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NYMNPA

28/04/2023

SCAIL ASSESSMENT

BURGATE

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DATE ISSUED: **12th APRIL 2023**

REPORT REFERENCE **P6230-R1-V1**

JSW COOK

BURGATE FARM, HARWOOD DALE

SCAIL ASSESSMENT

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APPENDICES

1 INTRODUCTION

1.1 Background

1.1.1 NoiseAir Limited has been commissioned to undertake a Simple Calculation of Atmospheric Impact Limits (SCAIL) Assessment in support of planning application for a replacement calving shed on land at Burgate Farm, Harwood Dale.

1.2 Background

1.2.1 The site is located at Burgate Farm, Harwood Dale, at approximate National Grid Reference (NGR): 497078, 495043.

1.2.2 The existing calving shed has the capacity to accommodate up to 20 cattle which are housed on a straw bedded Farmyard Manure (FYM) loose housing system. It is understood that the space allowance within the existing shed is inadequate by current animal welfare standards.

1.2.3 The proposals comprise the construction of a new building to provide improved calving facilities. The proposed shed will have the capacity to house up to 30 cattle on a straw bedded FYM loose housing system. Despite the increase in potential capacity of the new shed when compared to the existing, it is understood that cattle numbers will not be increased. The existing shed will be used for general storage of farmyard equipment.

1.2.4 Atmospheric emissions associated with the development have the potential to cause air quality impacts at statutory ecological designations in the vicinity of the site. A SCAIL Assessment was therefore undertaken to quantify changes in ammonia (NH_3) concentrations and nitrogen/acid deposition rates at sensitive locations as a result of the proposals and identify any requirement for further analysis. The associated model inputs, assessment criteria and results are provided in the following report. It should be noted that it was assumed that there will be 30 cattle in the new shed throughout the assessment in order to ensure robust results.

2 AMMONIA BACKGROUND

2.1 Atmospheric Ammonia and Nitrogen Deposition

2.1.1 The breakdown of urea or uric acid in animal manures produces NH_3. As such, the potential for atmospheric emissions of NH_3 from agricultural facilities depends largely on the type of animals housed, the manure management system utilised during production and building ventilation arrangements.

2.1.2 Exposure to high concentrations of NH_3 can lead to direct damage to vegetation, as well as acute toxicity in some sensitive plants. Certain species are more sensitive than others. For example, lichens and mosses have a much lower tolerance to atmospheric NH_3 than higher plants species such as grasses and trees.

2.1.3 Atmospheric emissions of NH_3 can also lead to indirect effects on vegetation. Deposition of the nitrogen component of NH_3 on to land can cause a fertilising effect which leads to an increase in plants which thrive in a nitrogen rich environment. This may lead to competition between species and imbalances in the natural diversity of flora within the receiving habitat.

2.1.4 The combination of these effects can lead to changes in ecosystem structure and function. Some of the most significant problems resulting from NH_3 and nitrogen deposition are found at nature conservation sites located in intensive agricultural areas.

2.2 Critical Loads and Levels

2.2.1 A critical load is defined by the UK Air Pollution Information System (APIS)[1] as:

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

2.2.2 A critical level is defined as:

"Concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge."

1 UK Air Pollution Information System, www.apis.ac.uk.

2.2.3 A critical load refers to deposition of a pollutant, while a critical level refers to pollutant concentrations in the atmosphere (which usually have direct effects on vegetation or human health).

2.2.4 When pollutant loads (or concentrations) exceed the critical load or level it is considered that there is a potential risk of harmful effects. The excess over the critical load or level is termed the exceedence. A larger exceedence is often considered to represent a greater risk of harm.

2.2.5 Maps of critical loads and levels and their exceedences have been used to show the potential extent of pollution damage and aid in developing strategies for reducing pollution. Decreasing deposition below the critical load is seen as means for preventing the risk of damage. However, even a decrease in the exceedence may infer that less harm will occur.

2.2.6 **Table 1** presents the critical levels for the protection of vegetation for pollutants considered within this assessment.

Table 1: Critical Levels for the Protection of Vegetation

Pollutant	Critical Level	
	Concentration (µg/m^3)	Averaging Period
NH_3	1	Where lichens and bryophytes are present (where they form a key part of the ecosystem integrity)
	3	Other vegetation

2.2.7 Critical loads have been designated within the UK based on the sensitivity of the receiving habitat and have been identified for the relevant designation considered within the assessment in Section 3.3.

3 SCAIL ASSESSMENT

3.1 Introduction

3.1.1 The proposed development and associated emissions has the potential to affect existing NH_3 concentrations, as well as nitrogen and acid deposition rates, at sensitive ecological designations in the vicinity of the site. Potential impacts were therefore quantified using the SCAIL tool for the following scenarios:

- Existing Scenario - NH_3 concentrations and deposition rates as a result of emissions from existing calving operations at the farm; and,
- Proposed Scenario - Predicted NH_3 concentrations and deposition rates as a result of emissions associated with proposed calving operations at the farm.

3.1.2 The SCAIL model inputs for the existing and proposed scenarios are outlined in the following Sections.

3.2 SCAIL Model Inputs

3.2.1 A summary of the SCAIL model inputs for the existing and proposed scenarios is provided in **Table 2.**

Table 2: SCAIL Model Inputs - Existing and Proposed Scenario

Input	Unit	Existing Building	Proposed Building
Location	NGR	497003.2, 495060.1	497017.6, 495046.0
Source Type	-	Housing	Housing
Source Details	-	20 dairy cows - Straw-bedded FYM loose housing	30 dairy cows - Straw-bedded FYM loose housing
Source Area	m^2	608.00	637.88
Source Height	m	5.00	6.36
Emission Period	Days	365	365

3.2.2 It should be noted that the model was run in conservative mode as required for regulatory purposes in accordance with SCAIL guidance[2]. Releases from the building were assumed to be constant in order to provide a worst-case assessment of potential impacts.

2 SCAIL-Agriculture: User Guide, Sniffer ER26, 2014.

3.3 Ecological Designation Locations

3.3.1 A consultation response prepared by Zara Hanshaw, Assistant Ecologist at North York Moors National Park Authority, on 14th November 2022[3] indicated that the following ecological designation should be considered in the assessment:

- Castlebeck and Scar Woods Site of Special Scientific Interest (SSSI).

3.4 Site Specific Critical Loads and Levels

3.4.1 The SCAIL tool was utilised to identify the features that are sensitive to increases in NH_3 concentrations and nitrogen and acid deposition rates within the designation, as well as the associated critical levels and loads.

3.4.2 The lowest annual mean NH_3 critical level of 1µg/m^3 was assigned to the designation in order to provide a worst-case assessment.

3.4.3 The relevant critical load for nitrogen deposition is presented in **Table 3**.

Table 3: Critical Load for Nitrogen Deposition

Designation	Habitat/Feature	Nitrogen Critical Load (kgN/ha/yr)
Castlebeck and Scar Woods SSSI	Bog - lowland	5

3.4.4 The relevant critical load for acid deposition is presented in **Table 4**.

Table 4: Critical Load for Acid Deposition

Designation	Habitat/Feature	Acid Critical Load (keq/ha/yr)
Castlebeck and Scar Woods SSSI	Bog - lowland	0.59

3 Ecologists Letter, North York Moors National Park Authority, 2022.

3.5 Assessment Criteria

3.5.1 The North York Moors National Park Authority consultation response[4] indicated that a screening threshold of 1% should be applied to all national and international ecological designations, including SSSIs.

3.5.2 Should predicted PCs be less than the threshold, further detailed assessment of potential impacts is not required. If predicted PCs exceed the threshold, additional consideration should be provided.

4 Ecologists Letter, North York Moors National Park Authority, 2022.

4 RESULTS

4.1 Introduction

4.1.1 The SCAIL model inputs outlined in Section 3.2 were utilised to predict NH_3 concentrations and nitrogen and acid deposition rates at the Castlebeck and Scar Woods SSSI for the existing and proposed scenarios. The results are summarised in the following Sections.

4.1.2 Reference should be made Appendix 2 and 3 for the SCAIL model outputs for the existing and proposed scenarios, respectively.

4.2 Ammonia

4.2.1 Predicted annual mean NH_3 PC concentrations at the Castlebeck and Scar Woods SSSI for the existing and proposed scenarios are summarised in Table 5.

Table 5: Predicted Annual Mean NH_3 PC Concentrations

Designation	Annual Mean NH_3 Concentration ($\mu g/m^3$)			Change as a Proportion of Critical Level (%)
	Existing Scenario PC	Proposed Scenario PC	PC Change	
Castlebeck and Scar Woods SSSI	0.012	0.017	0.005	0.5

4.2.2 As shown in Table 5, the predicted change in PCs as a proportion of the critical level was less than 1% at the Castlebeck and Scar Woods SSSI. As such, no further assessment of potential effects at the ecological designation as a result of NH_3 emissions was required.

4.1 Nitrogen Deposition

4.1.1 Predicted annual nitrogen PC deposition rates at the Castlebeck and Scar Woods SSSI for the existing and proposed scenarios are summarised in **Table 6**.

Table 6: Predicted Annual Mean PC Nitrogen Deposition Rates				
Designation	**Nitrogen Deposition (kgN/ha/yr)**			**Change as a Proportion of Critical Load (%)**
	Existing Scenario PC	**Proposed Scenario PC**	**PC Change**	
Castlebeck and Scar Woods SSSI	0.06	0.09	0.03	0.6

4.1.2 As shown in Table 6, the predicted change in PCs as a proportion of the critical load was less than 1% at the Castlebeck and Scar Woods SSSI. As such, no further assessment of potential effects at the ecological designation as a result of nitrogen deposition was required.

4.2 Acid Deposition

4.2.1 Predicted annual acid PC deposition rates at Castlebeck and Scar Woods SSSI for the existing and proposed scenarios are summarised in Table 7.

Table 7: Predicted Annual Mean PC Acid Deposition Rates				
Designation	**Acid Deposition (keq/ha/yr)**			**Change as a Proportion of Critical Load (%)**
	Existing Scenario PC	**Proposed Scenario PC**	**PC Change**	
Castlebeck and Scar Woods SSSI	0.004	0.006	0.002	0.3

4.2.2 As shown in Table 6, the predicted change in PCs as a proportion of the critical load was less than 1% at the Castlebeck and Scar Woods SSSI. As such, no further assessment of potential effects at the ecological designation as a result of acid deposition was required.

4.3 Summary

4.3.1 The results of the assessment indicated that the change in NH_3 concentrations and nitrogen and acid deposition rates as a result of the proposals at the Castlebeck and Scar Woods SSSI is less than 1%. As such, further assessment of potential effects is not required.

APPENDIX A - REPORT LIMITATIONS

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APPENDIX B - SCAIL MODEL OUTPUTS - EXISTING SCENARIO

Results

Content Specific Help Text

Site Information Castlebeck & Scar Woods (SSSI)

Region:	England
Site Name:	Castlebeck & Scar Woods
Site Code:	2927
Designation Status:	SSSI
Distance from Installation (m):	2694
Receptor Type:	Habitat
Grid Reference:	495092.6,496864.6
Met Site:	CHUR
Run Mode:	Conservative
PM_{10} Percentile:	Average

Installation Information

No.	Name	No. of sources	No. of new sources	PM_{10} (t/a)	NH_3 (t/a)	Odour (kOu/a)	Conc NH_3 (µg/m3)	Dep N (kg/ha/yr)	Dep Acid (kEq H+/ha/yr)	Conc PM_{10} (µg/m3)	Conc Odour (Ou/m3)
1	Existing Scenario	1	0	-	0.31	-	0.01	0.06	0.004	-	-

Total Depositions/Concentrations and Exceedances

Concentrations/Depositions and Critical Loads/Levels	NH_3 (µg/m3)	N Dep. (kg N/ha/yr)	Acid Dep. (kEq H+/ha/yr)	PM_{10} (µg/m3)	Odour (Ou/m3)
Process Contribution (PC) at receptor edge	0.01153	0.06	0.004	-	-
Background concentration at receptor edge	1.21	16.63	1.39 (N:1.20|S:0.19)	-	-
Predicted Environmental Concentration/Deposition (PEC)	1.22	16.69	1.39	-	-
Environmental Assessment Level or Critical Load / Level	Lower: 1 Upper: 3	5.0 Bog - lowland	maxN: 0.59 maxS: 0.27 minN: 0.32 Bog - lowland	-	-
		ALTERNATIVE CRITICAL LOAD INFO			
USE OWN THRESHOLDS?					
% of relevant standard PC	Lower: 1% Upper: 0%	1%	0%	-	-
% of relevant standard PEC	Lower: 122% Upper: 41%	334%	236%	-	-
EXCEEDANCE	Lower: 0.22 Upper: No exceedance	11.69	0.80	-	-

Project Notes

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APPENDIX C - SCAIL MODEL OUTPUTS - PROPOSED SCENARIO

Results

Scail Home | User Guide | SCAIL-Agriculture Report | SEPA/EA/NIEA/EPA Contact Details | Online Tutorial

Content Specific Help Text

Site Information Castlebeck & Scar Woods (SSSI)

Region:	England
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Met Site:	CHUR
Run Mode:	Conservative
PM_{10} Percentile:	Average

Installation Information

No.	Name	No. of sources	No. of new sources	PM_{10} (t/a)	NH_3 (t/a)	Odour (kOu/a)	Conc NH_3 (µg/m3)	Dep N (kg/ha/yr)	Dep Acid (kEq H+/ha/yr)	Conc PM_{10} (µg/m3)	Conc Odour (Ou/m3)
1	Proposed Scenario	1	1	-	0.47	-	0.02	0.09	0.006	-	-

Total Depositions/Concentrations and Exceedances

Concentrations/Depositions and Critical Loads/Levels	NH_3 (µg/m3)	N Dep. (kg N/ha/yr)	Acid Dep. (kEq H+/ha/yr)	PM_{10} (µg/m3)	Odour (Ou/m3)
Process Contribution (PC) at receptor edge	0.01701	0.09	0.006	-	-
Background concentration at receptor edge	1.22	16.80	1.39 (N:1.20|S:0.19)	-	-
Predicted Environmental Concentration/Deposition (PEC)	1.24	16.89	1.4	-	-
Environmental Assessment Level or Critical Load / Level	Lower: 1 Upper: 3	5.0 Bog - lowland	maxN: 0.59 maxS: 0.27 minN: 0.32 Bog - lowland	-	-
		ALTERNATIVE CRITICAL LOAD INFO			
USE OWN THRESHOLDS?					
% of relevant standard PC	Lower: 2% Upper: 1%	2%	2%	-	-
% of relevant standard PEC	Lower: 124% Upper: 41%	338%	237%	-	-
EXCEEDANCE	Lower: 0.24 Upper: No exceedance	11.89	0.81	-	-

Project Notes

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