessary.

There are no AURN monitoring stations within 10 km of the Facility. The closest AURN monitoring station to the Facility is the Leicester A594 Roadside site, a roadside site located approximately 16.5 km to the south-west. At this distance, the data from this analyser is not representative of concentrations in the vicinity of the Facility. Therefore, data from this site has not been considered further in this analysis.

3.4 LAQM monitoring data

CBC operated two automatic monitoring sites in 2020 (the latest data available in the 2021 Annual Status Report). Due to COVID-19, the data collection rates were below reportable levels, and the automatic monitoring sites have since been decommissioned. Both sites were over 5 km from the Facility and in roadside locations. Therefore, they are not considered to be representative of concentrations in the vicinity of the Facility. Therefore, data from the CBC automatic monitoring sites has not been considered further in this analysis.

CBC also undertake non-automatic (diffusion tube) monitoring for nitrogen dioxide at various sites across the area. 18 of these sites lie within 5 km of the Facility. Their locations are shown in Figure 1 (Appendix A).

A summary of monitoring data from the non-automatic (diffusion tube) monitoring sites within 5 km of the Facility is provided in Table 6. Data has been taken from the CBC 2021 Air Quality Annual Status Report (August 2021). There are no sites which recorded an exceedence the AQAL.

Table 6: Summary of Non-Automatic Nitrogen Dioxide Monitoring Results

Site ID	Site name	Mapped bg ($\mu g/m^3$)	Annual mean concentration ($\mu g/m^3$)				
			2016	2017	2018	2019	2020
Roadside sites							
DT3	Forest Rd	13.0	28.6	26.7	24.1	25.7	18.3
DT4	Haydon Rd	15.6	27.8	30.0	23.1	25.7	18.4
DT5	Alan Moss Rd /Epinal Way	15.6	23.7	24.8	20.4	21.4	14.9
DT6	Epinal Way / Ling Rd	13.5	26.7	29.1	26.0	27.7	19
DT8	Derby Rd	18.5	33.4	33.3	28.8	27.0	16.7
DT9	Derby Rd /Briscoe Avn	14.8	26.8	27.0	22.5	23.3	16.2
DT13	Alan Moss Rd /A6 Derby Rd	14.8	27.4	27.5	24.9	25.3	17.8
DT16	Ashby Rd	16.1	28.0	31.6	28.0	30.2	20.0
DT17	Cow Hill Lodge	13.4	27.1	25.4	23.3	26.6	17.8
DT18	Roseberry St	15.6	19.7	19.4	17.0	17.6	12.4

Site ID	Site name	Mapped bg (µg/m³)	Annual mean concentration (µg/m³)				
			2016	2017	2018	2019	2020
DT27	Ashby Rd Central	13.4	39.0	34.9	33.9	22.2	21.2
DT28	Loughborough Rd	11.5	30.1	28.3	25.0	20.3	16.9
DT46	74 Hathern Rd	16.8	22.2	21.5	20.4	19.8	13.9
DT47	7 Shepshed Rd	11.6	22.9	24.2	21.9	22.6	15.7
DT53	Frederick Street	16.1				26.2	17.3
Urban background sites							
DT10-12	Durham Rd 3	14.8	19.1	19.9	17.2	18.1	12.4
Suburban sites							
DT48	37 Darwin Crescent	11.5	17.6	15.8	14.3	13.9	8.6
Urban Centre sites							
DT15	Market Place	16.1	21.2	21.3	17.3	19.1	12.4

Source: Charnwood Borough Council 2020 Air Quality Annual Status Report (August 2021) and © Crown 2021 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

All non-automatic monitoring roadside sites have recorded nitrogen dioxide concentrations higher than the mapped background data for their locations. This is expected for roadside sites, but the urban background, urban centre and suburban sites all also recorded concentrations higher than the mapped background until 2020, in which these sites recorded lower concentrations than the mapped background data (likely COVID-19 influenced). None of the sites exceeded the AQAL.

Roadside sites are predominately determined by emissions from nearby traffic and are only representative of air quality for the immediate area of the diffusion tube. Therefore, the data from the roadside site diffusion tubes is not considered to be representative of the general background conditions. For the three background sites, the recorded concentrations are similar to or lower than the maximum mapped background concentration within 5 km of the Facility. Therefore, it is considered appropriate to use this maximum mapped background concentration within the modelling domain. The choice of baseline concentrations will be considered further if the impact of the Proposed Facility cannot be screened out as 'insignificant'.

3.5 Other national monitoring networks data

Neither the Defra mapped background dataset, AURN or LAQM include monitoring of other pollutants released from the Facility such as hydrogen chloride, hydrogen fluoride, VOCs, metals or dioxins. As such reference has been made to national modelling to determine a suitable baseline concentration.

3.5.1 Hydrogen chloride

Hydrogen chloride was measured until the end of 2015 on behalf of Defra as part of the UK Eutrophying and Acidifying Atmospheric Pollutants (UKEAP) project. This consolidates the previous Acid Deposition Monitoring Network (ADMN), and National Ammonia Monitoring Network (NAMN). Monitoring of hydrogen chloride ceased at the end of 2015. Prior to the cessation of the monitoring concentrations were fairly constant.

The maximum annual average monitored within the UK between 2011 and 2015 was 0.71 µg/m³. In lieu of any recent representative monitoring this has been used as the baseline concentration for this assessment as a conservative estimate.

3.5.2 Hydrogen fluoride

Baseline concentrations of hydrogen fluoride are not measured locally or nationally, since these are not generally of concern in terms of local air quality. However, the EPAQS report 'Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects' contains some estimates of baseline levels, reporting that measured concentrations have been in the range of 0.036 µg/m^3 to 2.35 µg/m^3.

In lieu of any local monitoring, the maximum measured baseline hydrogen fluoride concentration has been used for the purpose of this assessment as a conservative estimate.

3.5.3 Ammonia

Ammonia is also measured as part of the UKEAP project at rural background locations. The closest UKEAP monitoring site is Sutton Bonnington, 9.1 km to the north of the Facility. The concentrations recorded at this site between 2016 and 2020 were between 2.32 and 3.68 µg/m$^{3.}$ The maximum concentration is higher than the maximum mapped background value from within 5 km of the Facility (2.28 µg/m^3), so therefore, as a conservative measure, the higher value as recorded at Sutton Bonnington has been used for the purpose of this assessment.

3.5.4 Volatile Organic Compounds

As part of the Automatic and Non-Automatic Hydrocarbon Network, benzene concentrations are measured at sites co-located with the AURN across the UK. In 2007, due to low monitored concentrations of 1,3-butadiene at non-automatic sites, Defra took the decision to cease non-automatic monitoring of 1,3-butadiene. There are no monitoring locations within 10 km of the Facility. The nearest monitoring site is Nottingham Centre.

In lieu of any local monitoring of benzene or 1,3-butadiene, the maximum mapped background concentrations within the modelling domain have been used as the baseline concentrations for the purpose of this assessment as set out in Table 5.

3.5.5 Metals

Metals are measured as part of the Rural Metals and UK Urban/Industrial Networks (previously the Lead, Multi-Element and Industrial Metals Networks). There are no current monitoring locations within 10 km of the Facility (although a rural background site 4.6 km to the south-east of the Facility, Beacon Hill, operated until 2014).

A summary of the maximum annual data across all UK urban and rural background monitoring sites is presented in the following table.

Table 7: Metals Monitoring Maximum of all Background Sites – Urban and Rural

Substance	Annual mean concentration (ng/m³)						Max (as % of AQAL)
	AQAL	2016	2017	2018	2019	2020	
Cadmium	5	0.45	0.57	0.49	0.43	0.35	11.4%

Substance	Annual mean concentration (ng/m³)						Max (as % of AQAL)
	AQAL	2016	2017	2018	2019	2020	
Thallium	-	-	-	-	-	-	-
Mercury	250	2.50	2.50	2.70	2.80	-	1.1%
Antimony	5000	-	-	-	-	-	-
Arsenic	6	1.00	1.00	1.10	1.00	1.00	18.3%
Chromium	5000	29.00	31.00	34.00	39.00	25.00	0.78%
Cobalt	-	0.62	0.60	0.84	0.92	0.56	-
Copper	10000	20.00	33.00	20.00	26.00	22.00	0.33%
Lead	250	16.00	18.00	16.00	20.00	13.00	8.0%
Manganese	150	28.00	30.00	35.00	36.00	26.00	24.0%
Nickel	20	1.90	2.70	1.70	2.20	1.80	13.5%
Vanadium	5000	1.50	1.40	1.30	1.70	1.50	0.03%
NOTES: Excludes data from Sheffield Tinsley for lead and nickel – although this is a background site it is located close to industrial areas and as such has high levels of these pollutants far greater than that monitored at other sites.							

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As shown, the concentrations monitored between 2016 and 2020 were significantly lower than the AQALs at all monitoring sites considered.

The area surrounding the Facility is a mixture of rural, suburban and the M1 motorway. Although close to the town of Loughborough, this is not deemed to be an urban area. However, as a conservative approach, the maximum metal concentration across urban and rural background sites from between 2016 and 2020 has been used as the baseline concentration within this assessment, in lieu of any representative local monitoring. The choice of baseline concentration will be considered further if the impact of the Facility cannot be screened out as 'insignificant'.

3.5.6 Dioxins, furans and polychlorinated biphenyl (PCBs)

Dioxins, furans and PBCs are monitored on a quarterly basis at a number of urban and rural stations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) network. There are no monitoring locations within 10 km of the Facility. The closest site is Manchester Law Courts.

A summary of dioxin and furan and PCB concentrations from all monitoring sites across the UK is presented in Table 8 and Table 9. Note that monitoring data for dioxins and furans is only available up to the end of 2016 from the UK-Air website. For PCBs data is only available up to the end of 2018 from the UK-Air website.

Table 8:TOMPS – Dioxin and Furans Monitoring

Site	Annual mean concentration (fgTEQ/m³)				
	2012	2013	2014	2015	2016
Auchencorth Moss	0.13	0.86	0.01	0.01	0.13
Hazelrigg	8.75	2.02	2.61	5.27	4.59

Site	Annual mean concentration (fgTEQ/m³)				
	2012	2013	2014	2015	2016
High Muffles	4.32	0.6	1.07	0.54	2.73
London Nobel House	15.42	3.47	2.89	4.34	21.27
Manchester Law Courts	32.99	10.19	16.52	5.94	12.23
Weybourne	9.3	2.34	1.61	1.42	16.32

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Table 9:TOMPS – PCB Monitoring

Site	Annual mean concentration (pg/m³)				
	2014	2015	2016	2017	2018
Auchencorth Moss	23.23	24.27	25.32	19.09	12.31
Hazelrigg	25.84	41.68	52.58	33.15	22.22
High Muffles	26.11	33.43	37.76	31.63	8.86
London Nobel House	107.49	121.39	110.46	121.87	46.63
Manchester Law Courts	128.93	97.99	92.6	97.27	40.1
Weybourne	17	20.95	38.61	32.26	11.23

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As shown, the concentrations vary significantly between sites and years. As there are no monitoring sites located within close proximity of the Facility or any mapped background datasets, the maximum monitored concentration from the past 5 years has been used as the background concentration within this assessment. These values are 32.99 fg/TEQ/m³ for dioxins and furans and 128.93 pg/m³ for PCBs.

3.5.7 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) are monitored at a number of stations in the UK as part of the PAH network. There are no monitoring locations within 10 km of the Facility. The closest site is Nottingham Centre.

For the purpose of this assessment, benzo(a)pyrene is considered as this is the only PAH which an AQAL has been set. A summary of benzo(a)pyrene concentrations from all urban background monitoring sites within England and Wales is presented in Table 10.

Table 10: National Monitoring - Benzo(a)pyrene

Site Type	Quantity	AQAL (ng/m³)	Annual mean concentration (ng/m³)				
			2016	2017	2018	2019	2020
All Urban Background	Min	0.25	<0.01	<0.01	<0.01	<0.01	<0.01
	Max		0.35	0.60	0.36	0.28	0.50
	Average		0.15	0.22	0.16	0.15	0.19

Source: © Crown 2022 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

As shown, although the average monitored concentrations fall below the AQAL, the maximum monitored concentrations exceed the AQAL at a number years and urban background sites. The AQAL goes beyond the requirement of the European Directive (Commission Decision 2004/107/EC) which sets a target value of 1 ng/m^3. None of the maximum monitored urban background sites exceeded this value. In lieu of any local monitoring of PAHs or any mapped background datasets, the maximum of the England and Wales average concentration from any urban background site has been used. This is 0.60 ng/m^3, recorded at Nottingham Centre in 2016. The choice of background concentration will be investigated further if the process contribution is greater than 1% of the AQAL in accordance with the assessment methodology.

3.6 Summary

Table 11 outlines the values for the annual average baseline concentrations that have been used to evaluate the impact of the Facility. The choice of baseline concentration will be considered further if the impact of the Facility cannot be screened out as 'insignificant'.

Table 11: Summary of Baseline Concentrations

Pollutant	Annual mean concentration	Units	Justification
Nitrogen dioxide	18.54	µg/m^3	Maximum mapped background concentration within modelling domain (2018 Defra dataset)
Sulphur dioxide	5.61	µg/m^3	Maximum mapped background concentration within modelling domain (2001 Defra dataset)
Particulate matter (as PM_{10})	18.83	µg/m^3	Maximum mapped background concentration within modelling domain (2018 Defra dataset)
Particulate matter (as $PM_{2.5}$)	11.80	µg/m^3	
Carbon monoxide	390	µg/m^3	Maximum mapped background concentration within modelling domain (2001 Defra dataset)
Hydrogen chloride	0.71	µg/m^3	Maximum monitored concentration across the UK 2011 to 2015
Hydrogen fluoride	2.35	µg/m^3	Maximum measured concentration from EPAQS report
Ammonia	3.68	µg/m^3	Maximum concentration recorded at Sutton Bonnington UKEAP site (between 2016 and 2020)
Benzene	0.67	µg/m^3	Maximum mapped background concentration within modelling domain (2001 Defra dataset)
1,3-butadiene	0.27	µg/m^3	
Mercury	2.80	ng/m^3	Maximum UK monitored concentration at any background site between 2016 and 2020
Cadmium	0.57	ng/m^3	
Arsenic	1.10	ng/m^3	
Chromium	39.00	ng/m^3	
Cobalt	0.92	ng/m^3	

Pollutant	Annual mean concentration	Units	Justification
Copper	33.00	ng/m³	
Lead	20.00	ng/m³	
Manganese	36.00	ng/m³	
Nickel	2.70	ng/m³	
Vanadium	1.70	ng/m³	
Antimony	1.30	ng/m³	The maximum monitored at any background site from the last year this was monitored (2013)
Dioxins and furans	32.99	fg/m³	Maximum UK monitored concentration between 2012 and 2016
Polychlorinated biphenyl (PCBs)	128.93	pg/m³	Maximum UK monitored concentration between 2014 and 2018
Benzo(a)pyrene (PAHs)	0.960	ng/m³	Maximum monitored 2016 to 2020 at any England and Wales urban background site

3.7 Baseline conditions at ecological sites

The Air Pollution Information System (APIS) database sets out the baseline concentrations on a grid across the UK. Atmospheric concentrations of oxides of nitrogen and sulphur dioxide are provided on a 1km x 1km grid whilst ammonia concentrations, nitrogen deposition and sulphur deposition are provided on a 5 km x 5 km grid. Data is provided for the maximum across the ecological site. This data is the from 2018 to 2020 average presented on APIS.

Table 12: APIS Data for Ecological Sites

ID	Site	Maximum concentration (µg/m³)		
		Oxides of nitrogen	Sulphur dioxide	Ammonia
	Annual mean Critical Level	**30**	**10 / 20**	**1 / 3**
ER1	Beacon Hill, Hangingstone and Out Woods	14.43	1.65	2.99
ER2	Morley Quarry	12.93	1.44	2.96
ER3	White Horse Wood	12.85	1.44	2.96
ER4	Holywell Wood	17.63	1.54	2.80
ER5	Burleigh Wood	14.43	1.54	2.80
ER6	Charley Woodland	14.38	1.44	2.96
ER7	Iveshead	12.82	1.44	2.96
ER8	Morely Lane Field	12.93	1.44	2.96

ID	Site	Maximum concentration (µg/m³)		
		Oxides of nitrogen	Sulphur dioxide	Ammonia
ER9	Hermitage Estate	20.59	1.27	2.54
ER10	Nanpantan Hall Wood	13.17	1.54	2.80
ER11	Home Farm Wood	14.38	1.44	2.96
ER12	Nanpantan Reservoir	14.43	1.54	2.80
ER13	Buck Hill	13.17	1.54	2.80
ER14	Charley Road Fields	12.82	1.44	2.96
ER15	High Ground/British Piece	19	1.44	2.96
ER16	Longcliffe Golf Course	18.95	1.44	2.96
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	12.82	1.44	2.96
ER18	Little Garendon and Garendon Oaks	12.93	1.44	2.96
ER19	Blackbrook Reservoir Fields	12.19	1.44	2.96
ER20	Abbey Road Grassland and Woodland	12.82	1.44	2.96
ER21	Booth Wood	14.85	1.54	2.80
ER22	Black Brook	12.82	1.44	2.96
ER23	Five Tree Plantation	14.38	1.44	2.96

Source: APIS

As shown the baseline data presented in APIS shows that concentrations of oxides of nitrogen and sulphur dioxide are below the Critical Level at all sites. Concentrations of ammonia exceed the lower Critical Level applicable for lichen sensitive communities at all sites but are below the higher Critical Level for non-lichen sensitive communities at all sites.

Table 13: APIS data for Ecological Sites - Deposition

ID	Site	Habitat type	N deposition	Acid N deposition	Acid S deposition
			kgN/ha/yr	keqN/ha/yr	keqS/ha/yr
ER1	Beacon Hill, Hangingstone and Out Woods	Woodland	44.4	3.20	0.30
ER2	Morley Quarry	Grassland	25.34	1.81	0.27
		Woodland	44.10	3.15	0.33
ER3	White Horse Wood	Woodland	44.10	3.15	0.33
ER4	Holywell Wood	Woodland	40.74	2.91	0.21
ER5	Burleigh Wood	Woodland	40.74	2.91	0.21

ID	Site	Habitat type	N deposition	Acid N deposition	Acid S deposition
			kgN/ha/yr	keqN/ha/yr	keqS/ha/yr
ER6	Charley Woodland	Woodland	44.10	3.15	0.33
ER7	Iveshead	Grassland	25.34	1.81	0.27
ER8	Morley Lane Field	Grassland	25.34	1.81	0.27
ER9	Hermitage Estate	Grassland	20.86	1.49	0.16
		Woodland	37.10	2.65	0.20
ER10	Nanpantan Hall Wood	Woodland	40.74	2.91	0.21
ER11	Home Farm Wood	Woodland	44.10	3.15	0.33
ER12	Nanpantan Reservoir	Grassland	23.10	1.65	0.17
ER13	Buck Hill	Grassland	23.10	1.65	0.17
		Woodland	40.74	2.91	0.21
ER14	Charley Road Fields	Grassland	25.34	1.81	0.27
ER15	High Ground/British Piece	Woodland	44.10	3.15	0.33
ER16	Longcliffe Golf Course	Grassland	25.34	1.81	0.27
		Woodland	44.10	3.15	0.33
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	Grassland	25.34	1.81	0.27
		Woodland	44.10	3.15	0.33
ER18	Little Garendon and Garendon Oaks	Woodland	44.10	3.15	0.33
ER19	Blackbrook Reservoir Fields	Grassland	25.34	-	-
ER20	Abbey Road Grassland and Woodland	Grassland	25.34	1.81	0.27
		Woodland	44.10	3.15	0.33
ER21	Booth Wood	Woodland	40.74	2.91	0.21
ER22	Black Brook	Woodland	44.10	3.15	0.33
ER23	Five Tree Plantation	Woodland	44.10	3.15	0.33

Source: APIS

The values presented in the preceding tables are grid square averaged values based provided as a rolling 3-year mean and are derived from a mixture of interpolation from measured data, and modelled data as set out in APIS. The APIS explains that the use of a 3-year mean has been demonstrated to be a suitable time period to smooth out some of the inter-annual variations in deposition which occur due to the natural variability in annual weather patterns.

4 Sensitive Receptors

As part of this assessment, the predicted process contribution (PC) at the point of maximum impact and a number of sensitive receptors has been evaluated.

4.1 Human sensitive receptors

The human sensitive receptors identified for assessment are displayed in Figure 2 (Appendix A) and listed in Table 34 of Appendix B. These are the same human receptors which were used in the 2018 AQA. They include the closest residential properties in each wind direction, along with any schools and hospitals identified within 3 km of the Facility. The receptors remain appropriate and there have been no new residential receptors identified. However, Table 34 is not an exhaustive list of receptor, so reference has also been made to the distribution of emissions where areas of public exposure may not be captured by the specific receptors listed above.

4.2 Ecological sensitive receptors

A study was undertaken to identify the following sites of ecological importance in accordance with the following screening distances laid out in the Air Emissions Guidance:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Ramsar sites within 10 km of the Facility.
- Sites of Special Scientific Interest (SSSIs) within 2 km of the Facility; and
- National Nature Reserves (NNR), Local Nature Reserves (LNRs), local wildlife sites (LWS) and ancient woodlands within 2 km of the Facility.

The sensitive ecological receptors used for the purpose of this assessment have included the same receptors used for the 2018 AQA, (including additional receptors included within the 2018 AQA Schedule 5 response) and include the sites included within the EA habitats screening assessment. The ecological receptors used within this assessment are displayed in Figure 3 (Appendix A) and are listed in Table 14. In addition to those listed are two SSSIs – Newhurst Quarry and Iveshead. However, as both of these sites are designated for geological reasons, and as such are not sensitive to air pollution and have not been considered further in this assessment.

A review of the citation and APIS website for each site has been undertaken to determine if lichens or bryophytes are an important part of the ecosystem's integrity. If lichens or bryophytes are present, the more stringent Critical Level has been applied as part of the assessment.

Table 14: Ecological Sensitive Receptors

ID	Site	Designation	Closest point to site		Distance from stack at closest point (km)	Lichens/ bryo-phytes present
			X (m)	Y (m)		
UK designated sites						
ER1	Beacon Hill, Hangingstone and Out Woods	SSSI	450866	317263	2.1	Yes
Locally designated sites						
ER2	Morley Quarry	LNR/LWS	447600	317900	1.3	Yes*

ID	Site	Designation	Closest point to site		Distance from stack at closest point (km)	Lichens/ bryo-phytes present
			X (m)	Y (m)		
ER3	White Horse Wood	AW/LWS	447107	318353	1.8	Yes*
ER4	Holywell Wood	AW/LWS	450600	318200	1.7	Yes*
ER5	Burleigh Wood	LWS	450579	317633	1.7	Yes*
ER6	Charley Woodland	LWS	449400	316500	1.5	Yes*
ER7	Iveshead	LWS	448021	317085	1.2	Yes*
ER8	Morley Lane Field	LWS	447700	317900	1.2	Yes*
ER9	Hermitage Estate	LWS	448900	320100	2.2	Yes*
ER10	Nanpantan Hall Wood	LWS	450000	316900	1.5	Yes*
ER11	Home Farm Wood	LWS	449900	316600	1.7	Yes*
ER12	Nanpantan Reservoir	LWS	450700	317000	2.0	Yes*
ER13	Buck Hill	LWS	450700	316300	2.4	Yes*
ER14	Charley Road Fields	LWS	447300	316700	2.0	Yes*
ER15	High Ground/British Piece	LWS	448400	316500	1.5	Yes*
ER16	Longcliffe Golf Course	LWS	449120	317496	0.5	Yes*
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	LWS	447798	316401	1.9	Yes*
ER18	Little Garendon and Garendon Oaks	LWS	447004	317141	2.0	Yes*
ER19	Blackbrook Reservoir Fields	LWS	446700	317100	2.3	Yes*
ER20	Abbey Road Grassland and Woodland	LWS	447059	316739	2.2	Yes*
ER21	Booth Wood	LWS	450691	319281	2.3	Yes*
ER22	Black Brook	LWS	447504	316396	2.1	Yes*
ER23	Five Tree Plantation	LWS	449425	316617	1.4	Yes*

Notes:

*No information on lichen/bryophytes presence available but their presence has been presumed as a conservative measure.

5 Modelling Methodology

The latest variation to the EP was based on the results of the 2018 AQA. However, pre-operational (PO) condition 7 of the EP required that a review of the final design parameters against those which formed the basis of the 2018 AQA was undertaken. In response to PO7, a note was produced by SLR (SLR Ref No. 422.10589.00002, June 2020) which looked at the sensitivities of the 2018 AQA results, to conclude that the final design parameters would not result in any significant worsening changes to the results to the 2018 AQA. No additional modelling was carried out. Therefore, the impact for the Proposed Facility have been compared to the impact of modelling based on the inputs from the 2018 AQA.

5.1 Selection of model

Detailed dispersion modelling was undertaken using the model ADMS 5.2, developed and supplied by Cambridge Environmental Research Consultants (CERC) This is a new generation dispersion model, which characterises the atmospheric boundary layer in terms of the atmospheric stability and the boundary layer height. In addition, the model uses a skewed Gaussian distribution for dispersion under convective conditions, to take into account the skewed nature of turbulence. The model also includes modules to take account of the effect of buildings and complex terrain.

ADMS is routinely used for modelling of emissions for planning and environmental permitting purposes to the satisfaction of the EA and local authorities. The maximum predicted concentration for each pollutant and averaging period has been used to determine the significance of any potential impacts.

5.2 Source and emissions data

The principal inputs to the model with respect to the process emissions to air from the Proposed Facility is presented in Table 15 and Table 16. The emissions data has been provided by the technology provider (which provides an update from the 2018 AQA parameters). This is based on the Proposed Facility having a total thermal input of 128.9 MW. Assuming the waste has an NVC of 9 MJ/kg, this equates to 51.95 tonnes per hour (tph), operating at 102% MCR for 8.760 hours per annum. This equates to a throughput of 455,000 tonnes per annum (tpa).

Table 15: Stack Source Data

Item	Unit	Value
Stack data		
Height	m	96.5
Internal diameter	m	2.4
Stack location	m, m	448885,317913
Flue gas conditions		
Temperature	°C	132
Exit moisture content	% v/v	19.1%
Exit oxygen content	% v/v dry	6.6%
Reference oxygen content	% v/v dry	11.0%
Volume at reference conditions (dry, ref O_2)	Nm^3/s	72.0
Volume at actual conditions	Am^3/s	91.5

Item	Unit	Value
Exit velocity	m/s	20.23

The existing EP includes emission limits for emissions to air based on the IED. For the purpose of this assessment, it has been assumed that the same emission limits will apply – i.e. no allowance has been made to the future reduction in emission limits which will need to come through as part of the implementation of the Waste Incineration BREF[6]. This means that the results presented are conservative as actual impacts in future will be lower.

Table 16: Stack Emissions Data

Pollutant	Conc. (mg/Nm³)		Release rate (g/s)	
	Daily or periodic	Half-hourly	Daily or periodic	Half-hourly
Oxides of nitrogen (as NO_2)	200	400	14.400	28.800
Sulphur dioxide	50	200	3.600	14.400
Carbon monoxide	50	150	3.600	10.800
Fine Particulate Matter (PM)(2)	10	30	0.720	2.160
Hydrogen chloride	10	60	0.720	4.320
Volatile organic compounds (as TOC)	10	20	0.720	1.440
Hydrogen fluoride	1	4	0.070	0.290
Ammonia	10	-	0.720	-
Cadmium and thallium	0.05	-	3.600 mg/s	-
Mercury	0.05	-	3.600 mg/s	-
Other metals(3)	0.5	-	36.000 mg/s	-
Dioxins and furans	0.1 ng/Nm³	-	7.200 ng/s	-
Benzo(a)pyrene (PaHs)(4)	0.2 µg/Nm³	-	14.400 µg/s	-
PCBs(5)	0.005	-	0.360 mg/s	-

Notes:

All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K.

(1) Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.

(2) As a worst-case it has been assumed that the entire PM emissions consist of either PM_{10} or $PM_{2.5}$ for comparison with the relevant AQALs.

(3) Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).

(4) The maximum concentration of BaP recorded at a UK plant is 0.2 µg/Nm³ (2019 Waste Incineration BREF, Figure 8.121). This is assumed to be the emission concentration for the Proposed Facility.

[6] Best Available Techniques (BAT) Reference Document for Waste Incineration - 2019

Pollutant	Conc. (mg/Nm³)		Release rate (g/s)	
	Daily or periodic	Half-hourly	Daily or periodic	Half-hourly
(5) Table 3.8 of the 2006 Waste Incineration BREF states that the annual average total PCBs is less than 0.005 mg/Nm³ (dry, 11% oxygen, 273K). In lieu of other available operational data, this has been assumed to be the emission concentration for the Proposed Facility. If the Proposed Facility continually operated at the half-hourly limits, the daily limits would be exceeded. The Proposed Facility has been designed to achieve the daily limits and as such will only operate at the short-term limits for short periods on rare occasions.				

5.3 Other model inputs

5.3.1 Modelling domain

Modelling has been undertaken over a 6 km x 6 km grid with a spatial resolution of 45 m. The grid spacing in each direction has been chosen to be less than 1.5 times the minimum stack height considered in accordance with the EA's modelling guidance, and to provide accurate results close to the stack. Reference should be made to Figure 4 (Appendix A) for a graphical representation of the modelling domain used. The extent of the modelling domain is detailed in Table 17.

Table 17: Modelling Domain

Parameter	Value
Grid spacing (m)	45
Grid points	135
Grid Start X (m)	445885
Grid Finish X (m)	451915
Grid Start Y (m)	314885
Grid Finish Y (m)	320915

5.3.2 Meteorological data and surface characteristics

The impact of meteorological data was taken into account by using weather data from East Midlands Airport meteorological station for the years 2015 – 2019. East Midlands Airport is approximately 9 km to the north-west of the Proposed Facility and is the closest and most representative meteorological station available. The difference in elevation between East Midlands Airport and the Proposed Facility is only 2 m, and missing data percentages are less than 2% for all parameters. The 2018 AQA also used meteorological data from East Midlands Airport, although used data from between 2009 and 2013.

The EA recommends that 5 years of data are used to take into account inter-annual fluctuations in weather conditions. Wind roses for each year are presented in Figure 5(Appendix A).

The minimum Monin-Obukhov length can be selected in ADMS for both the dispersion site and the meteorological site. This is a measure of the minimum stability of the atmosphere and can be adjusted to account for urban heat island effects which prevent the atmosphere in urban areas from ever becoming completely stable. The minimum Monin-Obukhov length for the dispersion site has been set to the model default of 1 m, suitable for rural areas. This is deemed appropriate due to the majority of the land surrounding the Facility, especially across the prevailing wind path,

is rural open fields. The meteorological site also uses a minim Monin-Obukhov length of 1 m due to similar land use in the surrounding area.

The model has used a variable surface roughness file. This alters the surface roughness across the modelling domain according to the land use, using surface roughness data provided by Corine land cover data across the same grid and resolution as that used for terrain and presented in Table 18. A visual representation of the surface roughness file used is provided in Figure 6(Appendix A). Using a variable surface roughness file is useful to incorporate the variation in land use and surface roughness surrounding the Facility. The surface roughness value for the meteorological site has been entered at 0.3 m, as this best represents the open fields and rural surroundings of this location. The sensitivity of the modelling to the choice of surface roughness has been considered in Section 6.1.

5.3.3 Terrain

It is recommended that, where gradients within 500 m of the modelling domain are greater than 1 in 10, the complex terrain module within ADMS (FLOWSTAR) should be used. A review of the local area has deemed that the effect of terrain should be taken into account in the modelling.

A terrain file large enough to cover the output grid of points was created using Ordnance Survey Terrain 50 data. The parameters of the terrain files used are outlined in Table 18. Reference should be made to Figure 7 (Appendix A) for a graphical representation of the terrain file used. The sensitivity of the modelling to the use of terrain has been considered in Section 6.1

Table 18: Terrain File Parameters

Parameter	Value
Grid Start X	445000
Grid Finish X	453000
Grid Start Y	314000
Grid Finish Y	322000
Resolution	64 x 64

5.3.4 Buildings

The presence of adjacent buildings can significantly affect the dispersion of the atmospheric emissions in various ways:

- Wind blowing around a building distorts the flow and creates zones of turbulence. The increased turbulence can cause greater plume mixing.
- The rise and trajectory of the plume may be depressed slightly by the flow distortion. This downwash leads to higher ground level concentrations closer to the stack than those which would be present without the building.

The EA recommends that buildings should be included in the modelling if they are both:

- Within 5L of the stack (where L is the smaller of the building height and maximum projected width of the building); and
- Taller than 40% of the stack.

The ADMS 5.2 user guide also states that buildings less than one third of the stack height will not have any effect on dispersion.

The ADMS dispersion model works by combining the inputted individual buildings into a single effective building for each wind direction. A review of the site layout has been undertaken and a building sensitivity analysis undertaken. The results of this concluded that the most representative building layout to use within the model is as presented in Table 19 and Figure 8 (Appendix A).

Table 19: Building Details

Buildings	Centre point		Height (m)	Width (m)	Length (m)	Angle (°)
	X (m)	Y (m)				
Representative building	448900	317953	46.6	73	119	79.5

5.4 Chemistry

The Facility will release nitric oxide (NO) and nitrogen dioxide (NO_2) which are collectively referred to as NOx. In the atmosphere, nitric oxide will be converted to nitrogen dioxide in a reaction with ozone which is influenced by solar radiation. Since the AQALs are expressed in terms of nitrogen dioxide, it is important to be able to assess the conversion rate of nitric oxide to nitrogen dioxide.

Ground level NOx concentrations have been predicted through dispersion modelling. Nitrogen dioxide concentrations reported in the results section assume 70% conversion from NOx to nitrogen dioxide for annual means and a 35% conversion for short term (hourly) concentrations, based upon the worst-case scenario in the EA methodology. Given the short travel time to the areas of maximum concentrations, this approach is considered conservative.

5.5 Baseline concentrations

Background concentrations for the assessment have been derived from monitoring and national mapping as presented in section 3. For short term averaging periods, the background concentration has been assumed to be twice the long-term ambient concentration following the Air Emissions Guidance methodology.

5.6 Permitted Facility

A comparison model has been run in order to compare the impact to the previously consented scheme. Table 20 sets out the emissions parameters as stated in the 2018 AQA.

Table 20: Stack Source Data – Permitted Facility

Item	Unit	Value
Stack data		
Height	m	90
Internal diameter	m	2.7
Stack location	m, m	448885,317913
Flue gas conditions		
Temperature	°C	135
Exit moisture content	% v/v	18.02%
Exit oxygen content	% v/v dry	7.99%
Reference oxygen content	% v/v dry	11.00%

Item	Unit	Value
Volume at reference conditions (dry, ref O_2)	Nm^3/s	89.3
Volume at actual conditions	Am^3/s	125.0
Exit velocity	m/s	21.8

Table 21: Stack Emissions Data – 2018 AQA

Pollutant	Conc. (mg/Nm³)		Release rate (g/s)	
	Daily or periodic	Half-hourly	Daily or periodic	Half-hourly
Oxides of nitrogen (as NO_2)	200	400	17.860	35.72
Sulphur dioxide	50	200	4.465	17.86
Carbon monoxide	50	150	4.465	13.40
Fine Particulate Matter (PM)(2)	10	30	0.893	2.68
Hydrogen chloride	10	60	0.893	5.36
Volatile organic compounds (as TOC)	10	20	0.893	1.79
Hydrogen fluoride	1	4	0.089	0.36
Ammonia	10	-	0.893	-
Cadmium and thallium	0.05	-	4.465 mg/s	-
Mercury	0.05	-	4.465 mg/s	-
Other metals(3)	0.5	-	44.650 mg/s	-
Dioxins and furans	0.1 ng/Nm³	-	8.930 ng/s	-
Benzo(a)pyrene (PaHs)(4)	0.2 µg/Nm³	-	17.860 µg/s	-
PCBs(5)	0.005	-	0.446 mg/s	-

Notes:

All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K.

(1) Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.

(2) As a worst-case it has been assumed that the entire PM emissions consist of either PM_{10} or $PM_{2.5}$ for comparison with the relevant AQALs.

(3) Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).

(4) The maximum concentration of BaP recorded at a UK plant is 0.2 µg/Nm³ (2019 Waste Incineration BREF, Figure 8.121). This is assumed to be the emission concentration for the Proposed Facility.

(5) Table 3.8 of the 2006 Waste Incineration BREF states that the annual average total PCBs is less than 0.005 mg/Nm³ (dry, 11% oxygen, 273K). In lieu of other available operational data, this has been assumed to be the emission concentration for the Proposed Facility.

Table 20 shows that the volumetric flow rate used within the 2018 AQA is higher than that currently proposed. It is likely that the volumetric flow rate used within the 2018 AQA was calculated conservatively in lieu of the details from the technology provider.

6 Sensitivity Analysis

6.1 Surface roughness

The sensitivity of the results to using spatially varying surface roughness length has been considered by running the model without a varying surface roughness file. The sensitivity model used a surface roughness value of 0.3 m (agricultural areas maximum) for both the dispersion site and the meteorological site, which is deemed most appropriate for open fields and rural surroundings of both locations. For all sensitivity analysis the impact of changing model parameters on the maximum annual mean and short-term concentrations of oxides of nitrogen have been considered.

The following parameters were kept constant:

- Stack height – 96.5 m
- Buildings – included;
- Terrain file – included at 64 x 64 resolution;
- Meteorological site surface roughness – 0.3 m;
- Dispersion site Monin-Obukhov length – 1 m;
- Meteorological site Monin-Obukhov length – 1 m; and
- Meteorological data used – East Midlands 2019.

The contribution of the Proposed Facility to the ground level concentration of the emissions of oxides of nitrogen at the point of maximum predicted concentration is presented in Table 22.

Table 22: Surface Roughness Sensitivity Analysis

Scenario	Oxides of nitrogen PC (µg/m³)			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Using variable surface roughness file	1.13	24.93	0.97	24.53
Without using variable surface roughness file – SR 0.3 m	1.32	25.57	1.07	23.71

As shown, using a variable roughness file results in lower annual mean concentrations but higher short-term concentrations. This is a normal pattern seen when reducing the surface roughness value. This reflects that the surface roughness values provided in the surface roughness file are generally lower than the 0.3 m value used in the sensitivity model. The roughness file provides a more accurate representation of surface roughness because it varies across the modelling domain dependent on the land use, and therefore has been used within this assessment.

6.2 Building parameters

ADMS 5.2 has a buildings effects module to account for the impact of buildings when it calculates the air flow and dispersion of pollutants from a source. The model works by combining the inputted individual buildings into a single effective building for each wind direction.

The sensitivity of the results to the effect of buildings has been considered by running the model with the buildings presented in Table 19 and with no buildings at all.

The following parameters were kept constant:

- Stack height – 96.5 m;
- Terrain file – included at 64 x 64 resolution;
- Surface roughness file – included at 64 x 64 resolution;
- Meteorological site surface roughness value – 0.3 m;
- Dispersion site Monin-Obukhov length – 1 m;
- Meteorological site Monin-Obukhov length – 1 m; and
- Meteorological data used – East Midlands 2019.

Table 23 presents the ground level concentration of oxides of nitrogen at the point of maximum predicted concentration for each scenario.

Table 23: Effect of Buildings

Scenario	Oxides of nitrogen PC (µg/m³)			
	Point of maximum impact		Maximum impacted receptor	
	Annual Mean	Max 1-hour mean	Annual Mean	Max 1-hour mean
Including buildings as presented in Table 19	1.13	24.93	0.97	24.53
Excluding buildings	0.44	24.61	0.40	24.41

As shown, modelling the presence of buildings results in higher annual mean and short-term concentrations. Buildings have been included in the dispersion model as this represents a realistic and conservative approach.

6.3 Terrain

The sensitivity of the results to the effect of terrain has been considered by running the model with and without the main terrain file presented in section 5.3.3.

The following parameters were kept constant:

- Stack height – 96.5 m
- Buildings – included;
- Surface roughness file – variable included at 64 x 64 resolution;
- Meteorological site surface roughness – 0.3 m;
- Dispersion site Monin-Obukhov length – 1 m;
- Meteorological site Monin-Obukhov length – 1 m;
- Combined flue additional input file; and
- Meteorological data used – East Midlands 2019.

Table 24 presents the ground level concentration of oxides of nitrogen at the point of maximum predicted concentration for each terrain scenario.

Table 24: Effect of Terrain

Scenario	Oxides of nitrogen PC (µg/m³)			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Including terrain	1.13	24.93	0.97	24.53
Excluding terrain	1.24	23.87	1.03	23.93

As shown, including the effect of terrain has a slight decrease in the annual mean and slight increase in the maximum 1-hour concentrations at the point of maximum impact and at the maximum impacted receptor. The terrain file has been included in the dispersion model as this represents a realistic approach.

6.4 Sensitivity analysis – operating below 102% of the MCR point

Dispersion modelling has been undertaken based on the emission parameters based on 102% Maximum Continuous Rating (MCR) point. The Proposed Facility is to be operated as a commercial plant, so it is beneficial to operate at full capacity. If loading does fall below the modelled rate of 102% MCR, the volumetric flow rate and the exit velocity of the exhaust gases would reduce. The effect on this would decrease the quantity of pollutants emitted but also reduce the buoyancy of the plume due to momentum. The reduction in buoyancy, which would lead to reduced dispersion, would be more than offset by the decrease in the amount of pollutants being emitted, so that the impact of the plant when running below the design point would be reduced.

7 Impact on Human Health

7.1 Screening criteria

The EA's Air Emissions Guidance states that to screen out 'insignificant' process contributions:

- the long-term process contribution must be less than 1% of the long-term environmental standard; and
- the short-term process contribution must be less than 10% of the short-term environmental standard.

Consultation with the EA has confirmed that if the above criteria are achieved, it can be concluded that "it is not likely that emissions would lead to significant environmental impacts" and the process contributions can be screened out.

The long-term 1% process contribution threshold is based on the judgement that:

- it is unlikely that an emission at this level will make a significant contribution to air quality; and
- the threshold provides a substantial safety margin to protect health and the environment.

The short-term 10% process contribution threshold is based on the judgement that:

- spatial and temporal conditions mean that short-term process contributions are transient and limited in comparison with long-term process contributions; and
- the threshold provides a substantial safety margin to protect health and the environment.

If process contributions cannot be screened out, assessment is to be undertaken for the following:

- the predicted environmental concentration (PEC) at the point of maximum impact – defined as the process contribution plus the baseline concentration; and
- the process contribution and PEC at areas of public exposure.

In these cases, consultation with the EA has revealed that if the long term PEC is below 70% of the AQAL, or the short-term process contribution is less than 20% of the headroom[7] it can be concluded that "there is little risk of the PEC exceeding the AQAL", and the impact can be considered to be 'not significant'.

The EA guidance document 'Guidance on assessing group 3 metals stack emissions from incinerators – V.4 June 2016' ('EA metals guidance') states that where the process contribution for any metal exceeds 1% of the long term or 10% of the short term environmental standard (in this case the AQAL), this is considered to have potential for significant pollution. Where the process contribution exceeds these criteria, the PEC should be compared to the AQAL. The PEC can be screened out if is less than the AQAL. Where the impact is within these parameters it can be concluded that there is no risk of exceeding the AQAL.

[7] Calculated as the AQAL minus twice the long-term background concentration.

7.2 Results

Table 25 and Table 26 present the results of the dispersion modelling of process emissions from the Permitted Facility and the Proposed Facility at the point of maximum impact. This is a summary of the maximum predicted impact using 5-years of weather data. Detailed results tables for the Permitted Facility for each year of weather data are provided in Appendix D and in Appendix E for the Proposed Facility. Results are presented as the maximum predicted concentration based on the following:

- Modelling domain size – 6.0 x 6.0km at 45 m resolution;
- Buildings – included;
- Terrain – included at 64 x 64 resolution;
- Surface roughness – included at 64 x 64 resolution;
- Stack height – 96.5 m;
- 5 years of weather data 2015 to 2019 from East Midlands Airport meteorological recording station;
- Operation at the long term ELVs for 100% of the year;
- Operation at the short term ELVs during the worst-case conditions for dispersion of emissions (Table 26 only);
- EA's worst case conversion of NOx to nitrogen dioxide;
- The entire PM emissions are assumed to consist of either PM_{10}s or $PM_{2.5}$s.
- The entire VOC emissions are assumed to consist of either benzene or 1,3-butadiene; and
- Cadmium is released at the combined emission limit for cadmium and thallium.

The baseline concentration is taken from the review of baseline monitoring contained in section 3.

Impacts that cannot be described as 'insignificant' are highlighted. Where the impact cannot be screened out 'as 'insignificant', further analysis has been undertaken.

Table 25: Dispersion Modelling Results – Point of Maximum Impact - Daily ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	Permitted Facility		Proposed Facility				Change		
					Max PC	Max PC as % of AQAL	Max PC	Max PC as % of AQAL	Max PEC	Max PEC as % of AQAL	in PC	in PC as % of AQAL	in PC as % of Permitted Facility
Nitrogen dioxide	Annual mean	µg/m³	40	18.54	1.52	3.80%	1.11	2.76%	19.65	49.11%	-0.41	-1.03%	72.82%
	99.79th %ile of hourly means	µg/m³	200	37.08	9.90	4.95%	7.05	3.52%	44.13	22.06%	-2.85	-1.43%	71.20%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	11.22	4.54	3.63%	3.14	2.51%	14.36	11.49%	-1.40	-1.12%	69.09%
	99.73rd %ile of hourly means	µg/m³	350	11.22	7.01	2.00%	4.98	1.42%	16.20	4.63%	-2.04	-0.58%	70.94%
	99.9th %ile of 15 min. means	µg/m³	266	11.22	7.81	2.94%	5.61	2.11%	16.83	6.33%	-2.20	-0.83%	71.83%
PM_{10}	Annual mean	µg/m³	40	18.83	0.11	0.27%	0.08	0.20%	18.91	47.27%	-0.03	-0.07%	72.82%
	90.41th %ile of daily means	µg/m³	50	37.66	0.36	0.73%	0.26	0.51%	37.92	75.83%	-0.11	-0.21%	70.72%
$PM_{2.5}$	Annual mean	µg/m³	20	11.8	0.11	0.54%	0.08	0.39%	11.88	59.39%	-0.03	-0.15%	72.82%
Carbon monoxide	8 hour running mean	µg/m³	10,000	780	6.78	0.07%	4.81	0.05%	784.81	7.85%	-1.97	-0.02%	70.93%
	Hourly mean	µg/m³	30,000	780	8.51	0.03%	6.41	0.02%	786.41	2.62%	-2.10	-0.01%	75.32%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	1.70	0.23%	1.28	0.17%	2.70	0.36%	-0.42	-0.06%	75.32%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.01	0.07%	0.01	0.05%	2.36	14.74%	-0.003	-0.02%	72.82%
	Hourly mean	µg/m³	160	4.7	0.17	0.11%	0.13	0.08%	4.83	3.02%	-0.04	-0.03%	75.32%

Pollutant	Quantity	Units	AQAL	Bg conc.	Permitted Facility		Proposed Facility				Change		
					Max PC	Max PC as % of AQAL	Max PC	Max PC as % of AQAL	Max PEC	Max PEC as % of AQAL	in PC	in PC as % of AQAL	in PC as % of Permitted Facility
Ammonia	Annual mean	µg/m³	180	3.68	0.11	0.06%	0.08	0.04%	3.76	2.09%	-0.03	-0.02%	72.82%
	Hourly mean	µg/m³	2,500	7.36	1.70	0.07%	1.28	0.05%	8.64	0.35%	-0.42	-0.02%	75.32%
VOCs (as benzene)	Annual mean	µg/m³	5	0.67	0.11	2.17%	0.08	1.58%	0.75	14.98%	-0.03	-0.59%	72.82%
	Daily mean	µg/m³	30	0.67	1.14	3.80%	0.81	2.70%	1.48	4.93%	-0.33	-1.10%	71.10%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.27	0.11	4.82%	0.08	3.51%	0.35	15.51%	-0.03	-1.31%	72.82%
Mercury	Annual mean	ng/m³	250	2.8	0.54	0.22%	0.39	0.16%	3.19	1.28%	-0.15	-0.06%	72.82%
	Hourly mean	ng/m³	7,500	5.6	8.51	0.11%	6.41	0.09%	12.01	0.16%	-2.10	-0.03%	75.32%
Cadmium	Annual mean	ng/m³	5	0.57	0.54	10.85%	0.39	7.90%	0.96	19.30%	-0.15	-2.95%	72.82%
	Hourly mean	ng/m³	-	1.14	8.51	-	6.41	-	7.55	-	-2.10	-	75.32%
PAHs	Annual mean	pg/m³	250	600	2.17	0.87%	1.58	0.63%	601.58	240.63%	-0.59	-0.24%	72.82%
Dioxins	Annual mean	fg/m³	-	32.99	1.08	-	0.79	-	33.78	-	-0.29	-!	72.82%
PCBs	Annual mean	ng/m³	200	0.129	0.05	0.03%	0.04	0.02%	0.17	0.08%	-0.01	-0.01%	72.82%
	Hourly mean	ng/m³	6,000	0.258	0.85	0.01%	0.64	0.01%	0.90	0.01%	-0.21	-0.003%	75.32%
Other metals	Annual mean	ng/m³	-	-	5.42	-	3.95	-	-	-	-1.47	-	72.82%
	Daily mean	ng/m³	-	-	56.96	-	40.49	-	-	-	-16.46	-	71.10%
	Hourly mean	ng/m³	-	-	85.06	-	64.06	-	-	-	-21.00	-	75.32%

Notes:

All assessment is based on the maximum PC using all 5 years of weather data.

Assumes the Permitted and Proposed Facility operates for 100% of the time at the daily ELVs.

Table 26: Dispersion Modelling Results – Point of Maximum Impact - Short-Term ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	Permitted Facility		Proposed Facility				Change		
					Max PC	Max PC as % of AQAL	Max PC	Max PC as % of AQAL	Max PEC	Max PEC as % of AQAL	in PC	in PC as % of AQAL	in PC as % of Permitted Facility
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	37.08	19.80	9.90%	14.10	7.05%	51.18	25.59%	-5.70	-2.85%	71.20%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	11.22	28.06	8.02%	19.91	5.69%	31.13	8.89%	-8.15	-2.33%	70.94%
	99.9th %ile of 15 min. means	µg/m³	266	11.22	31.23	11.74%	22.43	8.43%	33.65	12.65%	-8.80	-3.31%	71.83%
Carbon monoxide	8 hour running mean	µg/m³	10,000	780	20.35	0.20%	14.43	0.14%	794.43	7.94%	-5.91	-0.06%	70.93%
	Hourly mean	µg/m³	30,000	780	25.52	0.09%	19.22	0.06%	799.22	2.66%	-6.30	-0.02%	75.32%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	5.10	0.68%	3.84	0.51%	5.26	0.70%	-1.26	-0.17%	75.32%
Hydrogen fluoride	Hourly mean	µg/m³	160	4.7	0.34	0.21%	0.26	0.16%	4.96	3.10%	-0.08	-0.05%	75.32%

Notes:

All assessment is based on the maximum PC using all 5 years of weather data.

Assumes the Permitted and Proposed Facility operates for 100% of the time at the half-hourly ELVs.

As shown, for the Proposed Facility, at the point of maximum impact the PC for all pollutants and averaging periods is less than 10% of the short-term AQAL and less than 1% of the annual mean AQAL when operating at the daily ELVs and can be screened out as 'insignificant', with the exception of the following:

- Annual mean nitrogen dioxide impacts;
- Annual mean VOCs impacts and
- Annual mean cadmium impacts.

At the point of maximum impact the PC for all pollutants and averaging periods is less than 10% of the short-term AQAL when operating at the half-hourly ELVs and can be screened out as 'insignificant'.

Further analysis of these pollutants, focusing on the change between the Proposed and Permitted Facility has been undertaken in the following sections. In addition, this has included additional consideration of the impact of particulate emissions in line with the WHO guideline values.

7.3 Further assessment

7.3.1 Annual mean nitrogen dioxide

As shown in Table 25, the Proposed Facility will result in a reduction in the predicted annual mean nitrogen dioxide impacts, compared to the Permitted Facility. As this reduction is greater than 1% of the AQAL, it is not 'insignificant'. Figure 9 (Appendix A) shows the contour plot of impacts. As shown, the area where the total impact is greater than 1% of the AQAL for the Proposed Facility is smaller than the Permitted Facility.

Although the modelling has shown the Proposed Facility impacts will be less than the Permitted Facility impacts, the total annual mean nitrogen dioxide impact of the Proposed Facility is still 2.76% of the AQAL at the point of maximum impact, which cannot be screened out as 'insignificant'.

As shown in Figure 9 (Appendix A) the location of the point of maximum impact is to the north-east of the facility, within agricultural fields (i.e. an area where the annual mean AQAL does not apply). Baseline concentrations in the area where the point of maximum impact occurs are likely to be similar to the mapped background concentration (i.e. 18.54 µg/m^3). Applying this baseline concentration, the PEC at the point of maximum impact would be 49.11% of the AQAL, which is well below 70% of the AQAL and therefore the impact is 'not significant'.

The impact at local residential receptors has also been investigated, the detailed results table is provided in Appendix F and spatially shown in Figure 9 (Appendix A). As shown, there are 23 of the identified sensitive receptors at which the PC exceeds 1% of the AQAL. The maximum impacted receptor is R3 (White Lodge), at which the impact is 2.03% of the AQAL. Figure 9 (Appendix A) shows there are two areas in which the impact exceeds the 1% of the AQAL; to the north east and east of the facility, which is mostly a rural area, but includes the residential receptors on Grassholme Drive, Pitsford Drive, Naseby Drive, Foxcote Drive, Belmont Way and Abberton Way; and to the south west, which is a rural area with no residential receptors. Using the mapped background concentration of 18.54 µg/m^3, the PEC at R3 is 48.38% of the AQAL, well below the 70% screening criteria. All other areas PECs are also well below 70% of the AQAL, and therefore the impact is 'not significant'.

7.3.2 Annual mean VOCs

There are two VOCs for which an AQAL has been set: benzene and 1,3-butadiene. For the purpose of this analysis it has been assumed that the entire VOC emissions consist of only benzene or 1,3-butadiene. This is a highly conservative assumption as it does not take into account the speciation of VOCs in the emissions and the modelling does not take into account the volatile nature of the compounds.

As shown in Table 25, the Proposed Facility will result in a reduction in predicted annual mean impacts compared to the Permitted Facility. The reduction for benzene is less than 1% of the AQAL, so is 'insignificant', but the reduction for 1,3-butadiene is greater than 1% of the AQAL, so is not 'insignificant'. Figure 10 and Figure 11 (Appendix A) shows the contour plot of impacts. As shown, the area where the impact is greater than 1% of the AQAL for the Proposed Facility is smaller than the Permitted Facility, for both VOCs.

The modelling has shown the impact of the Proposed Facility is less than the Permitted Facility. However, the total impact of the Proposed Facility cannot be screened out as 'insignificant' and so further analysis has been undertaken to determine the PEC.

As shown in Figure 10 and Figure 11 (Appendix A) the location of the point of maximum impact is to the north-east of the facility, within agricultural fields (i.e. an area where the annual mean AQAL does not apply). Baseline concentrations in the area where the point of maximum impact occurs are likely to be similar to the mapped background concentration (i.e. 0.67 µg/m^3 for benzene and 0.27 µg/m^3). Applying these baseline concentrations, the PECs at the point of maximum impact would be 14.98% of the AQAL for benzene and 15.51% of the AQAL for 1,3-butadiene, which is lower than 70% and therefore the impact of VOCs is 'not significant'. The impact at all other areas, including the sensitive receptors, will be lower than the point of maximum impact, so therefore will also be 'not significant'.

7.3.3 Annual mean cadmium

As shown in Table 25 the Proposed Facility will result in a reduction in predicted annual mean cadmium impacts, compared to the Permitted Facility. The reduction is greater than 1% of the AQAL, so is not 'insignificant'. Figure 12 (Appendix A) shows the contour plot of impacts. As shown, the area where the impact is greater than 1% of the AQAL for the Proposed Facility is smaller than the Permitted Facility.

The modelling has shown the Proposed Facility impacts is less than the Permitted Facility. The annual mean cadmium PC from the Proposed Facility is predicted to be 8.40% of the AQAL at the point of maximum impact, which cannot be screened out as 'insignificant'. However, this assumes that the entire cadmium and thallium emissions consist of only cadmium. The Waste Incineration BREF shows that the average concentration recorded from UK plants equipped with bag filters was 1.6 µg/Nm^3 (or 3.2% of the ELV of 0.05 mg/Nm^3), the highest recorded concentration of cadmium and thallium was 14 µg/Nm^3 (or 28% of the ELV of 0.05 mg/Nm^3) and only three lines recorded concentrations higher than 10 µg/Nm^3 (or 20% of the ELV of 0.05 mg/Nm^3).

Table 27 shows the annual mean cadmium PC at the point of maximum impact, for cadmium emitted at 100%, 50% and 3.2% of the ELV, referred to as the 'screening', 'worst case' and 'typical' scenarios.

Table 27: Cadmium impacts at the point of maximum impact

Screening (100% of ELV)		Worst-case (50% of ELV)		Typical (3.2% of ELV)	
Process Contribution (µg/m³)	% of AQAL	Process Contribution (µg/m³)	% of AQAL	Process Contribution (µg/m³)	% of AQAL
0.39	7.90%	0.20	3.95%	0.01	0.25%

As shown, under typical cadmium emissions, the point of maximum impact is less than 1% of the AQAL as is considered insignificant. The impact at all other areas, including the sensitive receptors, will be lower than the point of maximum impact, so therefore will also be 'not significant'. This is shown spatially on Figure 12 (Appendix A).

7.3.4 Particulate matter

As in section 2, the WHO recommends guidelines for particulate matter which are more stringent than those currently set in UK legislation. The Environment Act introduces a duty to set a legally binding target for $PM_{2.5}$s although to date this has not been set. For completeness, the maximum predicted impact of particulate matter has been compared to the WHO guidelines in Table 28. As shown, the maximum predicted impact is well within the 1% of the long-term guideline and 10% of the short-term guideline value from the WHO. Although the PECs are in exceedance or close to the AQAL, this is due to the high background levels, rather than the contribution from the facility, the impact from which is screened out as 'insignificant'. In addition, the assessment conservatively assumes that the entire dust emissions consist of only PM_{10} or $PM_{2.5}$s. Furthermore, as with the other pollutants, the modelling has shown the impact of the Proposed Facility is less than the Permitted Facility.

Table 28: Further Analysis of PM Impacts

Pollutant	WHO guideline (µg/m³)	Bg conc. (µg/m³)	PC at point of maximum impact		PEC (PC +Bg)	
			µg/m³	as % of AQAL	µg/m³	as % of AQAL
Annual mean						
PM_{10}	20	18.83	0.08	0.39%	18.91	94.54%
$PM_{2.5}$	10	11.80	0.08	0.79%	11.88	**118.79%**
Maximum daily mean						
PM_{10}	50	37.66	1.28	2.56%	38.94	77.88%
$PM_{2.5}$	25	23.60	1.28	5.13%	24.88	99.53%

7.3.5 Heavy metals – at the point of maximum impact

Table 29 and Table 30 detail the PC and PEC assuming that each metal is released at the combined metal ELVs respectively. If the PC is greater than 1% of the AQAL when it is assumed that each metal is emitted at the total metal ELV, further analysis has been undertaken assuming the release is no greater than the maximum monitored at an existing waste facility. The EA's metals guidance details the maximum monitored concentrations of group 3 metals emitted by Municipal Waste Incinerators and Waste Wood Co-Incinerators as a percentage of the group ELV. The maximum monitored emission presented in the EA's analysis has been used as a conservative assumption.

Table 29: Long-Term Metals Results – Point of Maximum Impact

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV (1)	Metals emitted as per EA maximum			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	6	1.10	3.95	65.81%	5.05	84.14%	5.0%	0.20	3.29%	1.30	21.62%
Antimony	5,000	1.30	3.95	0.08%	5.25	0.10%	2.3%	0.09	0.0018%	1.39	0.03%
Chromium	5,000	39.00	3.95	0.08%	42.95	0.86%	18.4%	0.73	0.01%	39.73	0.79%
Chromium (VI)	0.25	7.80	3.95	1579.4%	11.75	4699.4%	0.026%	0.0010	0.41%	7.80	3120.41%
Cobalt	-	0.92	3.95	-	4.87	-	1.1%	0.04	-	0.96	-
Copper	10,000	33.00	3.95	0.04%	36.95	0.37%	5.8%	0.23	0.002%	33.23	0.33%
Lead	250	20.00	3.95	1.58%	23.95	9.58%	10.1%	0.40	0.16%	20.40	8.16%
Manganese	150	36.00	3.95	2.63%	39.95	26.63%	12.0%	0.47	0.32%	36.47	24.32%
Nickel	20	2.70	3.95	19.74%	6.65	33.24%	44.0%	1.74	8.69%	4.44	22.19%
Vanadium	-	1.70	3.95	-	5.65	-	1.2%	0.05	-	1.75	-

Notes:
(1) Metal as maximum percentage of the group 3 ELV, as detailed in EA metals guidance document (V.4) Table A1.

Table 30: Short-Term Metals Results – Point of Maximum Impact

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV (1)	Metals emitted no worse than a currently permitted facility			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	-	2.20	64.06	-	66.26	-	5.0%	3.20	-	5.40	-
Antimony	150,000	2.60	64.06	0.04%	66.66	0.04%	2.3%	1.47	0.001%	4.07	0.003%
Chromium	150,000	78.00	64.06	0.04%	142.06	0.09%	18.4%	11.79	0.01%	89.79	0.06%
Chromium (VI)	-	15.60	64.06	-	79.66	-	0.026%	0.02	-	15.62	-
Cobalt	-	1.84	64.06	-	65.90	-	1.1%	0.72	-	2.56	-
Copper	200,000	66.00	64.06	0.03%	130.06	0.07%	5.8%	3.72	0.002%	69.72	0.03%
Lead	-	40.00	64.06	-	104.06	-	10.1%	6.44	-	46.44	-
Manganese	1,500,000	72.00	64.06	0.00%	136.06	0.01%	12.0%	7.69	0.001%	79.69	0.005%
Nickel	-	5.40	64.06	-	69.46	-	44.0%	28.19	-	33.59	-
Vanadium	1,000	3.40	40.49	4.05%	43.89	4.39%	1.2%	0.49	0.049%	3.89	0.39%

Notes:
(1) Metal as maximum percentage of the group 3 ELV, as detailed in EA metals guidance document (V.4) Table A1.

As shown in Table 29 and Table 30, if it is assumed that the entire emissions of metals consist of only one metal, the impact is greater than 1% of the long term and greater than 10% of the short term AQAL for annual mean impacts of arsenic, chromium (VI), lead, manganese, nickel and daily impacts of vanadium. The PEC is only predicted to exceed the long term AQAL for chromium (VI) using this worst-case screening assumption, and this is due to the high background concentrations. If it is assumed that the Proposed Facility would perform no worse than a currently operating facility, the PC is below 1% of the long term and 10% of the short term AQAL for all pollutants with the exception of annual mean arsenic and nickel. However, the PECs for arsenic and nickel are predicted to be below the AQALs so the impact on these pollutants can be screened out as 'insignificant'.

The results of the modelling for the Permitted Facility are included in Appendix D. The impacts of the Proposed Facility are a reduction from the impacts of the Permitted Facility.

7.4 Summary

This analysis shows that the Proposed Facility is predicted to have a lower impact that the Permitted Facility. The Proposed Facility has been modelled using more accurate emissions data, as provided by the technology provider. The data used for the Proposed Facility includes a higher stack height, which improves dispersion, and a lower volumetric flow rate, meaning that less pollutant is emitted per second from the stack.

8. Impact at Ecological Receptors

This section provides an assessment of the impact of emissions at the ecological receptors identified in Section 4.2.

8.1 Screening

The Air Emissions Guidance states that to screen out impacts as 'insignificant' at European and UK statutory designated sites:

- the long-term PC must be less than 1% of the long-term environmental standard (i.e. the Critical Level or Load); and
- the short-term PC must be less than 10% of the short-term environmental standard.

If the above criteria are met, no further assessment is required. If the long-term PC exceeds 1% of the long-term environmental standard, the PEC must be calculated and compared to the standard. If the resulting PEC is less than 70% of the long-term environmental standard, the Air Emissions Guidance states that the emissions are 'insignificant' and further assessment is not required. In accordance with the guidance, calculation of the PEC for short-term standards is not required.

The Air Emissions Guidance states further that to screen out impacts as 'insignificant' at local nature sites[8]:

- the long-term PC must be less than 100% of the long-term environmental standard; and
- the short-term PC must be less than 100% of the short-term environmental standard.

In accordance with the guidance, calculation of the PEC for local nature sites is not required. However, this has been calculated for completeness.

8.2 Methodology

8.2.1 Atmospheric emissions - Critical Levels

The impact of emissions from the Permitted Facility and Proposed Facility has been compared to the Critical Levels listed in Table 3 and the results are presented in Section 8.3.

For the purpose of the ecological assessment, the mapped background dataset from APIS has been used. If the PC is than 1% of the long-term or 10% of the short-term Critical Level further consideration will be made to the baseline concentrations.

8.2.2 Deposition of emissions - Critical Loads

In addition to the Critical Levels for the protection of ecosystems, habitat specific Critical Loads for nature conservation sites at risk from acidification and nitrogen deposition (eutrophication) are outlined in APIS.

An assessment has been made for each habitat feature identified in APIS for the specific site. The site-specific features tool has been used to identify the feature habitats. The lowest Critical Loads for each designated site have been used to ensure a robust assessment. The impact has been assessed against these Critical Load functions. Where a Critical Load function for acid deposition is

[8] Ancient woodlands, local wildlife sites and national and local nature reserves.

not available, the total nitrogen and sulphur deposition has been presented and compared with the background concentration.

APIS does not include site specific Critical Loads for locally designated sites. In lieu of this, the search by location function of APIS has been used to obtain Critical Loads based on the broad habitat type and location. The relevant Critical Loads are presented in Annex C [APIS Critical Loads].

If the impact of process emissions from the Permitted Facility and Proposed Facility upon nitrogen or acid deposition is greater than 1% of the Critical Load, further assessment has been undertaken.

8.2.3 Calculation methodology – nitrogen deposition

The impact of deposition has been assessed using the methodology detailed within the Habitats Directive AQTAG 6 (March 2014). The steps to this method are as follows.

1. Determine the annual mean ground level concentrations of nitrogen dioxide and ammonia at each site.
2. Calculate the dry deposition flux (µg/m^2/s) at each site by multiplying the annual mean ground level concentration by the relevant deposition velocity presented in Table 31.
3. Convert the dry deposition flux into units of kgN/ha/yr using the conversion factors presented in Table 31.
4. Compare this result to the nitrogen deposition Critical Load.

Table 31: Deposition Factors

Pollutant	Deposition velocity (m/s)		Conversion factor (µg/m^2/s to kg/ha/year)
	Grassland	Woodland	
Nitrogen dioxide	0.0015	0.003	96.0
Sulphur dioxide	0.0120	0.024	157.7
Ammonia	0.0200	0.030	259.7
Hydrogen chloride	0.0250	0.060	306.7

Source: AQTAG 6 (March 2014)

8.2.3.1 Acidification

Deposition of nitrogen, sulphur, hydrogen chloride and ammonia can cause acidification and should be taken into consideration when assessing the impact of the Permitted Facility and Proposed Facility.

The steps to determine the acid deposition flux are as follows.

1. Determine the dry deposition rate in kg/ha/yr of nitrogen, sulphur, hydrogen chloride and ammonia using the methodology outlined in Section 8.2.3.
2. Apply the conversion factor for N outlined in Table 31 to the nitrogen and ammonia deposition rate in kg/ha/year to determine the total keq N/ha/year.
3. Apply the conversion factor for S to the sulphur deposition rate in kg/ha/year to determine the total keq S/ha/year.
4. Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the dry keq Cl/ha/year.
5. Determine the wet deposition rate of HCl in kg/ha/yr by multiplying the model output by the factors presented in Table 32.

6. Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the wet keq Cl/ha/year.
7. Add the contribution from S to HCl dry and wet and treat this sum as the total contribution from S.
8. Plot the results against the Critical Load functions.

Table 32: Conversion Factors

Pollutant	Conversion factor (kg/ha/year to keq/ha/year)
Nitrogen	Divide by 14
Sulphur	Divide by 16
Hydrogen chloride	Divide by 35.5

Source: AQTAG (March 2014)

The March 2014 version of the AQTAG 6 document states that, for installations with an HCl emission, the PC of HCl, in addition to S and N, should be considered in the acidity Critical Load assessment. The H+ from HCl should be added to the S contribution (and treated as S in APIS tool). This should include the contribution of HCl from wet deposition.

Consultation with AQMAU confirmed that the maximum of the wet or dry deposition rate for HCl should be included in the calculation. For the purpose of this analysis it has been assumed that wet deposition of HCl is double dry deposition.

The contribution from the Permitted Facility and Proposed Facility has been calculated using APIS formula:

Where PEC N Deposition < CLminN:

PC as % of CL function = PC S deposition / CLmaxS

Where PEC N Deposition > CLminN:

PC as % of CL function = (PC S + N deposition) / CLmaxN

8.3 Results

Detailed results tables are provided in Appendix D for the Permitted Facility, Appendix E for the Proposed Facility, and Appendix G for the change in impact. Results are presented as the maximum predicted concentration based on the following:

- Stack height – 90 m for Permitted Facility and 96.5 m for Proposed Facility;
- Buildings – included;
- Terrain file – included at 64 x 64 resolution;
- Surface roughness file – included at 64 x 64 resolution;
- Meteorological site surface roughness value – 0.3 m;
- Dispersion site Monin-Obukhov length – 1 m;
- Meteorological site Monin-Obukhov length – 1 m; and
- 5 years meteorological data 2015 to 2019 from East Midlands Airport.
- Operation at the long term ELVs for 100% of the year;
- EA's worst case conversion of NOx to nitrogen dioxide;

- For the initial screening it has been assumed that the daily mean Critical Level for oxides of nitrogen is 75 µg/m^3;
- The nitrogen deposition impacts include the contribution from nitrogen dioxide and ammonia emissions;
- The acid deposition impacts include the contribution from nitrogen dioxide, ammonia, sulphur dioxide and hydrogen chloride;
- Wet deposition of HCl has been included in the acid S calculation as double dry deposition; and
- It has been assumed the most sensitive habitat is present at the point of maximum impact of emissions in each site.

As shown in Appendix G, at each of the identified ecological receptors, the change in impact is less than 1% of the long-term Critical Levels and Critical Loads and less than 10% of the short-term Critical Levels and can be screened out as 'insignificant'. Furthermore, the Proposed Facility is predicted to have a lower impact than the Permitted Facility.

Although the predicted impact of the Proposed Facility is less than the Permitted Facility, the total impact of the Proposed Facility on ecological receptors has been assessed below.

8.3.1 Further assessment

8.3.1.1 Local wildlife sites

For all local wildlife sites, the PC is less than 100% of the Critical Level and Critical Loads and can be screened out as 'insignificant' with no further assessment required.

8.3.1.2 European and UK designated sites

There is only one European or UK site within the screening distances; Beacon Hill, Hangingstone and Out Woods, which is a UK designated site (a SSSI). The Beacon Hill, Hangingstone and Out Woods SSSI covers an area to the south-west of Loughborough. There is only a small tip of it which falls within a 2 km distance from the Installation boundary (Unit 8 Nanpantan Reservoir Wood). Although the distance from the stack is 2.1 km, the site has been included for completeness noting that it is outside of the screening distances for SSSIs.

The annual mean impacts of oxides of nitrogen, sulphur dioxide and ammonia exceed 1% of the Critical Level, as do the impacts of nitrogen and acid deposition. The following table provides a summary. The detailed results tables can be found in the Appendices.

Table 33: Beacon Hill, Hangingstone and Out Woods SSSI results

Pollutant	Proposed Facility PC (as a % of CL)	Proposed Facility PEC (as a % of CL)	Change from Permitted Facility (as a % of CL)
Annual mean oxides of nitrogen	1.35%	49.45%	-0.28%
Annual mean sulphur dioxide	1.02%	17.52%	-0.21%
Annual mean ammonia	2.03%	301.03%	-0.41%
Annual mean nitrogen deposition (lower critical load)	2.40%	446.40%	-0.49%
Annual mean nitrogen deposition (upper critical load)	1.60%	297.60%	-0.33%

Pollutant	Proposed Facility PC (as a % of CL)	Proposed Facility PEC (as a % of CL)	Change from Permitted Facility (as a % of CL)
Annual mean acid deposition (lower critical load)	3.31%	189.28%	-0.67%
Annual mean acid deposition (upper critical load)	2.26%	129.49%	-0.46%

As shown, although the predicted impact of the Proposed Facility cannot be screened out as insignificant, the predicted impact is lower than the Permitted Facility. Where the PEC is predicted to exceed the Critical Level or Load, this is exceeded due to the baseline.

9 Conclusions

This Dispersion Modelling Assessment has been undertaken to support an application for a variation to the EP for the Facility. As this is a variation to an existing permitted process a comparison has been made to the impact of the Permitted Facility. To ensure that a direct comparison is being made between the Proposed Facility and Permitted Facility dispersion modelling has been carried out for both. This has been undertaken based on the assumption that for both scenarios the Facility will operate continually at the emission limits prescribed in the existing EP.

This assessment has included a review of baseline pollution levels, dispersion modelling of emissions and quantification of the impact of these emissions on local air quality.

The primary conclusions of the assessment are presented below.

1. In relation to the impact on human health:
    a. The Proposed Facility will result in a reduction in air quality impacts as compared to the Permitted Facility.
    b. Emissions from the operation of the Proposed Facility will not cause a breach of any AQAL.
    c. The impacts of the Proposed Facility are assessed as insignificant.
    d. There is no risk of exceeding an AQAL for any metal either on a long or short-term basis.
2. In relation to the impact on ecologically sensitive sites:
    a. For all local wildlife sites, the PC is less than 100% of the Critical Level and Critical Loads and can be screened out as 'insignificant'.
    b. For European and UK designated ecological receptors, although the predicted impact of the Proposed Facility cannot be screened out as insignificant, the predicted impact is lower than the Permitted Facility, and where the PEC is predicted to exceed the Critical Level or Load, this is exceeded due to the baseline.

As such there should be no air quality constraint in granting a variation to the existing EP for the increased throughput as proposed.

Annexes

A Figures

B List of human receptors

Table 34: Human Sensitive Receptors

ID	Location		Distance from the stack (m)
	X (m)	Y (m)	
R1	449463	318026	589
R2	449910	318443	1,154
R3	449421	319058	1,264
R4	450126	318426	1,342
R5	450128	318474	1,364
R6	450182	318513	1,429
R7	450199	318636	1,499
R8	450300	318585	1,567
R9	450295	318520	1,535
R10	450261	318673	1,572
R11	450346	318537	1,589
R12	450305	318692	1,620
R13	450225	318707	1,557
R14	450252	318823	1,642
R15	450274	318876	1,690
R16	450320	318794	1,683
R17	450368	318748	1,702
R18	450395	318707	1,706
R19	450409	318653	1,694
R20	450482	318631	1,751
R21	450487	318721	1,794
R22	450300	318951	1,755
R23	450521	318951	1,937
R24	450535	318816	1,881
R25	450589	318736	1,892
R26	450550	318360	1,724
R27	449903	317592	1,067
R28	450378	317517	1,544
R29	450368	317428	1,560
R30	450433	317319	1,659
R31	450533	317386	1,730
R32	450555	317193	1,818
R33	450167	316899	1,634
R34	450419	316715	1,946

ID	Location		Distance from the stack (m)
	X (m)	Y (m)	
R35	449525	316168	1,859
R36	449118	316439	1,492
R37	449096	316667	1,264
R38	447753	316449	1,851
R39	447311	316349	2,219
R40	447156	316285	2,375
R41	448592	317042	919
R42	448507	317209	800
R43	448572	317617	431
R44	448471	317625	504
R45	448335	317716	584
R46	447936	317770	959
R47	447401	317557	1,526
R48	447321	319310	2,097
R49	447809	319616	2,014
R50	448478	319653	1,787
R51	448338	318953	1,175
R52	448009	318575	1,098
R53	447404	317709	1,495
R54	447401	317818	1,487
R55	447432	317974	1,455
R56	447478	318163	1,429
R57	447277	318063	1,615
R58	447206	318143	1,695
R59	447090	318234	1,824
R60	447094	318023	1,795
R61	447561	318252	1,367
R62	447646	318246	1,283
R63	448016	318234	926
R64	448094	318168	832
R65	448086	318240	864
R66	448115	318246	839
R67	448231	318217	721
R68	448377	318386	694
R69	448741	318550	653
R70	448876	318310	397

ID	Location		Distance from the stack (m)
	X (m)	Y (m)	
R71	448559	318165	412
R72	448971	318455	549
R73	448795	318374	470
R74	448266	318327	745
R75	448128	318333	865

C APIS Critical Loads

Table 35: Nitrogen Deposition Critical Loads

ID	Site	Species/Habitat Type	Broad Habitat	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Maximum Background (kgN/ha/yr)
ER1	Beacon Hill, Hangingstone and Out Woods	Woodland	Broadleaved Mixed and Yew Woodland	10	15	44.4
ER2	Morley Quarry	Grassland	Alpine and subalpine grasslands	5	10	25.34
		Woodland	Broadleaved deciduous woodland	10	20	44.10
ER3	White Horse Wood Ancient Woodland	Woodland	Broadleaved deciduous woodland	10	20	44.10
ER4	Holywell Wood Ancient Woodland	Woodland	Broadleaved deciduous woodland	10	20	40.74
ER5	Burleigh Wood	Woodland	Broadleaved deciduous woodland	10	20	40.74
ER6	Charley Woodland	Woodland	Broadleaved deciduous woodland	10	20	44.10
ER7	Iveshead	Grassland	Heath	10	20	25.34
ER8	Morley Lane Field	Grassland	Heath	10	20	25.34
ER9	Hermitage Estate	Grassland	Alpine and subalpine grasslands	5	10	20.86
		Woodland	Broadleaved deciduous woodland	10	20	37.10
ER10	Nanpantan Hall Wood	Woodland	Broadleaved deciduous woodland	10	20	40.74
ER11	Home Farm Wood	Woodland	Broadleaved deciduous woodland	10	20	44.1
ER12	Nanpantan Reservoir	Grassland	Alpine and subalpine grasslands	5	10	23.10
ER13	Buck Hill	Grassland	Alpine and subalpine grasslands	5	10	23.10
		Woodland	Broadleaved deciduous woodland	10	20	40.74
ER14	Charley Road Fields	Grassland	Alpine and subalpine grasslands	5	10	25.34

ID	Site	Species/Habitat Type	Broad Habitat	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Maximum Background (kgN/ha/yr)
ER15	High Ground/British Piece	Woodland	Broadleaved deciduous woodland	10	20	44.10
ER16	Longcliffe Golf Course	Grassland	Alpine and subalpine grasslands	5	10	25.34
		Woodland	Broadleaved deciduous woodland	10	20	44.1
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	Grassland	Alpine and subalpine grasslands	5	10	25.34
		Woodland	Broadleaved deciduous woodland	10	20	44.1
ER18	Little Garendon and Garendon Oaks	Woodland	Broadleaved deciduous woodland	10	20	44.1
ER19	Blackbrook Reservoir Fields	Grassland	Valley mires, poor fens and transition mires	10	15	25.34
ER20	Abbey Road Grassland and Woodland	Grassland	Alpine and subalpine grasslands	5	10	25.34
		Woodland	Broadleaved deciduous woodland	10	20	44.1
ER21	Booth Wood	Woodland	Broadleaved deciduous woodland	10	20	40.74
ER22	Black Brook	Woodland	Broadleaved deciduous woodland	10	20	44.1
ER23	Five Tree Plantation	Woodland	Broadleaved deciduous woodland	10	20	44.1

Table 36: Acid Deposition Critical Loads

ID	Site	Species/Habitat Type	Acidity Class	Critical Load Function (keq/ha/yr)			Maximum Background (keq/ha/yr)	
				CLminN	CLmaxN	CLmaxS	Nitrogen	Sulphur
ER1	Beacon Hill, Hangingstone and Out Woods	Woodland	Broadleaved Mixed and Yew Woodland	0.14	1.88	1.53	3.20	0.30
				0.38	2.75	2.61		
ER2	Morley Quarry	Grassland	Acid Grassland	0.44	1.32	0.88	1.81	0.27
		Woodland	Broadleaved/coniferous unmanaged woodland	1.87	0.36	1.52	3.15	0.33
ER3	White Horse Wood Ancient Woodland	Woodland	Broadleaved/coniferous unmanaged woodland	0.14	2.74	2.59	3.15	0.33
ER4	Holywell Wood Ancient Woodland	Woodland	Broadleaved/coniferous unmanaged woodland	0.14	2.75	2.60	2.91	0.21
ER5	Burleigh Wood	Woodland	Broadleaved/coniferous unmanaged woodland	0.14	2.75	2.61	2.91	0.21
ER6	Charley Woodland	Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.88	1.53	3.15	0.33
ER7	Iveshead	Grassland	Acid Grassland	0.44	1.32	0.88	1.81	0.27
ER8	Morley Lane Field	Grassland	Acid Grassland	0.44	1.32	0.88	1.81	0.27
ER9	Hermitage Estate	Grassland	Acid Grassland	0.22	1.10	0.09	1.49	0.16
		Woodland	Broadleaved/coniferous unmanaged woodland	0.14	2.73	2.59	2.65	0.20
ER10	Nanpantan Hall Wood	Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.89	1.53	2.91	0.21
ER11	Home Farm Wood	Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.88	1.53	3.15	0.33
ER12	Nanpantan Reservoir	Grassland	Acid Grassland	0.22	1.11	0.89	1.65	0.17

ID	Site	Species/Habitat Type	Acidity Class	Critical Load Function (keq/ha/yr)			Maximum Background (keq/ha/yr)	
				CLminN	CLmaxN	CLmaxS	Nitrogen	Sulphur
ER13	Buck Hill	Grassland	Acid Grassland	0.44	1.33	0.89	1.65	0.17
		Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.89	1.53	2.91	0.21
ER14	Charley Road Fields	Grassland	Acid Grassland	0.44	1.32	0.88	1.81	0.27
ER15	High Ground/British Piece	Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.88	1.53	3.15	0.33
ER16	Longcliffe Golf Course	Grassland	Acid Grassland	0.44	1.32	0.88	1.81	0.27
		Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.88	1.52	3.15	0.33
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	Grassland	Acid Grassland	0.44	1.32	0.88	1.81	0.27
		Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.88	1.53	3.15	0.33
ER18	Little Garendon and Garendon Oaks	Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.87	1.52	3.15	0.33
ER19	Blackbrook Reservoir Fields*	Grassland	Fen Marsh and Swamp	-	-	-	-	-
ER20	Abbey Road Grassland and Woodland	Grassland	Acid Grassland	0.44	1.32	0.88	0.44	1.32
		Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.88	1.53	0.36	1.88
ER21	Booth Wood	Woodland	Broadleaved/coniferous unmanaged woodland	0.14	2.74	2.60	0.14	2.74
ER22	Black Brook	Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.88	1.53	0.36	1.88
ER23	Five Tree Plantation	Woodland	Broadleaved/coniferous unmanaged woodland	0.36	1.88	1.53	0.36	1.88

ID	Site	Species/Habitat Type	Acidity Class	Critical Load Function (keq/ha/yr)			Maximum Background (keq/ha/yr)	
				CLminN	CLmaxN	CLmaxS	Nitrogen	Sulphur
*Not sensitive to acidity								

D Detailed results tables – Permitted Facility

Table 37: Dispersion Modelling Results – Permitted Facility– Point of Maximum Impact - Daily ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	PC at point of maximum impact						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2015	2016	2017	2018	2019	Max			
Nitrogen dioxide	Annual mean	µg/m³	40	18.54	1.52	0.94	1.22	0.92	1.07	1.52	3.80%	20.06	50.15%
	99.79th%ile of hourly means	µg/m³	200	37.08	9.90	9.42	9.66	9.50	9.44	9.90	4.95%	46.98	23.49%
Sulphur dioxide	99.18th%ile of daily means	µg/m³	125	11.22	4.54	3.17	3.73	3.89	3.01	4.54	3.63%	15.76	12.61%
	99.73rd%ile of hourly means	µg/m³	350	11.22	7.01	6.65	6.85	6.68	6.66	7.01	2.00%	18.23	5.21%
	99.9th%ile of 15 min. means	µg/m³	266	11.22	7.81	7.59	7.66	7.64	7.51	7.81	2.94%	19.03	7.15%
PM_{10}	Annual mean	µg/m³	40	18.83	0.11	0.07	0.09	0.07	0.08	0.11	0.27%	18.94	47.35%
	90.41th%ile of daily means	µg/m³	50	37.66	0.36	0.25	0.32	0.24	0.29	0.36	0.73%	38.02	76.05%
$PM_{2.5}$	Annual mean	µg/m³	20	11.8	0.11	0.07	0.09	0.07	0.08	0.11	0.54%	11.91	59.54%
Carbon monoxide	8 hour running mean	µg/m³	10000	780	6.56	6.78	6.40	6.31	6.26	6.78	0.07%	786.78	7.87%
	Hourly mean	µg/m³	30000	780	7.91	8.21	8.41	8.51	8.01	8.51	0.03%	788.51	2.63%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	1.58	1.64	1.68	1.70	1.60	1.70	0.23%	3.12	0.42%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.01	0.01	0.01	0.01	0.01	0.01	0.07%	2.36	14.76%
	Hourly mean	µg/m³	160	4.7	0.16	0.16	0.17	0.17	0.16	0.17	0.11%	4.87	3.04%
Ammonia	Annual mean	µg/m³	180	3.68	0.11	0.07	0.09	0.07	0.08	0.11	0.06%	3.79	2.10%

Pollutant	Quantity	Units	AQAL	Bg conc.	PC at point of maximum impact						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2015	2016	2017	2018	2019	Max			
	Hourly mean	µg/m³	2500	7.36	1.58	1.64	1.68	1.70	1.60	1.70	0.07%	9.06	0.36%
VOCs (as benzene)	Annual mean	µg/m³	5	0.67	0.11	0.07	0.09	0.07	0.08	0.11	2.17%	0.78	15.57%
	Daily mean	µg/m³	30	0.67	1.14	0.87	0.81	0.98	0.72	1.14	3.80%	1.81	6.03%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.27	0.11	0.07	0.09	0.07	0.08	0.11	4.82%	0.38	16.82%
Mercury	Annual mean	ng/m³	250	2.8	0.54	0.34	0.44	0.33	0.38	0.54	0.22%	3.34	1.34%
	Hourly mean	ng/m³	7500	5.6	7.91	8.21	8.41	8.51	8.01	8.51	0.11%	14.11	0.19%
Cadmium	Annual mean	ng/m³	5	0.57	0.54	0.34	0.44	0.33	0.38	0.54	10.85%	1.11	22.25%
	Hourly mean	ng/m³	-	1.14	7.91	8.21	8.41	8.51	8.01	8.51	-	9.65	-
PAHs	Annual mean	pg/m³	250	600	2.17	1.35	1.74	1.32	1.53	2.17	0.87%	602.17	240.87%
Dioxins	Annual mean	fg/m³	-	32.99	1.08	0.67	0.87	0.66	0.76	1.08	-	34.07	-
PCBs	Annual mean	ng/m³	200	0.12893	0.05	0.03	0.04	0.03	0.04	0.05	0.03%	0.18	0.09%
	Hourly mean	ng/m³	6000	0.25786	0.79	0.82	0.84	0.85	0.80	0.85	0.01%	1.11	0.02%
Other metals	Annual mean	ng/m³	-	-	3.37	4.36	3.30	3.82	5.42	3.37	See metals assessment – Table 39 and Table 40		
	Daily mean	ng/m³	-	-	43.43	40.50	48.80	35.85	56.96	43.43			
	Hourly mean	ng/m³	-	-	82.08	84.08	85.06	80.09	85.06	82.08			

Note:

All assessment is based on the maximum PC using all 5 years of weather data.

Table 38: Dispersion Modelling Results – Permitted Facility Point of Maximum Impact - Short-Term ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	PC at point of maximum impact						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2015	2016	2017	2018	2019	Max			
Nitrogen dioxide	99.79th%ile of hourly means	µg/m³	200	37.08	19.80	18.85	19.33	19.00	18.87	19.80	9.90%	56.88	28.44%
Sulphur dioxide	99.73rd%ile of hourly means	µg/m³	350	11.22	28.06	26.62	27.41	26.73	26.65	28.06	8.02%	39.28	11.22%
	99.9th%ile of 15 min. means	µg/m³	266	11.22	31.23	30.36	30.62	30.57	30.05	31.23	11.74%	42.45	15.96%
Carbon monoxide	8 hour running mean	µg/m³	10000	780	19.69	20.35	19.21	18.92	18.78	20.35	0.20%	800.35	8.00%
	Hourly mean	µg/m³	30000	780	23.72	24.62	25.23	25.52	24.03	25.52	0.09%	805.52	2.69%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	4.74	4.92	5.05	5.10	4.81	5.10	0.68%	6.52	0.87%
Hydrogen fluoride	Hourly mean	µg/m³	160	4.7	0.32	0.33	0.34	0.34	0.32	0.34	0.21%	5.04	3.15%
Note: All assessment is based on the maximum PC using all 5 years of weather data and operation at the short-term ELVs.													

Table 39: Long-Term Metals Results – Permitted Facility - Point of Maximum Impact

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV (1)	Metals emitted as per EA maximum			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	6	1.10	5.42	90.38%	6.52	108.71%	5.0%	0.27	4.52%	1.37	22.85%
Antimony	5,000	1.30	5.42	0.11%	6.72	0.13%	2.3%	0.12	0.00%	1.42	0.03%
Chromium	5,000	39.00	5.42	0.11%	44.42	0.89%	18.4%	1.00	0.02%	40.00	0.80%
Chromium (VI)	0.25	7.80	5.42	2169.1%	13.22	5289.1%	0.0%	0.00	0.56%	7.80	3120.56%
Cobalt	-	0.92	5.42	-	6.34	-	1.1%	0.06	-	0.98	-
Copper	10,000	33.00	5.42	0.05%	38.42	0.38%	5.8%	0.31	0.003%	33.31	0.33%
Lead	250	20.00	5.42	2.17%	25.42	10.17%	10.1%	0.55	0.22%	20.55	8.22%
Manganese	150	36.00	5.42	3.62%	41.42	27.62%	12.0%	0.65	0.43%	36.65	24.43%
Nickel	20	2.70	5.42	27.11%	8.12	40.61%	44.0%	2.39	11.93%	5.09	25.43%
Vanadium	0	1.70	5.42	-	7.12	-	1.2%	0.07	-	1.77	-

Notes:
(1) Metal as maximum percentage of the group 3 ELV, as detailed in EA metals guidance document (V.4) Table A1.

Table 40: Short-Term Metals Results –Permitted Facility - Point of Maximum Impact

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV (1)	Metals emitted no worse than a currently permitted facility			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	-	2.20	85.06	-	87.26	-	5.0%	4.25	-	6.45	-
Antimony	150,000	2.60	85.06	0.06%	87.66	0.06%	2.3%	1.96	0.001%	4.56	0.00%
Chromium	150,000	78.00	85.06	0.06%	163.06	0.11%	18.4%	15.65	0.01%	93.65	0.06%
Chromium (VI)	-	15.60	85.06	-	100.66	-	0.026%	0.02	-	15.62	-
Cobalt	-	1.84	85.06	-	86.90	-	1.1%	0.95	-	2.79	-
Copper	200,000	66.00	85.06	0.04%	151.06	0.08%	5.8%	4.93	0.002%	70.93	0.04%
Lead	-	40.00	85.06	-	125.06	-	10.1%	8.56	-	48.56	-
Manganese	1,500,000	72.00	85.06	0.01%	157.06	0.01%	12.0%	10.21	0.001%	82.21	0.005%
Nickel	-	5.40	85.06	-	90.46	-	44.0%	37.43	-	42.83	-
Vanadium	1,000	3.40	56.96	5.70%	60.36	6.04%	1.2%	0.68	0.068%	4.08	0.41%

Notes:
(1) Metal as maximum percentage of the group 3 ELV, as detailed in EA metals guidance document (V.4) Table A1.

Table 41: Impact at Ecological Sites – Permitted Facility

Site ID	Site name	Site designation	Lichen Sensitive	Pollutant impacts as a % of CL					
				Annual mean NOx	Daily mean NOx	Annual mean SO_2	Weekly mean HF	Daily mean HF	Annual mean NH_3
Critical level (µg/m³)				**30**	**75****	**10 / 20**	**0.5**	**5**	**1**
ER1	Beacon Hill, Hangingstone and Out Woods	SSSI/AW	Yes	**1.63%**	5.50%	**1.22%**	1.91%	0.41%	**2.44%**
ER2	Morley Quarry	LNR/LWS	Yes*	0.88%	9.52%	0.33%	2.00%	0.71%	1.32%
ER3	White Horse Wood	AW/LWS	Yes*	0.65%	5.47%	0.24%	1.09%	0.41%	0.97%
ER4	Holywell Wood	AW/LWS	Yes*	2.66%	7.61%	1.00%	2.89%	0.57%	3.99%
ER5	Burleigh Wood	LWS	Yes*	2.49%	8.37%	0.93%	2.83%	0.63%	3.73%
ER6	Charley Woodland	LWS	Yes*	0.63%	8.59%	0.24%	1.58%	0.64%	0.95%
ER7	Iveshead	LWS	Yes*	2.47%	14.46%	0.92%	6.05%	1.08%	3.70%
ER8	Morley Lane Field	LWS	Yes*	0.96%	10.38%	0.36%	2.22%	0.78%	1.44%
ER9	Hermitage Estate	LWS	Yes*	0.87%	4.86%	0.33%	1.17%	0.36%	1.30%
ER10	Nanpantan Hall Wood	LWS	Yes*	1.01%	8.80%	0.38%	1.53%	0.66%	1.52%
ER11	Home Farm Wood	LWS	Yes*	0.66%	5.22%	0.25%	1.05%	0.39%	0.99%
ER12	Nanpantan Reservoir	LWS	Yes*	1.15%	5.44%	0.43%	1.53%	0.41%	1.72%
ER13	Buck Hill	LWS	Yes*	0.58%	5.40%	0.22%	0.91%	0.41%	0.87%
ER14	Charley Road Fields	LWS	Yes*	1.51%	7.89%	0.57%	3.06%	0.59%	2.27%
ER15	High Ground/British Piece	LWS	Yes*	0.88%	10.69%	0.33%	3.26%	0.80%	1.32%
ER16	Longcliffe Golf Course	LWS	Yes*	0.33%	5.08%	0.12%	0.92%	0.38%	0.49%
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	LWS	Yes*	1.15%	9.47%	0.43%	3.33%	0.71%	1.73%
ER18	Little Garendon and Garendon Oaks	LWS	Yes*	1.29%	7.85%	0.48%	3.45%	0.59%	1.93%
ER19	Blackbrook Reservoir Fields	LWS	Yes*	1.04%	5.97%	0.39%	2.83%	0.45%	1.56%

Site ID	Site name	Site designation	Lichen Sensitive	Pollutant impacts as a % of CL					
				Annual mean NOx	Daily mean NOx	Annual mean SO_2	Weekly mean HF	Daily mean HF	Annual mean NH_3
ER20	Abbey Road Grassland and Woodland	LWS	Yes*	1.47%	7.73%	0.55%	2.88%	0.58%	2.20%
ER21	Booth Wood	LWS	Yes*	1.97%	6.95%	0.74%	2.09%	0.52%	2.96%
ER22	Black Brook	LWS	Yes*	1.16%	7.41%	0.43%	3.09%	0.56%	1.73%
ER23	Five Tree Plantation	LWS	Yes*	0.70%	8.21%	0.26%	1.79%	0.62%	1.05%

Note:

*No information on lichen/bryophytes presence available but their presence has been presumed as a conservative measure for the ammonia Critical Level. For the sulphur dioxide Critical Level, 20 has been used as advised by APIS.

**Daily mean impacts have been compared to the Critical Level of 75 µg/m^3 as a screening noting that the Critical Level of 200 µg/m^3 is more appropriate.

Table 42: Annual Mean PC used for Deposition Analysis- Permitted Facility

ID	Site	Annual mean PC (ng/m^3)			
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia
ER1	Beacon Hill, Hangingstone and Out Woods	342.2	122.2	24.4	24.4
ER2	Morley Quarry	184.3	65.8	13.2	13.2
ER3	White Horse Wood	136.4	48.7	9.7	9.7
ER4	Holywell Wood	558.0	199.3	39.9	39.9
ER5	Burleigh Wood	522.6	186.6	37.3	37.3
ER6	Charley Woodland	132.5	47.3	9.5	9.5
ER7	Iveshead	517.8	184.9	37.0	37.0
ER8	Morley Lane Field	201.2	71.8	14.4	14.4
ER9	Hermitage Estate	182.3	65.1	13.0	13.0
ER10	Nanpantan Hall Wood	212.3	75.8	15.2	15.2

ID	Site	Annual mean PC (ng/m³)			
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia
ER11	Home Farm Wood	138.8	49.6	9.9	9.9
ER12	Nanpantan Reservoir	240.8	86.0	17.2	17.2
ER13	Buck Hill	122.3	43.7	8.7	8.7
ER14	Charley Road Fields	317.4	113.4	22.7	22.7
ER15	High Ground/British Piece	184.1	65.8	13.2	13.2
ER16	Longcliffe Golf Course	69.2	24.7	4.9	4.9
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	241.9	86.4	17.3	17.3
ER18	Little Garendon and Garendon Oaks	270.0	96.4	19.3	19.3
ER19	Blackbrook Reservoir Fields	219.0	78.2	15.6	15.6
ER20	Abbey Road Grassland and Woodland	308.0	110.0	22.0	22.0
ER21	Booth Wood	414.2	147.9	29.6	29.6
ER22	Black Brook	242.6	86.7	17.3	17.3
ER23	Five Tree Plantation	147.7	52.7	10.5	10.5

Table 43: Deposition Calculation – Grassland – Permitted Facility

ID	Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
ER1	Beacon Hill, Hangingstone and Out Woods	0.05	0.23	0.37	0.13	0.18	0.01	0.03
ER2	Morley Quarry	0.03	0.12	0.20	0.07	0.09	0.01	0.01
ER3	White Horse Wood	0.02	0.09	0.15	0.05	0.07	0.01	0.01
ER4	Holywell Wood	0.08	0.38	0.61	0.21	0.29	0.02	0.04
ER5	Burleigh Wood	0.08	0.35	0.57	0.19	0.27	0.02	0.04
ER6	Charley Woodland	0.02	0.09	0.15	0.05	0.07	0.00	0.01
ER7	Iveshead	0.07	0.35	0.57	0.19	0.27	0.02	0.04
ER8	Morley Lane Field	0.03	0.14	0.22	0.07	0.10	0.01	0.01
ER9	Hermitage Estate	0.03	0.12	0.20	0.07	0.09	0.01	0.01
ER10	Nanpantan Hall Wood	0.03	0.14	0.23	0.08	0.11	0.01	0.02
ER11	Home Farm Wood	0.02	0.09	0.15	0.05	0.07	0.01	0.01
ER12	Nanpantan Reservoir	0.03	0.16	0.26	0.09	0.12	0.01	0.02
ER13	Buck Hill	0.02	0.08	0.13	0.05	0.06	0.00	0.01
ER14	Charley Road Fields	0.05	0.21	0.35	0.12	0.16	0.01	0.02
ER15	High Ground/British Piece	0.03	0.12	0.20	0.07	0.09	0.01	0.01
ER16	Longcliffe Golf Course	0.01	0.05	0.08	0.03	0.04	0.00	0.01
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	0.03	0.16	0.26	0.09	0.12	0.01	0.02
ER18	Little Garendon and Garendon Oaks	0.04	0.18	0.30	0.10	0.14	0.01	0.02
ER19	Blackbrook Reservoir Fields	0.03	0.15	0.24	0.08	0.11	0.01	0.02

ID	Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
ER20	Abbey Road Grassland and Woodland	0.04	0.21	0.34	0.11	0.16	0.01	0.02
ER21	Booth Wood	0.06	0.28	0.45	0.15	0.21	0.02	0.03
ER22	Black Brook	0.03	0.16	0.27	0.09	0.12	0.01	0.02
ER23	Five Tree Plantation	0.02	0.10	0.16	0.05	0.08	0.01	0.01

Table 44: Deposition Calculation – Woodland – Permitted Facility

ID	Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
ER1	Beacon Hill, Hangingstone and Out Woods	0.10	0.46	0.90	0.19	0.29	0.02	0.05
ER2	Morley Quarry	0.05	0.25	0.48	0.10	0.16	0.01	0.03
ER3	White Horse Wood	0.04	0.18	0.36	0.08	0.12	0.01	0.02
ER4	Holywell Wood	0.16	0.75	1.47	0.31	0.47	0.03	0.09
ER5	Burleigh Wood	0.15	0.71	1.37	0.29	0.44	0.03	0.08
ER6	Charley Woodland	0.04	0.18	0.35	0.07	0.11	0.01	0.02
ER7	Iveshead	0.15	0.70	1.36	0.29	0.44	0.03	0.08
ER8	Morley Lane Field	0.06	0.27	0.53	0.11	0.17	0.01	0.03
ER9	Hermitage Estate	0.05	0.25	0.48	0.10	0.15	0.01	0.03
ER10	Nanpantan Hall Wood	0.06	0.29	0.56	0.12	0.18	0.01	0.03
ER11	Home Farm Wood	0.04	0.19	0.36	0.08	0.12	0.01	0.02
ER12	Nanpantan Reservoir	0.07	0.33	0.63	0.13	0.20	0.01	0.04
ER13	Buck Hill	0.04	0.17	0.32	0.07	0.10	0.01	0.02
ER14	Charley Road Fields	0.09	0.43	0.83	0.18	0.27	0.02	0.05
ER15	High Ground/British Piece	0.05	0.25	0.48	0.10	0.16	0.01	0.03
ER16	Longcliffe Golf Course	0.02	0.09	0.18	0.04	0.06	0.00	0.01
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	0.07	0.33	0.64	0.13	0.20	0.01	0.04
ER18	Little Garendon and Garendon Oaks	0.08	0.36	0.71	0.15	0.23	0.02	0.04
ER19	Blackbrook Reservoir Fields	0.06	0.30	0.58	0.12	0.18	0.01	0.03

ID	Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
ER20	Abbey Road Grassland and Woodland	0.09	0.42	0.81	0.17	0.26	0.02	0.05
ER21	Booth Wood	0.12	0.56	1.09	0.23	0.35	0.02	0.07
ER22	Black Brook	0.07	0.33	0.64	0.14	0.20	0.01	0.04
ER23	Five Tree Plantation	0.04	0.20	0.39	0.08	0.12	0.01	0.02

Table 45: Detailed Results – Nitrogen Deposition – Permitted Facility

ID	Site name	Broad Habitat	Lower CL	Upper CL	Background	PC impacts as a % of CL		PEC	
						% of Lower CL	% of Upper CL	% of Lower CL	% of Upper CL
ER1	Beacon Hill, Hangingstone and Out Woods	Broadleaved Mixed and Yew Woodland	10	15	44.40	**2.9%**	**1.9%**	**446.9%**	**297.9%**
ER2	Morley Quarry	Alpine and subalpine grasslands	5	10	25.34	1.9%	0.9%	508.7%	254.3%
		Broadleaved deciduous woodland	10	20	44.10	1.6%	0.8%	442.6%	221.3%
ER3	White Horse Wood	Broadleaved deciduous woodland	10	20	44.10	1.2%	0.6%	442.2%	221.1%
ER4	Holywell Wood	Broadleaved deciduous woodland	10	20	40.74	4.7%	2.4%	412.1%	206.1%
ER5	Burleigh Wood	Broadleaved deciduous woodland	10	20	40.74	4.4%	2.2%	411.8%	205.9%
ER6	Charley Woodland	Broadleaved deciduous woodland	10	20	44.10	1.1%	0.6%	442.1%	221.1%
ER7	Iveshead	Heath	10	20	25.34	2.7%	1.3%	256.1%	128.0%
ER8	Morley Lane Field	Heath	10	20	25.34	1.0%	0.5%	254.4%	127.2%
ER9	Hermitage Estate	Alpine and subalpine grasslands	5	10	20.86	1.9%	0.9%	419.1%	209.5%
		Broadleaved deciduous woodland	10	20	37.10	1.5%	0.8%	372.5%	186.3%
ER10	Nanpantan Hall Wood	Broadleaved deciduous woodland	10	20	40.74	1.8%	0.9%	409.2%	204.6%
ER11	Home Farm Wood	Broadleaved deciduous woodland	10	20	44.10	1.2%	0.6%	442.2%	221.1%
ER12	Nanpantan Reservoir	Alpine and subalpine grasslands	5	10	23.10	2.5%	1.2%	464.5%	232.2%
ER13	Buck Hill	Alpine and subalpine grasslands	5	10	23.10	1.3%	0.6%	463.3%	231.6%
		Broadleaved deciduous woodland	10	20	40.74	1.0%	0.5%	408.4%	204.2%
ER14	Charley Road Fields	Alpine and subalpine grasslands	5	10	25.34	3.3%	1.6%	510.1%	255.0%
ER15	High Ground/British Piece	Broadleaved deciduous woodland	10	20	44.10	1.6%	0.8%	442.6%	221.3%
ER16	Longcliffe Golf Course	Alpine and subalpine grasslands	5	10	25.34	0.7%	0.4%	507.5%	253.8%
		Broadleaved deciduous woodland	10	20	44.10	0.6%	0.3%	441.6%	220.8%

ID	Site name	Broad Habitat	Lower CL	Upper CL	Background	PC impacts as a % of CL		PEC	
						% of Lower CL	% of Upper CL	% of Lower CL	% of Upper CL
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	Alpine and subalpine grasslands	5	10	25.34	2.5%	1.2%	509.3%	254.6%
		Broadleaved deciduous woodland	10	20	44.10	2.0%	1.0%	443.0%	221.5%
ER18	Little Garendon and Garendon Oaks	Broadleaved deciduous woodland	10	20	44.10	2.3%	1.1%	443.3%	221.6%
ER19	Blackbrook Reservoir Fields	Valley mires, poor fens and transition mires	10	15	25.34	1.1%	0.8%	254.5%	169.7%
ER20	Abbey Road Grassland and Woodland	Alpine and subalpine grasslands	5	10	25.34	3.2%	1.6%	510.0%	255.0%
		Broadleaved deciduous woodland	10	20	44.10	2.6%	1.3%	443.6%	221.8%
ER21	Booth Wood	Broadleaved deciduous woodland	10	20	40.74	3.5%	1.7%	410.9%	205.4%
ER22	Black Brook	Broadleaved deciduous woodland	10	20	44.10	2.0%	1.0%	443.0%	221.5%
ER23	Five Tree Plantation	Broadleaved deciduous woodland	10	20	44.10	1.2%	0.6%	442.2%	221.1%

Table 46: Detailed Results – Acid Deposition – Permitted Facility

ID	Site name	Broad Habitat	Background		PC as a % of Min CL Function	PEC as a % of Min CL Function
			N	S		
ER1	Beacon Hill, Hangingstone and Out Woods	Broadleaved Mixed and Yew Woodland	3.20	0.30	**4.0%**	**190.0%**
ER2	Morley Quarry	Acid Grassland	1.81	0.27	1.5%	159.4%
		Broadleaved/coniferous unmanaged woodland	3.15	0.33	11.3%	986.1%
ER3	White Horse Wood	Broadleaved/coniferous unmanaged woodland	3.15	0.33	1.1%	128.3%
ER4	Holywell Wood	Broadleaved/coniferous unmanaged woodland	2.91	0.21	4.4%	118.1%
ER5	Burleigh Wood	Broadleaved/coniferous unmanaged woodland	2.91	0.21	4.2%	117.6%
ER6	Charley Woodland	Broadleaved/coniferous unmanaged woodland	3.15	0.33	1.5%	186.5%
ER7	Iveshead	Acid Grassland	1.81	0.27	4.3%	162.1%
ER8	Morley Lane Field	Acid Grassland	1.81	0.27	1.7%	159.5%
ER9	Hermitage Estate	Acid Grassland	1.49	0.16	1.8%	151.4%
		Broadleaved/coniferous unmanaged woodland	2.65	0.20	1.5%	106.0%
ER10	Nanpantan Hall Wood	Broadleaved/coniferous unmanaged woodland	2.91	0.21	2.5%	167.5%
ER11	Home Farm Wood	Broadleaved/coniferous unmanaged woodland	3.15	0.33	1.6%	186.5%
ER12	Nanpantan Reservoir	Acid Grassland	1.65	0.17	2.4%	165.9%
ER13	Buck Hill	Acid Grassland	1.65	0.17	1.0%	138.1%
		Broadleaved/coniferous unmanaged woodland	2.91	0.21	1.4%	166.5%
ER14	Charley Road Fields	Acid Grassland	1.81	0.27	2.6%	160.5%
ER15	High Ground/British Piece	Broadleaved/coniferous unmanaged woodland	3.15	0.33	2.1%	187.0%
ER16		Acid Grassland	1.81	0.27	0.6%	158.4%

ID	Site name	Broad Habitat	Background		PC as a % of Min CL Function	PEC as a % of Min CL Function
			N	S		
	Lubcloud Farm (for Lubcloud fields, alder and willow)	Broadleaved/coniferous unmanaged woodland	3.15	0.33	0.8%	186.4%
ER17	Little Garendon and Garendon Oaks	Acid Grassland	1.81	0.27	2.0%	159.8%
		Broadleaved/coniferous unmanaged woodland	3.15	0.33	2.8%	187.6%
ER18	Blackbrook Reservoir Fields	Not sensitive to acidity	-	-	3.2%	188.9%
ER19	Abbey Road Grassland and Woodland	Acid Grassland	1.81	0.27	-	-
ER20	Abbey Road Grassland and Woodland	Broadleaved/coniferous unmanaged woodland	3.15	0.33	2.6%	160.4%
ER21	Booth Wood	Broadleaved/coniferous unmanaged woodland	2.91	0.21	3.6%	188.4%
ER22	Black Brook	Broadleaved/coniferous unmanaged woodland	3.15	0.33	3.3%	117.3%
ER23	Five Tree Plantation	Broadleaved/coniferous unmanaged woodland	3.15	0.33	2.8%	187.6%

E Detailed results tables – Proposed Facility

Table 47: Dispersion Modelling Results – Proposed Facility– Point of Maximum Impact - Daily ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	PC at point of maximum impact						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2015	2016	2017	2018	2019	Max			
Nitrogen dioxide	Annual mean	µg/m³	40	18.54	1.11	0.70	0.91	0.69	0.79	1.11	2.76%	19.65	49.11%
	99.79th%ile of hourly means	µg/m³	200	37.08	7.05	6.76	6.85	6.84	6.85	7.05	3.52%	44.13	22.06%
Sulphur dioxide	99.18th%ile of daily means	µg/m³	125	11.22	3.14	2.24	2.61	2.81	2.11	3.14	2.51%	14.36	11.49%
	99.73rd%ile of hourly means	µg/m³	350	11.22	4.98	4.79	4.83	4.85	4.84	4.98	1.42%	16.20	4.63%
	99.9th%ile of 15 min. means	µg/m³	266	11.22	5.61	5.41	5.44	5.52	5.49	5.61	2.11%	16.83	6.33%
PM_{10}	Annual mean	µg/m³	40	18.83	0.08	0.05	0.06	0.05	0.06	0.08	0.20%	18.91	47.27%
	90.41th%ile of daily means	µg/m³	50	37.66	0.26	0.18	0.22	0.18	0.21	0.26	0.51%	37.92	75.83%
$PM_{2.5}$	Annual mean	µg/m³	20	11.8	0.08	0.05	0.06	0.05	0.06	0.08	0.39%	11.88	59.39%
Carbon monoxide	8 hour running mean	µg/m³	10,000	780	4.71	4.81	4.49	4.52	4.48	4.81	0.05%	784.81	7.85%
	Hourly mean	µg/m³	30,000	780	6.41	6.05	5.84	6.12	6.23	6.41	0.02%	786.41	2.62%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	1.28	1.21	1.17	1.22	1.25	1.28	0.17%	2.70	0.36%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.01	0.00	0.01	0.00	0.01	0.01	0.05%	2.36	14.74%
	Hourly mean	µg/m³	160	4.7	0.13	0.12	0.12	0.12	0.12	0.13	0.08%	4.83	3.02%
Ammonia	Annual mean	µg/m³	180	3.68	0.08	0.05	0.06	0.05	0.06	0.08	0.04%	3.76	2.09%

Pollutant	Quantity	Units	AQAL	Bg conc.	PC at point of maximum impact						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2015	2016	2017	2018	2019	Max			
	Hourly mean	µg/m³	2,500	7.36	1.28	1.21	1.17	1.22	1.25	1.28	0.05%	8.64	0.35%
VOCs (as benzene)	Annual mean	µg/m³	5	0.67	0.08	0.05	0.06	0.05	0.06	0.08	1.58%	0.75	14.98%
	Daily mean	µg/m³	30	0.67	0.81	0.62	0.58	0.68	0.51	0.81	2.70%	1.48	4.93%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.27	0.08	0.05	0.06	0.05	0.06	0.08	3.51%	0.35	15.51%
Mercury	Annual mean	ng/m³	250	2.8	0.39	0.25	0.32	0.25	0.28	0.39	0.16%	3.19	1.28%
	Hourly mean	ng/m³	7,500	5.6	6.41	6.05	5.84	6.12	6.23	6.41	0.09%	12.01	0.16%
Cadmium	Annual mean	ng/m³	5	0.57	0.39	0.25	0.32	0.25	0.28	0.39	7.90%	0.96	19.30%
	Hourly mean	ng/m³	-	1.14	6.41	6.05	5.84	6.12	6.23	6.41	-	7.55	-
PAHs	Annual mean	pg/m³	250	600	1.58	1.00	1.30	0.98	1.13	1.58	0.63%	601.58	240.63%
Dioxins	Annual mean	fg/m³	-	32.99	0.79	0.50	0.65	0.49	0.56	0.79	-	33.78	-
PCBs	Annual mean	ng/m³	200	0.12893	0.04	0.02	0.03	0.02	0.03	0.04	0.02%	0.17	0.08%
	Hourly mean	ng/m³	6,000	0.25786	0.64	0.61	0.58	0.61	0.62	0.64	0.01%	0.90	0.01%
Other metals	Annual mean	ng/m³	-	-	3.95	2.49	3.24	2.46	2.82	3.95	See metals assessment –Table 29 and Table 30		
	Daily mean	ng/m³	-	-	40.49	30.83	29.12	33.96	25.34	40.49			
	Hourly mean	ng/m³	-	-	64.06	60.54	58.37	61.23	62.32	64.06			

Note:

All assessment is based on the maximum PC using all 5 years of weather data.

Table 48: Dispersion Modelling Results – Proposed Facility Point of Maximum Impact - Short-Term ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	PC at point of maximum impact						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2015	2016	2017	2018	2019	Max			
Nitrogen dioxide	99.79th%ile of hourly means	µg/m³	200	37.08	14.10	13.51	13.71	13.68	13.70	14.10	7.05%	51.18	25.59%
Sulphur dioxide	99.73rd%ile of hourly means	µg/m³	350	11.22	19.91	19.14	19.33	19.41	19.37	19.91	5.69%	31.13	8.89%
	99.9th%ile of 15 min. means	µg/m³	266	11.22	22.43	21.63	21.75	22.06	21.97	22.43	8.43%	33.65	12.65%
Carbon monoxide	8 hour running mean	µg/m³	10,000	780	14.12	14.43	13.48	13.57	13.43	14.43	0.14%	794.43	7.94%
	Hourly mean	µg/m³	30,000	780	19.22	18.16	17.51	18.37	18.70	19.22	0.06%	799.22	2.66%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	3.84	3.63	3.50	3.67	3.74	3.84	0.51%	5.26	0.70%
Hydrogen fluoride	Hourly mean	µg/m³	160	4.7	0.26	0.24	0.23	0.24	0.25	0.26	0.16%	4.96	3.10%

Note:

All assessment is based on the maximum PC using all 5 years of weather data and operation at the short-term ELVs.

Table 49: Impact at Ecological Sites – Proposed Facility

Site ID	Site name	Site designation	Lichen Sensitive	Pollutant impacts as a % of CL					
				Annual mean NOx	Daily mean NOx	Annual mean SO_2	Weekly mean HF	Daily mean HF	Annual mean NH_3
Critical level (µg/m³)				**30**	**75****	**10 / 20**	**0.5**	**5**	**1**
ER1	Beacon Hill, Hangingstone and Out Woods	SSSI/AW	Yes	1.35%	4.41%	1.02%	1.57%	0.33%	2.03%
ER2	Morley Quarry	LNR/LWS	Yes*	0.74%	7.41%	0.28%	1.62%	0.56%	1.10%
ER3	White Horse Wood	AW/LWS	Yes*	0.55%	4.44%	0.21%	0.89%	0.33%	0.82%
ER4	Holywell Wood	AW/LWS	Yes*	2.18%	6.11%	0.82%	2.32%	0.46%	3.27%
ER5	Burleigh Wood	LWS	Yes*	2.05%	6.80%	0.77%	2.30%	0.51%	3.07%
ER6	Charley Woodland	LWS	Yes*	0.52%	7.03%	0.20%	1.27%	0.53%	0.79%
ER7	Iveshead	LWS	Yes*	2.02%	11.71%	0.76%	4.89%	0.88%	3.03%
ER8	Morley Lane Field	LWS	Yes*	0.80%	7.99%	0.30%	1.78%	0.60%	1.20%
ER9	Hermitage Estate	LWS	Yes*	0.72%	3.95%	0.27%	0.94%	0.30%	1.07%
ER10	Nanpantan Hall Wood	LWS	Yes*	0.84%	7.02%	0.31%	1.23%	0.53%	1.26%
ER11	Home Farm Wood	LWS	Yes*	0.55%	4.27%	0.21%	0.87%	0.32%	0.83%
ER12	Nanpantan Reservoir	LWS	Yes*	0.96%	4.39%	0.36%	1.24%	0.33%	1.44%
ER13	Buck Hill	LWS	Yes*	0.49%	4.44%	0.18%	0.75%	0.33%	0.73%
ER14	Charley Road Fields	LWS	Yes*	1.26%	6.47%	0.47%	2.51%	0.49%	1.89%
ER15	High Ground/British Piece	LWS	Yes*	0.74%	8.69%	0.28%	2.66%	0.65%	1.12%
ER16	Longcliffe Golf Course	LWS	Yes*	0.26%	4.74%	0.10%	0.67%	0.36%	0.39%
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	LWS	Yes*	0.96%	7.78%	0.36%	2.76%	0.58%	1.44%
ER18	Little Garendon and Garendon Oaks	LWS	Yes*	1.07%	6.40%	0.40%	2.87%	0.48%	1.61%
ER19	Blackbrook Reservoir Fields	LWS	Yes*	0.87%	4.95%	0.33%	2.35%	0.37%	1.30%

Site ID	Site name	Site designation	Lichen Sensitive	Pollutant impacts as a % of CL					
				Annual mean NOx	Daily mean NOx	Annual mean SO_2	Weekly mean HF	Daily mean HF	Annual mean NH_3
ER20	Abbey Road Grassland and Woodland	LWS	Yes*	1.22%	6.34%	0.46%	2.40%	0.48%	1.84%
ER21	Booth Wood	LWS	Yes*	1.62%	5.66%	0.61%	1.70%	0.42%	2.43%
ER22	Black Brook	LWS	Yes*	0.97%	6.14%	0.36%	2.56%	0.46%	1.45%
ER23	Five Tree Plantation	LWS	Yes*	0.58%	6.54%	0.22%	1.43%	0.49%	0.87%

Note:

*No information on lichen/bryophytes presence available but their presence has been presumed as a conservative measure for the ammonia Critical Level. For the sulphur dioxide Critical Level, 20 has been used as advised by APIS.

**Daily mean impacts have been compared to the Critical Level of 75 µg/m^3 as a screening noting that the Critical Level of 200 µg/m^3 is more appropriate.

Table 50: Annual Mean PC used for Deposition Analysis – Proposed Facility

ID	Site	Annual mean PC (ng/m³)			
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia
ER1	Beacon Hill, Hangingstone and Out Woods	284.4	101.6	20.3	20.3
ER2	Morley Quarry	154.6	55.2	11.0	11.0
ER3	White Horse Wood	115.4	41.2	8.2	8.2
ER4	Holywell Wood	457.9	163.5	32.7	32.7
ER5	Burleigh Wood	430.0	153.6	30.7	30.7
ER6	Charley Woodland	110.2	39.4	7.9	7.9
ER7	Iveshead	423.8	151.4	30.3	30.3
ER8	Morley Lane Field	168.0	60.0	12.0	12.0
ER9	Hermitage Estate	150.4	53.7	10.7	10.7
ER10	Nanpantan Hall Wood	176.4	63.0	12.6	12.6
ER11	Home Farm Wood	115.8	41.4	8.3	8.3
ER12	Nanpantan Reservoir	201.1	71.8	14.4	14.4
ER13	Buck Hill	102.5	36.6	7.3	7.3
ER14	Charley Road Fields	265.1	94.7	18.9	18.9
ER15	High Ground/British Piece	156.3	55.8	11.2	11.2
ER16	Longcliffe Golf Course	54.2	19.4	3.9	3.9
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	202.2	72.2	14.4	14.4
ER18	Little Garendon and Garendon Oaks	225.2	80.4	16.1	16.1
ER19	Blackbrook Reservoir Fields	182.6	65.2	13.0	13.0
ER20	Abbey Road Grassland and Woodland	257.1	91.8	18.4	18.4
ER21	Booth Wood	339.6	121.3	24.3	24.3

ID	Site	Annual mean PC (ng/m³)			
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia
ER22	Black Brook	202.9	72.5	14.5	14.5
ER23	Five Tree Plantation	122.4	43.7	8.7	8.7

Table 51: Deposition Calculation – Grassland - Proposed Facility

ID	Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
ER1	Beacon Hill, Hangingstone and Out Woods	0.04	0.19	0.31	0.11	0.15	0.01	0.02
ER2	Morley Quarry	0.02	0.10	0.17	0.06	0.08	0.01	0.01
ER3	White Horse Wood	0.02	0.08	0.13	0.04	0.06	0.00	0.01
ER4	Holywell Wood	0.07	0.31	0.50	0.17	0.24	0.02	0.03
ER5	Burleigh Wood	0.06	0.29	0.47	0.16	0.22	0.02	0.03
ER6	Charley Woodland	0.02	0.07	0.12	0.04	0.06	0.00	0.01
ER7	Iveshead	0.06	0.29	0.46	0.16	0.22	0.02	0.03
ER8	Morley Lane Field	0.02	0.11	0.18	0.06	0.09	0.01	0.01
ER9	Hermitage Estate	0.02	0.10	0.16	0.06	0.08	0.01	0.01
ER10	Nanpantan Hall Wood	0.03	0.12	0.19	0.07	0.09	0.01	0.01
ER11	Home Farm Wood	0.02	0.08	0.13	0.04	0.06	0.00	0.01
ER12	Nanpantan Reservoir	0.03	0.14	0.22	0.07	0.10	0.01	0.01
ER13	Buck Hill	0.01	0.07	0.11	0.04	0.05	0.00	0.01
ER14	Charley Road Fields	0.04	0.18	0.29	0.10	0.14	0.01	0.02
ER15	High Ground/British Piece	0.02	0.11	0.17	0.06	0.08	0.01	0.01
ER16	Longcliffe Golf Course	0.01	0.04	0.06	0.02	0.03	0.00	0.00
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	0.03	0.14	0.22	0.08	0.10	0.01	0.01
ER18	Little Garendon and Garendon Oaks	0.03	0.15	0.25	0.08	0.12	0.01	0.02
ER19	Blackbrook Reservoir Fields	0.03	0.12	0.20	0.07	0.09	0.01	0.01

ID	Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
ER20	Abbey Road Grassland and Woodland	0.04	0.17	0.28	0.10	0.13	0.01	0.02
ER21	Booth Wood	0.05	0.23	0.37	0.13	0.17	0.01	0.02
ER22	Black Brook	0.03	0.14	0.22	0.08	0.10	0.01	0.01
ER23	Five Tree Plantation	0.02	0.08	0.13	0.05	0.06	0.00	0.01

Table 52: Deposition Calculation – Woodland - Proposed Facility

ID	Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
ER1	Beacon Hill, Hangingstone and Out Woods	0.08	0.38	0.75	0.16	0.24	0.02	0.05
ER2	Morley Quarry	0.04	0.21	0.41	0.09	0.13	0.01	0.02
ER3	White Horse Wood	0.03	0.16	0.30	0.06	0.10	0.01	0.02
ER4	Holywell Wood	0.13	0.62	1.20	0.25	0.39	0.03	0.07
ER5	Burleigh Wood	0.12	0.58	1.13	0.24	0.36	0.03	0.07
ER6	Charley Woodland	0.03	0.15	0.29	0.06	0.09	0.01	0.02
ER7	Iveshead	0.12	0.57	1.11	0.24	0.36	0.03	0.07
ER8	Morley Lane Field	0.05	0.23	0.44	0.09	0.14	0.01	0.03
ER9	Hermitage Estate	0.04	0.20	0.40	0.08	0.13	0.01	0.02
ER10	Nanpantan Hall Wood	0.05	0.24	0.46	0.10	0.15	0.01	0.03
ER11	Home Farm Wood	0.03	0.16	0.30	0.06	0.10	0.01	0.02
ER12	Nanpantan Reservoir	0.06	0.27	0.53	0.11	0.17	0.01	0.03
ER13	Buck Hill	0.03	0.14	0.27	0.06	0.09	0.01	0.02
ER14	Charley Road Fields	0.08	0.36	0.70	0.15	0.22	0.02	0.04
ER15	High Ground/British Piece	0.05	0.21	0.41	0.09	0.13	0.01	0.02
ER16	Longcliffe Golf Course	0.02	0.07	0.14	0.03	0.05	0.00	0.01
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	0.06	0.27	0.53	0.11	0.17	0.01	0.03
ER18	Little Garendon and Garendon Oaks	0.06	0.30	0.59	0.13	0.19	0.01	0.04
ER19	Blackbrook Reservoir Fields	0.05	0.25	0.48	0.10	0.15	0.01	0.03

ID	Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
ER20	Abbey Road Grassland and Woodland	0.07	0.35	0.68	0.14	0.22	0.02	0.04
ER21	Booth Wood	0.10	0.46	0.89	0.19	0.29	0.02	0.05
ER22	Black Brook	0.06	0.27	0.53	0.11	0.17	0.01	0.03
ER23	Five Tree Plantation	0.04	0.17	0.32	0.07	0.10	0.01	0.02

Table 53: Detailed Results – Nitrogen Deposition- Proposed Facility

ID	Site name	Broad Habitat	Lower CL	Upper CL	Background	PC impacts as a % of CL		PEC	
						% of Lower CL	% of Upper CL	% of Lower CL	% of Upper CL
ER1	Beacon Hill, Hangingstone and Out Woods	Broadleaved Mixed and Yew Woodland	10	15	44.40	**2.4%**	**1.6%**	**446.4%**	**297.6%**
ER2	Morley Quarry	Alpine and subalpine grasslands	5	10	25.34	1.6%	0.8%	508.4%	254.2%
		Broadleaved deciduous woodland	10	20	44.10	1.3%	0.7%	442.3%	221.2%
ER3	White Horse Wood	Broadleaved deciduous woodland	10	20	44.10	1.0%	0.5%	442.0%	221.0%
ER4	Holywell Wood	Broadleaved deciduous woodland	10	20	40.74	3.9%	1.9%	411.3%	205.6%
ER5	Burleigh Wood	Broadleaved deciduous woodland	10	20	40.74	3.6%	1.8%	411.0%	205.5%
ER6	Charley Woodland	Broadleaved deciduous woodland	10	20	44.10	0.9%	0.5%	441.9%	221.0%
ER7	Iveshead	Heath	10	20	25.34	2.2%	1.1%	255.6%	127.8%
ER8	Morley Lane Field	Heath	10	20	25.34	0.9%	0.4%	254.3%	127.1%
ER9	Hermitage Estate	Alpine and subalpine grasslands	5	10	20.86	1.5%	0.8%	418.7%	209.4%
		Broadleaved deciduous woodland	10	20	37.10	1.3%	0.6%	372.3%	186.1%
ER10	Nanpantan Hall Wood	Broadleaved deciduous woodland	10	20	40.74	1.5%	0.7%	408.9%	204.4%
ER11	Home Farm Wood	Broadleaved deciduous woodland	10	20	44.10	1.0%	0.5%	442.0%	221.0%
ER12	Nanpantan Reservoir	Alpine and subalpine grasslands	5	10	23.10	2.1%	1.0%	464.1%	232.0%
ER13	Buck Hill	Alpine and subalpine grasslands	5	10	23.10	1.1%	0.5%	463.1%	231.5%
		Broadleaved deciduous woodland	10	20	40.74	0.9%	0.4%	408.3%	204.1%
ER14	Charley Road Fields	Alpine and subalpine grasslands	5	10	25.34	2.7%	1.4%	509.5%	254.8%
ER15	High Ground/British Piece	Broadleaved deciduous woodland	10	20	44.10	1.3%	0.7%	442.3%	221.2%
ER16	Longcliffe Golf Course	Alpine and subalpine grasslands	5	10	25.34	0.6%	0.3%	507.4%	253.7%
		Broadleaved deciduous woodland	10	20	44.10	0.5%	0.2%	441.5%	220.7%

ID	Site name	Broad Habitat	Lower CL	Upper CL	Background	PC impacts as a % of CL		PEC	
						% of Lower CL	% of Upper CL	% of Lower CL	% of Upper CL
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	Alpine and subalpine grasslands	5	10	25.34	2.1%	1.0%	508.9%	254.4%
		Broadleaved deciduous woodland	10	20	44.10	1.7%	0.9%	442.7%	221.4%
ER18	Little Garendon and Garendon Oaks	Broadleaved deciduous woodland	10	20	44.10	1.9%	1.0%	442.9%	221.5%
ER19	Blackbrook Reservoir Fields	Valley mires, poor fens and transition mires	10	15	25.34	0.9%	0.6%	254.3%	169.6%
ER20	Abbey Road Grassland and Woodland	Alpine and subalpine grasslands	5	10	25.34	2.6%	1.3%	509.4%	254.7%
		Broadleaved deciduous woodland	10	20	44.10	2.2%	1.1%	443.2%	221.6%
ER21	Booth Wood	Broadleaved deciduous woodland	10	20	40.74	2.9%	1.4%	410.3%	205.1%
ER22	Black Brook	Broadleaved deciduous woodland	10	20	44.10	1.7%	0.9%	442.7%	221.4%
ER23	Five Tree Plantation	Broadleaved deciduous woodland	10	20	44.10	1.0%	0.5%	442.0%	221.0%

Table 54: Detailed Results – Acid Deposition- Proposed Facility

ID	Site name	Broad Habitat	Background		PC as a % of Min CL Function	PEC as a % of Min CL Function
			N	S		
ER1	Beacon Hill, Hangingstone and Out Woods	Broadleaved Mixed and Yew Woodland	3.20	0.30	**3.3%**	**189.3%**
ER2	Morley Quarry	Acid Grassland	1.81	0.27	1.3%	159.1%
		Broadleaved/coniferous unmanaged woodland	3.15	0.33	9.5%	984.3%
ER3	White Horse Wood	Broadleaved/coniferous unmanaged woodland	3.15	0.33	0.9%	128.1%
ER4	Holywell Wood	Broadleaved/coniferous unmanaged woodland	2.91	0.21	3.6%	117.3%
ER5	Burleigh Wood	Broadleaved/coniferous unmanaged woodland	2.91	0.21	3.4%	116.8%
ER6	Charley Woodland	Broadleaved/coniferous unmanaged woodland	3.15	0.33	1.3%	186.2%
ER7	Iveshead	Acid Grassland	1.81	0.27	3.5%	161.3%
ER8	Morley Lane Field	Acid Grassland	1.81	0.27	1.4%	159.2%
ER9	Hermitage Estate	Acid Grassland	1.49	0.16	1.5%	151.1%
		Broadleaved/coniferous unmanaged woodland	2.65	0.20	1.2%	105.7%
ER10	Nanpantan Hall Wood	Broadleaved/coniferous unmanaged woodland	2.91	0.21	2.0%	167.1%
ER11	Home Farm Wood	Broadleaved/coniferous unmanaged woodland	3.15	0.33	1.3%	186.3%
ER12	Nanpantan Reservoir	Acid Grassland	1.65	0.17	2.0%	165.5%
ER13	Buck Hill	Acid Grassland	1.65	0.17	0.8%	137.9%
		Broadleaved/coniferous unmanaged woodland	2.91	0.21	1.2%	166.3%
ER14	Charley Road Fields	Acid Grassland	1.81	0.27	2.2%	160.0%
ER15	High Ground/British Piece	Broadleaved/coniferous unmanaged woodland	3.15	0.33	1.8%	186.6%
ER16	Lubcloud Farm (for Lubcloud fields, alder and willow)	Acid Grassland	1.81	0.27	0.5%	158.3%
		Broadleaved/coniferous unmanaged woodland	3.15	0.33	0.6%	186.2%

ID	Site name	Broad Habitat	Background		PC as a % of Min CL Function	PEC as a % of Min CL Function
			N	S		
ER17	Little Garendon and Garendon Oaks	Acid Grassland	1.81	0.27	1.7%	159.5%
		Broadleaved/coniferous unmanaged woodland	3.15	0.33	2.3%	187.2%
ER18	Blackbrook Reservoir Fields	Not sensitive to acidity	-	-	2.6%	188.3%
ER19	Abbey Road Grassland and Woodland	Acid Grassland	1.81	0.27	-	-
ER20	Abbey Road Grassland and Woodland	Broadleaved/coniferous unmanaged woodland	3.15	0.33	2.1%	160.0%
ER21	Booth Wood	Broadleaved/coniferous unmanaged woodland	2.91	0.21	3.0%	187.8%
ER22	Black Brook	Broadleaved/coniferous unmanaged woodland	3.15	0.33	2.7%	116.7%
ER23	Five Tree Plantation	Broadleaved/coniferous unmanaged woodland	3.15	0.33	2.4%	187.2%

F Detailed results tables at human sensitive receptors

Table 55: Annual Mean Nitrogen Dioxide – Impact at Sensitive Receptors

Receptor	Permitted Facility		Proposed Facility				Change		
	Max PC (µg/m³)	Max PC as % of AQAL	Max PC (µg/m³)	Max PC as % of AQAL	Max PEC (µg/m³)	Max PEC as % of AQAL	in PC (µg/m³)	in PC as % of AQAL	in PC as % of Permitted Facility
R1	0.49	1.23%	0.29	0.72%	18.83	47.07%	-0.20	-0.51%	58.59%
R2	0.75	1.88%	0.59	1.47%	19.13	47.82%	-0.16	-0.41%	78.24%
R3	1.03	2.57%	0.81	2.03%	19.35	48.38%	-0.22	-0.54%	78.93%
R4	0.63	1.58%	0.50	1.26%	19.04	47.61%	-0.13	-0.31%	80.06%
R5	0.62	1.55%	0.50	1.24%	19.04	47.59%	-0.12	-0.31%	80.13%
R6	0.59	1.48%	0.48	1.19%	19.02	47.54%	-0.12	-0.29%	80.37%
R7	0.60	1.49%	0.48	1.20%	19.02	47.55%	-0.12	-0.29%	80.43%
R8	0.54	1.36%	0.44	1.10%	18.98	47.45%	-0.10	-0.26%	80.99%
R9	0.55	1.39%	0.45	1.12%	18.99	47.47%	-0.11	-0.26%	81.04%
R10	0.57	1.41%	0.46	1.14%	19.00	47.49%	-0.11	-0.27%	80.71%
R11	0.54	1.34%	0.44	1.09%	18.98	47.44%	-0.10	-0.25%	81.26%
R12	0.54	1.36%	0.44	1.10%	18.98	47.45%	-0.10	-0.26%	80.99%
R13	0.59	1.48%	0.48	1.19%	19.02	47.54%	-0.11	-0.29%	80.60%
R14	0.59	1.47%	0.47	1.19%	19.01	47.54%	-0.11	-0.28%	80.81%
R15	0.58	1.44%	0.47	1.17%	19.01	47.52%	-0.11	-0.28%	80.95%
R16	0.55	1.36%	0.44	1.10%	18.98	47.45%	-0.10	-0.26%	80.99%
R17	0.52	1.29%	0.42	1.05%	18.96	47.40%	-0.10	-0.24%	81.13%
R18	0.51	1.27%	0.41	1.03%	18.95	47.38%	-0.09	-0.24%	81.38%
R19	0.50	1.25%	0.41	1.01%	18.95	47.36%	-0.09	-0.23%	81.39%

Receptor	Permitted Facility		Proposed Facility				Change		
	Max PC (µg/m³)	Max PC as % of AQAL	Max PC (µg/m³)	Max PC as % of AQAL	Max PEC (µg/m³)	Max PEC as % of AQAL	in PC (µg/m³)	in PC as % of AQAL	in PC as % of Permitted Facility
R20	0.48	1.19%	0.39	0.98%	18.93	47.33%	-0.09	-0.22%	81.73%
R21	0.47	1.18%	0.39	0.96%	18.93	47.31%	-0.09	-0.22%	81.63%
R22	0.57	1.42%	0.46	1.15%	19.00	47.50%	-0.11	-0.27%	81.10%
R23	0.47	1.18%	0.38	0.96%	18.92	47.31%	-0.09	-0.22%	81.60%
R24	0.46	1.15%	0.38	0.94%	18.92	47.29%	-0.08	-0.21%	81.82%
R25	0.44	1.10%	0.36	0.90%	18.90	47.25%	-0.08	-0.20%	81.88%
R26	0.53	1.34%	0.44	1.09%	18.98	47.44%	-0.10	-0.24%	81.87%
R27	0.52	1.30%	0.41	1.02%	18.95	47.37%	-0.11	-0.28%	78.63%
R28	0.50	1.25%	0.41	1.02%	18.95	47.37%	-0.09	-0.23%	81.84%
R29	0.45	1.12%	0.37	0.92%	18.91	47.27%	-0.08	-0.20%	81.97%
R30	0.38	0.96%	0.32	0.79%	18.86	47.14%	-0.07	-0.17%	82.40%
R31	0.42	1.05%	0.35	0.87%	18.89	47.22%	-0.07	-0.18%	82.44%
R32	0.32	0.79%	0.26	0.65%	18.80	47.00%	-0.05	-0.13%	82.91%
R33	0.23	0.57%	0.19	0.48%	18.73	46.83%	-0.04	-0.10%	83.02%
R34	0.18	0.45%	0.15	0.38%	18.69	46.73%	-0.03	-0.07%	83.60%
R35	0.11	0.27%	0.09	0.22%	18.63	46.57%	-0.02	-0.04%	83.30%
R36	0.14	0.35%	0.12	0.30%	18.66	46.65%	-0.02	-0.05%	85.56%
R37	0.16	0.40%	0.14	0.34%	18.68	46.69%	-0.02	-0.06%	85.09%
R38	0.25	0.63%	0.21	0.53%	18.75	46.88%	-0.04	-0.10%	83.52%
R39	0.25	0.63%	0.21	0.52%	18.75	46.87%	-0.04	-0.10%	83.51%
R40	0.24	0.61%	0.20	0.51%	18.74	46.86%	-0.04	-0.10%	83.34%
R41	0.22	0.55%	0.18	0.44%	18.72	46.79%	-0.04	-0.11%	80.51%

Receptor	Permitted Facility		Proposed Facility				Change		
	Max PC (µg/m³)	Max PC as % of AQAL	Max PC (µg/m³)	Max PC as % of AQAL	Max PEC (µg/m³)	Max PEC as % of AQAL	in PC (µg/m³)	in PC as % of AQAL	in PC as % of Permitted Facility
R42	0.29	0.72%	0.22	0.56%	18.76	46.91%	-0.07	-0.16%	77.32%
R43	0.24	0.59%	0.14	0.34%	18.68	46.69%	-0.10	-0.25%	57.15%
R44	0.44	1.11%	0.29	0.72%	18.83	47.07%	-0.16	-0.39%	64.47%
R45	0.44	1.10%	0.31	0.79%	18.85	47.14%	-0.13	-0.31%	71.57%
R46	0.30	0.74%	0.24	0.60%	18.78	46.95%	-0.06	-0.14%	81.37%
R47	0.27	0.68%	0.23	0.56%	18.77	46.91%	-0.04	-0.11%	83.46%
R48	0.11	0.28%	0.09	0.23%	18.63	46.58%	-0.02	-0.04%	84.52%
R49	0.09	0.24%	0.08	0.20%	18.62	46.55%	-0.02	-0.04%	83.21%
R50	0.16	0.39%	0.13	0.32%	18.67	46.67%	-0.03	-0.07%	82.17%
R51	0.14	0.36%	0.11	0.28%	18.65	46.63%	-0.03	-0.08%	78.90%
R52	0.16	0.41%	0.13	0.33%	18.67	46.68%	-0.03	-0.08%	80.22%
R53	0.21	0.52%	0.17	0.44%	18.71	46.79%	-0.03	-0.08%	83.94%
R54	0.17	0.43%	0.15	0.37%	18.69	46.72%	-0.03	-0.07%	84.31%
R55	0.16	0.41%	0.14	0.34%	18.68	46.69%	-0.03	-0.06%	84.35%
R56	0.17	0.41%	0.14	0.35%	18.68	46.70%	-0.03	-0.07%	84.15%
R57	0.15	0.37%	0.12	0.31%	18.66	46.66%	-0.02	-0.06%	84.76%
R58	0.14	0.36%	0.12	0.30%	18.66	46.65%	-0.02	-0.05%	84.72%
R59	0.14	0.34%	0.12	0.29%	18.66	46.64%	-0.02	-0.05%	84.54%
R60	0.14	0.35%	0.12	0.29%	18.66	46.64%	-0.02	-0.05%	84.40%
R61	0.17	0.43%	0.15	0.36%	18.69	46.71%	-0.03	-0.07%	83.90%
R62	0.18	0.46%	0.15	0.38%	18.69	46.73%	-0.03	-0.07%	83.69%
R63	0.20	0.51%	0.16	0.41%	18.70	46.76%	-0.04	-0.09%	81.55%

Receptor	Permitted Facility		Proposed Facility				Change		
	Max PC (µg/m³)	Max PC as % of AQAL	Max PC (µg/m³)	Max PC as % of AQAL	Max PEC (µg/m³)	Max PEC as % of AQAL	in PC (µg/m³)	in PC as % of AQAL	in PC as % of Permitted Facility
R64	0.20	0.49%	0.16	0.39%	18.70	46.74%	-0.04	-0.09%	80.71%
R65	0.19	0.49%	0.16	0.39%	18.70	46.74%	-0.04	-0.09%	80.75%
R66	0.19	0.47%	0.15	0.38%	18.69	46.73%	-0.04	-0.09%	80.37%
R67	0.16	0.41%	0.13	0.32%	18.67	46.67%	-0.04	-0.09%	78.47%
R68	0.14	0.36%	0.10	0.25%	18.64	46.60%	-0.04	-0.11%	69.39%
R69	0.15	0.37%	0.09	0.24%	18.63	46.59%	-0.05	-0.14%	63.52%
R70	0.04	0.10%	0.02	0.04%	18.56	46.39%	-0.02	-0.05%	44.98%
R71	0.03	0.07%	0.02	0.05%	18.56	46.40%	-0.01	-0.02%	77.00%
R72	0.38	0.95%	0.20	0.51%	18.74	46.86%	-0.18	-0.44%	53.48%
R73	0.05	0.13%	0.03	0.07%	18.57	46.42%	-0.02	-0.06%	53.58%
R74	0.15	0.37%	0.11	0.28%	18.65	46.63%	-0.03	-0.08%	77.62%
R75	0.18	0.44%	0.14	0.35%	18.68	46.70%	-0.03	-0.09%	80.32%

G Detailed results tables – ecological results change in impact

Table 56: Impact at Ecological Sites - Change in Impact

ID	Site	Oxides of nitrogen (% of CL)		Sulphur dioxide (% CL)	Hydrogen fluoride (% CL)		Ammonia (% CL)
		Annual Mean	Daily Mean	Annual Mean	Weekly Mean	Daily Mean	Annual Mean
ER1	Beacon Hill, Hangingstone and Out Woods	-0.28%	-1.10%	-0.21%	-0.34%	-0.08%	-0.41%
ER2	Morley Quarry	-0.14%	-2.12%	-0.05%	-0.39%	-0.16%	-0.21%
ER3	White Horse Wood	-0.10%	-1.03%	-0.04%	-0.20%	-0.08%	-0.15%
ER4	Holywell Wood	-0.48%	-1.50%	-0.18%	-0.57%	-0.11%	-0.71%
ER5	Burleigh Wood	-0.44%	-1.57%	-0.17%	-0.53%	-0.12%	-0.66%
ER6	Charley Woodland	-0.11%	-1.55%	-0.04%	-0.31%	-0.12%	-0.16%
ER7	Iveshead	-0.45%	-2.75%	-0.17%	-1.16%	-0.21%	-0.67%
ER8	Morley Lane Field	-0.16%	-2.39%	-0.06%	-0.44%	-0.18%	-0.24%
ER9	Hermitage Estate	-0.15%	-0.90%	-0.06%	-0.23%	-0.07%	-0.23%
ER10	Nanpantan Hall Wood	-0.17%	-1.77%	-0.06%	-0.30%	-0.13%	-0.26%
ER11	Home Farm Wood	-0.11%	-0.95%	-0.04%	-0.18%	-0.07%	-0.16%
ER12	Nanpantan Reservoir	-0.19%	-1.05%	-0.07%	-0.29%	-0.08%	-0.28%
ER13	Buck Hill	-0.09%	-0.96%	-0.04%	-0.16%	-0.07%	-0.14%
ER14	Charley Road Fields	-0.25%	-1.42%	-0.09%	-0.55%	-0.11%	-0.37%
ER15	High Ground/British Piece	-0.13%	-2.00%	-0.05%	-0.60%	-0.15%	-0.20%
ER16	Longcliffe Golf Course	-0.07%	-0.34%	-0.03%	-0.25%	-0.03%	-0.11%
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	-0.19%	-1.70%	-0.07%	-0.58%	-0.13%	-0.28%

ID	Site	Oxides of nitrogen (% of CL)		Sulphur dioxide (% CL)	Hydrogen fluoride (% CL)		Ammonia (% CL)
		Annual Mean	Daily Mean	Annual Mean	Weekly Mean	Daily Mean	Annual Mean
ER18	Little Garendon and Garendon Oaks	-0.21%	-1.45%	-0.08%	-0.58%	-0.11%	-0.32%
ER19	Blackbrook Reservoir Fields	-0.17%	-1.03%	-0.07%	-0.48%	-0.08%	-0.26%
ER20	Abbey Road Grassland and Woodland	-0.24%	-1.38%	-0.09%	-0.48%	-0.10%	-0.36%
ER21	Booth Wood	-0.36%	-1.29%	-0.13%	-0.40%	-0.10%	-0.53%
ER22	Black Brook	-0.19%	-1.27%	-0.07%	-0.53%	-0.10%	-0.28%
ER23	Five Tree Plantation	-0.12%	-1.66%	-0.05%	-0.36%	-0.12%	-0.18%
ER1	Beacon Hill, Hangingstone and Out Woods	-0.28%	-1.10%	-0.21%	-0.34%	-0.08%	-0.41%
ER2	Morley Quarry	-0.14%	-2.12%	-0.05%	-0.39%	-0.16%	-0.21%
ER3	White Horse Wood	-0.10%	-1.03%	-0.04%	-0.20%	-0.08%	-0.15%
ER4	Holywell Wood	-0.48%	-1.50%	-0.18%	-0.57%	-0.11%	-0.71%
ER5	Burleigh Wood	-0.44%	-1.57%	-0.17%	-0.53%	-0.12%	-0.66%
ER6	Charley Woodland	-0.11%	-1.55%	-0.04%	-0.31%	-0.12%	-0.16%

Table 57: Nitrogen Deposition - Change in Impact

ID	Site name	Broad Habitat	PC impacts as a % of CL		PEC	
			% of Lower CL	% of Upper CL	% of Lower CL	% of Upper CL
ER1	Beacon Hill, Hangingstone and Out Woods	Broadleaved Mixed and Yew Woodland	-0.49%	-0.33%	-0.49%	-0.33%
ER2	Morley Quarry	Acid grassland	-0.31%	-0.15%	-0.31%	-0.15%
		Broadleaved Mixed and Yew Woodland	-0.25%	-0.13%	-0.25%	-0.13%
ER3	White Horse Wood	Broadleaved Mixed and Yew Woodland	-0.18%	-0.09%	-0.18%	-0.09%
ER4	Holywell Wood	Broadleaved Mixed and Yew Woodland	-0.84%	-0.42%	-0.84%	-0.42%
ER5	Burleigh Wood	Broadleaved Mixed and Yew Woodland	-0.78%	-0.39%	-0.78%	-0.39%
ER6	Charley Woodland	Broadleaved Mixed and Yew Woodland	-0.19%	-0.09%	-0.19%	-0.09%
ER7	Iveshead	Acid grassland	-0.48%	-0.24%	-0.48%	-0.24%
ER8	Morley Lane Field	Acid grassland	-0.17%	-0.09%	-0.17%	-0.09%
ER9	Hermitage Estate	Acid grassland	-0.33%	-0.16%	-0.33%	-0.16%
		Broadleaved Mixed and Yew Woodland	-0.27%	-0.13%	-0.27%	-0.13%
ER10	Nanpantan Hall Wood	Broadleaved Mixed and Yew Woodland	-0.30%	-0.15%	-0.30%	-0.15%
ER11	Home Farm Wood	Broadleaved Mixed and Yew Woodland	-0.19%	-0.10%	-0.19%	-0.10%
ER12	Nanpantan Reservoir	Acid grassland	-0.41%	-0.20%	-0.41%	-0.20%
ER13	Buck Hill	Acid grassland	-0.20%	-0.10%	-0.20%	-0.10%
		Broadleaved Mixed and Yew Woodland	-0.17%	-0.08%	-0.17%	-0.08%
ER14	Charley Road Fields	Acid grassland	-0.54%	-0.27%	-0.54%	-0.27%
ER15	High Ground/British Piece	Broadleaved Mixed and Yew Woodland	-0.23%	-0.12%	-0.23%	-0.12%
ER16	Longcliffe Golf Course	Acid grassland	-0.15%	-0.08%	-0.15%	-0.08%
		Broadleaved Mixed and Yew Woodland	-0.13%	-0.06%	-0.13%	-0.06%

ID	Site name	Broad Habitat	PC impacts as a % of CL		PEC	
			% of Lower CL	% of Upper CL	% of Lower CL	% of Upper CL
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	Acid grassland	-0.41%	-0.20%	-0.41%	-0.20%
		Broadleaved Mixed and Yew Woodland	-0.34%	-0.17%	-0.34%	-0.17%
ER18	Little Garendon and Garendon Oaks	Broadleaved Mixed and Yew Woodland	-0.38%	-0.19%	-0.38%	-0.19%
ER19	Blackbrook Reservoir Fields	Fen Marsh and Swamp	-0.19%	-0.13%	-0.19%	-0.13%
ER20	Abbey Road Grassland and Woodland	Acid grassland	-0.52%	-0.26%	-0.52%	-0.26%
		Broadleaved Mixed and Yew Woodland	-0.43%	-0.22%	-0.43%	-0.22%
ER21	Booth Wood	Broadleaved Mixed and Yew Woodland	-0.63%	-0.31%	-0.63%	-0.31%
ER22	Black Brook	Broadleaved Mixed and Yew Woodland	-0.34%	-0.17%	-0.34%	-0.17%
ER23	Five Tree Plantation	Broadleaved Mixed and Yew Woodland	-0.21%	-0.11%	-0.21%	-0.11%

Table 58: Acid Deposition - Change in Impact

ID	Site name	Broad Habitat	PC as a % of Min CL Function	PEC as a % of Min CL Function
ER1	Beacon Hill, Hangingstone and Out Woods	Broadleaved Mixed and Yew Woodland	-0.67%	-0.67%
ER2	Morley Quarry	Acid grassland	-0.25%	-0.25%
		Broadleaved Mixed and Yew Woodland	-1.82%	-1.82%
ER3	White Horse Wood	Broadleaved Mixed and Yew Woodland	-0.17%	-0.17%
ER4	Holywell Wood	Broadleaved Mixed and Yew Woodland	-0.80%	-0.80%
ER5	Burleigh Wood	Broadleaved Mixed and Yew Woodland	-0.74%	-0.74%
ER6	Charley Woodland	Broadleaved Mixed and Yew Woodland	-0.26%	-0.26%
ER7	Iveshead	Acid grassland	-0.78%	-0.78%
ER8	Morley Lane Field	Acid grassland	-0.28%	-0.28%
ER9	Hermitage Estate	Acid grassland	-0.32%	-0.32%
		Broadleaved Mixed and Yew Woodland	-0.26%	-0.26%
ER10	Nanpantan Hall Wood	Broadleaved Mixed and Yew Woodland	-0.42%	-0.42%
ER11	Home Farm Wood	Broadleaved Mixed and Yew Woodland	-0.27%	-0.27%
ER12	Nanpantan Reservoir	Acid grassland	-0.39%	-0.39%
ER13	Buck Hill	Acid grassland	-0.16%	-0.16%
		Broadleaved Mixed and Yew Woodland	-0.23%	-0.23%
ER14	Charley Road Fields	Acid grassland	-0.44%	-0.44%
ER15	High Ground/British Piece	Broadleaved Mixed and Yew Woodland	-0.32%	-0.32%
ER16	Longcliffe Golf Course	Acid grassland	-0.12%	-0.12%
		Broadleaved Mixed and Yew Woodland	-0.17%	-0.17%

ID	Site name	Broad Habitat	PC as a % of Min CL Function	PEC as a % of Min CL Function
ER17	Lubcloud Farm (for Lubcloud fields, alder and willow)	Acid grassland	-0.33%	-0.33%
		Broadleaved Mixed and Yew Woodland	-0.46%	-0.46%
ER18	Little Garendon and Garendon Oaks	Broadleaved Mixed and Yew Woodland	-0.52%	-0.52%
ER19	Blackbrook Reservoir Fields	Fen Marsh and Swamp	-	-
ER20	Abbey Road Grassland and Woodland	Acid grassland	-0.42%	-0.42%
		Broadleaved Mixed and Yew Woodland	-0.59%	-0.59%
ER21	Booth Wood	Broadleaved Mixed and Yew Woodland	-0.60%	-0.60%
ER22	Black Brook	Broadleaved Mixed and Yew Woodland	-0.46%	-0.46%
ER23	Five Tree Plantation	Broadleaved Mixed and Yew Woodland	-0.29%	-0.29%

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