



East Midlands Energy Re-Generation
(EMERGE) Centre

Ecological interpretation of AQA

Appendix D2

Prepared for Axis PED on behalf of Uniper UK
Limited

Kevin Barry Honour MSc MCIEEM

Version 1.0 / Ref. 20-002 - EP

24/07/2020




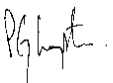
Unit 14 The Greenhouse Greencroft Industrial Park
Annfield Plain County Durham DH9 7XN

T: 01207 524859 F: 01207 524895 www.argusecology.co.uk

East Midlands Energy Re-Generation (EMERGE) Centre

Ecological interpretation of AQA

Report Reference	Ref. 20-002 - EP
Date	24/07/2020
Date of survey/s	n/a

Issue	Prepared by	Checked by	Approved by	Status	Date
FINAL	Kevin Barry Honour MSc MCIEEM	Claire Gilchrist MSc	Paul Lupton MSc	FINAL	24/07/2020
		C. Gilchrist			

All Argus Ecology Ltd. staff subscribe to the Chartered Institute of Ecology and Environmental Managements (CIEEM) code of professional conduct in their work.

This report has been prepared in accordance with CIEEM's Guidelines for Ecological Report Writing.

This report is not to be used for contractual purposes unless this approval sheet is signed and designated as 'FINAL'.

This report has been prepared by Argus Ecology Ltd. in its professional capacity as Ecological Consultants. Its contents reflect the conditions that prevailed and the information available or supplied at the time of preparation. The report, and the information contained therein, is provided by Argus Ecology Ltd. solely for the use and reliance by the Client in performance of Argus Ecology Ltd.'s duties and liabilities under its contract with the client. The contents of the report do not, in any way purport to include any manner of legal advice or opinion.

Contents

1	Introduction	3
2	Scope and Methodology	4
2.1	Scope of Assessment	4
2.2	Methodology	6
3	Sensitivity of Ecological Receptors	10
3.1	Introduction	10
3.2	Statutory Designated Sites	10
3.3	Non-statutory Sites	11
3.4	Background Levels	14
4	Predicted ecological effects	17
4.1	Current and Future Baseline	17
4.2	Predicted Effects at Lockington Marshes SSSI	18
4.3	Predicted effects at Locally Designated Sites	19
4.4	Magnitude and Ecological Significance of Predicted Effects	20
5	Conclusions	23
5.1	Conclusions	23
5.2	Recommendations	23

1 Introduction

- 1.1 This document provides an assessment of the likely effects of changes in air quality at sensitive ecological receptors, as a consequence of the operation of the proposed EMERGE Centre, (the 'Installation'), to be located to the north of Ratcliffe-on-Soar Power Station, Nottinghamshire.
- 1.2 The assessment was originally designed both to provide an ecological interpretation of the Air Quality chapter (8.0) in the Environmental Statement (ES), and to inform the ecological impact assessment set out in the Ecology and Nature Conservation chapter (6.0) of the ES submitted by Uniper UK Limited on 29 June 2020 as part of the planning application. Although primarily written within the context of guidance for the assessment of planning applications, it was also designed to inform an Environmental Permit application for the Installation.
- 1.3 This analysis is based on dispersion and deposition modelling undertaken by Uniper, and reported in the Air Quality Assessment (Appendix 8-1 to the ES). The Permit Application also includes an equivalent Air Quality Assessment (Appendix D1 to the Permit Application) which applies the Environment Agency significance screening criteria for impacts on ecological sites. For consistency, all references to results in the Air Quality Assessment (AQA) in this document refer to Appendix D1 to the Permit Application. This analysis focusses on potential ecological effects at sensitive receptors where exceedances of the identified screening thresholds are predicted. Further ecological assessment has been undertaken to:
- Confirm sensitivity of qualifying and notified features;
 - Assess potential effects by comparing dispersion and deposition model plots with the spatial distribution of sensitive habitats; and
 - Provide an informed ecological opinion on the likelihood of significant effects or significant harm.

2 Scope and Methodology

2.1 Scope of Assessment

Geographic Scope of Assessment

2.1.1 In accordance with Environment Agency guidance¹ for combustion processes, the effects on sensitive ecological receptors were considered within the following radii from the proposed emission source:

- 10 km for Ramsar Sites and European designated conservation sites, comprising existing and proposed Special Areas of Conservation (SACs) and Special Protection Areas (SPAs);
- 2 km for nationally designated Sites of Special Scientific Interest (SSSIs); and
- 2 km for ancient woodlands, Local Nature Reserves (LNR), and Local Wildlife Sites (LWS) and other locally designated sites ('local nature sites').

Screening Thresholds

2.1.2 Screening thresholds in this guidance are set out in the AQA, and can be summarised as follows:

- For Ramsar, Natura 2000 sites and SSSIs, predicted process contributions (PCs) below 1 % of the relevant long-term (annual) Critical Level and Critical Load or 10 % of the relevant short-term (24-hour) Critical Level are screened out;
- For Ramsar, European sites and SSSIs, PCs above 1 %, where the predicted environmental concentration (PEC; PC plus background) is <70 % of the Critical Level and Critical Load are screened out; and
- For local nature sites, PCs below 100 % of the relevant Critical Level and Critical Load are screened out.

2.1.3 For Natura 2000 sites the 1 % PC has been regarded as a *de minimis* threshold, below which effects can be considered inconsequential. The English and Welsh agencies which make up the Air Quality Technical Advisory Group (AQTAG) clarified that projects below the 1 % PC do not have to be considered in an in-combination

¹ Gov.uk: *Air emissions risk assessment for your environmental permit*. 2 August 2016. <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas> (accessed 29/05/20)

assessment², although this has been subject to further revision (particularly with respect to cumulative vehicle emissions) through UK and European case law.

2.1.4 The Institute of Air Quality Management (IAQM) published guidance on the assessment of air quality impacts on designated sites in June 2019³. This confirmed the use of the 1 % long-term / 10 % short-term thresholds for industrial point source emissions, with some important clarifications:

- *'The 1 % screening criterion is not a threshold of harm and exceeding this threshold does not, of itself, imply damage to a habitat'* (IAQM 2019, para. 5.5.1.8);
- The 70 % PEC threshold *'was intended to be a trigger for detailed dispersion modelling. It is not intended to be a damage threshold.'* (5.5.3.2); and
- The 100 % threshold for locally designated sites and ancient woodlands used in permit applications purposes may be inappropriate in a planning context, failing to provide adequate protection (5.5.2.2).

2.1.5 IAQM guidance suggests that for planning purposes the 1 % screening threshold is used for locally designated sites, but results should be interpreted in the context of the lower level of policy protection afforded to local sites: *'it is ...normal practice to treat such sites in the same manner as SSSIs and European sites, although the determination of the significance of the effect may be different.'* (5.5.2.2).

Pollutants Considered in Assessment

2.1.6 The AQA models a range of pollutants with respect to their impact on sensitive ecological receptors. These include predictions of ambient levels of ammonia (NH₃), short and long-term oxides of nitrogen (NO_x), daily and weekly hydrogen fluoride (HF), and sulphur dioxide (SO₂) levels, together with nitrogen and acid deposition rates.

2.1.7 In terms of the ecological assessment, HF and SO₂ can be safely excluded from consideration as the predicted environmental concentration (PEC) always remains well below the relevant Critical Level.

² Environment Agency (2015). AQTAG position. In-combination guidance and assessment. Response to PINS, March 2015.

³ Holman et al (2019). A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.0, Institute of Air Quality Management, London. www.iaqm.co.uk/text/guidance/airquality-impacts-on-nature-sites-2019.pdf

2.1.8 Short-term (24 hour mean) oxides of nitrogen levels are considered less accurate predictors of ecological effect than long-term (annual mean) levels. Although short-term levels can have measurable physiological effects at the level of individual plants (e.g. stimulation of leaf nitrate reductase activity), there is little evidence of any phytotoxic effects in the absence of elevated SO₂ or ozone levels. Annual mean levels are a better predictor of the potential for effects to occur at the plant community level, for example by changes in competitive advantage in species due to differential response to elevated nitrogen levels. In turn, nitrogen deposition rates provide better prediction of ecological effect, as they incorporate longer range wet and occult deposition of nitrogen compounds in rain and cloud water.

2.2 Methodology

Data Search

2.2.1 The assessment was informed by a desktop study including:

- a web-based data search for statutory designated sites and ancient woodlands within a 2 km radius of the Installation, using the Multi-agency Geographic Information for the Countryside (MAGIC) database, together with collation of information on notified features of SSSIs;
- a web-based data search for European (Natura 2000) and internationally designated sites within 10 km of the Installation, together with collation of information on qualifying features and Conservation Objectives;
- data requests from local biological records centres, comprising Nottinghamshire Biological and Geological Records Centre (NBGRC), Derbyshire Wildlife Trust (DWT) and Leicestershire Environmental Records Network (LERN) for Local Wildlife Site information within an area encompassing a 2 km buffer around the Installation boundary.

Identification of Appropriate Habitats and Environmental Quality Standards

2.2.2 The Air Pollution Information System (APIS) website's Site Relevant Critical Loads function was used to provide an initial assessment of the sensitivity of statutory designated sites to pollutant impacts. This provides habitat-specific critical loads for nitrogen and acid deposition, as well as setting out recommended Critical Levels for long-term (annual mean) ammonia (NH₃) and sulphur dioxide (SO₂), which vary

according to whether bryophytes and lichens are an important component of the ecosystem.⁴

2.2.3 With respect to locally designated sites, it is necessary to determine the appropriate EQS from habitat information supplied by the biological records centres. The appropriate EUNIS⁵ habitat was identified, and cross-referenced with the corresponding Critical Loads for nitrogen deposition on APIS. For acid deposition, the appropriate Broad Habitat is selected for the relevant 1 km grid square of the site, using the 'Search by Location' tool.⁶

Assessment of Effect Magnitude and Significance

2.2.4 There are no currently accepted thresholds for assessing the magnitude of air quality effects on ecological receptors. At the time of preparation of this report, draft CIEEM / IAQM guidance has been published, but has not yet been finalised and cannot yet be referred to; neither this draft document nor the IAQM (2019) guidance provides any guidance on effect magnitude or ecological significance thresholds. In the absence of current guidance for ecological receptors, Environmental Protection UK (EPUK, 2010)⁷ advice can be applied with caution; although this was primarily developed for assessment of nitrogen dioxide and particulate emissions on human health in a development control context, it provides a useful descriptor to express impact magnitude as a percentage of the relevant assessment level (see Table 2.1 below). This has now been superseded by revised advice, which is now explicitly reserved for application in a human health assessment context.

Table 2.1: EPUK (2010) Guidance on Impact Magnitude

Magnitude of change	Annual mean value increase / decrease (as percentage of assessment level)
Large	>10 %
Medium	5–10 %
Small	1–5 %
Imperceptible	<1 %

⁴ <http://www.apis.ac.uk/src/>

⁵ Strachan, I.M. (2015). *Manual of terrestrial EUNIS habitats in Scotland*. Scottish Natural Heritage Commissioned Report No. 766

⁶ <http://www.apis.ac.uk/search-location>

⁷ Environmental Protection UK (2010) *Development Control: Planning for Air Quality (2010 Update)* EPUK, April 2010.

- 2.2.5 With respect to assessing **significance** of ecological effects, it is important to note that the 1 % screening threshold is not an effect threshold. The magnitude of impact which might result in a significant ecological effect is likely to depend on baseline conditions and sensitivity of the receiving environment.
- 2.2.6 CIEEM (2016⁸) define a significant ecological effect as: “*an impact on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area.*” The guidelines do not favour a matrix approach to the assessment of significance, because these can downplay impacts on features of local importance, and the ecological meaning of the resulting terms is often poorly defined. Instead, significance is defined at the geographic scale at which it occurs.
- 2.2.7 With respect to assessing whether it is possible to conclude no adverse effect on site integrity (European site) and to conclude no damage (SSSIs) in a permitting context in England and Wales, Environment Agency (EA) guidance⁹ distinguished between circumstances when:
- the background concentration is less than the appropriate environmental criterion but a small process contribution leads to an exceedance; or
 - the background concentration is currently exceeding the appropriate environmental criterion and the new process contribution will cause an additional **small** increase; and
 - the background concentration is less than the appropriate environmental criterion, but the process contribution is significant (*i.e. of higher magnitude*) and leads to an exceedance; or
 - the background concentration is more than the appropriate environmental criterion, and the process contribution is **large**.
- 2.2.8 In the first two circumstances, the EA recommends that a decision is based on local circumstances, based on factors set out in guidance (such as spatial disposition of sensitive habitats relative to predicted effects); in the latter two circumstances, the EA state that it is not possible to conclude no adverse effect. The EA goes on distinguishing between the varying level of legal and policy protection applied to European sites relative to SSSIs. For European sites (SACs, SPAs and Ramsar sites) the

⁸ CIEEM (2016). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition*. Chartered Institute of Ecology and Environmental Management, Winchester

⁹ Environment Agency (2012). *Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation. Operational Instruction 67_12, Issued 08/05/12*

key policy test is 'no likely significant effect', which is best understood as 'no possible significant effect according to best available scientific knowledge'. For SSSIs, the EA refers to 'operations likely to damage' a SSSI.

3 Sensitivity of Ecological Receptors

3.1 Introduction

3.1.1 This section describes sensitive ecological receptors surrounding the Installation Site. When reading this section reference should be made to Figure 3.1 as it provides the location of the receptors.

3.2 Statutory Designated Sites

European (Natura 2000) Sites

3.2.1 There are no European conservation sites (existing or SAC or SPA) within the 10 km screening radius of the emission source.

UK Statutory Designated Sites

3.2.2 There is one SSSI and one LNR within the 2 km screening radius. Table 3.1 summarises their ecological interest features, and sensitivity to ammonia levels, nitrogen and acid deposition.

Table 3.1: Sensitivity of Statutory Designated Sites

Site	Habitat (EUNIS code)	CL NH ₃ (µg/m ³)	CL N dep. (kg N/ha/yr)	CL acid dep. (CLmaxN) (keq H ⁺ /ha/yr)
Lockington Marshes SSSI	S5 <i>Glyceria maxima</i> swamp (C3.2)	3	Not sensitive	Not sensitive
Lockington Marshes SSSI	S7 - <i>Carex acutiformis</i> swamp (C3.2)	3	Not sensitive	Not sensitive
Lockington Marshes SSSI	W6 - <i>Alnus glutinosa</i> - <i>Urtica dioica</i> woodland (G1.21)	3	Not sensitive	Not sensitive
Lockington Marshes SSSI	Invertebrate assemblage (n/a)	n/a	n/a	No critical load assigned
Forbes Hole LNR	Rich fens (D4.1)	3	15–30	Not sensitive
Forbes Hole LNR	Broadleaved woodland (G1)	3	10–20	1.762

3.2.3 APIS Site Relevant Critical Loads for Lockington Marshes SSSI¹⁰ sets the critical load for nitrogen deposition at 10–20 kg N/ha/yr for W6 woodland, based on the ‘broadleaved deciduous woodland’ Broad Habitat critical load class. However, there is an anomaly in the interpretation of plant communities by APIS, which results in a different Critical Load for W6 alder woodland depending on whether it is a notified

¹⁰ <http://www.apis.ac.uk/src/select-a-feature?site=1000882&SiteType=SSSI&submit=Next>

feature of a SSSI or a qualifying feature of a SAC. The relevant European Annex I habitat applied which includes the W6 community is '*Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) (H91E0)*'. APIS advise that this community is not sensitive to nitrogen deposition; this is partly because it occupies naturally nutrient-rich habitats, but also because alder trees support nitrogen-fixing bacteria, resulting in high levels of nitrogen in the soil. This community is similarly not regarded as sensitive to acid deposition.

3.2.4 The Site Relevant Critical Load advice with respect to the two notified swamp communities is that they are not sensitive to either nitrogen or acid deposition. They are both plant communities associated with eutrophic wetlands, with nutrient inputs likely to be predominantly derived from fluvial and / or groundwater inputs.

3.2.5 With respect to ammonia levels, APIS state that 'site specific advice' should be sought with respect to sensitivity. The site citation does not identify bryophytes and lichens as being important elements of the plant community, and there is no indication that species of high sensitivity will be present. The 3 µg/m³ Critical Level for ammonia is therefore appropriate for this site, as well as the broadly similar habitats present at Forbes Hole LNR.

3.3 Non-statutory Sites

Ancient Woodlands

3.3.1 There are no ancient woodlands within a 2 km radius of the emission source, based on shapefile data from Ancient Woodlands Inventory v.3.7.

Local Wildlife Sites

3.3.2 Those relevant LWSs within 2 km of the Site boundary are set out in Table 3.2, with relevant habitats and sensitivities. Note that Leicestershire designates a number of individual trees and hedgerows as LWSs; this approach is not followed in Derbyshire or Nottinghamshire. It is not appropriate to apply Critical Levels or Critical Loads at the level of individual trees; they have been derived from ecosystem or habitat-level studies, and do not denote concentrations or deposition rates at which directly toxic effects would occur at the level of individual plants. These features have therefore been excluded from further analysis and are not included in the table.

Table 3.2: Sensitivity of Locally Designated Sites

LWS Site	Habitat (EUNIS code)	CL NH ₃ (µg/m ³)	CL N dep. (kg N/ha/yr)	CL acid dep. (CLmaxN) (keq H ⁺ /ha/yr)
Attenborough West Gravel Pits	Rich fens (D4.1)	3	15–30	Not sensitive
Erewash Canal	Surface standing waters	n/a	Depends on N or P limitation	Not sensitive
Gotham Hill Wood	Meso and eutrophic Quercus woodland (G1.A)	3	15–20	10.976
Lockington Confluence Backwater	Seasonally wet and wet grasslands (E3.5)	3	15–25	4.928
Lockington Fen	Rich fens (D4.1)	3	15–30	Not sensitive
Lockington, swamp by SSSI	Water-fringing reedbeds (C3.2)	3	Not sensitive	Not sensitive
Meadow Lane Carr	Rich fens (D4.1)	3	15–30	Not sensitive
Meadow Lane Carr	Broadleaved woodland (G1)	3	10–20	1.762
Narrow Bridge Fish Pond	Rich fens (D4.1)	3	15–30	Not sensitive
Poplars Fish Pond	Rich fens (D4.1)	3	15–30	Not sensitive
Rare Plant Register Mousetail Pasture	Arable land (with rare plant) (I1.5)	3	Not sensitive	Not sensitive
Ratcliffe Lane Pasture and Stream	Low and medium altitude hay meadows (E2.2)	3	20–30	4.856
Red Hill, Ratcliffe on Soar	Sub-Atlantic semi-dry calcareous grassland (E1.26)	3	15–25	4.928
Redhill Marina Backwater	Rich fens (D4.1)	3	15–30	Not sensitive
River Soar West Bank south of A453	Surface running waters (C2)	3	Depends on N or P limitation	Not sensitive
River Soar, Loughborough Meadows to Trent	Surface running waters (C2)	3	Depends on N or P limitation	Not sensitive
River Soar, Loughborough Meadows to Trent	Rich fens (D4.1)	3	15–30	Not sensitive
River Trent North Bank	Low and medium altitude hay meadows (E2.2)	3	20–30	4.856
Sheetstores Junction Pond	Rich fens (D4.1)	3	15–30	Not sensitive
Soar Meadow near Ratcliffe Lock	Low and medium altitude hay meadows (E2.2)	3	20–30	5.071

LWS Site	Habitat (EUNIS code)	CL NH ₃ (µg/m ³)	CL N dep. (kg N/ha/yr)	CL acid dep. (CLmaxN) (keq H ⁺ /ha/yr)
South Junction Pond	Water-fringing reedbeds (C3.2)	3	Not sensitive	Not sensitive
Thrumpton Park	Low and medium altitude hay meadows (E2.2)	3	20–30	4.928
Thrumpton Park	Meso and eutrophic Quercus woodland (G1.A)	3	15–20	10.977
Trent Floodplain Wetland – Lock m07	Surface standing waters (C1)	3	Depends on N or P limitation	Not sensitive
Trent Lock Marsh	Water-fringing reedbeds (C3.2)	3	Not sensitive	Not sensitive
Trent Lock Marsh	Broadleaved woodland (G1)	3	10–20	1.763

3.3.3 There are no habitats present which would justify application of the lower critical level for ammonia; this is supported by site descriptions in citations received by the respective biological records centres. Lowland broadleaved woodlands will contain bryophytes and lichens, as will rich fen communities, but given the relatively urban and industrial setting of the search area are unlikely to be important elements of the plant community. Their lower plant flora is likely to reflect both the elevated ammonia levels of recent decades, and the legacy effects of past acidifying pollutants. This can be contrasted, for example, with sites in rural Nottinghamshire supporting habitats where bryophytes and lichens do form important parts of the plant community; one example would be Birklands and Bilhaugh SAC, which is an old acidophilous oak woodland – a community where bryophytes and particularly epiphytic lichens can be important elements of the overall biodiversity interest of the Installation Site.

3.4 Background Levels

Statutory Designated Sites

3.4.1 The following background annual average pollutant levels and deposition rates are given for Lockington Marshes SSSI, based on the Site Relevant Critical Loads in APIS. For Forbes Hole LNR, rates are taken from the Query by Location function on APIS.

Background levels in bold exceed the relevant Critical Level or Critical Load.

Table 3.3: Background levels at statutory designated sites¹¹

Site	Deposition velocity	NH ₃ (µg/m ³)	NO _x (µg/m ³)	SO ₂ (µg/m ³)	N dep. (kg N/ha/yr)	Acid dep. (keq N+S/ha/yr)
Lockington Marshes SSSI	Grassland	2.13	23.43	1.46	19.4	1.6
Lockington Marshes SSSI	Woodland	2.13	23.43	1.46	33.4	2.6
Forbes Hole LNR	Grassland	2.09	28.97	1.87	19.18	1.26
Forbes Hole LNR	Woodland	2.09	28.97	1.87	32.76	2.11

Locally Designated Sites

3.4.2 Values given in Table 3.4 are all taken from the APIS Query by Location function. Background levels in bold exceed the relevant Critical Level or Critical Load for the most sensitive habitat(s) found on the site, as set out in Table 3.3 above.

Table 3.4: Background levels at locally designated sites¹¹

Site	Deposition velocity	NH ₃ (µg/m ³)	NO _x (µg/m ³)	SO ₂ (µg/m ³)	N dep. (kg N/ha/yr)	Acid dep. (keq N+S/ha/yr)
Attenborough West Gravel Pits	Grassland	2.21	23.66	1.56	19.32	1.27
Erewash Canal	Surface waters	2.09	26.74	1.87	19.18	1.26
Gotham Hill Wood	Woodland	2.21	21.74	1.56	33.46	2.15
Lockington Confluence Backwater	Grassland	2.09	23.92	1.87	19.18	1.96
Lockington Fen	Grassland	2.18	23.41	1.56	19.74	1.30

¹¹ It should be noted that the concentration and deposition values in Table 3.3 and Table 3.4 may differ slightly from those stated in the AQA for the Lockington Marshes SSSI as the AQA used concentration and deposition values extracted from the APIS using the Query by Location function at the location of the maximum impact from the Proposed Development.

Site	Deposition velocity	NH ₃ (µg/m ³)	NO _x (µg/m ³)	SO ₂ (µg/m ³)	N dep. (kg N/ha/yr)	Acid dep. (keq N+S/ha/yr)
Lockington Shooting Ground Marsh, Grassland	Grassland	2.09	23.92	1.87	19.18	1.26
Lockington, swamp by SSSI	Grassland	2.09	22.95	1.87	19.18	1.26
Meadow Lane Carr	Grassland	2.09	28.97	1.87	19.18	1.26
Meadow Lane Carr	Woodland	2.09	28.97	1.87	32.76	2.11
Narrow Bridge Fish Pond	Grassland	2.09	26.74	1.87	19.18	1.26
Poplars Fish Pond	Grassland	2.09	26.74	1.87	19.18	1.26
Rare Plant Register Mousetail Pasture	Grassland	2.09	23.92	1.87	19.18	1.26
Ratcliffe Lane and Stream Pasture	Grassland	2.09	26.74	1.87	19.18	1.26
Red Hill, Ratcliffe on Soar	Grassland	2.09	23.92	1.87	19.18	1.26
Redhill Marina Backwater	Grassland	2.09	23.92	1.87	19.18	1.26
River Soar West Bank south of A453	Surface waters	2.18	24.14	1.56	19.74	1.30
River Soar, Loughborough Meadows to Trent	Grassland	2.09	23.92	1.87	19.18	1.26
River Trent North Bank	Grassland	2.21	23.12	1.56	19.32	1.27
Sheetstores Junction Pond	Grassland	2.09	26.74	1.87	19.18	1.26
Soar Meadow near Ratcliffe Lock	Grassland	2.18	25.37	1.56	19.74	1.30
South Junction Pond	Grassland	2.09	26.74	1.87	19.18	1.26
Thrumpton Park	Grassland	2.21	21.21	1.56	19.32	1.27
Thrumpton Park	Woodland	2.21	21.21	1.56	33.46	2.15

Site	Deposition velocity	NH ₃ (µg/m ³)	NO _x (µg/m ³)	SO ₂ (µg/m ³)	N dep. (kg N/ha/yr)	Acid dep. (keq N+S/ha/yr)
Trent Floodplain Wetland – Lock m07	Surface waters	2.09	26.74	1.87	19.18	1.26
Trent Marsh Lock	Grassland	2.09	23.66	1.87	19.18	1.26
Trent Marsh Lock	Woodland	2.09	23.66	1.87	32.76	2.11

3.4.3 Note that APIS do not give deposition velocities to surface waters, and grassland values substituted accordingly; these are lower than grassland velocities, so their use is therefore precautionary.

3.4.4 Table 3.4 illustrates that background nitrogen deposition rates are above the lower Critical Load for most sensitive habitats, including rich fens and calcareous grassland (15 kg N/ha/yr) and close to the Critical Load for neutral grassland (low and medium altitude hay meadows: 20 kg N/ha/yr). Due to the higher deposition velocity to woodland habitats, background nitrogen deposition rates significantly exceed both lower and upper Critical Loads. This is typical of the situation in most lowland woodlands in England.

4 Predicted ecological effects

4.1 Current and Future Baseline

Current Baseline

4.1.1 The AQA has undertaken dispersion modelling using the four different scenarios:

- Scenario A: The Installation operating continuously including only the buildings associated with the energy recovery facility;
- Scenario B: The Installation and the open-cycle gas turbine generating facility (OCGTs) operating continuously including only the buildings associated with the energy recovery facility;
- Scenario C: The Installation and the OCGTs operating continuously including the Installation buildings and buildings on the Ratcliffe site above 30 m in height (above 1/3 of the lowest stack height); and
- Scenario D: The Installation, the OCGTs and the coal-fired Power Station all operating continuously including the Installation buildings and buildings on the Ratcliffe site above 30 m in height (above 1/3 of the lowest stack height).

4.1.2 For the purposes of ecological impact assessment, modelling results for Scenario A provide the process contribution of the Installation, subject to variations in dispersion caused by proximal buildings which are addressed in the other scenarios. This is because the contributions of the OCGT and the Power Station are already taken account of in the modelling of background pollutant levels. The CBED (Concentration Based Estimated Deposition) model used by APIS estimates total nitrogen and sulphur deposition at a 5 km grid-square scale of resolution. This is derived from national scale monitoring of each component pollutant¹², modified by information from the emissions inventory to improve the spatial pattern of the deposition maps. As established emission sources, the contribution of the Power Station and OCGTs will be reflected in monitoring data, which have recently been updated to 2016–2018 average values. With respect to source attribution, the Power Station is identified as a major contributor to deposition at statutory designated sites (e.g. 12 % contribution to sulphur deposition (as keq H⁺/ha/yr) at Lockington Marshes SSSI). Source attribution is based on 2012 emission rates, using the FRAME model; however, it should be noted that in recent years the annual load factor associated with the Power

¹² The UK Eutrophying and Acidifying Pollutants (UKEAP) network: see <http://www.apis.ac.uk/cbed-concentration-based-estimated-deposition>

Station has been well below the 2012 level and the source attribution data cannot be regarded as representative of recent operation.

Future Baseline

4.1.3 The key change in the future baseline is the anticipated closure of the Power Station. This will result in a reduction in local point-source emissions, which as a ‘best-case’ scenario could in simple terms be regarded as being broadly equivalent to Scenario D minus Scenario C. However, as Scenario D is modelled on a full loading capacity of the Power Station, whereas average annual load averaged only 17 % over the past five years, the actual reduction in pollutant concentrations at sensitive receptors is likely to be substantially lower. Nevertheless, when considering the effects of the Installation, the future baseline will provide some headroom, with the prospect of a net reduction in annual average concentrations and deposition rates.

4.2 Predicted Effects at Lockington Marshes SSSI

Predicted Impacts of Installation

4.2.1 As discussed in Section 3.1, alder woodland and swamp habitats at Lockington Marshes SSSI are not considered sensitive to nitrogen or acid deposition.

4.2.2 The PCs to annual mean ammonia , sulphur dioxide and oxides of nitrogen levels are set out in Tables 21, 23 & 25 of the AQA. They are summarised in Table 4.1, with percentage contributions to Critical Level and PECs.

Table 4.1: Predicted Impacts at Lockington Marsh SSSI

Pollutant	Critical Level (µg/m³)	Background (µg/m³)	PC (µg/m³)	% of CL	PEC (µg/m³)	% of CL
Ammonia	3.0	2.13	0.014	0.47	2.14	71.47
Oxides of nitrogen	30	23.43	0.164	0.55	23.59	78.65
Sulphur dioxide	20	1.46	0.04	0.20	1.5	7.5

Effect Magnitude and Significance

4.2.3 In all cases the PC is below 1 % and can be regarded as *de minimis* in ecological assessment terms, and does not require more detailed ecological interpretation. In addition, the PEC remains below the relevant environmental quality standard for all parameters.

4.3 Predicted effects at Locally Designated Sites

Environmental Permitting Considerations

4.3.1 The AQA does not predict any effects in excess of the 100 % Environment Agency screening threshold for locally designated sites (LNRs and LWSs), and there is therefore no requirement for further ecological interpretation for permitting purposes.

Effects above IAQM Screening Thresholds

Nitrogen Deposition Rates

4.3.2 The following modelled impacts are above the 1 % screening threshold, in a situation where either background levels or the PEC are close to or exceed the Critical Load. Values in Table 4.2 are taken from Table 32 of the AQA.

Table 4.2: Nitrogen Deposition Rates above Screening Thresholds (values all kg N/ha/yr)

Site	Habitat	CL	Back-ground (% of CL)	PC (% of CL)	PEC	% of CL
Gotham Hill Wood	Broadleaved woodland (G1)	10	33.46 (334.6 %)	0.299 (3.0 %)	33.76	337.6
Thrumpton Park	Meso and eutrophic Quercus woodland (G1.A)	15	33.46 (223.1 %)	0.296 (1.97 %)	33.76	225.0
Thrumpton Park	Low and medium altitude hay meadows (E2.2)	20	19.32 *	0.182 (0.9 %)	19.50	97.51
* % of CL is not available						

4.3.3 Nitrogen deposition rates in grassland habitats at Thrumpton Park LWS have been included in Table 4.2, as the PEC is close to the lower Critical Load, and the PC is close to the 1 % screening threshold.

Acid Deposition Rates

4.3.4 In Table 4.3, the modelled impacts are above the 1 % screening threshold, when background levels or the PEC are close to or exceed the relevant Critical Load.

4.3.5 As explained in the AQA, the method for calculating the PC to acid deposition can be simplified as:

$$PC \text{ as \% of CL function} = ((PC \text{ of } S+N \text{ deposition} / CL_{maxN}) * 100)$$

4.3.6 Both are woodland sites where background deposition rates already exceed the relevant Critical Load.

Table 4.3: Acid Deposition Rates above Screening Thresholds (values in keq H⁺/ha/yr)

Site	Habitat	CLmaxN	Back-ground (% of CL)	PC (% of CL)	PEC	% of CL
Forbes Hole LNR	Broadleaved woodland (G1)	1.762	2.11 (119.75%)	0.017 (0.96%)	2.13	120.71
Meadow Lane Carr LWS	Broadleaved woodland (G1)	1.762	2.11 (119.75%)	0.018 (1.02%)	2.13	120.77

Ammonia Levels

4.3.7 The maximum modelled PC to ammonia levels is 0.027 µg/m³, which is just below the 1 % threshold for the 3 µg/m³ Critical Level. These values are predicted at Gotham Hill Woods LNR, River Trent North Bank LNR, and Thrumpton Park LNR. None of the PECs approach the 3 µg/m³ Critical Level.

Oxides of Nitrogen levels

4.3.8 In Table 4.4, the modelled impacts are above the 1 % screening threshold of 0.3 µg/m³ annual mean.

Table 4.4: Oxides of Nitrogen Levels above Screening Thresholds

Site	CL	Back-ground µg/m ³ (% of CL)	PC (µg/m ³) (% of CL)	PEC (µg/m ³)	% of CL
Gotham Hill Woods LWS	30	21.74 (72.47%)	0.319 (1.06%)	22.06	73.53
River Trent North Bank LWS	30	23.12 (77.06%)	0.329 (1.10%)	23.45	78.16
Thrumpton Park LWS	30	21.21 (70.07%)	0.308 (1.03%)	21.52	71.73

4.3.9 The PC in all these cases only just exceeds the 1 % screening threshold, and can be considered a small magnitude effect.

4.4 Magnitude and Ecological Significance of Predicted Effects

Lockington Marshes SSSI

4.4.1 The magnitude of impacts at Lockington Marshes SSSI is negligible, and there is no risk of any ecological effects as a consequence of the Installation.

Local Nature Reserves

- 4.4.2 Current baseline levels of nitrogen and acid deposition at Forbes Hole LNR are above the relevant Critical Loads. There will be a negligible (<1 %) increase in nitrogen deposition as a consequence of the Installation, with a negligible to minor magnitude increase (just below 1 %) increase in acid deposition.
- 4.4.3 There is no risk that such low magnitude impacts would have any ecological effect on woodland habitats within the LNR. No other air quality parameters approach screening thresholds at the LNR.

Local Wildlife Sites

Nitrogen Deposition Rates

- 4.4.4 There are two small magnitude (2–3 %) exceedances of nitrogen deposition rates at woodland LWSs: Thrumpton Park and Gotham Hill Woods. Deposition rates are similar at both sites at just under 0.3 kg N/ha/yr; however, Thrumpton Park LWS can be regarded as an example of the less sensitive G1.A meso- and eutrophic *Quercus* woodland category, with a 15 kg N/ha/yr lower Critical Load. This is justified in the Site Description supplied by Nottinghamshire biological records centre, which states:
- 4.4.5 *‘Wooded areas have a canopy containing Beech Fagus sylvatica and Ash Fraxinus excelsior with Hawthorn Crataegus monogyna dominating scrubby areas. Plants found in the ground flora include Wood Sedge Carex sylvatica, Ramsons Allium ursinum and Bluebell Hyacinthoides non-scripta.’*
- 4.4.6 This is clearly a description of the National Vegetation Classification W8 community, which translates to the EUNIS G1.A habitat.
- 4.4.7 Gotham Hill Woods was not identified as a LWS in the written information supplied by the records centre, although it is within the 2 km radius and was identified as a sensitive receptor in the AQA. Published descriptions suggest this is an elm woodland community, although without further information on ground flora it is more precautionary to default to the broadleaved woodland broad habitat (EUNIS level 2 community G1) with a lower critical load of 10 kg N/ha/yr.
- 4.4.8 With regard to significance of effect, these both fall into the situation defined by the EA where *‘the background concentration is currently exceeding the appropriate environmental criterion and the new process contribution will cause an additional **small** increase’* (see subsection 2.2 above). In common with most lowland woodlands, there may have been long-term changes in plant community structure or other

parameters (e.g. litter decomposition rates; mycorrhizal communities) which are harder to detect. However, the very small magnitude increase in impact is very unlikely to have a further measurable effect on the woodland community.

- 4.4.9 In addition, the predicted increase in local deposition rates will be short-term in nature, and subject to a net reduction following the projected closure of the coal-fired Power Station in line with UK Government policy. This is not dependent on the reduction of other emission sources, such as reductions in agricultural emissions or reductions following changes in vehicle emission factors.

Acid Deposition Rates

- 4.4.10 Acid deposition rates at Meadow Lane Carr LWS just exceed the 1 % screening threshold using the APIS Query by Location function for broadleaved woodland broad habitat (see Table 4.3).
- 4.4.11 The data search from Derbyshire Wildlife Trust described this site as a 'secondary broad-leaved wet woodland', without specifying the species composition. Some wet woodland communities, notably alder woodlands, are not regarded as sensitive to acid deposition; lowland wetland communities are generally well-buffered with respect to base cations, so it is possible that the values in the APIS Query by Location function are over-precautionary for this site.
- 4.4.12 A process contribution of this small magnitude is extremely unlikely to have a measurable ecological effect. In addition, future baseline deposition rates will show a net reduction relative to current and past values following closure of the coal-fired Power Station.

Ammonia Levels

- 4.4.13 No effects are predicted above screening thresholds, and in no cases does the PEC exceed the 3 µg/m³ Critical Level.

Oxides of Nitrogen Levels

- 4.4.14 The PEC shown in Table 4.4 in all cases exceeds the 70 % Environment Agency screening threshold, but remains safely below the Critical Level for the protection of ecosystems. There is therefore no risk that the Installation would have any ecological effect on these sites as a consequence of increased long-term oxides of nitrogen levels.

5 Conclusions

5.1 Conclusions

Current Baseline

- 5.1.1 Following consideration of the results of the dispersion and deposition modelling, with regard to the sensitivity of ecological receptors, it can be safely concluded that there will be no ecologically significant effects as a consequence of emissions to air from the Installation.
- 5.1.2 No impacts in excess of screening thresholds are predicted at Lockington Marshes SSSI, the only nationally important statutory designated site in a 2 km radius of the Installation.
- 5.1.3 Two woodland LWSs are predicted to experience small magnitude exceedances of screening thresholds for nitrogen deposition. Forbes Hole LNR, and one LWS, is predicted to have a small magnitude process contribution to acid deposition, around or just above the 1 % screening threshold. These impacts are not likely to have a measurable ecological effect, and cannot be regarded as significant in EIA terms, or significant in terms of the policy protection accorded to locally designated sites in the NPPF.

Future Baseline

- 5.1.4 The closure of the coal-fired Power Station is likely to result in a net reduction in nitrogen and acid deposition rates at nature conservation sites in the vicinity of the Installation. This provides further certainty that there would be no adverse ecological effects as a consequence of emissions from the Installation.

5.2 Recommendations

- 5.2.1 This assessment has not identified a requirement for further ecological mitigation measures to be applied, either at emission source or receptor, in addition to those already incorporated in the design of the Installation and taken account of in the dispersion and deposition modelling set out in the AQA.

