Book 2 Combustion activity operational permit habitats regulations assessment report

Proposed Sizewell C nuclear power station

July 2022

Version 1

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1. Introduction

This is a record of the Habitats Regulations Assessment (HRA) as required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended), carried out by the Environment Agency in respect of the permission, plan or project (PPP) for an operational combustion activity permit. This HRA report (HRAR) has been completed using the legislation/guidance and tests set out in Legal chapter.

The operation of Sizewell C (SZC) requires various permissions from the Environment Agency, including a combustion activity (CA) permit for the use of diesel generators (DG) during commissioning and routine maintenance of the power station, and during any loss of operation power (LOOP) scenarios.

This assessment will have regard to the following information supplied by the applicant:

- Combustion Activity Permit Application Appendix C, Air Quality Assessment (NNB GenCo, 2020a)
- Combustion Activity Permit Application, Appendix D Shadow Appropriate Assessment Report (NNB GenCo, 2020b)
- Combustion Activity Permit Application Appendix E, Noise Assessment (NNB GenCo, 2020c)

The air quality and noise assessments have been audited by our Air Quality Modelling and Assessment Unit (AQMAU), the results of which will be considered in our assessment (Environment Agency, 2021c).

1.1. Proposed timing of the permission

The CA permit will cover the operational lifetime of SZC, currently expected to be 60 years. However, the operation of the DGs will not occur continuously over this period.

Commissioning of SZC CA will last for 2 years, with each unit being commissioned individually for one year, after which the generators will undergo routine testing. Routine testing is the ongoing testing of the generators to make sure they are available to perform their role, as a critical nuclear safety function, should a LOOP event occur. Each essential diesel generator (EDG), of which there are 8, and ultimate diesel generator (UDG), of which there are 4, is tested individually for a total of 60 hours a year for an aggregated total of 720 hours of testing per year for all 12 generators.

Each generator is also tested individually for a full 24-hour period following a maintenance outage, which aggregates to 288 hours of testing per year.

For the LOOP scenario, the applicant has stated that: “… an exact period of operation under such a scenario cannot be specified. Such an event is not intended to occur at all, is statistically unlikely to occur more than once in the plant design life and in such an event is likely to last for well under 24-hours.” (NNB GenCo, 2021b).

1.2. Description of the proposal

Sizewell C combustion plant installation consists of:

- 8 x 23.1MWth EDGs
- 4 x 10.53MWth UDGs
- associated fuel storage tanks and interconnecting pipework

All of these will be housed within purpose built concrete buildings, each containing 2 EDGs and one UDG.

Each generator would require:

- an exhaust stack on roof at a height of 27.2m AOD (for dispersion of generator combustion gases), 3 stacks per building, one per generator
- two fresh-air intakes at mid-level, one either side of the building (per generator), therefore a total of 6 per generator building
- two fresh-air in/warm air out louvres per generator at higher level, therefore a total of 6 per generator building

These 3 elements would comprise the primary sound sources during the operation of the back-up generators used in the sound level model (NNB GenCo, 2020c) as:

“the installation has an aggregated thermal input of 227 MWth and will operate under Part 1 of Schedule 1 to Environmental Permitting Regulations (EPR) as a Section 1.1 Part A1(a) process - Burning any fuel in an appliance with a rated thermal input of 50 or more megawatts.”

The diesel generators are safety classified standby installations and will only be operated in the event of a power failure, maintenance purposes and during periodic testing.

The main emissions are to air via exhaust stacks of approximately 27.2 metres in height and will consist of combustion gases containing oxides of sulphur, nitrogen and carbon and particulates.

The ‘conceptual design stack locations’ are provided in the Combustion Activity Permit Application (NNB GenCo, 2020a), replicated in Figure 1. The proposed purpose-built building containing generators A1, A2 and A3 are closest to the adjacent Minsmere to Walberswick SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar.

Source reference, generator type and grid reference:

- A1: EDG, NGR 647224, 264307
- A2: EDG, NGR 647243, 264307
- A3: UDG, NGR 647259, 264307
- A4: EDG, NGR 647224, 264133
- A5: EDG, NGR 647243, 264133
- A6: UDG, NGR 647259, 264132
- A7: EDG, NGR 647224, 264074
- A8: EDG, NGR 647243, 264074
- A10: EDG, NGR 647224, 263900
- A11: EDG, NGR 647243, 263900
- A12: UDG, NGR 647259, 263900

Figure 1 Proposed location of the purpose-built concrete buildings, each containing 2 EDGs and one UDG. Units A1, A2 and A3 are closest to the adjacent Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar. Taken from Fig. 12C.1, NNB GenCo, 2020a

1.3. Modelling scenarios

Section 3 of the Combustion Activity Permit Application Appendix C (NNB GenCo, 2020a) sets out the scenarios assessed in the modelling for combustion activities and the associated noise, these being commissioning and routine maintenance scenarios and loss of operation power event (LOOP) scenario.

These scenarios will be used to determine whether there will be a likely significant effect on the features of the relevant Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsars from the direct toxic effects of nitrous oxides (NOx) and sulphur dioxide (SO_2), nutrient enrichment and acidification on the designated habitat features.

An assessment will also be made on the potential for noise to result in disturbance to protected bird species as a result of operation of the diesel generators during these modelling scenarios.

These modelling scenarios have been audited by the Environment Agency's Air Quality Modelling and Assessment Unit (Environment Agency, 2021b).

1.3.1. Scenario 1 – Commissioning

The first modelled scenario is for commissioning, where all of the generators are tested for reliability and performance prior to the start of nuclear activities. Each of the 8 EDGs are tested for 242.5 hours and each of the 4 UDGs are tested for 738 hours. Unit 1 will undergo commissioning first and unit 2 will undergo commissioning the following year. Therefore, each year, 4 EDGs and 2 UDGs are tested, which aggregates to 2,446 hours of testing per year. While unit 2 is undergoing commissioning, unit 1 will begin undergoing routine operational testing.

Commissioning will also involve simulated LOOP events for each unit. The 4 EDGs are tested all together for a 3-hour period. The applicant has not stated how often these simulated LOOP events are likely to occur. The applicant has suggested that it is possible that a 3-hour simulated LOOP event during commissioning of unit 2 could coincide with 5 hours of routine operational testing of unit 1. Therefore, a worst-case scenario during a 24-hour period is 5 EDGs running simultaneously for 3 hours and one of the EDGs running for an additional 2 hours.

The applicant has modelled the long-term (LT) process contributions (PC) for the commissioning phase by running a single generator all year and using time-varying emissions data to factor the PCs down to 2,446 hours per year. This method captures worst-case meteorological conditions. It has assumed that this generator is always an EDG, which have much higher emission rates than the UDGs. There are twice as many EDGs than UDGs. However, around 60% of the testing will be UDGs, therefore we consider the modelling assumptions to be conservative.

The applicant has modelled the short-term (ST) PCs for commissioning by assuming a worst-case scenario of 5 EDGs running simultaneously for 3 hours and one of the EDGs running for an additional 2 hours. It has run this scenario all year to capture worst-case

meteorological conditions. We consider this modelled scenario to be reasonably worst case.

1.3.2. Scenario 2 – Routine testing

Following a year of commissioning for each unit, the generators will undergo routine testing. Routine testing is the ongoing testing of the generators to make sure they are available to perform their role, as a critical nuclear safety function, should a LOOP event occur. Each EDG and UDG is tested individually for a total of 60 hours a year for an aggregated total of 720 hours of testing per year.

Each generator is also tested individually for a full 24-hour period following a maintenance outage, which aggregates to 288 hours of testing per year. The applicant has not described what a maintenance outage could consist of or specified how often they are likely to occur. The applicant has not stated whether the 288 hours of generator testing following a maintenance outage are already accounted for in the 720 hours of total testing per year.

The applicant has modelled the LT PCs for routine testing by running a single generator all year and using time-varying emissions data to factor the PCs down to 720 hours per year. This method captures worst-case meteorological conditions. It has assumed that this generator is always an EDG, therefore, we consider these modelling assumptions to be conservative because only around 66% of the testing will be EDGs.

The applicant has modelled the ST PCs for routine testing by running one EDG all year. This method captures worst-case meteorological conditions. The applicant has assumed a worst-case scenario where one EDG is tested for 24 hours following a maintenance outage. We consider this to be an appropriate worst-case scenario.

1.3.3. Scenario 3 – Loss of offsite power (LOOP)

A LOOP event involves running all 8 EDGs for the duration of the event. It is not easily determined how often a LOOP event is likely to occur or how long it will last. The applicant suggests that “a short LOOP event (<2 hours) is expected to occur a limited number of times during the lifetime of the plant and a long LOOP event (2-24 hours) is expected to occur about once in the lifetime of a fleet of nuclear sites.”

While the applicant has modelled the ST PCs for the LOOP event by running all 8 EDGs all year, an assessment was not carried out at the protected sites.

2. Identification of relevant European sites for assessment

The screening criteria applied to the assessment of the effects of combustion activities on sensitive qualifying features of European sites is 10km (Environment Agency, 2012a). This distance has also been applied to screen for the effects of noise on bird qualifying features of relevant SPA and Ramsar sites.

Qualifying features for these sites are then reviewed to determine whether they are sensitive to the risks associated with combustion activities, these being:

- direct toxic effect of the pollutants
- nutrient enrichment
- acidification

Or the risks associated with noise generated by the combustion activities:

- disturbance

There are 11 European sites within 10km of SZC that are relevant for screening for potential direct and indirect effects from the proposed operational CA permit.

- Alde, Ore and Butley Estuaries SAC
- Alde-Ore Estuary Ramsar
- Alde-Ore Estuary SPA
- Dew's Pond SAC
- Minsmere to Walberswick Heaths and Marshes SAC
- Minsmere-Walberswick Ramsar
- Minsmere-Walberswick SPA
- Orfordness-Shingle Street SAC
- Outer Thames Estuary SPA
- Sandlings SPA
- Southern North Sea SAC

Information on the qualifying features of these sites is provided in Annex 2 of this report (Environment Agency, 2022b), the location of the European sites in relation to SZC is provided in Annex 1 of the SZC HRAR (Environment Agency, 2022a). An ecological narrative on the features within the sites is provided in Annex 3 of the SZC HRAR (Environment Agency, 2022c).

The applicant referenced the Air Pollution Information System (APIS) to identify the features at greatest risk from the combustion activity emissions, the criteria used to assess

the direct toxic effects of the emissions (critical levels (CL)), and the deposition of nutrient nitrogen and acidification (critical loads).

The Southern North Sea SAC is designated for its population of harbour porpoise (Phocoena phocoena) only and is within 1km of SZC. The open sea is not sensitive to aerial emissions or deposition from combustion processes. Harbour porpoise are sensitive to disturbance from underwater noise. There is therefore no pathway of effect between noise resulting from the operation of the EDGs and UDGs during the commissioning and operation of SZC CA and the SAC. This site will therefore not progress further than this initial screening step.

The remaining sites have features or supporting habitats that are sensitive to aerial pollutants and will require an assessment.

The applicant did not identify Dew's Pond SAC as being relevant for an assessment. However, it falls within the 10km screening criteria, and therefore requires consideration under the screening stage. The site is designated for the presence of great crested newts (Triturus cristatus). At this distance, the site can be screened out for impacts of disturbance from noise resulting from the operation of SZC CA.

All features associated with the SPAs are sensitive to disturbance from noise and will require an assessment of the impacts of disturbance on the protected bird population.

The following sites will be screened for likely significant effects from combustion processes:

- Alde-Ore and Butley Estuaries SAC
- Alde-Ore Estuary Ramsar
- Alde-Ore Estuary SPA
- Dew's Pond SAC
- Minsmere to Walberswick Heaths and Marshes SAC
- Minsmere-Walberswick Ramsar
- Minsmere-Walberswick SPA
- Orfordness-Shingle Street SAC
- Outer Thames Estuary SPA
- Sandlings SPA

The following sites will be screened for likely significant effects from noise associated with the combustion processes:

- Alde-Ore Estuary SPA
- Alde-Ore Estuary Ramsar
- Minsmere-Walberswick Ramsar
- Minsmere-Walberswick SPA
- Outer Thames Estuary SPA
- Sandlings SPA

An assessment will also be carried out of the off-site impacts on the bird populations of the Minsmere-Walberswick SPA and Ramsar from the commissioning and routine testing of SZC CA on ‘functionally linked land’. In developing the methodology for this screening assessment, we have referred to a Natural England’s commissioned report on functional linkage (Chapman and others, 2016), which says the term ‘functional linkage’ refers to “the role or ‘function’ that land or sea beyond the boundary of a European site might fulfil in terms of ecologically supporting the populations for which the site was designated or classified. Such land is therefore ‘linked’ to the European site in question because it provides an important role in maintaining or restoring the population of qualifying species at favourable conservation status.”

It is considered appropriate to assess the Minsmere-Walberswick Heaths and Marshes SSSI (where it occurs outside of the SPA) and Sizewell Marshes SSSI as providing functionally linked land to the following SPA and Ramsars:

- Minsmere-Walberswick SPA
- Minsmere-Walberswick Ramsar
- Alde-Ore and Butley Estuaries SPA and Ramsar

To inform the assessment, the applicant modelled noise and aerial emissions at the closest point to SZC within the relevant European sites (Table 1).

The applicant modelled deposition at various points within the sites, which were representative of the designated or supporting habitats.

Table 1 European sites receptors included within the applicant's model. Taken from Table 4-2, NNB GenCo, 2020a

Receptor modelling point	Name	Type of receptor	Grid reference	Location relative to installation
E1	Alde-Ore and Butley Estuaries	SAC, SPA and Ramsar	643321, 258097	5km south-west
E2	Minsmere-Walberswick Heaths and Marshes	SAC, SPA and Ramsar	647473, 264520	Adjacent - north
E3	Orfordness to Shigle Street	SAC	646214, 254433	8km south
E4	Sandlings	SPA	646677, 262459	1km south-west

Modelling carried out by the applicant (NNB GenCo, 2020a) to inform an assessment under the Countryside and Rights of Way (CRoW) Act, will be used to for the assessment of functionally linked land (Table 2).

Table 2 SSSI receptors included within the applicant's model assessed as functionally linked land. Taken from Table 4-2, NNB GenCo, 2020a

Receptor modelling point	Name	Type of receptor	Grid reference	Location relative to installation
E5	Sizewell Marshes	SSSI	646994, 264422	Adjacent - west

The locations of the modelling points within the closest European sites and functionally linked land are shown in Figure 2.

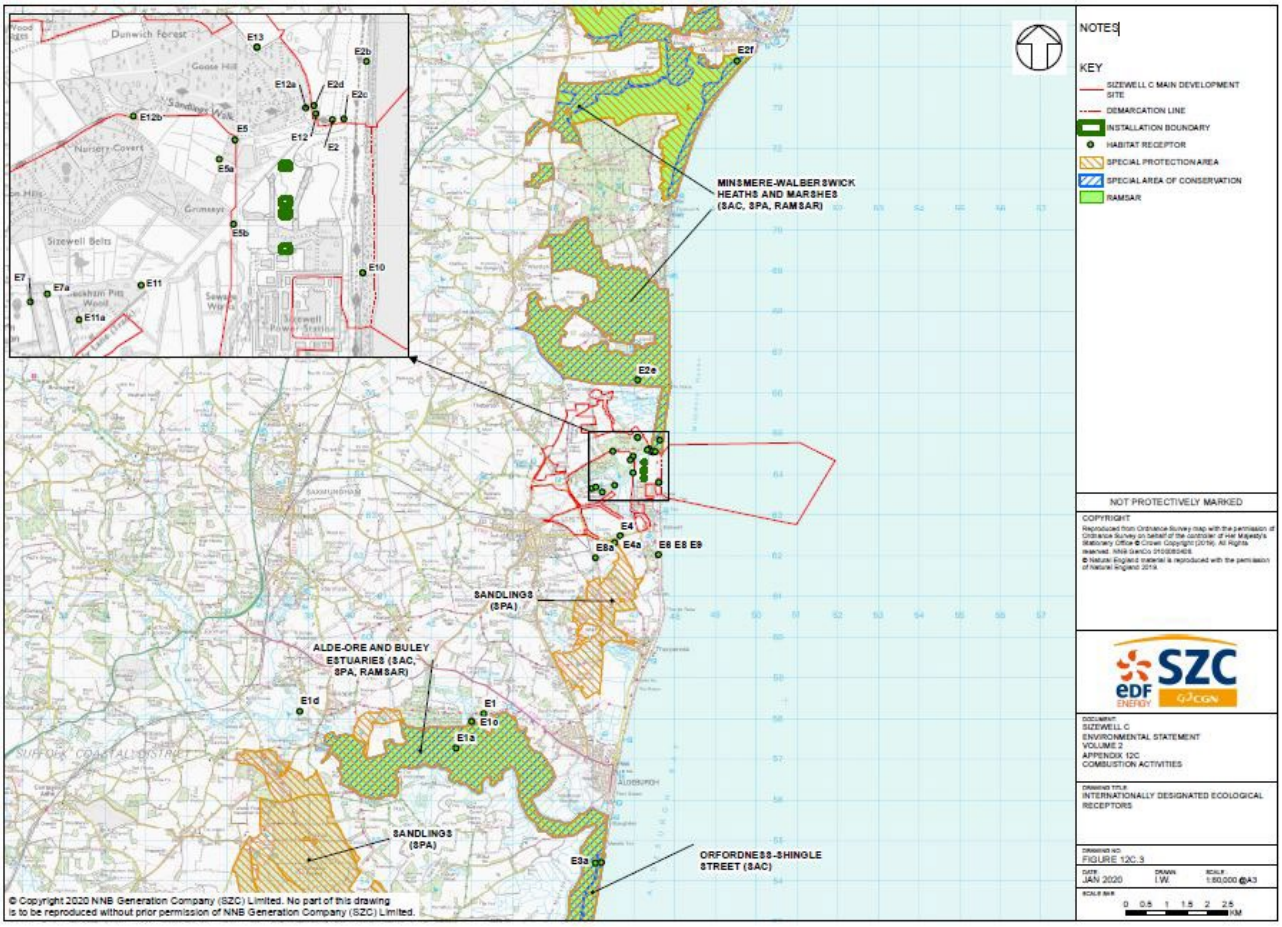

Figure 2 Location of modelled habitat receptor points within Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SAC and Ramsar (E1); Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Ramsar (E2); Orfordness to Shingle Street SAC (E3); and Sandlings SPA (E4); Sizewell Marshes SSSI (E5). Taken from Figure 12.C, NNB GenCo, 2020a.

3. Assessment of effects

Regulation 63 (1) of the Conservation of Habitats and Species Regulations 2017 requires that an appropriate assessment is carried out where a likely significant effect on a European site has been identified and that the appropriate assessment is carried out in view of the site's conservation objectives. The relevant conservation objectives for European sites being assessed are provided in Annex 2 of this report (Environment Agency, 2022b) and all relevant information provided in supplementary advice on conservation objectives (SACO) will also be considered as part of this assessment.

An overview of the legal requirements of the Habitats Regulations and relevant case law is provided in the Legal chapter and will be considered fully in this HRA of effects from the operational CA permit application.

There is a prescribed screening process for the assessment of likely significant effects for aerial emissions and deposition (Environment Agency, 2012a), for disturbance, a likely

significant effect will be presumed where noise levels are modelled to be above background levels within the relevant European sites.

Both the assessment of likely significant effects and adverse effects will be carried out alone and in-combination where no effect alone has been established.

3.1. In-combination assessment

Regulation 63 of the Conservation of Habitats and Species Regulations 2017 requires the competent authority to consider within the HRA, any permission, plans or projects (including Environment Agency permissions and plans/projects) that are likely to have a significant effect on a European site, either alone or in combination with other permissions, plans or projects (PPP). Consideration will be given to the potential for in-combination effects with other PPP at both the likely significant effect (LSE) screening and appropriate assessment stages, where relevant.

In-combination effects can be one of the following:

- additive - the total effect of a number of effects is equal to the sum of the individual effects
- synergistic - the effect of the interaction of a number of effects is greater than the sum of the individual effects
- neutralistic - the effects counteract each other, reducing the overall effect
- overlapping - affecting the same spatial area of a feature and/or the same attributes of the feature. For example, the mixing zones of 2 separate discharges overlap
- discrete - affecting different areas and different attributes of the feature. For example, 2 combustion processes affect geographically discrete areas of a habitat within a site. In combination, the total area of habitat affected may be unacceptable in terms of site integrity

The assessment will consider the following (PINS, 2017):

- projects that are under construction
- permitted application(s) not yet implemented
- submitted application(s) not yet determined
- projects on the National Infrastructure’s programme of projects
- projects identified in the relevant development plan (and emerging development plans – with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited and the degree of uncertainty which may be present

This will also include within project or interlinked decisions in combination from the SZC project itself, where applicable.

The main aspects to consider for in-combination effects are the:

- temporal and geographic boundaries of the effects of activities
- interactions between the activities and the overall ecosystems
- environmental effects of the project, and past and future projects and activities
- thresholds of sensitivity of the existing environment

To be considered within the in-combination assessment, other PPP should meet the following criteria:

- generate their own residual impacts of at least minor significance
- be likely to be constructed or operate over similar time periods
- be spatially linked to the proposed development (for example, using the same local road network)

3.1.1. Identification of relevant PPP

For aerial emissions and deposition, background levels obtained from APIS for use in this HRA, use the 3-year mean from 2017 to 2019, and include those PPP that have been completed or permitted. Typically, emission sources are considered to be in APIS background if they were operational by 31 December of the mid-year within the 3-year average dataset. Therefore, only plans or permissions commencing operation after the 31 December 2018 need to be considered in combination.

Consideration will also be given to whether the PPP activities identified would give rise to disturbance within the European sites, where relevant.

To ensure that the list to be considered for the in-combination assessment is appropriate we have regard to:

1. if there is a potential pathway or mechanism for in combination effects. If none could be identified, then the PPP will be excluded from consideration

2. whether the PPP was a construction or works project that is now complete. If so, the PPP will already have been considered as part of the prevailing environmental conditions and effectively taken into consideration in the alone assessment. As a result, it will not be considered further in the in-combination assessment to avoid double counting

3. whether the PPP is an ongoing permission issued prior to 31 December 2018. If so, the PPP will already have been considered as part of the prevailing environmental conditions and effectively taken into consideration in the alone assessment. As a result, it will not be considered further in the in-combination assessment to avoid double counting

4. whether the PPP is an ongoing permission issued after 31 December 2018. If so, the PPP will be considered in the in-combination assessment if a potential pathway or mechanism for in combination effects is identified

3.1.2. Within-project in-combination - construction

There is the potential for an in-combination effect between the construction phase of the SZC project and the commissioning of SZC CA prior to operation. The applicant has provided a schematic of when construction activities would be expected to take place on site, and when the nuclear units would be expected to be operational (NNB GenCo, 2021c). There is the potential for an overlap between Phase 5 due to complete mid-2034 (commissioning of the emergency diesel generators), Phase 4 due to complete end of 2033 (mechanical and electrical installation), and potentially Phase 3 due to complete early 2032 (main civils) (Figure 3). However, the applicant has confirmed that the desalination plant will only use diesel engines for the first three years of its operation during the early construction phase, after which it will be powered by the main electricity supply (NNB GenCo, 2021c).

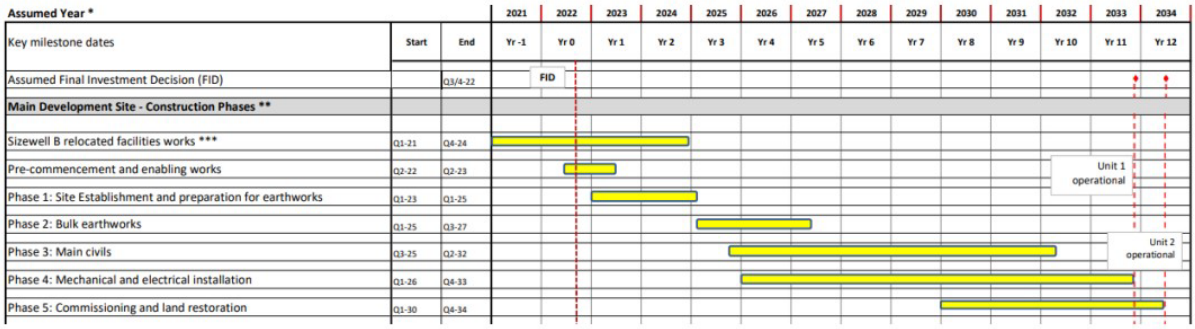

Figure 3 Timeline for the construction of SZC and overlaps between construction and commissioning phases. Phase 5 due to complete mid-2034, Phase 4 due to complete end of 2033 and Phase 3 due to complete early 2032 (Source: NNB GenCo, 2021b)

As exact timings are not known for the interaction between the phased construction of SZC and the commissioning of unit 1, a precautionary approach will be taken assuming that a temporal overlap will exist.

The applicant was asked to provide information to enable us to carry out a within project in-combination assessment, covering construction and operation of SZC CA. It has been confirmed that this information was collated and assessed as part of the Development Consent Order (DCO) submission for the proposed desalination plant (NNB GenCo, 2021c). This assessment will therefore be used as best available information to inform this in-combination assessment and can be accessed via the planning inspectorate website: EN010012-008310-SZC Co. - Other- Desalination Air Quality Assessment.pdf (planninginspectorate.gov.uk).

Para 1.1.5 of the desalination assessment (NNB GenCo, 2021c) states that “It is assumed that the required 2 x 800kW diesel generators would be operational on the main platform site for a maximum period of three years.” After this time, the plant will be powered by the main 1342kV power supplies. There is no potential for an overlap between the use of diesel generators for the desalination plant and the commissioning of SZC CA. An assessment will be made to determine if there is the potential for any residual effects within the European sites from emissions and deposition associated with the desalination

plant diesel generators, that could act in-combination with the commissioning and routine testing of SZC CA diesel generators.

We have not received the modelling outputs to verify the results of the modelling for the desalination plant and combined heat and power plant (CHP) presented by the applicant (NNB GenCo, 2020e). However, this is considered to be the best information available to inform our in-combination assessment for this operational CA permit HRA. A full in-combination assessment will be carried out on submission of the construction permit applications.

The applicant has also confirmed that temporary construction generators, such as those required for power tools, welfare facilities or construction machinery have not been included within its in-combination assessment or DCO application. This is because the "number, size, location and operational hours of such generators is yet to be confirmed, and therefore it is considered that a meaningful assessment of such equipment cannot be carried out. This has been the position that has been applied throughout the DCO process. Although the impact from such plant has not been quantified, the risk at relevant receptors has been considered and mitigation measures included in the Code of Construction Practice (CoCP)." (NNB GenCo, 2021d)

We will carry out a full assessment of the temporary construction generators when they are applied for, including a within project in-combination assessment, where required.

3.1.3. Within project in-combination – operation

The applicant carried out an in-combination assessment of the operational CA, water discharge activity (WDA) and radioactive substances regulations (RSR) permits (NNB GenCo, 2021b) and concluded the following:

"When considering the potential for combined effects between the three operational permits due to the same risk pathway, it can be seen … that only nutrient enrichment is a relevant consideration (i.e., due to the potential for combined effect between the operational CA permit and operational WDA permit)."

The following potential in-combination effects between the operational permits (CA, RSR, and WDA) and discharges in the marine and freshwater environment and emissions to air have been identified:

- Aerial emissions: operational CA and operational RSR
- Marine discharges: operational RSR and operational WDA

No in-combination effects were identified for freshwater discharges.

The following risks need to be considered in-combination between the operational permits (CA, RSR and WDA):

- Radiological effects: operational RSR
- Nutrient enrichment: operational CA and operational WDA
- Toxic effects of pollutants (chemicals): operational CA and operational WDA

The following effects have no potential for in-combination effects:

- Acidification: operational CA
- Disturbance (noise): operational CA
- Thermal effects: operational WDA

When considering the potential for an interaction between different risk and effect pathways, the applicant concludes, “the potential effects of the operational CA permit activities (air quality and noise) are confined to the terrestrial environment. While aerial emissions could disperse to the marine environment, and therefore represent a theoretical potential for effect, in reality there is no effect pathway to marine mammal and migratory fish qualifying interest features of Special Areas of Conservation (SACs) or to marine supporting habitats of bird qualifying features of Special Protection Areas (SPAs). The conclusion regarding lack of a realistic effect pathway is reached on the basis of the assessment of sensitivity to aerial concentrations of ammonia, NOx and SO_2 and nutrient nitrogen and acid deposition reported in the Air Pollution Information System (APIS) which confirms these features and habitats are not exposed or sensitive to this effect pathway.” (NNB GenCo, 2021b)

No further consideration will be given in this assessment to in-combination effects between the CA, RSR and WDA operational permit applications.

The CHP plant will be operational during the commissioning and routine testing of SZC CA (NNB GenCo, 2020e) and will be considered in-combination where required.

3.1.4. Existing Environment Agency permits

The Environment Agency’s mapping tool, Easimap was interrogated to identify any existing activities with aerial emissions within 10km of the modelled receptor point (Table 1 and Table 2) within the relevant European sites. Those permitted post 31 December 2018 will be considered in-combination.

Consideration will also be given to permits that could give rise to noise and disturbance within European sites designated for the protection of birds, where required.

3.1.5. Other competent authority plans, permissions and projects

The applicant identified PPP in its Shadow Habitats Regulations Assessment Report (Table C.1: Screening other projects for in-combination, Volume 1 Appendix C of its DCO submission (NNB GenCo, 2020d)); a review of permits we issued as a competent authority; and through our consultation with other relevant competent authorities carried out in June 2021. The list of competent authorities we consulted is as follows:

Local authorities:

- Boston Borough Council
- East Riding of Yorkshire
- East Suffolk Council
- Hull City Council
- Lincolnshire County Council

- Norfolk County Council
- South Holland District Council
- Suffolk County Council

Inshore Fisheries and Conservation Authorities (IFCA):

- Eastern IFCA

Defra organisations:

- Marine Management Organisation
- Natural England

Of the competent authorities identified above, we received responses from:

- East Suffolk Council
- Eastern IFCA
- Hull City Council
- North Lincolnshire Council
- North Norfolk District Council

For the remaining competent authorities, it must be assumed that there are no relevant PPP to be considered in combination.

The applicant did not identify any PPP with associated combustion activities (Table C.1 Volume 1 (NNB GenCo, 2020d)). None were identified by the competent authorities who responded to our in-combination consultation. An assessment of PPP issued by other relevant competent authorities is therefore not required for any in-combination assessment of aerial emissions and deposition.

A list of the PPP identified by the competent authorities is provided in the in-combination assessment for the operational WDA permit HRA (Environment Agency, 2022d).

The applicant did identify PPP that could result in disturbance effects on the features of the Minsmere-Walberswick SPA and Ramsar, Outer Thames Estuary SPA and Sandlings SPA (Table C.1 Volume 1, NNB GenCo, 2020d) due to disturbance effects on species populations from construction projects and disturbance due to increased recreational pressure. These projects will be considered as part of the disturbance (noise) impact assessment of this HRA, where required.

4. Air quality impact assessment

The applicant used ADMS 5.2 air dispersion modelling software to predict impacts of emissions and deposition from the facility at modelled habitat receptor points within the relevant SAC, SPA and Ramsar sites (Figure 2).

Emissions of NOx and SO_2 and resulting nutrient deposition and acidification will be assessed alone, in the context of prevailing environmental conditions, and in-combination with other plans, projects and permissions. These tests will be applied at both the screening and appropriate assessment stage.

4.1. Screening for likely significant effects methodology

Guidance on carrying out an assessment of likely significant effect for aerial emissions is set out in the Environment Agency's operational instruction (Environment Agency, 2012a), the principles of which the applicant followed. Section 5.1 of the applicant's Shadow HRA Report (NNB GenCo, 2020b) sets out this agreed methodology for the assessment of likely significant effects from aerial pollutants and will be replicated in this assessment.

This guidance sets out that if the process contribution (PC) is:

- <1% critical level or load, long-term emissions from the application **are not significant**
- >1% critical level or load, long-term emissions from the application have the potential to be significant, the relevant predicted environmental concentration (PEC) at the national network site(s) must be considered: PEC = PC + background
- PEC <70% critical level or load, long-term emissions from the application **are not significant**
- PEC >70% critical level or load, long-term emissions from the application **are significant** and an appropriate assessment is required

The commissioning and operation of diesel generators at SZC are set in the context of a wider project, including operational radioactive substances activity and water discharge activity permits and will be subject to construction permits. An in-combination assessment will therefore be carried out where the PEC is predicted to be <70% critical level or load, to ensure that this threshold will not be exceeded when considering those PPP that will take place prior to the operation of SZC CA and where there is enough information available to inform an assessment.

Consideration must also be given to the short-term effects of pollutants on protected sites, including NOx. Detailed assessment at protected sites is required where modelling predicts that the PC >10% critical level. There is no requirement to consider short-term effects in-combination with background (PEC). There are no short-term critical loads.

The modelling used to inform this screening for likely significant effects was carried out by the applicant as presented in the permit application (NNB GenCo, 2020a) and in section 1.3 of this HRAR. It represents the worst-case precautionary approach, with emission

levels that are unlikely to be reached in reality. This is an appropriate approach for screening purposes.

The Air Pollution Information System (APIS) was referenced by the applicant to identify the qualifying features at greatest risk of a likely significant effect from the combustion activity emissions, the criteria used to assess the direct toxic effects of the emissions (critical levels) and the deposition of nutrient nitrogen and acidification (critical loads). These have been reviewed and confirmed as appropriate for use. Tables 5.1, 5.2 and 5.3 of the applicant's Shadow HRA Report (NNB GenCo, 2020b) are replicated below in the sections on Critical levels and Critical loads.

4.1.1. Direct toxic effects

APIS (accessed 22/07/21) provides the following information on the direct effects of toxic contamination from emissions of NOx:

"It is likely that the strongest effect of emissions of nitrogen oxides across the UK is through their contribution to total nitrogen deposition. However, direct effects of gaseous nitrogen oxides may also be important, especially in areas close to sources (e.g. roadside verges). The critical level for all vegetation types from the effects of NOx has been set to 30 µg/m³. Experimental evidence suggests that moderate concentrations of NOx may produce both positive and negative growth responses, with the potential for synergistic interactions with sulphur dioxide (SO_2) being very important. There is substantial evidence to suggest that the effects of nitrogen dioxide (NO_2) are much more likely to be negative in the presence of equivalent concentrations of SO_2. At the same time the ratio of SO_2 to NO_2 has decreased greatly in urban areas of the UK over the past 30 years."

APIS also states that, "background level concentrations of SO_2 in the UK have fallen so much that there is no longer a threat to plant health." However, it is still relevant to assess the emissions of SO_2 against the relevant critical levels.

Critical levels

Sulphur dioxide (SO_2)

- 10µg/m³ where lichens or bryophytes are present, annual
- 20µg/m³, annual

Nitrogen oxide (NOx)

- 30µg/m³, annual
- 75µg/m³, daily

4.1.2. Nutrient enrichment

An overview of nitrogen deposition effects on habitats and species is available on APIS (accessed 22/07/21), and is provided in part below:

"Vascular plants take up most of their N through their roots, but some can be absorbed above ground via stomata (gases) or the cuticle. Nonvascular plants can absorb N through

their entire surface (e.g., lichens and bryophytes). Most plants use reactive N, but some can use organic N, e.g., amino acids. If carbon (C) assimilation is restricted, e.g. by insufficient phosphorous (P), light or water, then N can potentially accumulate to excess and become toxic. In other words, N no longer acts as a nutrient rather it becomes a pollutant. Too much N is accepted as one of the main drivers of biodiversity change across the globe.

“Communities most at risk from N eutrophication are those rich in bryophytes and where species richness is comprised of slow growing species. Many semi-natural plants do not have the capacity to assimilate nitrogen in the presence of increased N availability (from N deposition) and can be outcompeted by plants that can, e.g. many graminoids (grass) species. This species loss is caused by shading or an inability to compete for other limiting resources. Low growing species such as forbs and non-vascular plants are especially at risk. Such species replacements can lead to loss of specialised communities and ecosystems, e.g., heathland transformed into grassland in the Netherlands.

“N deposition can also increase the risk of damage from abiotic factors, e.g. drought (summer and winter) and frost. Where N deposition leads to enhanced foliar N concentrations there is increased risk of damage from pests and pathogens both above and below ground. Detrimental impacts of N below-ground include loss of species diversity with respect to ectomycorrhiza and reductions in decomposer populations, e.g. enchytraeid worms. Nitrogen can also increase litter fall, reducing the amount of light passing through to ground dwelling species.”

Critical loads

The critical loads provided in Table 5 to Table 16 of this HRAR are taken from Table 5.2 Shadow HRA Report (NNB GenCo, 2020d), and have been cross-referenced with APIS, and updated to include all features that are identified as sensitive to nutrient enrichment.

Critical loads are defined as: " a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge". (APIS)

Guidance is provided by the Centre for Ecology and Hydrology on the setting of empirical critical loads for nutrient nitrogen for different habitat types (What is a Critical Load? | Critical Loads and Dynamic Modelling (ceh.ac.uk)). They are based on observed changes in the structure or function of ecosystems, or in a few cases dynamic ecosystems modelling.

Each ecosystem or broad habitat is assigned a critical load range, minimum and maximum, taking account of:

1. intra-ecosystem variation between different regions where an ecosystem has been investigated

2. the finite intervals between additions of nitrogen in experiments

3. uncertainties in estimated total atmospheric deposition values

An indication of the confidence in the critical loads is given by an uncertainty rating:

- “reliable” where a number of published papers of various studies showed comparable results
- “quite reliable” when the results of some studies were comparable
- “expert judgement” when no empirical data were available for the ecosystem and the nitrogen critical load was based on expert judgement and knowledge of comparable ecosystems

There is more certainty that an exceedance of a “reliable” critical load will result in damage to the sensitive features of SSSIs.

The applicant used the most stringent and precautionary (that is, lower) critical load from the range provided in its assessment.

Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA, Alde-Ore Estuary Ramsar

Table 3 Critical loads for nutrient nitrogen deposition for Alde-Ore and Butley Estuaries

Qualifying features	Modelling point and NGR	Relevant nitrogen critical load class as defined in APIS	Critical load kgN/ha/yr
Estuaries	E1a 642637, 257245	Pioneer, low-mid, mid-upper saltmarshes	20 - 30
Atlantic salt meadow	E1c 643031, 257904	Pioneer, low-mid, mid-upper saltmarshes	20 - 30

APIS states that there is ‘no comparable habitat with established critical load estimate available’ for the feature mudflats and sandflats not covered by seawater at low tide.

Table 4 Critical loads for nutrient nitrogen deposition for Alde-Ore Estuary SPA and Olde-Ore Estuary Ramsar

Qualifying features	Modelling point and NGR	Relevant nitrogen critical load class as defined in APIS	Critical load kgN/ha/yr
Marsh harrier, (Circus aeruginosus) (breeding)	E1d 638800, 258155	Rich Fens - fen, marsh and swamp	15 - 30
Avocet, (Recurvirostra avosetta) (breeding)	E1c 643031, 257904	Pioneer, low-mid, mid-upper saltmarshes	20 – 30

APIS identifies the relevant nitrogen critical load class for the sandwich tern and little tern as being coastal stable dune grasslands and shifting coastal dunes. The applicant states in its permit application (NNB GenCo, 2020a), that there is "no evidence of this habitat type cited for this receptor, nor on the www.magic.defra.gov.uk website." Natural England's conservation advice for marine protected areas lists the potential supporting habitat for both the little and sandwich terns of the Alde-Ore Estuary SPA as follows:

- coastal lagoons
- intertidal coarse sediment
- intertidal mixed sediments
- intertidal sand and muddy sand
- water column

The critical loads in Table 4 will provide protection for the supporting habitat of the sandwich tern and little tern.

APIS states that there is no negative impact on the ruff, lesser black-backed gull and common redshank due to impacts on the species' broad habitat and they are therefore not relevant for assessment.

The Alde-Ore Estuary Ramsar is designated for its wetland plant and invertebrate assemblages, water bird assemblages and the following individually designated species:

- redshank (Tringa totanus)
- lesser black-backed gull (Larus fuscus graellsii)
- avocet (Recurvirostra avosetta)

Results for modelling points E1a and E1c will be used to inform the assessment for the Alde-Ore Estuary Ramsar.

Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar

Table 5 Critical loads for nutrient nitrogen deposition for Minsmere to Walberswick Heaths and Marshes SAC site and associated modelling point

Qualifying features	Modelling point and NGR	Relevant nitrogen critical load class as defined in APIS	Critical load kgN/ha/yr
Perennial vegetation of stony banks	E2b 647639, 264809	Coastal stable dune grasslands	8 - 15
European dry heaths	E2c 647530, 264525	Dry heath	10 - 20

The annual vegetation of drift lines feature of the SAC is not sensitive to nutrient enrichment (APIS) and is therefore not relevant for assessment.

Table 6 Critical loads for nutrient nitrogen deposition for Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar and associated modelling points

Qualifying features	Modelling point and NGR	Relevant nitrogen critical load class as defined in APIS	Critical load kgN/ha/yr
Nightjar (Caprimulgus europaeus) (breeding)	E2c 647530, 264525	Dry heath	10 - 20
Little tern (Sterna albifrons) (breeding)	E2b 647639, 264809	Coastal stable dune grasslands – acid type	8 - 10
Bittern (Botaurus stellaris) (breeding)	E2e 647106, 266290	Rich fens - fen, marsh and swamp (swamp, fen meadow and reedbeds)	15 - 30
Marsh harrier (Circus aeruginosus) (breeding)	E2e 647106, 266290	Rich fens - fen, marsh and swamp (swamp, fen meadow and reedbeds)	15 - 30
Avocet (Recurvirostra avosetta) (breeding)	E2f 649540, 274132	Pioneer, low-mid, mid-upper saltmarshes	20 – 30
Wetland plant assemblages	E2e 647106, 266290	Rich fens - fen, marsh and swamp (swamp, fen meadow and reedbeds)	15 - 30

There is not expected to be a negative impact on the hen harrier, teal, shoveler, greater white fronted goose features of the SPA due to impacts on these species' broad habitat (APIS).

There are no comparable habitats with an established critical load for the standing open water supporting habitat of the gadwall feature of the SPA (APIS).

Modelling point E2f is located at approximately 10km from SZC (Figure 2) and was therefore not included in the modelling submitted by the applicant. However, protection will be afforded to the supporting habitat of the avocet as an assessment will be made against more stringent critical loads at the closer modelling points.

The Ramsar is designated for its reedbeds, perennial vegetation of stony banks and annual vegetation of drift lines habitats. It is also designated for wetland species and assemblages of species including:

- snail (Vertigo angustior)
- wetland plant and invertebrate assemblages
- waterbird assemblages

The results of the modelling at points E2b and E2e will be used to inform the assessment of Minsmere-Walberswick Ramsar.

Orfordness-Shingle Street SAC

Table 7 Critical loads for nutrient nitrogen deposition for Orfordness-Shingle Street SAC

Qualifying features	Modelling point and NGR	Relevant nitrogen critical load class as defined in APIS	Critical load kgN/ha/yr
Perennial vegetation of stony banks	E3a 646064, 254424	Coastal stable dune grasslands	8 - 15

Annual vegetation of drift lines habitats are not sensitive to eutrophication and are therefore not relevant for assessment (APIS).

The coastal lagoons feature is located at more than 10km from SZC and is therefore not relevant for assessment.

Outer Thames Estuary SPA

Table 8 Critical loads for nutrient nitrogen deposition for the Outer Thames Estuary SPA

Qualifying features	Modelling point and NGR	Relevant nitrogen critical load class as defined in APIS	Critical load kgN/ha/yr
Little tern (Sterna albifrons) and common tern (Sterna hirundo) (breeding)	E2b 647639, 264809	Coastal stable dune grasslands	8 - 15
Little tern and common tern (breeding)	E2b 647639, 264809	Shifting coastal dunes	10 - 20

APIS states that there is no negative impact on the red throated diver due to impacts on the species' broad habitat and this is therefore not relevant for assessment.

The applicant stated in Table 5.2 of its Shadow HRA that, "The SPA protects the marine foraging areas for these species and, therefore, is not considered sensitive to nitrogen deposition." However, the SACO for the Outer Thames Estuary provides a target to "maintain concentrations and deposition of air pollutants at below the site-relevant critical load or level values given for this feature of the site on the Air Pollution Information System" as the "structure and function of habitats which support this SPA feature may be sensitive to changes in air quality." It is therefore right that an assessment of nutrient deposition is made against the critical loads set out in Table 8.

Sandlings SPA

Table 9 Critical loads for nutrient nitrogen deposition for the Sandlings SPA

Qualifying features	Modelling point and NGR	Relevant nitrogen critical load class as defined in APIS	Critical load kgN/ha/yr
Nightjar (Caprimulgus europaeus) and woodlark (Lullula arborea) (breeding)	E4a 646542, 262295	Dry heath	10 - 20

The citation for the SPA states that, “Woodlark and nightjar have also adapted to breeding in the large conifer forest blocks, using areas that have recently been felled and recent plantation, as well as areas managed as open ground.” APIS states that there is no negative impact on the nightjar due to impacts on the species’ supporting habitat of coniferous woodland and is therefore not relevant for assessment.

Functionally linked land

Table 10 Critical loads for nutrient nitrogen deposition for functionally linked land

Supporting habitat	Qualifying feature	Modelling point and NGR	Functionally linked SSSI	Critical load (kgN/ha/yr)
Fen, marsh and swamp (rush pasture)	Bittern Marsh harrier	E2d 647382, 264592	Minsmere-Walberswick Heaths and Marshes	15 - 25
Fen, marsh and swamp (rich fens)	Bittern Marsh harrier	E5a 646916, 264326	Sizewell Marshes	15 - 30
Fen, marsh and swamp (rush pasture)	Bittern Marsh harrier	E5b 646986, 264008	Sizewell Marshes	15 - 25

The bittern and marsh harrier features of the Minsmere-Walberswick SPA and Alde-Ore Estuary SPA have the potential to use the supporting habitat within Sizewell Marshes SSSI and Minsmere-Walberswick Heaths and Marshes SSSI (outside the European site) as functionally linked land.

4.1.3. Acidification

An overview of acidification effects on habitats and species is available on APIS (accessed 22/07/21), and is provided in part below:

“Acid deposition represents the mix of air pollutants that deposit from the atmosphere leading to acidification of soils and freshwaters. It mainly consists of pollutants emitted by the combustion of fossil fuels (e.g. power generation). The removal of these pollutants from the atmosphere is in the form of wet deposition in rainfall, cloud-water or occult deposition, mist and dew, but also includes dry deposited acidifying gases.

“Many effects of acid deposition are indirect, associated with acid deposition lowering soil pH and increasing solubility of toxic Al^{3+} ions, which is often associated with reduced base cation concentrations. Leaching of base cations, especially magnesium from soils, have been linked to leaf chlorosis, a common symptom on trees in some German forests in the 1980s, where this yellowing was associated with forest decline. Decomposition rates can be reduced in acid soils which will mean nutrient availability is compromised as mineral nutrients remain immobilised. Acid deposition can lead to calcium being leached from conifer needles, e.g. red spruce, which become less able to withstand winter freezing / desiccation damage. The effect on food crops is minimised by the application of lime and fertilizers to replace lost nutrients and maintain a more neutral soil pH.”

Critical loads

The critical loads were provided in the Table 5.3 of the applicant’s Shadow HRA (NNB GenCo, 2020b) and have been cross-referenced with APIS.

Critical loads are defined as: "a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge." (APIS)

Critical loads for acidification are presented as a critical load function comprising of the maximum critical load for sulphur (CLmaxS), minimum critical load for nitrogen (CLminN) and maximum critical load for nitrogen (CLmaxN). When compared with deposition data for sulphur and nitrogen, they can be used to assess critical load exceedances.

The applicant used the most stringent and precautionary (that is, lower) critical load function from the range provided in its assessment.

The Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Ramsar sites, Minsmere-Walberswick SPA and Sandlings SPA are either not sensitive to acidification (SACs), or there is no expected negative impact on species (SPA) due to impacts on their broad habitat and they are therefore not relevant for assessment.

The following features and sites are also not sensitive to acidification, and will not be considered in this assessment:

annual vegetation of drift lines:

- Minsmere to Walberswick Heaths and Marshes SAC
- Minsmere-Walberswick Ramsar
- Orfordness–Shingle Street SAC

coastal lagoon:

- Orfordness–Shingle Street SAC

The only species within the Outer Thames Estuary SPA that is sensitive to acidity impacts due to impacts on its broad habitat is the common tern.

Minsmere to Walberswisk Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar

Table 11 Critical loads for acid deposition for Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar site

Qualifying features	Modelling point and NGR	Acidity class	MinCLMinN	MinCLMaxN	MinCLMaxS
Perennial vegetation of stony banks	E2b 647639, 264809	Acid grassland	0.223	0.568	0.202
European dry heaths	E2c 647530, 264525	Dwarf shrub health	0.714	1.237	0.202
Wetland plant assemblages	E2e 647106, 266290	Rich Fens - fen, marsh and swamp (swamp, fen meadow & reedbeds)	0.223	0.568	0.202

The annual vegetation of drift lines feature of the SAC is not sensitive to acidification (APIS) and is therefore not relevant for assessment.

Outer Thames Estuary SPA

Table 12 Critical loads for acid deposition for the Outer Thames Estuary SPA

Qualifying features	Modelling point and NGR	Acidity class	MinCLMinN	MinCLMaxN	MinCLMaxS
Common tern **Little tern**	E2b 647639, 264809	Acid grassland	0.223	0.568	0.202

Acid grassland is used in APIS as the acidity class representative of the supralittoral sediment supporting habitat of the little tern and common tern.

All remaining features and supporting habitats within the SPA are not sensitive to acidification.

Orfordness-Shingle Street SAC

Table 13 Critical loads for acid deposition for Orfordness-Shingle Street SAC

Qualifying features	Modelling point and NGR	Acidity class	MinCLMinN	MinCLMaxN	MinCLMaxS
Perennial vegetation of stony banks	E3a 646064, 254424	Acid grassland	0.223	4.353	4.120

All remaining features within the SAC are not sensitive to acidification (APIS).

Functionally linked land

Table 14 Critical loads for acid deposition for functionally linked land

Supporting habitat	Qualifying feature	Modelling point and NGR	Acidity class	MinCLMinN	MinCLMaxN	MinCLMaxS
Fen, marsh and swamp (rush pasture)	Bittern Marsh harrier	E2d 647382, 264592	Acid grassland	0.223	0.568	0.202
Fen, marsh and swamp (rich fens)	Bittern Marsh harrier	E5a 646916, 264326	Acid grassland	0.223	0.568	0.202
Fen, marsh and swamp (rush pasture)	Bittern Marsh harrier	E5b 646986, 264008	Acid grassland	0.223	0.568	0.202

Acid grassland is used in APIS as the acidity class representative of the fen marsh and swamp supporting habitat of the bittern and marsh harrier.

4.2. Screening for likely significant effects

This assessment will address European sites in relation to their proximity to SZC. Those closest, and therefore at greatest risk of a likely significant effect, will be screened first.

4.2.1. Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walbserwick Ramsar

Details on the features of the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar and associated conservation objectives are provided in Annex 2 of this HRAR (Environment Agency, 2022b). The sites are adjacent to SZC.

The SAC and Ramsar are vulnerable to the direct effects of toxic contamination, nutrient enrichment and acidification (APIS).

The SPA is vulnerable to the direct effects of toxic contamination and nutrient enrichment. However, the supporting features of the notable bird species are not vulnerable to acidification. APIS states that there is no expected negative impact on the species due to impacts on the species' broad habitat.

Toxic contamination

The results of modelling carried out by the applicant for the commissioning and routine testing of SZC CA, are provided in Table 15 and Table 16 of this HRAR (NNB GenCo, 2020a), with the exception of short-term effects of NOx. The applicant did not model for short-term effects during commissioning, stating that emissions would not occur over a 24-hour period. AQMAU modelling, completed to support the permit determination, has therefore been used to inform the commissioning short-term NOx assessment.

Table 15 Assessment of direct toxic effects on Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar during commissioning of SZC

Pollutant	Critical level (µg/m³)	PC (µg/m³)	PC >Y% CL	Background	PEC (µg/m³)	PEC > 70% CL
NOx (long term)	30	13.5	Yes 45%	10.06	23.56	Yes 79%
NOx (short term)	75	223.8	Yes 298%	Not applicable	Not applicable	N/A
SO_2	20	0.5	Yes 2%	0.6	1.1	No 6%
SO_2 (lower plants)	10	0.5	Yes 5%	0.6	1.1	No 11%

Y = 1%, long term; 10% short term

Table 16 Assessment of direct toxic effects on Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar during routine testing of back-up generators

Pollutant	Critical level (µg/ m³)	PC (µg/ m³)	PC >Y% CL	Background (µg/ m³)	PEC (µg/ m³)	PEC > 70%
NOx (long term)	30	3.9	Yes 1 3%	10.06	13.96	No 47%
NOx (short term)	75	303.6	Yes 405%	Not applicable	Not applicable	Not applicable
SO_2	20	0.1	No 0.5%	Not applicable	Not applicable	Not applicable
SO_2 (lower plants)	10	0.1	Yes 1%	0.6	0.7	No 7%

Y = 1%, long term; 10% short term

NOx commissioning

The modelled PC for the commissioning of SZC CA (Table 15) is greater than 1% of the long-term relevant critical level for NOx and the PEC is predicted to be greater than 70% than the critical level.

Short-term emissions of NOx are predicted to be greater than 10% of the short-term critical level during commissioning of SZC CA (Table 15).

We conclude that there is a **likely significant effect alone** on the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar from the **short and long-term** direct toxic effects of NOx from the commissioning of SZC CA.

NOx routine testing

The modelled PC for the routine testing of SZC CA (Table 16) is greater than 1% of the long-term relevant critical level for NOx. However, the PEC is predicted to be less than the LSE decision-making threshold of 70% of the critical level.

Where the PEC is less than the LSE decision making threshold of 70%, an appropriate assessment is not required, due to there being no risk that the critical level will be exceeded.

SZC CA will not be fully operational until 2034, however current background levels available in APIS were used to determine the PEC for the routine testing LSE assessment. The applicant used information available on the Defra pollutant database[1] to forecast predicted NOx levels to best represent the operational background levels of NOx. The year 2030 has been used, as this is the last year of data available, so assumed to be the same for 2034 when operation commences.

Defra background concentrations of NOx are predicted to be 7.5µg/m³ in 2030, giving a PEC of 11.4µg/m³ or 38% of the CL at Minsmere-Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar. It is unlikely that there will be other plans or projects that would contribute a further overlapping 42% of the CL, resulting in the threshold of 70% of the CL being exceeded.

An in-combination assessment is required to determine if there is the potential for a likely significant effect with other plans, permissions or projects that could result in the PEC threshold being exceeded. Background levels on APIS are based on the 3-year average deposition for 2017 to 2019 and include those plans or projects that have been completed or permitted. Typically, emission sources are considered to be in APIS background if they were operational by 31 December of the mid-year within the 3-year average dataset. Therefore, only plans or permissions commencing operation after 31 December 2018 need to be considered in combination to avoid double counting.

Environment Agency permits

The Environment Agency's mapping tool, Easimap was accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of modelling point E2 within Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar to determine if there is any potential for an overlapping in-combination effect.

[1] Modelled background pollution data - Defra, UK

Table 17 Environmental Permitting Regulations installation permits within 10km of modelling point E2, Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar

Permit number installation name	Grid reference	Distance from modelling point E2	Pollutant	Operational before 31 December 2018?
EP3634LR Sizewell B Power Station	TM47366351	1km	NOx	Yes
LP3639NN Redhouse Farm	TM40326154	7.8km	Ammonia	Yes
MP3433UX Darsham Poultry Farm	TM41037198	9.8km	Ammonia	Yes
PP3431XK Park Farm Thorington	TM42157283	9.9km	Ammonia	Yes

There are 4 Environment Agency permits within 10km of the modelling point E2 within Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Ramsar that have associated aerial emissions, all of which were permitted prior to 31 December 2018. Of these, only Sizewell B (SZB) emits NOx emissions, which could have the potential for an overlapping in-combination effect. However, emissions from SZB are already accounted for in the 1km grid square background NOx concentrations in APIS and will therefore be accounted for as part of the modelled PEC within the European site.

The Environment Agency's mapping tool, Easimap was also accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of Minsmere to Walberswick SAC and Minsmere-Walberswick SPA and Ramsar to determine if there is any potential for a discrete in-combination effect.

Table 18 Additional Environmental Permitting Regulations installation permits within 10km of Minsmere to Walberswick Heaths and Marshes SAC, Minsmere–Walberswick SPA and Minsmere-Walberswick Ramsar

Permit number installation name	Grid reference	Distance from modelling point E2	Pollutant	Operational before 31 December 2018?
EP3634LR Sizewell B power station	TM47366351	1km	NOx	Yes
LP3639NN Redhouse Farm	TM40326154	7.8km	Ammonia	Yes
MP3433UX Darsham Poultry Farm	TM41037198	9.8km	Ammonia	Yes
PP3431XK Park Farm Thorington	TM42157283	9.9km	Ammonia	Yes
NP3636WR Peasenhall Poultry Farm	TM35706860	8.4km	Ammonia	Yes
KP3203MZ Wenhaston Farm Broiler Unit	TM41537507	4.4km	Ammonia	Yes
RP3631AE Westhall Poultry Unit	TM40208210	9.5km	Ammonia	Yes
LP3333UL Brampton Poultry Unit	TM43088127	7.1km	Ammonia	Yes

Permit number installation name	Grid reference	Distance from modelling point E2	Pollutant	Operational before 31 December 2018?
CP3036WD **Frostenden Farm and Wangford Farm**	TM48808060	4.8km	Ammonia	Yes
PP3632HJ **Westhall Poultry Farm**	TM43418019	6km	Ammonia	Yes
VP3531CR **Holton Renewable Power Limited**	TM40337925	7.5km	NOx	Yes
CP3831DG **Holton Poultry Processing**	TM40267891	7.5km	NOx	Yes
TP3433ZA **Chediston Hall Pig Farm**	TM36967770	10km	Ammonia	Yes

This process identified a further 2 permits with associated NOx emissions that could have the potential for discrete in-combination effects. However, these were permitted prior to 31 December 2018 and are therefore part of the prevailing environmental conditions of the European site as a whole. Background levels of NOx within Minsmere to Walberswick SAC and Minsmere-Walberswick SPA and Ramsar are below the critical level for the protection of vegetation.

It is therefore possible to conclude no in-combination effects with Environment Agency permissions.

Within project in-combination: construction

All construction activities, apart from the CHP plant associated with the accommodation, will be complete prior to the operation of SZC CA, therefore consideration is needed as to whether impacts from construction have the potential for residual effects within the European site. Emissions from the CHP will be considered in-combination with the routine testing of SZC CA.

The applicant has confirmed that the desalination plant will only use diesel engines for the first 3 years of its operation during the early construction phase, after which it will be powered by the main electricity supply.

Table 3-1 of the Desalination Plant Air Impact Assessment (NNB GenCo, 2021c) provides the predicted annual average PCs for NOx from the desalination plant diesel generators on the relevant European sites. The modelled PC for the receptor E2 Minsmere is 1.19µg/m³ or 4% of the critical level for the protection of vegetation. The PEC is predicted to be 30% of the critical level, therefore there is no potential for any residual effect on the Minsmere to Walberswick SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar from the 3-year operation of diesel generators associated with the desalination plant.

Modelling of NOx emissions at sensitive ecological receptors from the CHP is provided in Table 12F.5 Chapter 12 of the applicant's environmental statement (NNB GenCo, 2020e). Emissions of NOx are predicted to be 0.08µg/m³, or 0.3% of the critical level, and are insignificant.

There is no potential for a likely significant effect between the operation of SZC CA and diesel generators associated with the construction of SZC. The significance decision making threshold of 70% of the critical level will not be exceeded.

Within project in-combination: construction traffic

The applicant carried out modelling of road and rail transport impacts as part of its environmental statement to support its DCO application (NNB GenCo, 2020e), including the following scenarios:

- baseline 2018 scenario or baseline case (BC) (2018 BC) to enable model verification
- early year 2023 reference case (RC) scenario (2023 RC), that is, without the proposed development
- early year 2023 typical day or average day (AD) scenario (2023 AD), that is, with some elements of the associated developments under construction
- peak year 2028 reference case (RC) scenario (2028 RC), that is, without the proposed development
- peak year 2028 typical day or average day (AD) scenario (2028 AD), that, with the peak construction of the proposed development
- peak year 2028 busiest day (BD) scenario (2028 BD), that is, with the peak construction of the proposed development

- operational year 2034 reference case (RC) scenario (2034 RC), that is, without the proposed development
- operational year 2034 typical day or average day (AD) scenario (2034 AD), that is, with the proposed development in place

Table 1.30, Appendix 12B (NNB GenCo, 2020e) provides the maximum modelled road contribution of pollutants for a 2034 typical day scenario relative to the 2034 reference case including NOx, at ecological receptors. Road traffic is not predicted to contribute any NOx to the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar during routine testing of SZC CA, and therefore has no potential for an in-combination effect.

Conclusion

It is therefore possible to conclude that there will be **no likely significant effect alone and in combination** on the Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar from the direct toxic **long-term effects of NOx** from the routine testing of SZC CA.

Short-term emissions of NOx are predicted to be greater than 10% of the short-term critical level during the routine testing of SZC CA (Table 16).

It is therefore possible to conclude that there will be a **likely significant effect alone** on the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar from the direct toxic **short-term effects of NOx** from the routine testing of SZC CA.

SO_2 commissioning and routine testing

The modelled PC for the routine testing of SZC CA is 0.5% of the critical level for the protection of vegetation and is therefore insignificant.

The modelled PC for the commissioning of SZC CA is 2% of the critical level for SO_2 for the protection of vegetation and 10% of the critical level for lichens and bryophytes. The PC is 1% of the critical level for the routine testing of SZC CA (lichens and bryophytes). Consideration of the PEC is therefore required for these scenarios.

The PEC is predicted to be significantly less than 70% of the long-term relevant critical levels for SO_2 for the commissioning (protection of vegetation and lichens and bryophytes) and routine testing (protection of lichens and bryophytes) of SZC CA. The maximum modelled PEC is 11% of the critical level for the protection of lower plants during the commissioning of SZC.

It is therefore possible to conclude that there will be **no likely significant effect** on the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar from the direct toxic effects of SO_2 from the commissioning and routine testing of SZC CA.

Nutrient enrichment

Critical load ranges for Minsmere to Walberswick Heaths and Marshes, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar are provided in Table 5 and Table 6, the lower end of the range is used in this assessment.

The results of the worst-case modelling scenarios for commissions and routine testing of diesel generators are provided in Table 19 and Table 20.

Table 19 Assessment of nutrient enrichment on Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar during commissioning

Modelling point	PC kgN/ha/yr	PC >1% minimum critical load	Background kgN/ha/yr	PEC kgN/ha/yr	PEC > 70% minimum critical load
E2b	0.44	Yes 6%	13.8	14.24	Yes 178%
E2c	1.14	Yes 11%	13.8	14.94	Yes 149%
E2e	0.07	No 0.5%	Not applicable	Not applicable	Not applicable

Table 20 Assessment of nutrient enrichment on Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar during routine testing of back-up generators

Modelling point	PC kgN/ha/yr	PC >1% minimum critical load	Background kgN/ha/yr	PEC kgN/ha/yr	PEC > 70% minimum critical load
E2b	0.13	Yes 2%	13.8	13.93	Yes 174%
E2c	0.33	Yes 3%	13.8	14.13	Yes 141%
E2e	0.02	No 0.1%	Not applicable	Not applicable	Not applicable

Commissioning and routine testing

The modelled PC for the commissioning and routine testing of SZC CA is predicted to be greater than 1% of the relevant critical loads for nitrogen deposition (Table 19 and Table 20), except for modelling point E2e. This is the modelling point for the broad habitat feature fen, marsh and swamp (swamp and reed beds).

The PC at modelling point E2e is predicted to be 0.5% (commissioning, Table 19) and 0.1% (routine testing, Table 20) of the critical load for the broad habitat fen, marsh and swamp (swamp and reedbeds). These levels are therefore considered to be insignificant and there will be **no likely significant effect alone and in-combination**.

The predicted environmental concentration is greater than 70% of the relevant critical load for nitrogen deposition at modelling points E2b and E2c for both commissioning and routine testing of SZC CA. We conclude that there will be **a likely significant effect alone**, in the context of prevailing environmental conditions, on the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar from the effects of nutrient enrichment due to the commissioning and routine testing of SZC CA for the following broad habitats and supported species:

- perennial vegetation of stony banks, little tern
- European dry heath, nightjar

Acidification

For the purposes of the screening assessment the minimum critical loads for acidification have been used: minimum CLminN, minimum CLmaxN and minimum CLmaxS, as provided in Table 11, together with the maximum acid deposition process contributions for N and S.

Annual vegetation of drift lines habitat and the supporting features of the designated bird species are not sensitive to acidification and are therefore not included in this assessment.

Table 21 Assessment of process contribution of acidification on Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberwick and Ramsar during commissioning of SZC

Modelling point	PC N keq/ha/yr	PC S keq/ha/yr	PC>1% CL	Background N keq/ha/yr	Background S keq/ha/yr	PEC N keq/ha/yr	PEC S keq/ha/yr	PEC > 70%CL
E2b	0.03	0.02	Yes 5%	1	0.1	1.03	0.21	Yes 199%
E2c	0.08	0.05	Yes 11%	1	0.1	1.08	0.15	Yes 99%
E2e	0.005	0.003	Yes 2%	1	0.1	1.01	0.1	Yes 195%

Table 22 Assessment of process contribution of acidification on Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberwick Ramsar, for routine testing of back-up generators

Modelling point	PC N keq/ha/yr	PC S keq/ha/yr	PC>1% CL	Background N keq/ha/yr	Background S keq/ha/yr	PEC N keq/ha/yr	PEC S keq/ha/yr	PEC > 70%CL
E2b	0.009	0.005	Yes 2%	1	0.1	1.01	0.11	Yes 195%
E2c	0.02	0.01	Yes 3%	1	0.1	1.02	0.11	Yes 92%
E2e	0.001	0.0008	No 0%	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

Commissioning

The modelled PCs are more than 1% of the critical load function for acidification, therefore consideration of the PEC is needed.

The PECs are > 70% of the critical load functions, so there is likely to be a **significant effect alone,** in the context of prevailing environmental conditions, on the interest features of the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar. An appropriate assessment of acidification from the commissioning of SZC CA is therefore required.

Routine testing

We conclude **no likely significant effect alone and in combination** for the fen, marsh and swamp (swamp and reed beds) feature of the Minsmere-Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar. The PC is predicted to be 0% of the critical load function during the routine testing of SZC CA.

The remaining PCs are more than 1% of the critical load function for acidification, therefore consideration of the PEC is needed.

The PECs are > 70% of the critical load functions, so there is likely to be a **significant effect alone**, in the context of prevailing environmental conditions, on the interest features of the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick

Ramsar. An appropriate assessment of acidification from the routine testing of SZC CA is therefore required.

Screening for likely significant effects conclusion

Minsmere to Walberswick Heaths and Marshes SAC

The annual vegetation of drift lines feature of the SAC is not sensitive to nutrient enrichment and acidification.

Commissioning

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of SO_2: all features of the European site
- nutrient enrichment: fen, marsh and swamp (swamp and reedbeds)
- screening for likely significant effects conclusion: routine testing

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of NOx and SO_2: all features of the European site
- nutrient enrichment: fen, marsh and swamp (swamp and reedbeds)

Routine testing

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of NOx and SO_2: all features of the European site
- nutrient enrichment: fen, marsh and swamp (swamp and reedbeds)

Minsmere-Walberswick SPA

There is not expected to be a negative impact on the hen harrier, teal, shoveler, greater white-fronted goose features of the SPA due to impacts on these species' broad habitat from nutrient enrichment.

There are no comparable habitats with an established critical load for the standing open water supporting habitat of the gadwall feature of the SPA.

None of the bird populations of the SPA are sensitive to acidification due to impacts on their broad habitat.

Commissioning

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of SO_2: all features of the European site

- nutrient enrichment: fen, marsh and swamp (swamp and reedbeds)

Routine testing

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of NOx and SO_2: all features of the European site
- nutrient enrichment: Rich fens – fen, marsh and swamp supporting habitat of the great bittern, marsh harrier. Avocet – pioneer, low-mid, mid-upper saltmarshes.

Minsmere-Walberswick Ramsar

The annual vegetation of drift lines feature of the Ramsar is not sensitive to nutrient enrichment and acidification.

None of the bird populations of the Ramsar are sensitive to acidification due to impacts on their broad habitat

Commissioning

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of SO_2: all features of the European site
- nutrient enrichment: Rich fens – fen, marsh and swamp, representative of the wetland plant assemblages
- acidification: Rich fens – fen, marsh and swamp, representative of the wetland plant assemblages

Routine testing

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of SO_2: all features of the European site
- nutrient enrichment: Rich fens – fen, marsh and swamp, representative of the wetland plant assemblages
- acidification: Rich fens – fen, marsh and swamp, representative of the wetland plant assemblages

4.2.2. Functionally linked land – Sizewell Marshes SSSI and Minsmere-Walberswick Heaths and Marshes SSSI

Toxic contamination

The results of modelling carried out by the applicant for the commissioning and routine testing of SZC CA are provided in Table 23 and Table 24 (NNB GenCo, 2020a). The applicant did not model for short-term effects during commissioning, stating that emissions would not occur over a 24-hour period. AQMAU modelling, completed to support the permit determination, has therefore been used to inform the commissioning short-term NOx assessment.

Table 23 Assessment of direct toxic effects of NOx and SO_2 on functionally linked land (E5, Sizewell Marshes) during commissioning

Pollutant	Critical level µg/m³	PC µg/m³	PC > Y% CL	Background	PEC µg/m³	PEC> Y% CL
NOx (long term)	30	3.9	Yes 13%	9.9	13.8	No 46%
NOx (short term)	75	251.5	Yes 335%	Not applicable	Not applicable	Not applicable
SO_2	20	0.1	No 0.5%	Not applicable	Not applicable	Not applicable

Y = 1%, long term; 10% short term NOx

Table 24 Assessment of direct toxic effects of NOx and SO_2 on functionally linked land (E5, Sizewell Marshes) during routine testing of back-up generators

Pollutant	Critical level µg/m³	PC µg/m³	PC > Y% CL	Background	PEC µg/m³	PEC> Y% CL
NOx (long term)	30	1.1	Yes 4%	9.9	11	No 37%
NOx (short term)	75	327.5	Yes 437%	Not applicable	Not applicable	Not applicable
SO_2	20	0.04	No 0.2%	Not applicable	Not applicable	Not applicable

Y = 1%, long term; 10% short term NOx

NOx commissioning and routine testing

The modelled PC for both the commissioning and routine testing of SZC CA (Table 23 and Table 24) is greater than 1% of the long-term relevant critical level for NOx. Consideration of the PEC is required for both scenarios.

The PEC is predicted to be less than the decision-making threshold of 70% CL for the commissioning and routine testing of SZC CA.

An in-combination assessment is therefore required to determine whether there are any other plans and projects that could act in combination with the routine testing of SZC CA, resulting in the 70% PEC threshold being exceeded.

The functionally linked land at Sizewell Marshes SSSI is situated between Minsmere-Walberswick SPA and the Sandlings SPA. In-combination assessments have been carried out for these sites on the long-term effects of NOx, and it was possible to conclude no likely significant effect in combination. This conclusion can also be inferred for the functionally linked land given that the PEC is substantially below the 70% decision-making threshold.

We conclude that there will be **no likely significant effect alone and in-combination** on the functionally linked land from the direct toxic effects of NOx from the commissioning and routine testing of SZC CA.

Emissions of NOx are predicted to be greater than 10% of the short-term critical level for both modelled scenarios (Table 23 and Table 24).

We conclude that there will be **a likely significant effect** on the functionally linked land from the direct toxic effects of NOx from the commissioning of SZC CA, and the short-term toxic effects during routine testing.

SO_2 commissioning and routine testing

The process contribution from the commissioning and routine testing of SZC CA is less than 1% of the relevant critical level for SO_2, with the PC during the commissioning of SZC CA predicted to be 0.5% of the CL and 0.2% of the CL during the routine testing of SZC CA.

We conclude that there will be **no likely significant effect** on functionally linked land from the direct toxic effects of SO_2 alone and in combination.

Nutrient enrichment commissioning and routine operation

The assessment of nutrient deposition within the functionally linked land is based on the critical loads (Table 10) and background levels obtained from APIS on 9 September 2021. Background levels are for the midyear of 2018, with total N deposition to moorland used at the closest point (5km gridsquare) to SZC.

The lower end of the critical loads presented in Table 10 are used in the assessment, with the maximum PC at the functionally linked land and highest background deposition rate used to represent worst-case scenario. The modelling points used to inform this assessment are:

- E2d: Minsmere-Walberswick Heaths and Marshes SSSI (where it occurs outside of the SPA)
- E5a and b: Sizewell Marshes SSSI

Table 25 Assessment of nutrient enrichment on functionally linked land, Minsmere-Walberswick Heaths and Marshes SSSI and Sizewell Marshes SSSI during commissioning

Modelling point	PC kgN/ha/yr	PC > 1% minimum critical load	Background kgN/ha/yr	PEC kgN/ha/yr	PEC> 70% minimum critical load
E2d	1.09	Yes 7%	13.8	14.89	Yes 99%
E5a	0.28	Yes 2%	13.8	14.08	Yes 94%
E5b	0.48	Yes 3%	13.8	14.28	Yes 95%

Table 26 Assessment of nutrient enrichment on functionally linked land, Minsmere-Walberswick Heaths and Marshes SSSI and Sizewell Marshes SSSI during routine testing of back-up generators

Modelling point	PC kgN/ha/yr	PC > 1% minimum critical load	Background kgN/ha/yr	PEC kgN/ha/yr	PEC> 70% minimum critical load
E2d	0.31	Yes 2%	13.8	14.11	Yes 94%
E5a	0.09	No 0.6%	Not applicable	Not applicable	Not applicable
E5b	0.14	Yes 1%	13.8	13.94	Yes 93%

Nitrogen deposition during the commissioning phase is predicted to be more than 1% of the relevant critical loads at all 3 modelling points, with the PEC exceeding the decision-making threshold of 70%.

There is likely to be a **significant effect alone** on the interest features of the functionally linked land represented by modelling points E2d, E5a and E5b during the commissioning of SZC CA.

Modelling of nutrient deposition during the routine testing of SZC CA has predicted that the PC will be less than 1% of the critical load for rich fens at point 5a, resulting in a screening conclusion of **no likely significant effect**.

However, the PC is predicted to be at or above 1% of the relevant critical loads at modelling points E2d and E5b, with PECs exceeding the 70% decision-making threshold.

There is likely to be a **significant effect alone** on the interest features of the functionally linked land represented by modelling points E2d and E5b.

An appropriate assessment is therefore required of nutrient deposition from the commissioning and routine testing of SZC CA.

Acidification

The functionally linked land provides supporting habitat for the great bittern and marsh harrier features of the Minsmere-Walberswick SPA and Alde-Ore Estuary SPA, neither of which are expected to be sensitive to acidification due to impacts on their broad habitat (APIS)

4.2.3. Outer Thames Estuary SPA

Details on the features of the Outer Thames Estuary SPA and associated conservation objectives are provided in Annex 2 of this HRAR (Environment Agency, 2022b). The Outer Thames Estuary SPA is within 1km of SZC.

The SPA is vulnerable to the direct effects of toxic contamination and nutrient enrichment (APIS) for the little tern and common tern features. There is not expected to be any negative impact on the red throated diver from the emissions or deposition of NOx and SO_2.

The applicant did not model emissions and deposition at the Outer Thames Estuary SPA, results from the Minsmere-Walberswick SPA will be used to inform this screening assessment.

Toxic contamination

The results of modelling carried out by the applicant for the commissioning and routine testing of SZC CA at Minsmere-Walberswick SPA are provided in Table 15 and Table 16 (NNB GenCo, 2020a), with the exception of short-term effects of NOx. The applicant did not model for short-term effects during commissioning, stating that emissions would not occur over a 24-hour period. AQMAU modelling, completed to support the permit determination, has therefore been used to inform the commissioning short-term NOx assessment.

NOx commissioning

The modelled PC for the commissioning of SZC CA (Table 15) is greater than 1% of the long-term relevant critical level for NOx and the PEC is predicted to be greater than 70% than the critical level.

Short-term emissions of NOx are predicted to be greater than 10% of the short-term critical level during commissioning of SZC CA (Table 15).

It is therefore possible to conclude that there will be **a likely significant effect alone** on the Outer Thames Estuary SPA from the short and long-term direct toxic effects of NOx from the commissioning of SZC CA.

NOx routine testing

The modelled PC for the routine testing of SZC CA (Table 16) is greater than 1% of the long-term relevant critical level for NOx. However, the PEC is predicted to be less than the decision-making threshold of 70% of the critical level.

Where the PEC is less than the LSE decision making threshold of 70%, an appropriate assessment is not required, due to there being no risk that the critical level will be exceeded.

SZC will not be operational until 2034. However, current background levels available in APIS were used to determine the PEC for the routine testing LSE assessment. The applicant used information available on the Defra pollutant database[2] to forecast predicted NOx levels to best represent the operational background levels of NOx. The year 2030 has been used, as this is the last year of data available, so assumed to be the same for 2034 when operation commences.

Defra background concentrations of NOx are predicted to be 7.5µg/m³ in 2030, giving a PEC of 11.4µg/m³ or 38% of the CL at Minsmere-Walberswick SPA and therefore the Thames Estuary SPA. It is unlikely that there will be other plans or projects that would contribute a further overlapping 42% of the CL, resulting in the threshold of 70% of the CL being exceeded.

An in-combination assessment was carried out for the Minsmere-Walberswick SPA. This concluded that that there will be **no likely significant effect alone and in-combination** from the direct toxic long-term effects of NOx from the routine testing of SZC CA. This conclusion can also be reached for the Outer Thames Estuary SPA.

Short-term emissions of NOx are predicted to be greater than 10% of the short-term critical level during the routine testing of SZC CA (Table 16).

[2] http://uk-air.defra.gov.uk

It is therefore possible to conclude that there will be a **likely significant effect**, in the context of prevailing environmental conditions, on the Outer Thames Estuary SPA from the direct toxic short-term effects of NOx during the routine testing of SZC CA.

SO_2 commissioning and routine testing

The modelled PC for the commissioning of SZC CA is 2% of the long-term relevant critical level for SO_2 for the protection of vegetation.

The modelled PC for the routine testing of SZC CA is 0.5% of the critical level for the protection of vegetation. It is therefore possible to conclude that there will be **no likely significant effect** on the Outer Thames Estuary SPA from the direct toxic effects of SO_2 from the commissioning and routine testing of SZC CA.

Nutrient enrichment commissioning and routine testing

The assessment of nutrient deposition at the Outer Thames Estuary SPA is based on the results of modelling at point E2b within Minsmere-Walberswick SPA. The assessment is based on the broad habitat groups identified in Table 8. Critical loads and background levels were obtained from APIS on 9 September 2021. Background levels are for the midyear of the range 2017 to 2019, with total N deposition to moorland used at the closest point (5km grid square) to SZC.

The supporting habitat of the red-throated diver is not sensitive to the effects of nutrient enrichment and is therefore not included in this assessment. Modelling point E2b is representative of the little tern and common tern populations that have 2 supporting broad habitats: coastal stable dune grasslands and shifting coastal dunes. Both critical loads will be assessed.

The lower end of the critical loads presented in Table 8 are used in the assessment, with the maximum PC at the SPA, and highest background deposition rate used to represent worst-case scenario.

The results of the worst-case modelling scenarios for commissioning and routine testing of DGs are provided in Table 27 and Table 28.

Table 27 Assessment of nutrient enrichment on the Outer Thames Estuary SPA during commissioning

Modelling point	PC kgN/ha/yr	PC >1% minimum critical load	Background kgN/ha/yr	PEC kgN/ha/yr	PEC > 70% minimum critical load
E2b **Shifting coastal dunes**	0.44	Yes 4%	13.8	14.24	Yes 142%
E2b **Coastal stable dune grasslands**	0.44	Yes 6%	13.8	14.24	Yes 178%

Table 28 Assessment of nutrient enrichment on the Outer Thames Estuary SPA during routine testing of back-up generators

Modelling point	PC kgN/ha/yr	PC >1% minimum critical load	Background kgN/ha/yr	PEC kgN/ha/yr	PEC > 70% minimum critical load
E2b **Shifting coastal dunes**	0.13	Yes 1%	13.8	13.93	Yes 139%
E2b **Coastal stable dune grasslands**	0.13	Yes 2%	13.8	13.93	Yes 174%

The process contribution from the commissioning and routine testing of SZC CA is at or greater than 1% of the relevant critical load for nitrogen deposition.

The predicted environmental concentration is greater than 70% of the relevant critical load for nitrogen deposition.

We conclude that there will be **a likely significant effect alone**, in the context of prevailing environmental conditions, on the Outer Thames Estuary SPA from the effects of nutrient enrichment from the commissioning and routine testing of SZC CA.

Acidification commissioning and routine operation

The assessment of acidification at the Outer Thames Estuary SPA is based on results at modelling point E2b within Minsmere-Walberswick SPA. The assessment is based on the broad habitat groups identified in APIS. Critical load functions and background levels were obtained from APIS on 9 September 2021. Background levels are for the midyear of 2018, with acid deposition to moorland used at the closest point (5km grid square) to SZC.

The following features are not sensitive to the effects of acidification on their supporting habitats:

- little tern
- red-throated diver

This assessment will therefore be carried out on the supporting habitat of the common tern. This is represented by the broad habitat 'coastal stable dune grassland'.

The minimum critical load functions are used in the assessment, with the maximum PC at the SPA and highest background deposition rate used to represent worst-case scenario.

Table 29 Assessment of process contribution of acidification on the Outer Thames Estuary SPA during commissioning

Modelling point	PC N keq/ha/yr	PC S keq/ha/yr	PC>1% critical load	Background N keq/ha/yr	Background S keq/ha/yr	PEC N keq/ha/yr	PEC S keq/ha/yr	PEC > 70%critical load
E2b	0.03	0.02	Yes 9%	1.0	0.1	1.03	0.21	Yes 202%

Table 30 Assessment of process contribution of acidification on the Outer Thames Estuary SPA during routine testing of back-up generators

Modelling point	PC N keq/ha/yr	PC S keq/ha/yr	PC>1% critical load	Background N keq/ha/yr	Background S keq/ha/yr	PEC N keq/ha/yr	PEC S keq/ha/yr	PEC > 70%critical load
E2b	0.009	0.005	Yes 2%	1	0.1	1.01	0.11	Yes 196%

The process contribution from the commissioning and routine testing of SZC CA is greater than 1% of the relevant critical load range for acidification.

The predicted environmental concentration is greater than 70% of the relevant critical load range for acidification.

We conclude that there will be **a likely significant effect alone**, in the context of prevailing environmental conditions, on the common tern population of the Outer Thames Estuary SPA from the effects of acidification from the commissioning and routine testing of SZC CA.

Screening for likely significant effects conclusion

There is not expected to be a negative impact on the red-throated diver feature of the SPA due to impacts on these species' broad habitat from nutrient enrichment and acidification.

There is not expected to be a negative impact on the little tern feature of the SPA due to impacts on its broad habitat from acidification.

Commissioning

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of SO_2: all features of the European site

Routine testing

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of SO_2: all features of the European site

4.2.4. Sandlings SPA

Details on the features of the Sandlings SPA and associated conservation objectives are provided in Annex 2 of this HRAR (Environment Agency, 2022b). The SPA is located at 1km from SZC.

The SPA is vulnerable to the direct effects of toxic contamination, nutrient enrichment and acidification (APIS).

The applicant has stated that for the coniferous woodland supporting habitat "Listed species not sensitive due to nutrient nitrogen impacts on broad habitat, and in any case it is understood that this woodland has been felled." (NNB GenCo, 2020a).

Toxic contamination

The results of modelling carried out by the applicant for the commissioning and routine testing of SZC CA are provided in Table 31 and Table 32 (NNB GenCo, 2020a), with the exception of short-term effects of NOx. The applicant did not model for short-term effects during commissioning, stating that emissions would not occur over a 24-hour period. AQMAU modelling, completed to support the permit determination, has therefore been used to inform the commissioning short-term NOx assessment.

Table 31 Assessment of direct toxic effects on the Sandlings SPA during commissioning

Pollutant	Critical level µg/m³	PC µg/m³	PC >Y% CL	Background µg/m³	PEC µg/m³	PEC > 70% CL
NOx (long term)	30	0.5	Yes 2%	11.8	12.3	No 41%
NOx (short term)	75	26.4	Yes 35%	Not applicable	Not applicable	Not applicable
SO_2	20	0.02	No 0.1%	1.47	1.49	No 7%

Y = 1% long term; 10% short term

Table 32 Assessment of direct toxic effects on the Sandlings SPA during routine testing of back-up generators

Pollutant	Critical level µg/m³	PC µg/m³	PC >Y% CL	Background µg/m³	PEC µg/m³	PEC > 70% CL
NOx (long term)	30	0.2	No 0.5%	11.8	12	No 40%
NOx (short term)	75	25.4	Yes 34%	Not applicable	Not applicable	Not applicable
SO_2	20	0.024	No 0.1%	1.47	1.49	No 7%

Y = 1% long term; 10% short term

NOx commissioning

The PC from the commissioning of SZC CA is greater than 10% of the short-term critical level for NOx. We conclude that there will be **a likely significant effect alone** on the features of the Sandlings SPA from the **short-term toxic effects** of NOx.

The PC from the commissioning and routine testing of SZC CA is greater than 10% of the short-term critical level for NOx. We conclude that there will be **a likely significant effect alone** on the features of the Sandlings SPA from the short-term toxic effects of NOx.

The PC from the commissioning of SZC CA is greater than 1% of the long-term relevant critical levels for NOx. Consideration was therefore given to the background levels and the predicted environmental concentration.

The predicted environmental concentration is less than 70% of the long-term relevant critical levels for NOx during commissioning of SZC CA. As the commissioning of SZC CA is not due to commence until 2028 (NNB GenCo, 2020a), consideration will be given to the potential for an in-combination effect that could result in the 70% decision-making threshold being exceeded.

The applicant estimates that SZC will not be commissioned until 2028 (NNB GenCo, 2020a). However, current background levels available in APIS were used to determine the PEC for the commissioning LSE assessment. The applicant used information available on

the Defra pollutant database[3] to forecast predicted NOx levels to best represent the operational background levels of NOx in 2028 at SZC.

Defra background concentrations of NOx in the location of SZC are predicted to be 7.7µg/m³ in 2028, giving a PEC of 8.2 µg/m³ or 27% of the CL. It is unlikely that there will be other plans or projects that would contribute a further 43% of the CL, resulting in the threshold of 70% of the CL being exceeded.

Background levels on APIS are based on the 3-year average deposition for 2017 to 2019 and include those plans or projects that have been completed or permitted. Typically, emission sources are considered to be in APIS background if they were operational by 31 December of the mid-year within the 3-year average dataset. Therefore, only plans or permissions commencing operation after 31 December 2018 need to be considered in combination to avoid double counting.

Environment Agency permits

The Environment Agency's mapping tool, Easimap was accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of modelling point E4 within Sandlings SPA to determine if there is any potential for an overlapping in-combination effect.

Table 33 Environmental Permitting Regulations installation permits within 10km of modelling point E4, Sandlings SPA

Permit number installation name	Grid reference	Distance from modelling point E4	Pollutant	Operational before 31 December 2018?
EP3634LR Sizewell B Power Station	TM47366351	1km	NOx	Yes
LP3639NN Redhouse Farm	TM40326154	6.2km	Ammonia	Yes

There are 2 Environment Agency permits within 10km of modelling point E4 with associated aerial emissions. Of these, only Sizewell B (SZB) emits NOx emissions, which could have the potential for an overlapping in-combination effect. However, emissions

[3] http://uk-air.defra.gov.uk

from SZB are already accounted for in the 1km grid square background NOx concentrations in APIS and will therefore be accounted for as part of the background levels within the SPA.

The Environment Agency's mapping tool, Easimap was also accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of Sandlings SPA to determine if there is any potential for a discrete in-combination effect.

One additional permit was identified, HP3137MR, Hill Farm Pig Unit (TM39595230). This farm emits ammonia, was operational before 31 December 2018, and is located 8.8km from Sandlings SPA. There is no potential for an in-combination effect with the commissioning of SZC CA.

It is therefore possible to conclude no in-combination effects with Environment Agency permissions.

Within project in-combination: SZC construction

All construction activities, apart from the CHP plant associated with the accommodation, will be complete prior to the operation of SZC CA. Therefore, consideration is needed as to whether impacts from construction have the potential for residual effects within the European site. Emissions from the CHP will be considered in-combination with the routine testing of SZC CA.

The applicant has confirmed that the desalination plant will only use diesel engines for the first 3 years of its operation during the early construction phase, after which it will be powered by the main electricity supply (NNB GenCo, 2021a).

Table 3-1 of the Desalination Plant Air Impact Assessment (NNB GenCo, 2021a) provides the predicted annual average PCs for NOx from the desalination plant diesel generators on the relevant European sites. The modelled PC for the receptor E4 Sandlings SPA is 0.07µg/m³ or 0.2% of the critical level for the protection of vegetation. Therefore, there is no potential for any residual effect on the Sandlings SPA from the 3-year operation of diesel generators associated with the desalination plant.

Modelling of NOx emissions at sensitive ecological receptors from the CHP is provided in Table 12F.5 Chapter 12 of the applicant's environmental statement (NNB GenCo, 2020e). Emissions of NOx are predicted to be 0.02µg/m³, or 0.06% of the critical level and are inconsequential.

There is **no potential for a likely significant effect** in-combination between the commissioning of SZC CA and diesel generators associated with the construction of SZC.

Within project in-combination: SZC construction traffic

The applicant carried out modelling of road and rail transport impacts as part of its DCO application (NNB GenCo, 2020e) including the following scenarios:

- baseline 2018 scenario (2018 BC) to enable model verification
- early year 2023 reference case scenario (2023 RC), that is, without the proposed development
- early year 2023 typical day scenario (2023 AD), that is, with some elements of the associated developments under construction
- peak year 2028 reference case scenario (2028 RC), that is, without the proposed development
- peak year 2028 typical day scenario (2028 AD), that is, with the peak construction of the proposed development
- peak year 2028 busiest day scenario (2028 BD), that is, with the peak construction of the proposed development
- operational year 2034 reference case scenario (2034 RC), that is, without the proposed development
- operational year 2034 typical day scenario (2034 AD), that is, with the proposed development in place.

Table 1.29 (NNB GenCo, 2020e) presents the maximum modelled rail and road contribution of pollutants based on the 2028 busiest day scenario relative to 2028 reference case, and Table 1.28 the average day scenario. The year 2028 is used to represent commissioning of SZC CA and should be considered in combination with the CA commissioning assessment.

The predicted PCs are as follows:

- 2028 average day scenario: 0.8 µg/m³, 2.7% CL
- 2028 busiest day scenario: 0.8 µg/m³, 2.7% CL

The combined PCs for the SZC CA commissioning and associated traffic is predicted to be 1µg/m³, with a PEC of 8.7µg/m³, 29% of the CL for the protection of vegetation. This is still below the LSE decision making threshold of 70%.

It is therefore possible to conclude that there will be **no likely significant effect in-combination**, in the context of prevailing environmental conditions, on the features of the Sandlings SPA from the **long-term toxic effects** of NOx during the commissioning of SZC CA.

NOx routine testing

The PC from the routine testing of SZC CA is 0.5% of the critical level and is considered to be insignificant.

It is therefore possible to conclude that there will be **no likely significant effect alone and in-combination** on the features of the Sandlings SPA from the **long-term toxic effects** of NOx during the routine testing of SZC CA.

The PC during the routine testing of SZC CA is greater than 10% of the short-term critical level for NOx. We conclude that there will be **a likely significant effect alone** on the features of the Sandlings SPA from the **short-term toxic effects** of NOx.

SO_2 commissioning and routine testing

The process contribution from the commissioning and routine testing of SZC CA is less than 1% of the relevant long-term critical levels for SO_2 (Table 32).

We conclude that there will be **no likely significant effect** on the Sandlings SPA due to the direct toxic effects of SO_2 from the commissioning and routine testing of SZC CA.

Nutrient enrichment, commissioning and routine testing

The assessment of nutrient deposition at the Sandlings SPA is based on the broad habitat groups identified in Table 9. Critical loads and background levels were obtained from APIS on 9 September 2021. Background levels are for the midyear of 2018, with total N deposition to moorland used at the closest point (5km gridsquare) to SZC.

The lower end of the critical loads presented in Table 9 are used in the assessment, with the maximum PC at the SPA, and highest background deposition rate used to represent a worst-case scenario.

The PC during commissioning is predicted to be 0.05kg N/ha/yr at modelling point E4a within the SPA. This is 0.5% of the minimum critical load.

The PC during routine testing is predicted to be 0.01kg N/ha/yr at modelling point E4a within the SPA. This is 0.1% of the minimum critical load.

The process contribution from the commissioning and routine testing of SZC CA is less than 1% of the relevant critical load for nutrient-N deposition. We conclude that there will be **no likely significant effect** on the features of the Sandlings SPA.

Screening for likely significant effects conclusion

There is not expected to be a negative impact on the European nightjar and woodlark feature of the SPA due to impacts on these species' broad habitat from nutrient enrichment and acidification.

Commissioning

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of NOx and SO_2: all features of the European site
- nutrient enrichment: all features of the European site.

Routine testing

It has been possible to conclude **no likely significant effect alone and in-combination** for the following risks and features:

- toxic contamination from long-term effects of NOx and SO_2: all features of the European site
- nutrient enrichment: all features of the European site

4.2.5. Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar

Details on the features of the Alde-Ore and Butley Estuaries SAC and Alde-Ore Estuary SPA and Ramsar and their associated conservation objectives are provided in Annex 2 of this HRAR (Environment Agency, 2022b).

Both the SAC and Ramsar are vulnerable to the direct effects of toxic contamination and nutrient enrichment. However, the notable habitat features of the SAC, and therefore the Ramsar, are not vulnerable to acidification (APIS).

The SPA is vulnerable to the direct effects of toxic contamination and nutrient enrichment. However, the supporting features of the notable bird species are not vulnerable to acidification. APIS states “there is no expected negative impact on the species due to impacts on the species’ broad habitat.”

This assessment of likely significant effect will therefore be carried out on the direct toxic effects of NOx and SO_2 and nutrient enrichment.

Toxic contamination

The results of modelling carried out by the applicant for the commissioning and routine testing of SZC CA are provided in Table 34 and Table 35 (NNB GenCo, 2020a), with the exception of short-term effects of NOx. The applicant did not model for short-term effects during commissioning, stating that emissions would not occur over a 24-hour period. AQMAU modelling, completed to support the permit determination, has therefore been used to inform the commissioning short-term NOx assessment.

Table 34 Assessment of direct toxic effects, Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar during commissioning

Pollutant	Critical level µg/m³	PC µg/m³	PC >Y% CL
NOx (long term)	30	0.07	No 0.2%
NOx (short term)	75	4.8	No 6%
SO_2	20	0.003	No <0.01%

Y = 1%, long term; 10% short term

Table 35 Assessment of direct toxic effects, Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar during routine testing of back-up generators

Pollutant	Critical level µg/m³	PC µg/m³	PC >Y% CL
NOx (long term)	30	0.02	No <0.1%
NOx (short term)	75	4.8	No 6%
SO_2	20	0.001	No <0.01%

Y = 1%, long term; 10% short term

NOx commissioning

The process contribution from the commissioning of SZC CA is less than 1% of the relevant long-term critical level for NOx.

The PC is predicted to be less than 10% of the short-term critical level for NOx. There is no requirement for an in-combination assessment of the short-term effects of NOx. It is therefore possible to conclude that there will be **no likely significant effect** on the Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Butley Ramsar from the **long-term** and **short-term toxic effects** of NOx.

NOx routine testing

The process contribution from the routine testing of SZC CA is inconsequential at <0.1% of the CL for long-term effects of NOx. The process contribution is also less than 10% of the short-term critical level for NOx. There is no requirement for an in-combination assessment of the short-term effects of NOx.

It is therefore possible to conclude that there will be **no likely significant effect** on the Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar from the **long-term** and **short-term toxic effects** of NOx.

SO_2 commissioning and routine testing

Emissions of SO_2 at the Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar are inconsequential at less than 0.1% of the critical load for the protection of vegetation for the commissioning and routine testing of SZC CA.

It is possible to conclude that there will be **no likely significant effect** on the Alde-Ore and Butley Estuaries SAC and Alde-Ore Estuary SPA and Ramsar from the direct toxic effects of SO_2 alone and in-combination during the commissioning and routine testing of SZC CA.

Nutrient enrichment, commissioning and routine operation

The assessment of nutrient deposition at the Alde-Ore Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar is on the broad habitat groups identified Table 3 and Table 4, critical loads and background levels were obtained from APIS on 9 September 21. Background levels are for the midyear of 2018, with total N deposition to moorland used at the closest point (5km gridsquare) to SZC.

The lower end of the critical loads presented in Table 3 and Table 4 are used in the assessment, with the maximum PC at the SAC, SPA and Ramsar, and highest background deposition rate used to represent worst-case scenario.

The results of the worst-case modelling scenarios for commissioning and routine testing of DGs are provided in Table 36 and Table 37.

Table 36 Assessment of nutrient enrichment on the Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar during commissioning

Modelling point	PC (kg N/ha/yr)	PC >1% minimum critical load
E1a	0.006	No 0.03%
E1c	0.007	No 0.04%
E1d	0.005	No 0.04%

Table 37 Assessment of nutrient enrichment on the Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar during routine testing of back-up generators

Modelling point	PC (kg N/ha/yr)	PC >1% minimum Critical Load
E1a	0.002	No 0.01%
E1c	0.002	No 0.01%
E1d	0.001	No 0.01%

The process contribution from the commissioning and routine testing of SZC CA is inconsequential for all features of the SAC, SPA and Ramsar with deposition at <0.1% of the relevant critical loads. We conclude that there will be **no likely significant effect** on the Alde-Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar from nutrient enrichment.

Screening for likely significant effects conclusion

There is not expected to be a negative impact on the features of the SAC and Ramsar due to acidification.

It has been possible to conclude **no likely significant effect alone and in-combination** for all remaining risks associated with the operational CA permit.

An appropriate assessment will be carried out on the LOOP scenario as it was not assessed by the applicant.

4.2.6. Orfordness-Shingle Street SAC

Details on the features of the Orfordness-Shingle Street SAC and associated conservation objectives are provided in Annex 2 of this HRAR. The SAC is located at 8km from SZC.

The SAC is vulnerable to the direct effects of toxic contamination, nutrient enrichment and acidification (APIS).

Toxic contamination

The results of modelling carried out by the applicant for the commissioning and routine testing of SZC CA are provided in Table 38 and Table 39 (NNB GenCo, 2020a), with the exception of short-term effects of NOx. The applicant did not model for short-term effects during commissioning, stating that emissions would not occur over a 24-hour period. AQMAU modelling, completed to support the permit determination, has therefore been used to inform the commissioning short-term NOx assessment (AQMAU, 2021).

Table 38 Assessment of direct toxic effects on the Orfordness-Shingle Street SAC during commissioning

Pollutant	Critical level µg/m³	PC µg/m³	PC >Y% CL
NOx (long term)	30	0.05	No 0.2%
NOx (short term)	75	4.2	No 6%
SO_2	20	0.012	No <0.1%

Pollutant	Critical level µg/m³	PC µg/m³	PC >Y% CL
SO_2 (lower plants)	10	0.012	No 0.1%

Y = 1% long term; 10% short term

Table 39 Assessment of direct toxic effects on the Orfordness-Shingle Street SAC during routine testing of back-up generators

Pollutant	Critical level µg/m³	PC µg/m³	PC >Y% CL
NOx (long term)	30	0.01	No <0.1%
NOx (short term)	75	3.3	No 4%
SO_2	20	0.003	No <0.1%
SO_2 (lower plants)	10	0.003	No <0.1%

Y = 1% long term; 10% short term

NOx commissioning

The process contribution from the commissioning of SZC CA is less than 1% of the relevant long-term critical levels for NOx and SO_2 and less than 10% of the short-term critical level for NOx. We conclude that there will be **no likely significant effect** on the features of the Orfordness-Shingle Street SAC.

NOx routine testing

The process contribution from the commissioning of SZC CA is less than 1% of the relevant long-term critical levels for NOx and SO_2 and less than 10% of the short-term

critical level for NOx. We conclude that there will be **no likely significant effect** on the features of the Orfordness-Shingle Street SAC.

SO_2 commissioning and routine testing

The process contribution from the commissioning and routine testing of SZC CA is less than 1% of the relevant critical level for SO_2.

We conclude that there will be **no likely significant effect** on Orfordness-Shingle Street SAC from the direct toxic effects of SO_2.

Nutrient enrichment, commissioning and routine testing

The assessment of nutrient deposition at the Orfordness-Shingle Street SAC, is based on the critical loads (Table 7) and background levels obtained from APIS on 9 September 2021. Background levels are for the midyear of 2018, with total N deposition to moorland used at the closest point (5km gridsquare) to SZC.

The lower end of the critical loads presented in Table 7 are used in the assessment, with the maximum PC at the SAC and highest background deposition rate used to represent the worst-case scenario.

The maximum PC is predicted to be 0.005kg N/ha/yr during commissioning of SZC CA, which is 0.06% of the minimum critical load for perennial vegetation of drift lines, and 0.001kg N/ha/yr during the routine testing of SZC CA, which is 0.02% of the minimum critical.

Deposition from SZC CA is therefore inconsequential, and we conclude that there will be **no likely significant** effect on the features of the Orfordness-Shingle Street SAC.

Acidification commissioning and routine testing

For the purposes of the screening assessment the minimum critical loads for acidification have been used: minimum CLminN, minimum CLmaxN and minimum CLmaxS, together with the maximum acid deposition process contributions for N and S.

Annual vegetation of drift lines and coastal lagoon habitats are not sensitive to acidification and are therefore not included in this assessment.

The PC for N is predicted to be 0.001keq/ha/yr and for S is predicted to be 0.0004keq/ha/yr during the commissioning of SZC at modelling point E3a. This is <0.1% of the minimum critical load function.

The PC for S is predicted to be 0.0002keq/ha/yr and for S is predicted to be 0.001keq/ha/yr during routine testing at SZC at modelling point E3a. This is <0.1% of the minimum critical load function.

The maximum PC during commissioning and routine testing of SZC CA is predicted to <0.1% of the minimum critical load function. We conclude that there will be **no likely significant effect** on the features of the Orfordness-Shingle Street SAC.

Screening for likely significant effects conclusion

It has been possible to conclude **no likely significant effect alone and in-combination** for all risks associated with the operational CA permit.

An appropriate assessment will be carried out on the LOOP scenario as it was not assessed by the applicant.

4.2.7. Dew's Pond SAC

Details on the features of Dew's Pond SAC and associated conservation objectives are provided in Annex 2 of this HRAR (Environment Agency, 2022b).

The applicant did not carry out any modelling at Dew's Pond SAC. A qualitative assessment will therefore be carried out for the purposes of the LSE screen.

Dew's Pond SAC is designated for its population of great crested newts. There are 12 ponds within the site, ranging from long established farm ponds to more recently dug ones. Rough, semi-improved grassland surrounds the ponds with some scrub and hedgerow habitat. The terrestrial habitats are important to newts for feeding, shelter and hibernation during the non-breeding season. The Site Improvement Plan for the SAC does not identify any issues for the site.

There is no comparable habitat with established critical load or levels available for open water (ponds) on APIS, with a decision recommended to be taken on a case by case basis.

Dew's Pond SAC is the most distant site from SZC at a distance of 9km. Orfordness-Shingle Street SAC is located 8km from SZC; the results at this distance will be used to inform the conclusion for Dew's Pond SAC.

Toxic contamination

It has been possible to conclude no LSE from the direct effects of NOx (long and short-term) and SO_2 at Orfordness-Shingle Street SAC (Table 38 and Table 39), with PC predicted to be <1% of the long-term critical level for both NOx and SO_2, and <10% of the short-term critical level for NOx for both the routine testing and commissioning scenarios.

We conclude that there will be **no likely significant effect** on the features of the Dew's Pond SAC.

Nutrient enrichment

There are no critical loads for N deposition for open waters. Terrestrial habitats within the SAC of rough, semi-improved grassland with some scrub and hedgerow habitat, support the great crested newts. APIS states that "since improved grasslands receive very high

doses of nitrogen in fertilisers and manures negative effects of atmospheric N deposition are not expected."

A critical load range of 10 to 20kg N/ha/yr is given in APIS for hedgerows. Deposition of nitrogen at Orfordness-Shingle Street SAC is predicted to be <1% of the critical load of 8kg N/ha/yr for both routine testing and commissioning. The process contribution would not be expected to exceed 1% of the critical load of 10kg N/ha/yr at the more distant Dew's Pond SAC.

We conclude that there will be **no likely significant effect** on the features of the Dew's Pond SAC.

Acidification

There are no critical loads for acidification for open waters or improved grasslands. A critical loads function for hedgerows at the location of Dew's Pond SAC (grid reference 638700, 271801) is provided on APIS: 8.36keq/ha maxS, 0.357keq/ha minN and 8.717keq/ha maxN. It is not expected that process contributions from the routine testing or commissioning of diesel engines at SZC CA would exceed 1% of this critical load, or indeed be measurable at 9km from SZC.

We conclude that there will be **no likely significant effect** on the features of the Dew's Pond SAC.

Screening for likely significant effects conclusion

It has been possible to conclude **no likely significant effect alone and in-combination** for all risks associated with the operational CA permit.

An appropriate assessment will be carried out on the LOOP scenario as it was not assessed by the applicant.

4.3. Scoping of the appropriate assessment

The conclusions reached in the screening for likely significant effects were based on assumptions that are not representative of the realistic operation and maintenance of the diesel generators. However, this enabled a worst-case screening exercise to be carried out, with all potential likely significant effects being progressed to appropriate assessment.

The applicant did not consider the short-term effects of a LOOP scenario in its permit application Shadow HRA, or the daily short-term effects of the commissioning of SZC CA. These will also therefore be carried forward for appropriate assessment.

4.3.1. Commissioning

The screening for likely significant effects identified that an appropriate assessment is required for the sites listed below due to the emission and deposition of pollutants during the commissioning of diesel generators:

Long-term effects of NOx

- Minsmere to Walberswick Heaths and Marshes SAC
- Minsmere-Walberswick SPA
- Minsmere-Walberswick Ramsar
- Outer Thames Estuary SPA

Short-term effects of NOx

- Minsmere to Walberswick Heaths and Marshes SAC:
- Minsmere-Walberswick SPA:
- Minsmere-Walberswick Ramsar
- Outer Thames Estuary SPA
- Sandlings SPA
- Functionally linked land

Nutrient enrichment

- Minsmere to Walberswick Heaths and Marshes SAC
- Minsmere-Walberswick SPA
- Minsmere-Walberswick Ramsar
- Outer Thames Estuary SPA
- Functionally linked land

Acidification

- Minsmere to Walberswick Heaths and Marshes SAC
- Minsmere-Walberswick Ramsar
- Outer Thames Estuary SPA
- Functionally linked land

4.3.2. Routine testing

The screening for likely significant effects identified that an appropriate assessment is required for the sites listed below due to the emission and deposition of pollutants during the routine testing of diesel generators:

Short-term effects of NOx:

- Minsmere to Walberswick Heaths and Marshes SAC
- Minsmere-Walberswick SPA
- Minsmere-Walberswick Ramsar
- Outer Thames Estuary SPA
- Sandlings SPA
- Functionally linked land

Nutrient enrichment:

- Minsmere to Walberswick Heaths and Marshes SAC
- Minsmere-Walberswick SPA
- Minsmere-Walberswick Ramsar
- Outer Thames Estuary SPA
- Functionally linked land

Acidification

- Minsmere to Walberswick Heaths and Marshes SAC
- Minsmere-Walberswick Ramsar
- Outer Thames Estuary SPA
- Functionally linked land

An appropriate assessment of the effects of a LOOP scenario will also be carried out on all the relevant sites within 10km of SZC (see section 2). No assessment was carried out as part of the permit application.

4.4. Appropriate assessment of aerial emissions and deposition

The assessment of likely significant effect was based on a worst-case conservative scenario. It is considered that modelled scenarios with more realistic combinations of generators would better represent the expected commissioning and routine testing of SZC CA and would better inform the appropriate assessment. Therefore, for features where the need for a detailed assessment was triggered, and in order to carry out a more realistic assessment of the predicted likely significant effects, a Schedule 5 Notice was sent to the applicant on 21 May 2021 to request further information. The request included the requirement to:

- assess the impacts against daily NOx critical level for a LOOP event
- assess real combinations of generators rather than assuming EDGs are running all the time
- provide information about typical number of hours a day that the generators could be operational for in all of the operational scenarios, allowing a better understanding of the likelihood of exceedances occurring
- provide some additional information regarding the ‘maintenance outages’ during routine testing, including information on what these are and how often they are likely to occur
- clarify whether the 24-hour testing of all the generators, which occur after a maintenance outage, are already included in the annual testing hours

A response was received from the applicant on 21 June 2021 (NNB GenCo, 2021a), and was subsequently reviewed by AQMAU (Environment Agency, 2021b).

The applicant's response provided the following additional information on the original and revised modelling approach:

"The routine operation assessment is based on the assumption of one EDG operating continuously throughout the year, with pro-rata emissions based on 720 hours of annual operation.

"The twelve DGs are spread over a relatively large area, with approximately 500m between the most northerly positioned DGs and the most southerly positioned DGs. The DGs that are closest to a specific receptor will result in the maximum impacts at that receptor, whilst the DGs furthest away will result in lower impacts at the same receptor."

The assessment presented in Appendix C of the Environmental Permit application (NNB GenCo, 2020a) reported impacts at each receptor based on the operation of the EDG that resulted in the highest impact at that receptor (i.e., the closest EDG, as detailed above), rather than considering that the operation of that EDG would only actually be for 60 hours, and operation of EDGs leading to lower results would account for a large proportion of the testing hours.

In addition, no consideration was given in the assessment to the fact that the four smaller UDGs have much lower emissions of NOx. Therefore, of the 720 hours of annual operation for the routine testing scenario, 480 hours would be associated with EDG operation, but 240 hours would be associated with UDG operation and therefore would result in considerably lower impacts due to the much lower NOx emissions of these units.

The applicant provided the following on assessing a LOOP event, "Such an event is not intended to occur at all, is statistically unlikely to occur more than once in the plant design life and in such an event is likely to last for well under 24-hours. The daily NOx Critical Level is also intended to protect habitat sites from concentrations occurring at that level each day, not to qualify a potential single 24-hour event occurring over the entire design life of an operational facility." (NNB GenCo, 2021a)

After carrying out check modelling and sensitivity analysis of the revised modelling, AQMAU concluded that (Environment Agency, 2021b)*:*

- the daily NOx PCs predicted to occur during a LOOP event to be reasonably representative of a worst-case LOOP scenario occurring during the worst-case 24-hour period of meteorological conditions
- the nutrient nitrogen and acid deposition PCs predicted to occur during commissioning and routine testing to be reasonably representative

The appropriate assessment for each relevant European site will be concluded by carrying out an assessment on that site's integrity. This final step will determine whether, in view of the European site's conservation objectives, it can be ascertained that the permissions 'either alone or in combination with other plans or projects' would not have an adverse effect on the integrity of the site.

The ‘integrity of the site’ relates to the site’s conservation objectives. This is because the appropriate assessment is to be carried out “in view of that site’s conservation objectives” as per Regulation 63(1) of the Habitats Regulations.

The Managing Natura 2000 sites advice explains the concept of the “integrity of the site” at section 4.6.4 (EEC, 2018).

“The expression ‘integrity of the site’ shows that the focus is here on the specific site. Thus, it is not allowed to destroy a site or part of it on the basis that the conservation status of the habitat types and species it hosts will anyway remain favourable within the European territory of the Member State.”

Integrity “clearly relates to ecological integrity. This can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation.”

“The ‘integrity of the site’ can usefully be defined as the coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated.”

“A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required.”

Taking each qualifying feature in turn, if the conservation objectives for a feature will be undermined, site integrity is not necessarily affected. On the contrary, site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in combination with other plans or projects. This would include low-impact effects that are too small or short-lived to undermine the achievement of the conservation objectives.

Where it cannot be concluded that the permission will not have an adverse effect on the integrity of a site, the permission should be refused, unless mitigation in the form of restrictions or conditions can be imposed to ensure there is no adverse effect on the integrity of the site(s).

Further guidance and case law relating to concluding HRAs and the integrity test is provided in the HRAR on the Environment Agency permits for SZC (Environment Agency, 2022e).

4.4.1. Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar

A likely significant effect was identified for the following effects and an appropriate assessment is required both alone and in combination:

- direct toxic effect of NOx (long-term) – commissioning
- direct toxic effect of NOx (short-term) – commissioning and routine testing
- nutrient enrichment – commissioning and routine testing
- acidification – commissioning and routine testing (SAC and Ramsar)

An appropriate assessment will also be carried out on the LOOP scenario which wasn't assessed as part of the permit application.

The following relevant conservation objectives will be considered when carrying out this appropriate assessment:

For Minsmere to Walberswick Heaths and Marshes SAC, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the favourable conservation status of its qualifying features, by maintaining or restoring the:

- extent and distribution of qualifying natural habitats and habitats
- structure and function of qualifying natural habitats

For Minsmere-Walberswick SPA the objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring the:

- extent and distribution of the habitats of the qualifying features
- structure and function of the habitats of the qualifying features

The Supplementary Advice on Conservation Objectives for Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA set a target to "restore concentrations and deposition of air pollutants to at or below the site-relevant critical load or level values" as provided on APIS. (Natural England, 2019, Minsmere-Walberswick SPA supplementary advice).

There are no objectives set for the Minsmere-Walberswick Ramsar. However, the objectives set for the SAC and SPA will be protective of the features of the Ramsar.

Appropriate assessment of the long-term effects of NOX alone: commissioning

A likely significant effect was identified alone for the long-term effects of NOx during the commissioning phase of SZC CA at the Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar.

The LSE assessment predicted that the PC would be 13.5µg/m³, 45% of the CL of 30µg/m³. The PEC was calculated using the maximum background level for the SAC, SPA and Ramsar provided for in APIS, for the period 2017 to 2019. This was 10.06µg/m³, resulting in a maximum PEC of 23.56 µg/m³ or 79% CL (Table 15).

SZC won't be commissioned until at least 2028. The applicant has therefore used Defra predicted NOx emissions for 2028[4] to forecast the prevailing environmental conditions that could be present at the time of commissioning.

Background levels of NOx in the area are predicted to be 7.7µg/m³ in 2028. This is consistent with the falling levels of NOx within Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar experienced since 2010, as shown in Figure 4.

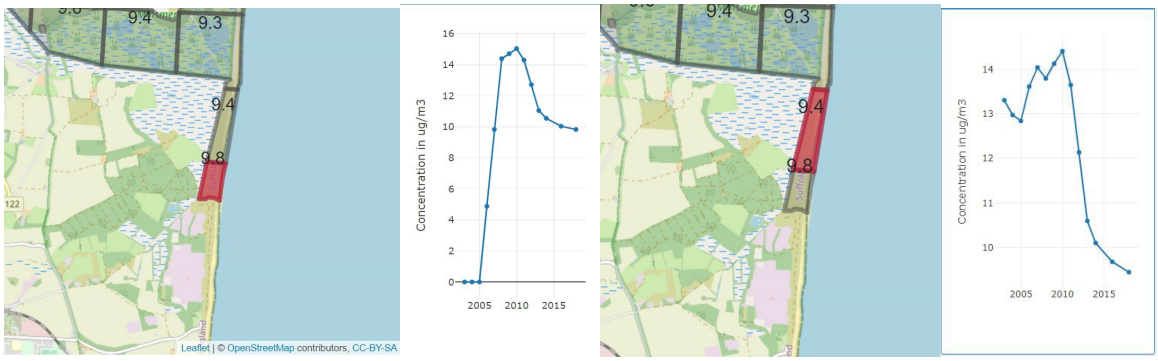

Figure 4 Trend in NOx emissions for the closest 1km grid squares within Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar to SZC. Source APIS

Both graphs in Figure 4 show that NOx emissions have been below the critical level for the protection of vegetation for over 15 years, with levels in decline for the last 10 years. The predicted PEC for commissioning (2028) is 21.2µg/m³ or 71% of the critical level. There is no risk that when units 1 and 2 are commissioned background levels of NOx will be at risk of exceeding the critical level of 30µg/m³.

The supplementary advice package on conserving and restoring site features for Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA provide a target to "Restore concentrations and deposition of air pollutants to at or below the site-relevant critical load or level values given for the feature's supporting habitat on the Air Pollution Information System" (Natural England, 2019, Minsmere-Walberswick SPA supplementary advice). This requirement can also be applied to the Ramsar.

This target will be met alone, when considering the prevailing environmental conditions within the SAC, SPA and Ramsar.

It is therefore possible to conclude **no adverse alone** on the features and supporting habitats of the Minsmere-Walberswick Heaths and Marshes SAC and Minsmere-

[4] http://uk-air.defra.gov.uk

Walberswick SPA and Minsmere-Walberswick Ramsar from the long-term toxic effects of NOx emissions.

Consideration is therefore required of the commissioning of SZC CA in combination with other plans and projects.

Appropriate assessment of the long-term effects of NOx in-combination: commissioning

An in-combination assessment is required to determine if there are other plans, permissions or projects that could result in an exceedance of the critical level for the protection of vegetation during the commissioning of SZC CA.

Background levels used in the LSE screening assessment were taken from APIS, which are based on the 3-year average deposition for 2017 to 2019 and include those plans or projects that have been completed or permitted.
considered to be in APIS background if they “were operational by 31 December of the mid-year within the 3-year average dataset”. Therefore, only plans or permissions commencing operation after 31 December 2018 need to be considered in combination to avoid double counting.

Environment Agency permits

The Environment Agency’s mapping tool, Easimap was accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of the modelling point E2 within the SAC, SPA and Ramsar to determine if there is the potential for an over-lapping in-combination effect.

There are 4 Environment Agency permits within 10km of the modelling point E2 within Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Ramsar that have associated aerial emissions (Table 17). Of these, only Sizewell B (SZB) emits NOx emissions. However, they are already accounted for in background levels at the European sites as they were permitted prior to 31 December 2018 and therefore in the predicted PEC.

The Environment Agency’s mapping tool, Easimap was also accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of Minsmere to Walberswick SAC and Minsmere-Walberswick SPA and Ramsar to determine if there is any potential for a discrete in-combination effect.

This process identified a further 2 permits (Table 18) with associated NOx emissions that could have the potential for discrete in-combination effects. However, these were permitted prior to 31 December 2018 and are therefore part of the prevailing environmental conditions of the European site as a whole.

Background levels of NOx within Minsmere to Walberswick SAC and Minsmere-Walberswick SPA and Ramsar are below the critical level for the protection of vegetation and have been in decline for the last 15 years (Figure 4).

It is therefore possible to conclude **no adverse effect** in-combination with other Environment Agency permits.

Within project in-combination: SZC construction

Table 3-1 of the Desalination Plant Air Impact Assessment (NNB GenCo, 2021c) provides the predicted annual average PCs for NOx from the desalination plant diesel generators on the relevant European sites. The modelled PC for the receptor E2 Minsmere is 1.19µg/m³ or 4% of the critical level for the protection of vegetation. The PEC is predicted to be 30% of the critical level, therefore there is no potential for any residual effect on the Minsmere to Walberswick SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar from the 3-year operation of diesel generators associated with the desalination plant.

Modelling of NOx emissions at sensitive ecological receptors from the CHP is provided in Table 12F.5 Chapter 12 of the applicant's environmental statement (NNB GenCo, 2020e). Emissions of NOx are predicted to be 0.08µg/m³, or 0.3% of the critical level.

While the CHP plant will be operational during the commissioning of SZC CA, the maximum deposition of nitrogen is predicted to be inconsequential and would not have the potential for an in-combination effect over the 2-year commissioning period.

Within project in-combination: SZC construction traffic

The applicant carried out modelling of road and rail transport impacts as part of its DCO application (ES V2 Ch12, App12B), including the following scenarios:

- baseline 2018 scenario (2018 BC) to enable model verification
- early year 2023 reference case scenario (2023 RC), that is, without the proposed development
- early year 2023 typical day scenario (2023 AD), that is, with some elements of the associated developments under construction
- peak year 2028 reference case scenario (2028 RC), that is, without the proposed development
- peak year 2028 typical day scenario (2028 AD), that is, with the peak construction of the proposed development
- peak year 2028 busiest day scenario (2028 BD), that is, with the peak construction of the proposed development
- operational year 2034 reference case scenario (2034 RC), that is, without the proposed development
- operational year 2034 typical day scenario (2034 AD), that is, with the proposed development in place

Information provided in the following tables within the Environmental Statement will be used to inform this commissioning impacts appropriate assessment:

- Table 1.28 (NNB GenCo, 2020e) provides the maximum modelled rail and road contribution of pollutants for a 2028 average day scenario relative to the 2028 reference case
- Table 1.29 (NNB GenCo, 2020e) provides the maximum modelled rail and road contribution of pollutants for a 2028 busiest day scenario relative to the 2028 reference case

The average busiest day scenarios for 2028 are both predicted to result in a PC of 0.9µg/m³ or 3% of the critical level for the protection of vegetation at the SAC, SPA and Ramsar.

In-combination assessment conclusion

The PCs to consider in-combination at modelling point E2, Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar are as follows:

- SZC CA commissioning PC: 13.5µg/m³
- CHP PC: 0.08µg/m³
- construction traffic PC: 0.9µg/m³
- background: 7.7µg/m³

The PEC is therefore predicted to be 22.18µg/m³, or 74% of the critical level.

The target to 'restore concentrations and deposition of air pollutants to at or below the site-relevant critical load or level values given for the feature's supporting habitat on the Air Pollution Information System' will not be compromised due to the potential for in-combination effects of the construction and commissioning of SZC CA, based on the information supplied by the applicant.

It is possible to conclude **no adverse effect in-combination** on the features and supporting habitats of the Minsmere-Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar from the **long-term toxic effects of NOx** emissions.

Appropriate assessment of the short-term effects of NOx

A likely significant effect was identified for the short-term effects of NOx during the commissioning phase and routine testing of diesel generators at SZC at the Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar.

The applicant assessed the short-term effects of NOx against the critical level of 75µg/m³ as part of its permit application. This indicated that under worst-case modelling scenarios the short-term CL of 75µg/m³ would be exceeded over an area of Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar, as shown in Figure 5.

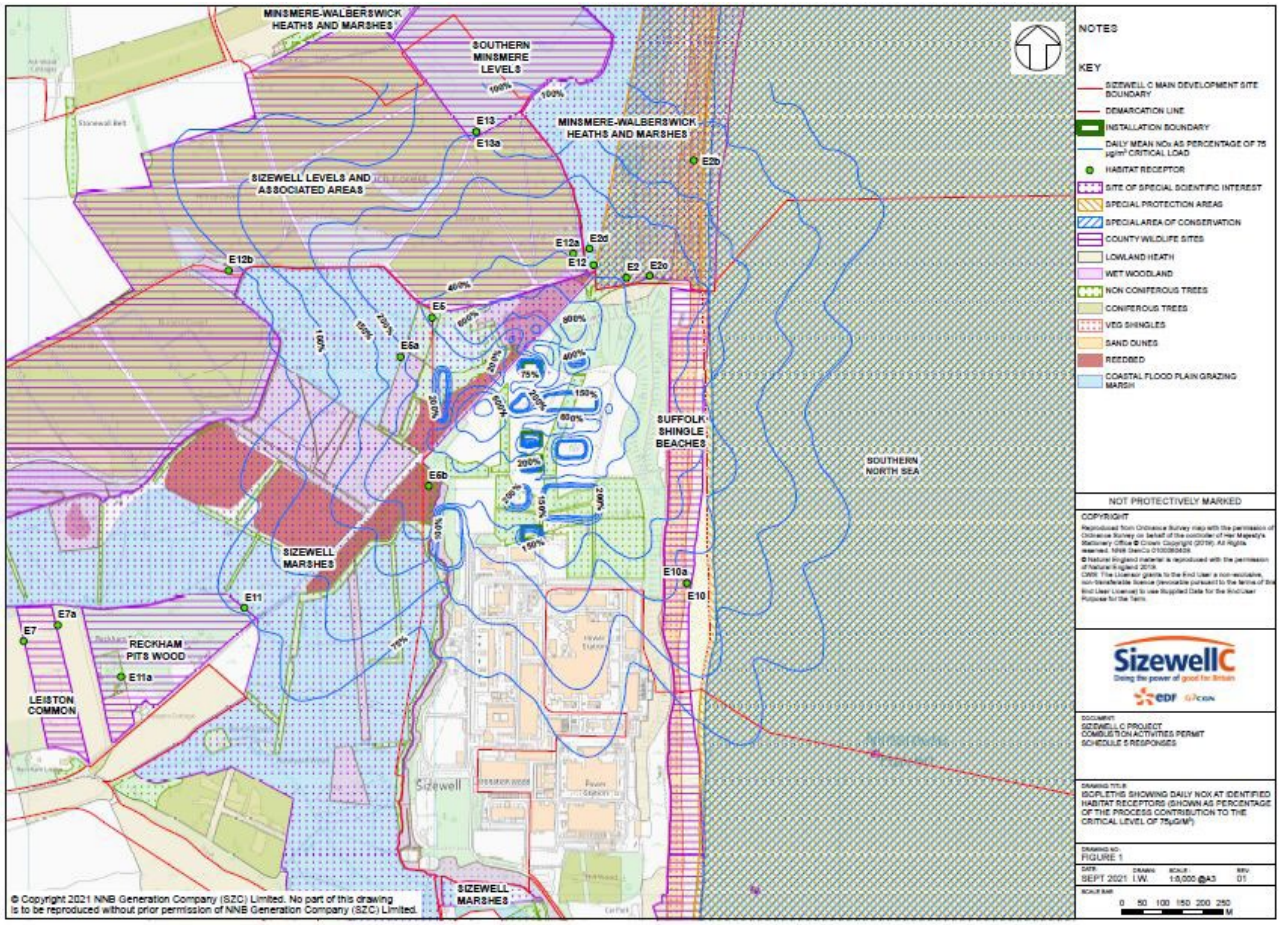

Figure 5 Isopleths showing daily NOx levels at identified habitat receptors, with process contributions shown as a percentage of the critical level of 75µg/m³

Guidance on the assessment of the short-term effects of NOx emissions (Holman and others, 2020) states that:

"The relative importance of the long term mean compared to the short term mean is reflected in several studies which state that the *'UNECE Working Group on Effects strongly recommended the use of the annual mean value, as the long term effects of NOx are thought to be more significant than the short term effects'.* This guidance, therefore, recommends that only the annual mean NOx concentration is used in assessments unless specifically required by a regulator; for instance, as part of an industrial permit application where high, short term peaks in emissions, and consequent ambient concentrations, may occur."

It is therefore appropriate to give some consideration to the short-term effects of NOx, the probability of them occurring and the area over which they will occur.

Commissioning and routine testing

The applicant has proposed that its PCs predicted for routine testing be used for commissioning as well. The worst-case scenario during commissioning involves simulating a LOOP event, whereby 4 EDGs are tested simultaneously for a 3-hour period. This scenario emits less NO_x over a 24-hour period compared to the worst-case scenario

during routine testing, which involves testing a single generator for 24 hours following a maintenance outage. Therefore, using routine testing PCs for commissioning is likely to be more conservative.

The applicant has calculated the probability of exceedances actually happening (NNB GenCo, 2021a), stating that: “This found that (assuming 100% operation of an Emergency Diesel Generator (EDG)) the daily NOx Critical Level is exceeded up until the 80th percentile for the worst-case year of met data, and therefore an exceedance of the Critical Level could only occur for 20% of the time. As the DGs are only operational for 8% of hours (720 ÷ 8760) for planned annual routine testing, this results in a probability of the unfavourable met conditions and the DG operation occurring at the same time having a 1.6% chance of actually occurring (20% x 8% = 1.6%).”

However, AQMAU (Environment Agency, 2021b) considers that this is incorrect because an exceedance of the daily critical level could occur if one or more exceedance days coincides with any of the 30 operational days. AQMAU have calculated the probability of one or more exceedances of the daily NOx critical level at habitat sites occurring during any year of routine testing. Based on the consultant’s 73 exceedance days per year with 30 operational events per year, AQMAU calculates the probability of one or more exceedances to be approximately 99.9%.

The PC for routine testing of DGs is predicted to be a maximum of 303.6µg/m³ at modelling point E2, which is located on the southernmost boundary of the European site. The PC will reduce with distance from the emission points, as illustrated in Figure 5.

It can be seen that the modelled exceedance of the short-term 75µg/m³ critical level is localised to the southern-most tip of Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar, areas of coastal floodplain and grazing marsh, and coastal sand dunes. This represents a small proportion of the SAC, SPA and Ramsar: the SAC covers an area of 1,256.47ha; and the SPA and Ramsar an area of 2,019ha.

While an exceedance of the critical level is expected on one or more of the 30 operational days during any given year of operation, it is unlikely its scale within the SAC, SPA and Ramsar and short-term nature, when considering the relative importance of the long-term mean compared to the short-term mean, will result in direct toxic effects on the features of Minsmere-Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar.

It should also be noted that this assessment is based on the worst-case operational scenario for SZC CA routine testing. The applicant has modelled the ST PCs for routine testing by running one EDG all year, which would capture the worst-case meteorological conditions. The applicant has also assumed a worst-case scenario where one EDG is tested for 24 hours following a maintenance outage and that this EDG is the closest one to the European site.

This approach does not factor in that each generator will only operate for 60 hours per year, and that the EDGs are spread over the SZC site in purpose-built buildings as shown in Figure 1, so emission levels will vary at the European site depending on the EDG being tested and that the UDGs have lower NOx emissions than EDGs.

It is therefore possible to conclude **no adverse effect** to the features of the Minsmere-Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar from the short-term effects of NOx during the commissioning and routine testing of SZC CA.

Appropriate assessment of the loss of operational power (LOOP) scenario

The applicant provided an assessment of the LOOP scenario at the Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar in section 2.2.2 of its Schedule 5 Notice response (NNB GenCo, 2021a). An assessment was not made in the permit application as "…an exact period of operation under such a scenario cannot be specified. Such an event is not intended to occur at all, is statistically unlikely to occur more than once in the plant design life and in such an event is likely to last for well under 24-hours. The daily NOx critical level is also intended to protect habitat sites from concentrations occurring at that level each day, not to qualify a potential single 24-hour event occurring over the entire design life of an operational facility."

The applicant has predicted that, based on the modelled assumption that 8 EDGs are operational concurrently, continuously throughout the year (ensuring that the assessment takes account of the meteorological conditions that result in the worst-case impacts), the PC will be 875.8µg/m³. This is 1,168% of the daily CL of 75µg/m³.

While these exceedances are extreme, the LOOP scenario is not expected to happen during the lifetime of the plant. The applicant predicted in its Schedule 5 response (NNB GenCo, 2021a) that:

- "a short LOOP (less than 2 hours) event has a predicted frequency of 3.72×10^{-2} per reactor year, therefore assuming the SCZ site is operational for 60 years, a short LOOP event is predicted to occur up to 4 times (2 times per reactor) during the site's operational lifetime
- a long LOOP event between 2 and 24 hours is predicted to occur 4.99×10^{-3} times per reactor year, therefore in terms of the SZC site it is predicted to occur 0.6 times during the site's 60-year operational lifetime (taking into account the 2 reactors). Such an event is therefore not likely to occur at all"

It is therefore possible to conclude **no adverse effect** on the features of the Minsmere-Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar from the short-term effects of NOx due to a LOOP event.

Appropriate assessment of nutrient enrichment alone

Background levels of nutrient nitrogen within the SAC, SPA and Ramsar already exceed the minimum critical load for dwarf shrub heath habitat, and coastal stable dunes, whereas background deposition is below the minimum critical load for the fen, marsh and swamp feature.

The supplementary advice package for Minsmere-Walberswick SPA sets a target to "restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for the feature's supporting habitat on the Air Pollution Information System." (Natural England, 2019)

Site Improvement Plans (SIPs) have been developed as part of the Improvement Programme for England's Natura 2000 sites (IPENS). Natura 2000 sites is another term for European sites used in this HRA for SZC CA. The plan provides a "high level overview of the issues (both current and predicted) affecting the condition of the features on the site", including Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA, and outlines the "priority measures required to improve them. It does not cover issues where remedial actions are already in place or ongoing management activities which are required for maintenance." (Natural England, 2014)

The SIP for Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA identifies air pollution and specifically the impact of nitrogen deposition as a "pressure/threat" for the European dry heaths feature of the SAC and the European nightjar feature of the SPA, with an action on Natural England to establish a Site Nitrogen Action Plan. There is no mention of the impacts of air quality effects on the little tern, or its supporting habitat in the SIP (Natural England, 2014).

Action 6 of the Issues and Actions table within the SIP (Natural England, 2014) relates to Air Pollution: impact of atmospheric nitrogen deposition. It states that "modelled aerial deposits of nitrogen exceed the threshold limit above which the diversity of heathland vegetation begins to be altered and adversely impacted. Many land use practices contribute to the problem including land spreading, outdoor pigs, high nutrient inputs on fields, etc." The action description is to "control, reduce and ameliorate atmospheric nitrogen deposition" through the mechanism of a Site Nitrogen Action Plan (SNAP).

Commissioning

For commissioning, the Schedule 5 response (NNB GenCo, 2021a) states that "The model has been run assuming that all DGs are operational continuously, and the emission rate has been factored for the anticipated commissioning hours for the EDGs of 242.5 each (242.5/8760 = 2.8%) and for the UDGs 738 hours each (738/8760 = 8.4%). Commissioning of Unit 1 DGs and Unit 2 DGS are anticipated to occur in separate years, and therefore all Unit 1 DGs have been assessed operating together, and all Unit 2 DGs have been assessed as operating together. The worst-case results from Unit 1 and Unit 2 have then been reported."

The results of the detailed, more realistic modelling for Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar is provided in Table 40. Background levels of nutrient-nitrogen as predicted by Defra for 2028 have been used to inform this assessment of commissioning impacts at modelling point E2b and E2c.

Table 40 Detailed assessment of nutrient enrichment, Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar, 12 diesel generators factored for commissioning hours

Notable feature/ modelling point	PC (KgN/ha/yr)	PC % minimum critical load	Background (KgN/ha/yr) 2028	PEC (KgN/ha/yr)	PEC % minimum critical load
E2b	0.18	2%	13.1	13.28	166%
E2c	0.44	4%	13.8	14.24	142%

E2b Perennial vegetation of stony banks and little tern

Stable coastal dunes broad habitat is included in APIS as representative of the 'supralittoral sediment (acidic type)' supporting habitat of the breeding little tern population of the Minsmere-Walberswick Heaths SPA, including intertidal coarse sediment, intertidal mixed sediments and intertidal sand and muddy sands (Natural England Conservation Advice for Marine Protected Areas). It is also representative of the perennial vegetation of stony banks feature of the SAC.

The Seabird 2000 dataset contains data from a full census of all the breeding seabirds in Britain and Ireland. The data were gathered between the years 1999 and 2003 from both coastal and inland colonies. The main objectives of the survey were to obtain distribution and population information for all 25 species of seabird that regularly breed in the UK and Ireland; and to get baseline figures for those species that had been surveyed poorly. Both counts returned positive sightings of nesting little terns, with the coastal location at Minsmere beach returning a count of 4 and the inland location of the Minsmere Scrape a count of 9 (source MagicMap).

While the applicant states that "the little tern population of the SPA is known to nest further north than the point of maximum impact, and at this point it is considered that the impacts would be insignificant" (NNB GenCo, 2021a), a precautionary approach will be taken in this assessment, with consideration given to the maximum predicted deposition at modelling point E2b.

The little tern colonies of the Suffolk and Norfolk coastline are functionally linked and all make up a larger meta-population of little tern - interlinked populations that will move up

and down the coast between colonies following prey species and nesting where their food source is most abundant or nesting habitat is most suitable (Minsmere-Walberswick SPA supplementary advice). As such, little terns are transitory in their nesting habits and may move between different colonies in response to factors, including disturbance and predation (Minsmere-Walberswick SPA supplementary advice).

The more realistic modelling scenario has resulted in a reduction of the predicted PC from 6% of the minimum critical load at modelling point E2b to 2%.

It is not expected that an additional maximum modelled nutrient-nitrogen contribution, of 2% of the critical load for coastal stable dunes ("quite reliable" critical load) alone will lead to an adverse effect on the little tern population of the SPA over the limited commissioning period of 2 years. In addition, the predicted deposition will not be experienced over the entire site, but will be localised, reducing beyond the modelling points.

An in-combination assessment is required.

E2c European dry heaths and European nightjar

Dwarf shrub heaths broad habitat is included in APIS as being representative of the 'European dry heaths' feature of Minsmere to Walberswick Heaths and Marshes SAC and supporting habitat of breeding European nightjar population of the Minsmere-Walberswick SPA and Ramsar.

The more realistic modelling scenario has resulted in a reduction of the predicted PC from 11% of the minimum critical load at modelling point E2c to 4% that was used by the applicant to assess the European dry heaths feature of the SAC and supporting feature of the European nightjar population of the SPA.

The predicted concentrations will not be experienced over the entire site but will be localised reducing rapidly from modelling point E2c as is shown in Figure 8 for the deposition of nutrient-N from the routine testing of SZC CA. The area of the European site closest to SZC is dominated by wetland habitat. The SAC supplementary advice package (Natural England, 2019) states that the high land at Minsmere, Westleton and Walberswick, which is part of East Suffolk Sandlings supports large areas of lowland heaths. Large continuous tracts of approximately 400ha of lowland heath are present at Minsmere, Dunwich and Westleton Heath, with smaller areas at Walberswick as shown in Table 5.

The nearest heathland habitat within the SAC is located at approximately 3km from modelling point E2c, deposition from SZC CA commissioning will be significantly reduced over this distance.

It is not expected that deposition of nutrient-nitrogen will directly lead to measurable damage of the European dry heaths over the limited period of 2 years, given the prevailing environmental conditions, which are predicted to be 142% of the minimum critical load and the distance to the heathland habitat.

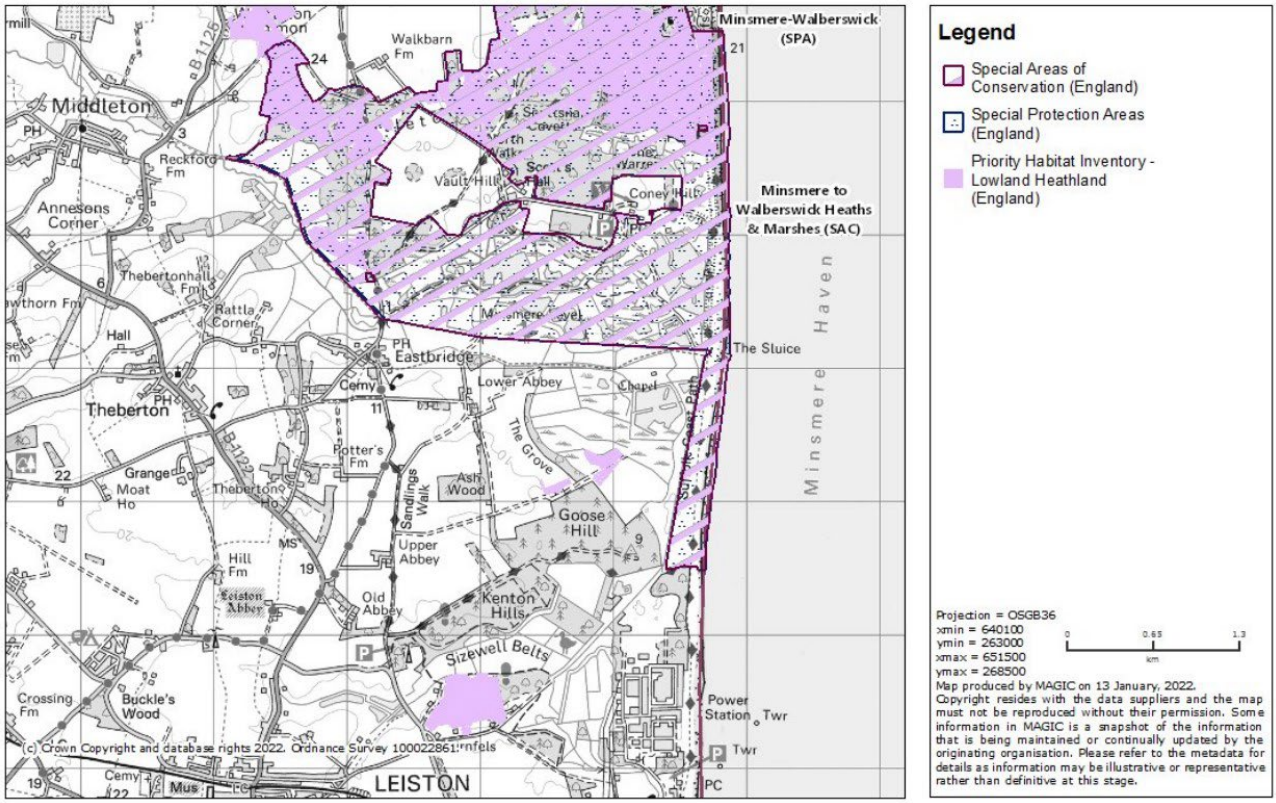

Figure 6 Map showing the location of lowland heathland within Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar (MagicMap accessed 13 January 2022)

Conclusion

The conclusion for the commissioning phase of SZC CA is precautionary, based on the modelling scenario for the routine testing of SZC CA. The worst-case scenario that will occur during commissioning involves simulating a LOOP event, whereby 4 EDGs are tested simultaneously for a 3-hour period. This scenario emits less NO_x over a 24-hour period compared to the worst-case scenario during routine testing, which involves testing a single generator for 24 hours following a maintenance outage. Therefore, using routine testing PCs for commissioning is likely to be more conservative, with emissions and resultant deposition being lower than modelled for the purposes of this assessment.

Critical loads are based on an annual average quantity and the critical loads for nitrogen deposition are based on an assumption of exposure to nutrient loadings of 20 to 30 years (CIEEM, 2021). Commissioning is expected to last for a period of 2 years, with the 2 reactor units being commissioned separately, for a prescribed length of time (as described in section 1.3.1).

The maximum PC is predicted to be 4% of the critical load for European dry heaths. However, it is not within an area of heathland habitat (Figure 6). Given the distance from modelling point E2c to the European dry heath and European nightjar habitat, and the limited timing of the commissioning phase of SZC CA there is no potential that deposition

from SZC CA commissioning alone will prevent the conservation objectives from being achieved. The same conclusion is reached for the supporting habitat of the little tern population and the perennial vegetation of stony banks feature of the SAC, with a PC of 2% of the minimum critical load in the context of a modelled PEC of 166%.

It is possible to conclude **no adverse effect alone** on the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar. A precautionary appropriate assessment in-combination with other plans and projects is required.

Routine testing

For the routine testing of SZC CA the Schedule 5 response (NNB GenCo, 2021a) provides the following, “The routine operation assessment was based on the assumption of one EDG operating continuously throughout the year, with pro-rata emissions based on 720 hours of annual operation.

The 12 DGs are spread over a relatively large area, with approximately 500m between the most northerly positioned DGs and the most southerly positioned DGs. The DGs that are closest to a specific receptor will result in the maximum impacts at that receptor, while the DGs furthest away will result in lower impacts at the same receptor.

The assessment presented in Appendix C of the environmental permit application (NNB GenCo, 2020a) reported impacts at each receptor based on the operation of the EDG that resulted in the highest impact at that receptor (that is, the closest EDG), rather than considering that the operation of that EDG would only actually be for 60 hours, and operation of EDGs leading to lower results would account for a large proportion of the testing hours.

In addition, no consideration was given in the assessment to the fact that the 4 smaller UDGs have much lower emissions of NOx. Therefore, of the 720 hours of annual operation for the routine testing scenario, 480 hours would be associated with EDG operation, but 240 hours would be associated with UDG operation and therefore would result in considerably lower impacts due to the much lower NOx emissions of these units.”

The applicant carried out further modelling to represent the most realistic scenario during the operational lifetime of SZC, the results are presented in Table 41.

Table 41 Detailed assessment of nutrient enrichment, Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar, 12 diesel generators factored for 60-hours operation each

Modelling point	PC kgN/ha/yr	PC % minimum critical load	Background kgN/ha/yr	PEC kgN/ha/yr	PEC % minimum critical load
E2b	0.06	0.8%	Not applicable	Not applicable	Not applicable
E2c	0.14	1%	13.8	13.94	139%

E2b Perennial vegetation of stony banks and little tern

Coastal stable dunes are included in APIS as representative of the 'supralittoral sediment (acidic type)' supporting habitat of the breeding little tern population of the Minsmere-Walberswick Heaths SPA, including intertidal coarse sediment, intertidal mixed sediments and intertidal sand and muddy sands (Natural England Conservation Advice for Marine Protected Areas). It is also representative of the perennial vegetation of stony banks feature of the SAC.

The little tern colonies of the Suffolk and Norfolk coastline are functionally linked and all make up a larger meta-population of little tern - interlinked populations that will move up and down the coast between colonies following prey species and nesting where their food source is most abundant or nesting habitat is most suitable (Minsmere-Walberswick SPA supplementary advice). As such, little terns are transitory in their nesting habits and may move between different colonies in response to factors, including disturbance and predation (Minsmere-Walberswick SPA supplementary advice).

While the applicant states that "the little tern population of the SPA is known to nest further north than the point of maximum impact, and at this point it is considered that the impacts would be insignificant" (NNB GenCo, 2021a), a precautionary approach to the SPA shall be taken in this assessment, with consideration given to the maximum predicted deposition at modelling point E2b. This point is also representative of the perennial vegetation of stony banks feature of the SAC.

The more realistic modelling scenario has resulted in a reduction of the predicted PC to 0.8% of the critical load, which is below the significance decision-making threshold and is the expected maximum deposition for breeding little tern supporting habitat.

As maximum deposition is predicted to be below the 1% decision-making threshold and will decrease rapidly as shown in Table 6, there is no requirement for an in-combination assessment with other plans and project.

It is possible to conclude **no adverse effect alone and in-combination** on the coastal stable dunes broad habitat, which is representative of the supralittoral sediment supporting habitat of the little tern population of the Minsmere-Walberswick SPA and bird assemblage of the Ramsar, in the context of prevailing environmental conditions.

E2c European dry heaths and European nightjar

Dwarf shrub heaths broad habitat is included in APIS as being representative of the 'European dry heaths' feature of Minsmere to Walberswick Heaths and Marshes SAC and supporting habitat of breeding European nightjar population of the Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar.

The maximum deposition during the routine testing of SZC CA is predicted to be 1.4% of the minimum critical load for dwarf shrub heath at modelling point E2c. The nitrogen deposition isopleths provided in Table 6 illustrate the localised nature of the deposition of nutrient nitrogen during the routine testing of SZC CA. Deposition will only be significant, that is, above the 1% decision-making threshold over a small area of the SAC, SPA and Ramsar, dropping to 0.6% of the critical level by modelling point E2b. The area between E2c and E2b is approximately 9ha, out of a total area of 1,256.47ha of the SAC and 2,019ha of the larger SPA and Ramsar.

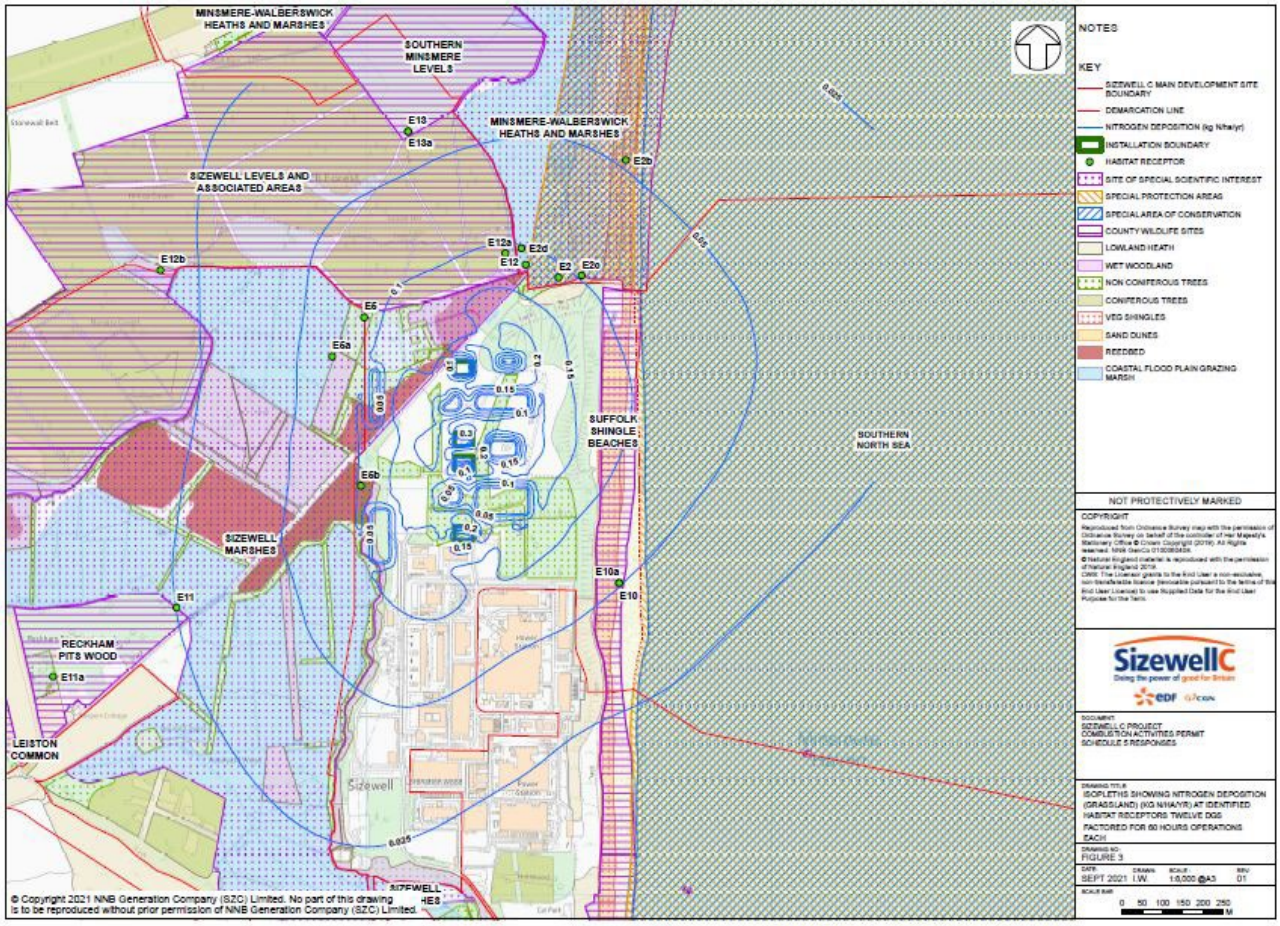

Figure 7 Isopleths showing nitrogen deposition (kg N/ha/yr) at identified habitat receptors based on 12 DGs factored for 60 hours operation each

The heathland habitat, habitat class N08, covers 23% of the SPA (Minsmere-Walberswick SPA standard data form), or 464.37ha, occurring more than 3km from modelling point E2c (Figure 6). This is supported by the SAC supplementary advice package (Natural England, 2019), which states that the high land at Minsmere, Westleton and Walberswick, which is part of East Suffolk Sandlings, supports large areas of lowland heaths. Large continuous tracts of approximately 400ha of lowland heath are present at Minsmere, Dunwich and Westleton Heath, with smaller areas at Walberswick.

The area where the 1% decision threshold will be exceeded is dominated by wetland habitat. Deposition from SZC CA during its routine testing is expected to imperceptible at the nearest heathland habitat within the European site.

It is possible to conclude **no adverse effect alone and in-combination** on the dwarf shrub heath broad habitat, which is representative of the European dry heaths feature of the Minsmere to Walberswick Heaths and Marshes SAC and supporting habitat of the European nightjar population of the Minsmere-Walberswick SPA.

Conclusion

The conclusion for the routine testing of SZC CA is based on a more realistic modelling assumption than used in the assessment of likely significant effect.

It was possible to conclude no adverse effect alone and in-combination on perennial vegetation of stony banks SAC feature and supporting habitat of the little tern population of the SPA and Ramsar and European dry heaths SAC feature and supporting habitat for European nightjar of the SPA. The maximum modelled nitrogen deposition is predicted to be below the significance decision-making threshold.

The supplementary advice packages for both the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA contain a target to “restore concentrations and deposition of air pollutants to at or below the site-relevant critical load or level values given for the feature” supporting habitat on the Air Pollution Information System (www.apis.ac.uk).” (Natural England, 2019, Minsmere-Walberswick SPA supplementary advice). Localised contributions that are below the significance decision-making threshold are not considered to put this target at risk of being met within the European site.

It is possible to conclude **no adverse effect** on the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar from the routine testing of SZC CA.

Appropriate assessment of nutrient enrichment in-combination: commissioning

It has been possible to conclude no adverse effect alone for the perennial stony banks feature of the Minsmere to Walberswick Heaths and Marshes SAC and supporting habitat of the little tern population of the Minsmere-Walberswick SPA and Ramsar, and European dry heaths feature of the SAC and supporting habitat of the European nightjar population of the SPA. An in-combination assessment is therefore required.

The following in-combination assessment will consider deposition of nutrient nitrogen from other PPP that have the potential for overlapping, additive in-combination effects, or result in residual effects that could act in-combination with the operational CA permit.

Environment Agency permits

The Environment Agency's mapping tool, Easimap was accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of the modelling point E2 within the SAC, SPA and Ramsar (overlapping effects) and within 10km of the European site boundary (discrete effects).

There are 4 Environment Agency permits within 10km of the modelling point E2 within Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Ramsar that have associated aerial emissions (Table 17) and a further 9 within 10km of the European site boundary (Table 18). However, they are already accounted for in background levels at the European sites and therefore in the predicted PEC.

It is therefore possible to conclude **no adverse effect** in-combination with other Environment Agency permits.

Within project in-combination: SZC construction

Table 3-5 of the Desalination Plant Air Impact Assessment (NNB GenCo, 2021c) provides the predicted N-deposition from the associated diesel generators on all European sites within 10km of SZC. The PC is predicted to be 0.181kg N/ha/yr at modelling point E2c European dry heaths, or 2% of the minimum critical load.

The applicant states that the proposed "relatively short stack height of the desalination generators means that the predicted deposition will drop off rapidly with distance from the generators, and therefore the area where the PC is predicted to be over 1% of the critical load threshold to determine an imperceptible effect is very small." The applicant goes on to state that "The European dry heaths qualifying feature, however, is not present within the 0.1kgN/ha/yr (1% of the critical load) contour line" (Figure 8) (NNB GenCo, 2021c). We agree with the applicant, there is no potential for an in-combination effect on the European dry heaths feature of the Minsmere to Walberswick SAC and supporting habitat of the European nightjar feature of the Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar due to the distance of the heathland habitat from modelling point E2c (Figure 6).

Our approach to the little tern population is to assume that they could be present within the perennial vegetation of stony banks SAC designated habitat (coastal stable dunes broad habitat). This is due to the interlinked populations that will move up and down the coast between colonies following prey species and nesting where their food source is most abundant or nesting habitat is most suitable. The applicant predicts that the PC will be 0.075kg N/ha/yr at modelling point E2b, or 0.9% of the minimum critical load.

Plate 4.1 of the report (NNB GenCo, 2021c) (reproduced in Figure 8) shows the isopleth lines as a percentage of the minimum critical for the protection of the European dry heaths

feature of 10kg N/ha/yr (blue line) and the boundary of the southern end of the Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar (red line).

The applicant has estimated that the area predicted to experience N-deposition over 1% of the critical load of 10kg N/ha/yr is approximately 200m x 200m, which is an area of 0.04km² or 4 hectares. The minimum critical load for the supporting habitat of the little tern is 8kg N/ha/yr, the area over which a 1% exceedance will occur will be marginally bigger than that shown in Figure 8, the 1% isopleth will be 1.25% of critical load of 8kg N/ha/yr, reducing to 0.9% by modelling point E2b.

The applicant has confirmed that the desalination plant will only be powered by diesel engines for the first 3 years of operation, prior to the commissioning and operation of units 1 and 2 of SZC. It is unlikely that a very localised contribution over 1% of the minimum critical load over this short a timescale, where the background is already exceeded, will result in a measurable change to the little tern supporting habitat that could result in a residual in-combination effect.

It is therefore possible to conclude that there will be no residual in-combination effect between the commissioning of SZC CA and the desalination plant diesel generators.

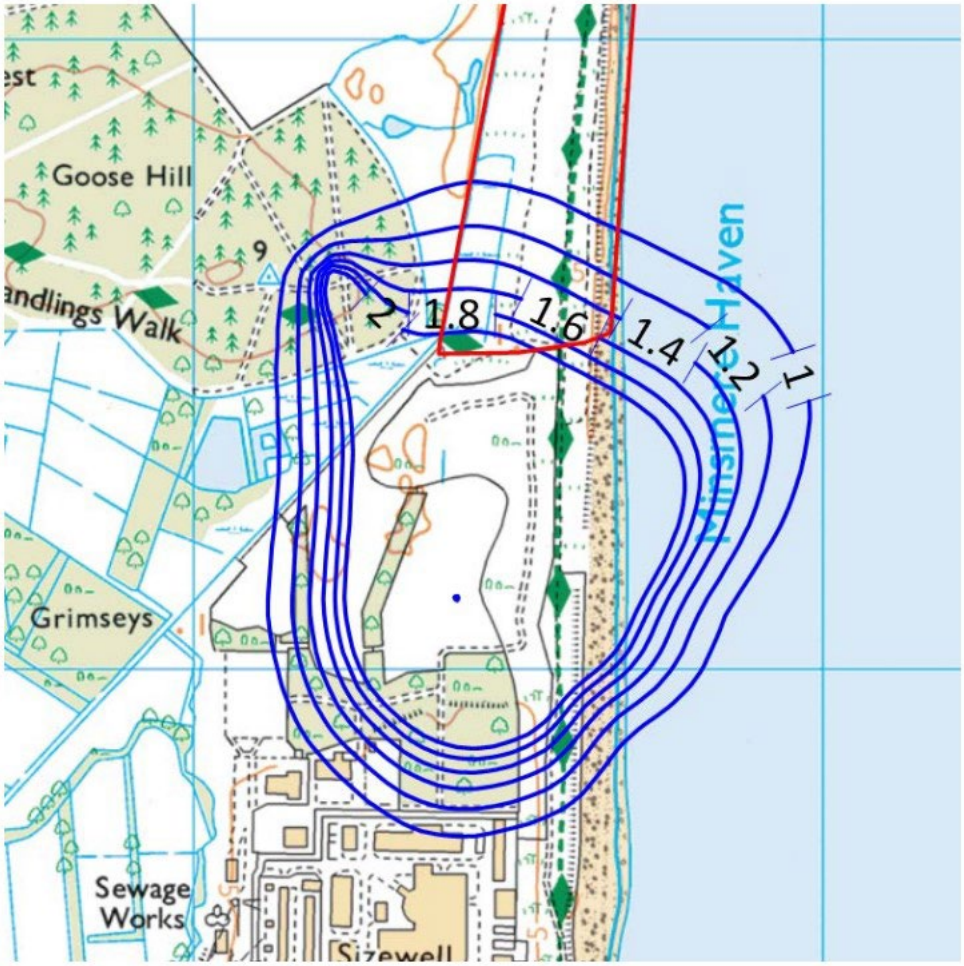

Figure 8 Isopleths of N-deposition, as a percentage of the 10kg N/ha/yr minimum critical load for the protection of European dry heaths. Taken from Desalination Plant Air Impact Assessment, Plate 4.1, NNB GenCo, 2021c

An assessment of nutrient nitrogen deposition from the operation of the CHP plant is provided in the Campus Combined Heat and Power Emissions Assessment, NNB GenCo, 2020e. Table 12F.4 of this report predicts that nitrogen deposition at modelling point E2 will 0.01kg N/ha/yr, or 0.13% of the minimum critical load for the supporting habitat of the little tern.

While the CHP plant will be operational during the commissioning of SZC CA, the maximum deposition of nitrogen is predicted to be inconsequential and would not have the potential for an in-combination effect.

Within project in-combination: SZC construction traffic

The applicant carried out modelling of road and rail transport impacts as part of its DCO application (NNB GenCo, 2020e) including the following scenarios:

- baseline 2018 scenario (2018 BC) to enable model verification
- early year 2023 reference case scenario (2023 RC), that is, without the proposed development
- early year 2023 typical day scenario (2023 AD), that is, with some elements of the associated developments under construction
- peak year 2028 reference case scenario (2028 RC), that is, without the proposed development
- peak year 2028 typical day scenario (2028 AD), that is, with the peak construction of the proposed development
- peak year 2028 busiest day scenario (2028 BD), that is, with the peak construction of the proposed development
- operational year 2034 reference case scenario (2034 RC), that is, without the proposed development
- operational year 2034 typical day scenario (2034 AD), that is, with the proposed development in place

Information provided in the following tables within the environmental statement will be used to inform this commissioning impacts appropriate assessment:

- Table 1.28 (NNB GenCo, 2020e) provides the maximum modelled rail and road contribution of pollutants for a 2028 average day scenario relative to the 2028 reference case
- Table 1.29 (NNB GenCo, 2020e) provides the maximum modelled rail and road contribution of pollutants for a 2028 busiest day scenario relative to the 2028 reference case

The busiest day scenario for 2028 is predicted to result in a PC of 0.945kg N/ha/yr, while the average day scenario is predicted to result in 0.124kg N/ha/yr at the SAC, SPA and Ramsar.

Conclusion

There is the potential for an in-combination effect between the traffic associated with the construction phase of the SZC project and the commissioning of SZC CA prior to operation on the supporting perennial vegetation of stony banks SAC habitat of the little tern population of the SPA and the European dry heaths feature of the SAC and associated European nightjar population of the SPA.

The PCs to consider in-combination at modelling point E2b, Minsmere-Walberswick SPA and Ramsar are as follows:

- SZC CA commissioning PC: 0.44kg N/ha/yr
- construction traffic PC: 0.945kg N/ha/yr (maximum), 0.124kg N/ha/yr (average)

- background: 13.8kg N/ha/yr

The worst-case PEC, based on best available information at the time of this appropriate assessment, is predicted to be 15.2kg N/ha/yr or 190% of the critical load for the protection of the supporting habitat of the little tern, of which 172% is due to background levels and 18% related to the construction and commissioning of SZC CA.

This overlap between maximum construction traffic and the commissioning of SZC units 1 and 2 is unlikely to occur, as the majority of the construction work will have completed.

When considering the average transport effects, the PEC is reduced to 14.4kg N/ha/yr, or 180% of the critical load, with 8% related to the construction and commissioning of SZC CA.

Critical loads are based on an annual average quantity and the critical loads for nitrogen deposition are based on an assumption of exposure to nutrient loadings of 20 to 30 years (CIEEM, 2021). Commissioning is expected to last for a period of 2 years, with the 2 reactor units being commissioned separately, for a prescribed length of time (as described in section 1.3.1).

In addition, the predicted concentrations and in-combination effects will not be experienced over the entire site, but will be localised over a small area of the European site.

It is therefore possible to conclude **no adverse effect** in-combination with other Environment Agency permits.

APIS states that “impacts on lowland heathlands are likely where relict heathlands remain surrounded by an intensive agricultural landscape. A wide range of sources apply (e.g., nearness to pig, poultry or cattle farming). Smaller impacts are expected from oxidised nitrogen deposition (NOx) due to the slower rate of deposition, although there is still high uncertainty regarding the scale of impacts on heathlands adjacent to major roads or cities. The nearness to agricultural grassland also increases the likelihood of invasion by more nitrophilic grasses. N inputs will enhance N availability via increased litter production, decomposition and increased N mineralization.”

It is therefore possible to conclude **no adverse effect in-combination** on the Minsmere to Walberswick Heaths SAC and Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar during the routine testing of SZC CA.

Appropriate assessment of acidification alone

Acidification was re-modelled by the applicant to represent more realistic scenarios at modelling point E2b, E2c and E2e.

Commissioning

For commissioning, the Schedule 5 Notice response (NNB GenCo, 2021) states that “the model has been run assuming that all DGs are operational continuously, and the emission

rate has been factored for the anticipated commissioning hours for the EDGs of 242.5 each (242.5/8760 = 2.8%) and for the UDGs 738 hours each (738/8760 = 8.4%).

Commissioning of Unit 1 DGs and Unit 2 DGS are anticipated to occur in separate years, and therefore all Unit 1 DGs have been assessed operating together, and all Unit 2 DGs have been assessed as operating together. The worst-case results from Unit 1 and Unit 2 have then been reported."

The results of the detailed, more realistic modelling are provided in Table 42. Background levels of acidification as predicted by Defra for 2028 have been used to inform this assessment of commissioning impacts at modelling point E2b and E2e.

The applicant did not re-model E2c as the original results predicted that the PEC would not exceed the critical load for the protection of the European dry heaths habitat. When considering background levels predicted for 2028, the PEC is further reduced to 89% of the critical load function.

Table 42 Detailed assessment of acidification, Minsmere-Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar, 12 diesel generators factored for commissioning hours

Modelling point	PC N keq/ha/yr	PC S keq/ha/yr	PC % Critical Load	Background N keq/ha/yr	Background S keq/ha/yr	PEC N keq/ha/yr	PEC S keq/ha/yr	PEC % Critical load
E2b	0.013	0.006	3%	1	0.1	1.01	0.11	197%
E2e	0.002	0.001	0%	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

E2e Wetland plant assemblages

The modelling of more realistic operating scenarios has resulted in a reduction in modelled process contributions of both N and S. For the fen, marsh and swamp feature (modelling point E2e), there is not expected to be any contribution to acidification from the commissioning of SZC CA. No further consideration will be given to this feature.

E2b Perennial vegetation of stony banks

The maximum PC predicted at modelling point E2b is 3% of the minimum critical load function for stable coastal dunes used as the broad habitat representative of the perennial vegetation of stony banks. APIS states that "soil acidification as a result of acid deposition has relatively little impact in UK dunes because sand dune soils are generally well-buffered, with the exception of the few acidic dune systems...Sand dune habitats are one of the most natural remaining vegetation types in the UK, supporting over 70 nationally rare or red-data book species. In sand dunes, decalcification (in response to rainfall) reduces pH and this has the strongest influence upon forb diversity for this habitat. The

majority of dune systems in the UK are calcareous, well buffered and low in heavy metals so should be tolerant of acid deposition."

It is not expected that acidification from the commissioning of SZC CA would result in measurable damage on the features of Minsmere-Walberswick Heaths and Marshes SAC, given the expected reduction in acidification with distance from SZC.

Conclusion

The conclusion for the commissioning phase of SZC CA is precautionary, based on the modelling scenario for the routine testing of SZC CA. The worst-case scenario that will occur during commissioning involves simulating a LOOP event, whereby 4 EDGs are tested simultaneously for a 3-hour period. This scenario emits less NO_x over a 24-hour period compared to the worst-case scenario during routine testing, which involves testing a single generator for 24 hours following a maintenance outage. Therefore, using routine testing PCs for commissioning is likely to be more conservative, with emissions and resultant deposition being lower than modelled for the purposes of this assessment.

When considering the prevailing environmental conditions, it is possible to conclude that there would be no measurable effect from the addition of 3% of the critical load function over a 2-year period, with background at approximately double the critical load function.

It is possible to conclude **no adverse effect alone** on the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar from the commissioning of SZC CA. An assessment in-combination with other plans and projects is required.

Routine testing

For the routine testing of SZC CA, the Schedule 5 response (NNB GenCo, 2021a) provides the following, "The routine operation assessment was based on the assumption of one EDG operating continuously throughout the year, with pro-rata emissions based on 720 hours of annual operation.

The twelve DGs are spread over a relatively large area, with approximately 500m between the most northerly positioned DGs and the most southerly positioned DGs. The DGs that are closest to a specific receptor will result in the maximum impacts at that receptor, whilst the DGs furthest away will result in lower impacts at the same receptor.

The assessment presented in Appendix C of the Environmental Permit application (NNB GenCo, 2020a) reported impacts at each receptor based on the operation of the EDG that resulted in the highest impact at that receptor (i.e., the closest EDG, as detailed above), rather than taking into account that the operation of that EDG would only actually be for 60 hours, and operation of EDGs leading to lower results would account for a large proportion of the testing hours.

In addition, no consideration was given in the assessment to the fact that the four smaller UDGs) have much lower emissions of NOx. Therefore, of the 720 hours of annual operation for the routine testing scenario, 480 hours would be associated with EDG

operation, but 240 hours would be associated with UDG operation and therefore would result in considerably lower impacts due to the much lower NOx emissions of these units."

The applicant carried out further modelling to represent the most realistic scenario during the operational lifetime of SZC, the results are presented in Table 43.

Table 43 Detailed assessment of acidification of Minsmere-Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar from routine testing based on 12 DGs factored for 60-hours operation each

Modelling point	PC N keq/ha/yr	PC S keq/ha/yr	PC % CL	Background N keq/ha/yr	Background S keq/ha/yr	PEC N keq/ha/yr	PEC S keq/ha/yr	PEC %CL
E2b	0.004	0.002	2%	1	0.1	1.004	0.102	195%
E2c	0.01	0.005	3%	1	0.1	1.01	0.105	92%

E2c European dry heaths

The acid deposition PEC is predicted to be below the minimum critical load function for the European dry heaths feature of the SAC at modelling point E2c, with SZC CA contributing 3%. This is a worst-case scenario for SZC CA as modelling point E2c is not within the nearest heathland habitat (Figure 6). The target to "restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given on the Air Pollution Information System" will be met when considering SZC CA routine testing and prevailing environmental conditions (Natural England, 2019)

E2b Perennial vegetation of stony banks

The perennial vegetation of stony banks feature of the SAC is represented in APIS by the broad habitat type 'coastal stable dune grasslands'.

The maximum PC predicted at modelling point E2b is 2% of the minimum critical load function for stable coastal dune grasslands. APIS states that "soil acidification as a result of acid deposition has relatively little impact in UK dunes because sand dune soils are generally well-buffered, with the exception of the few acidic dune systems...Sand dune habitats are one of the most natural remaining vegetation types in the UK, supporting over 70 nationally rare or red-data book species. In sand dunes, decalcification (in response to rainfall) reduces pH and this has the strongest influence upon forb diversity for this habitat. The majority of dune systems in the UK are calcareous, well buffered and low in heavy metals so should be tolerant of acid deposition."

It is not expected that acidification from the commissioning of SZC CA would result in measurable damage on the features of Minsmere to Walberswick Heaths and Marshes

SAC, given the expected reduction in acidification with distance from SZC and the elevated background levels, with a PEC of 195% of the minimum critical load function.

Conclusion

The conclusion for the routine testing of SZC CA is based on a more realistic modelling assumption than the one used in the assessment of likely significant effect.

The maximum PC is predicted to be 3% of the critical load function for the European dry heaths at modelling point E2c (outside of the heathland habitat, Figure 6) and the PEC is below the critical load function.

It is possible to conclude **no adverse effect alone** on the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar. An assessment in-combination with other plans and projects is required.

Appropriate assessment of acidification in-combination

An in-combination assessment is required to determine if there are other plans, permissions or projects that could result in an adverse on the features of the Minsmere to Walberswick Heaths and Marshes SAC and supporting feature of the SPA and Ramsar.

Commissioning

It has been possible to conclude no adverse effect alone for the perennial vegetation of stony banks feature of the SAC. An in-combination assessment is therefore required.

The following in-combination assessment will consider acidification from other PPP that have the potential for an overlapping, additive in-combination effect.

Environment Agency permits

The Environment Agency's mapping tool, Easimap was accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of the modelling point E2 within the SAC, SPA and Ramsar.

There are 4 Environment Agency permits within 10km of the modelling point E2 within Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar that have associated aerial emissions (Table 17) and a further 9 within 10km of the European site boundary (Table 18). However, they are already accounted for in background levels at the European sites and therefore in the predicted PEC.

It is therefore possible to conclude **no adverse effect** in-combination with other Environment Agency permits.

Within project in-combination: SZC construction

Table 3-6 of the Desalination Plant Air Impact Assessment (NNB GenCo, 2021c) provides the predicted acid deposition from the associated diesel generators on all European sites

within 10km of SZC. The results for modelling point E2b predict that the PC will be 0.005keqN/ha/yr and 0.003keq S/ha/yr, which is 1.4% of the critical load function.

The applicant has confirmed that the desalination plant will only be powered by diesel engines for the first 3 years of operation, prior to the commissioning and operation of units 1 and 2 of SZC. It is unlikely that a very localised contribution over 1% of the minimum critical load function over this short a timescale will result in a measurable change to the perennial vegetation of drift lines feature of the SAC that could result in a residual in-combination effect.

It is therefore possible to conclude that there will be no in-combination effect between the commissioning of SZC CA and the desalination plant diesel generators.

An assessment of acid nitrogen deposition from the operation of the CHP plant is provided in the Campus Combined Heat and Power Emissions Assessment, NNB GenCo, 2020e. Table 12F.4 of this report predicts that acid N deposition at modelling point E2 will be 0.001keq N/ha/yr, or 0.2% of the minimum critical load for the perennial vegetation of stony banks. There is assumed to be no acid S deposition from the CHP plant.

While the CHP plant will be operational during the commissioning of SZC CA, the maximum acid deposition is predicted to be inconsequential and would not have the potential for an in-combination effect.

Within project in-combination: SZC construction traffic

The applicant carried out modelling of road and rail transport impacts as part of its DCO application (NNB GenCo, 2020e), including the following scenarios:

- baseline 2018 scenario (2018 BC) to enable model verification
- early year 2023 reference case scenario (2023 RC), that is, without the proposed development
- early year 2023 typical day scenario (2023 AD), that is, with some elements of the associated developments under construction
- peak year 2028 reference case scenario (2028 RC), that is, without the proposed development
- peak year 2028 typical day scenario (2028 AD), that is, with the peak construction of the proposed development
- peak year 2028 busiest day scenario (2028 BD), that is, with the peak construction of the proposed development
- operational year 2034 reference case scenario (2034 RC), that is, without the proposed development
- operational year 2034 typical day scenario (2034 AD), that is, with the proposed development in place

Information provided in the following tables within the environmental statement will be used to inform this commissioning impacts appropriate assessment:

- Table 1.28 (NNB GenCo, 2020e) provides the maximum modelled rail and road contribution of pollutants for a 2028 average day scenario relative to the 2028 reference case
- Table 1.29 (NNB GenCo, 2020e) provides the maximum modelled rail and road contribution of pollutants for a 2028 busiest day scenario relative to the 2028 reference case

The assessment did not include modelling of S deposition.

The busiest and average day scenarios for 2028 were both predicted to result in a PC of 0.009keqN/ha/yr or 1.6% minimum CLmaxN.

Conclusion

There is the potential for an in-combination effect between the construction phase of the SZC project and the commissioning of SZC CA prior to operation. The applicant has provided a schematic of when construction activities would be expected to take place on site, and when the nuclear units would be expected to be operational (NNB GenCo, 2021b). There is the potential for an overlap between Phase 5 (commissioning of the emergency diesel generators), Phase 4 (mechanical and electrical installation), and potentially Phase 3 (main civils) (Figure 3). In line with the precautionary approach legally required for the appropriate assessment of plans, permissions, and projects under the Habitats Regulations as set out in the HRAR of Environment Agency Permits for SZC (Environment Agency, 2022e), it will be assumed that an overlap will exist between construction and commissioning of SZC CA.

As there are no emissions of S associated with the construction of SZC or traffic emissions, this assessment will consider the N deposition from the commissioning of SZC CA and assess against the minimum CLMaxN of 0.57keq N/ha/yr for the perennial vegetation of stony banks feature of the SAC.

The PCs to consider in-combination at modelling point E2b, Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar are as follows:

- SZC CA commissioning PC: 0.013keqN/ha/yr
- CHP plant PC: 0.001keqN/ha/yr
- construction traffic PC: 0.009keqN/ha/yr
- background: 1keqN/ha/yr

The worst-case PEC, based on the best available information at the time of this appropriate assessment, is predicted to be 1.023keqN/ha/yr or 179% of the minimum CLMaxN for the protection of the perennial vegetation of stony banks feature of the SAC. Of this, 175% is due to background and 4% due to the construction and commissioning of SZC CA.

This assessment is based on the assumption that there will be a temporal overlap between construction and the 2-year commissioning phase of the SZC reactor units and is therefore worse case. If any overlap does occur it will be at the end of construction period

when most civil works are complete. In addition, the predicted concentrations and in-combination effects will not be experienced over the entire site, but will be localised over a small area of the European site.

It is therefore possible to conclude **no adverse effect in-combination** with other plans and projects during commissioning of the SZC reactor units.

Routine testing

It has been possible to conclude no adverse effect alone for the European dry heaths and perennial vegetation of stony banks feature of the SAC, an in-combination assessment is therefore required.

The following in-combination assessment will consider acidification from other plans, permissions and projects, that have the potential for an overlapping, additive in-combination effect.

Environment Agency permits

The Environment Agency's mapping tool, Easimap was accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of the modelling point E2 within the SAC, SPA and Ramsar.

There are 4 Environment Agency permits within 10km of the modelling point E2 within Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Ramsar that have associated aerial emissions (Table 17) and a further 9 within 10km of the European site boundary (Table 18). However, they are already accounted for in background levels at the European sites and therefore in the predicted PEC.

It is therefore possible to conclude **no adverse effect** in-combination with other Environment Agency permits.

Within project in-combination: SZC construction

Table 3-6 of the Desalination Plant Air Impact Assessment (NNB GenCo, 2021c) provides the predicted acid deposition from the associated diesel generators on all European sites within 10km of SZC. The results for modelling point E2b predict that the PC will be 0.005keqN/ha/yr and 0.003keq S/ha/yr, which is 1.4% of the critical load function for the perennial vegetation of stony banks feature of the SAC. Acid deposition at modelling point E2c, European dry heaths is predicted to be 0.013keq N/ha/yr and 0.007keq S/ha/yr, which is 1.6% of the critical load function.

The applicant has confirmed that the desalination plant will only be powered by diesel engines for the first 3 years of operation, prior to the commissioning and operation of units 1 and 2 of SZC (NNB GenCo, 2021c). It is unlikely that very localised contributions over 1% of the minimum critical load function over this short a timescale will result in a measurable change to the perennial vegetation of drift lines feature of the SAC that could result in a residual in-combination effect.

It is therefore possible to conclude that there will be no in-combination effect between the routine testing of SZC CA and the desalination plant diesel generators.

An assessment of acid nitrogen deposition from the operation of the CHP plant is provided in Campus Combined Heat and Power Emissions Assessment (NNB GenCo, 2020,e). Table 12F.4 of this report predicts that acid N deposition at modelling point E2 will be 0.001keq N/ha/yr, or 0.2% of the critical load for the perennial vegetation of stony banks of 0.57keq N/ha/yr. This PC would be 0.08% of the critical load 1.237keq N/ha/yr for the European dry heaths.

There is assumed to be no acid S deposition from the CHP plant.

While the CHP plant will be operational during the commissioning of SZC CA, the maximum acid deposition is predicted to be inconsequential and would not have the potential for an in-combination effect.

It is therefore possible to conclude that there will be no in-combination effect between the commissioning of SZC CA and the desalination plant diesel generators.

Within project in-combination: SZC traffic

The applicant carried out modelling of road and rail transport impacts as part of its DCO application (NNB GenCo, 2020e), including the following scenarios:

- baseline 2018 scenario (2018 BC) to enable model verification
- early year 2023 reference case scenario (2023 RC), that is, without the proposed development
- early year 2023 typical day scenario (2023 AD), that is, with some elements of the associated developments under construction
- peak year 2028 reference case scenario (2028 RC), that is, without the proposed development
- peak year 2028 typical day scenario (2028 AD), that is, with the peak construction of the proposed development
- peak year 2028 busiest day scenario (2028 BD), that is, with the peak construction of the proposed development
- operational year 2034 reference case scenario (2034 RC), that is, without the proposed development
- operational year 2034 typical day scenario (2034 AD), that is, with the proposed development in place

Table 1.30 of Appendix 12 (NNB GenCo, 2020e) predicts that there will be no acid deposition associated with traffic during a typical day scenario for 2034. There is no potential for an in-combination effect with the routine testing of SZC CA.

Conclusion

There is the potential for an in-combination effect between the effects of traffic associated with SZC, the operation of the HCP plant and the routine testing of SZC. However, this in-

combination assessment has identified that the only feasible in-combination effect would be between the SZC CA and CHP plant. The best information that we have on acid deposition from the CHP indicates that it would be inconsequential at the Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar. A full assessment will be carried out when the CHP plant application is submitted.

4.4.2. Functionally linked land

A likely significant effect was identified for effects listed below and an appropriate assessment is required both alone and in combination:

- direct toxic effect of NOx (short-term) – commissioning and routine testing
- nutrient enrichment – commissioning and routine testing

An appropriate assessment will also be carried out on the LOOP scenario which wasn't assessed as part of the permit application.

Appropriate assessment of the short-term effects of NOx

A likely significant effect was identified for the short-term effects of NOx during the commissioning phase and routine testing of diesel generators at SZC at the functionally linked land at Sizewell Marshes SSSI and Minsmere-Walberswick Heaths and Marshes SSSI.

The applicant assessed the short-term effects of NOx against the critical level of 75µg/m³ as part of its permit application. This indicated that under worst-case modelling scenarios the short-term CL of 75µg/m³ would be exceeded within the functionally linked land, as shown in Figure 5.

Guidance on the assessment of the short-term effects of NOx emissions (Holman and others, 2020) states that:

"The relative importance of the long term mean compared to the short term mean is reflected in several studies which state that the 'UNECE Working Group on Effects strongly recommended the use of the annual mean value, as the long term effects of NOx are thought to be more significant than the short term effects'. This guidance, therefore, recommends that only the annual mean NOx concentration is used in assessments unless specifically required by a regulator; for instance, as part of an industrial permit application where high, short term peaks in emissions, and consequent ambient concentrations, may occur."

It is therefore appropriate to give some consideration to the short-term effects of NOx, the probability of them occurring and the area over which they will occur.

Commissioning and routine testing

The applicant has proposed that its PCs predicted for routine testing be used for commissioning as well. The worst-case scenario during commissioning involves simulating

a LOOP event, whereby 4 EDGs are tested simultaneously for a 3-hour period. This scenario emits less NO_x over a 24-hour period compared to the worst-case scenario during routine testing, which involves testing a single generator for 24 hours following a maintenance outage. Therefore, using routine testing PCs for commissioning is likely to be more conservative.

The applicant has calculated the probability of exceedances actually happening (NNB GenCo, 2021a), stating that: “this found that (assuming 100% operation of an Emergency Diesel Generator (EDG)) the daily NOx Critical Level is exceeded up until the 80th percentile for the worst-case year of met data, and therefore an exceedance of the Critical Level could only occur for 20% of the time. As the DGs are only operational for 8% of hours (720 ÷ 8760) for planned annual routine testing, this results in a probability of the unfavourable met conditions and the DG operation occurring at the same time having a 1.6% chance of actually occurring (20% x 8% = 1.6%).”

However, AQMAU (Environment Agency, 2021b) considers that this is incorrect because an exceedance of the daily critical level could occur if one or more exceedance days coincides with any of the 30 operational days. Based on the consultant’s 73 exceedance days per year with 30 operational events per year, AQMAU calculates the probability of one or more exceedances to be approximately 99.9%.

The PC for routine testing of DGs is predicted to be a maximum of 307.4µg/m³ at modelling point E4. The PC will reduce with distance from the emission points, as illustrated in Figure 5.

The highest contribution to the exceedance of the short-term 75µg/m³ critical level is within the area of the SSSI to the north of SZC (Figure 5), within unit 2, Goodram’s Fen. Goodram’s Fen (Figure 9) will be permanently lost as a result of the construction of SZC, with compensatory habitat having been created at Aldhurst Farm.

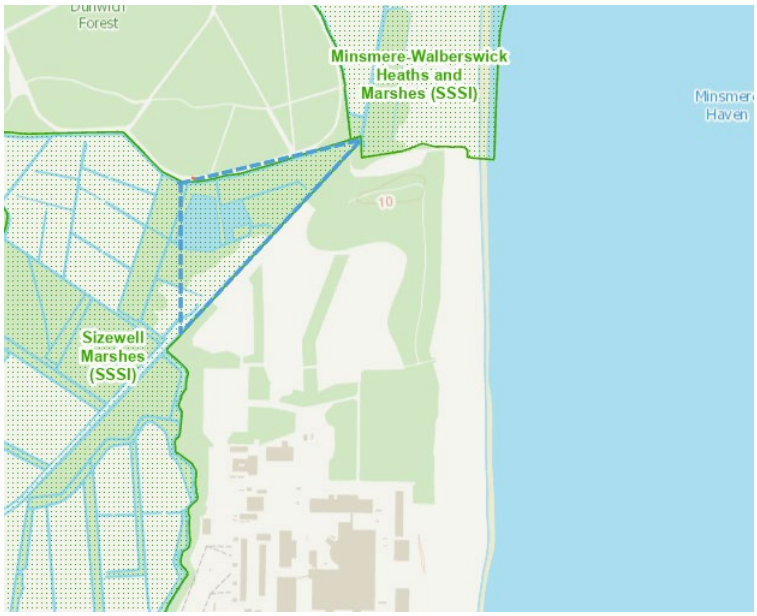

Figure 9 Goodram's Fen approximate shown in dashed-blue line, indicative area within Sizewell Marshes SSSI lost to SZC construction

An exceedance of the short-term critical level is predicted to occur outside of Goodram Fen within the functionally linked land at Sizewell Marshes SSSI and within Minsmere-Walberswick Heaths and Marshes SSSI. However, as stated in section 1.1, this assessment is based on the worst-case operational scenario, without factoring the 60 hours of operation for each generator, the location of the generators within the SZC development, or the relative importance of the long-term mean compared to the short-term mean.

It is therefore possible to conclude **no adverse effect** on the features of the functionally linked land at Sizewell Marshes SSSI Minsmere-Walberswick Heaths and Marshes SSSI from the short-term effects of NOx during the commissioning and routine testing of SZC CA.

Appropriate assessment of the loss of operational power (LOOP) scenario

The applicant provided an assessment of the LOOP scenario at the Sizewell Marshes SSSI in section 2.2.2 of its Schedule 5 Notice response (NNB GenCo, 2021a). An assessment was not made in the permit application as "…an exact period of operation under such a scenario cannot be specified. Such an event is not intended to occur at all, is statistically unlikely to occur more than once in the plant design life and in such an event is likely to last for well under 24-hours. The daily NOx Critical Level is also intended to protect habitat sites from concentrations occurring at that level each day, not to qualify a potential single 24-hour event occurring over the entire design life of an operational facility."

The applicant has predicted that, based on the modelled assumption that 8 EDGs are operational concurrently, continuously throughout the year (ensuring that the assessment takes account of the meteorological conditions that result in the worst-case impacts), the PC will be 827.3µg/m³. This is 1,103% of the daily CL of 75µg/m³.

While this exceedance is extreme, the LOOP scenario is not expected to happen during the lifetime of the plant. The applicant predicted in its Schedule 5 response (NNB GenCo, 2021a) that:

- "a short LOOP (less than 2 hours) event has a predicted frequency of 3.72 x 10^{-2} per reactor year, therefore assuming the SCZ site is operational for 60 years, a short LOOP event is predicted to occur up to 4 times (2 times per reactor) during the site's operational lifetime
- a long LOOP event between 2 – 24 hours is predicted to occur 4.99 x 10^{-3} times per reactor year, therefore in terms of the SZC site it is predicted to occur 0.6 times during the site's 60-year operational lifetime (taking into account the 2 reactors). Such an event is therefore not likely to occur at all"

A conclusion of no adverse effect has been reached for the Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar. It is therefore also possible to conclude no adverse effect on Minsmere-Walberswick Heaths and Marshes SSSI where it occurs outside of the European sites.

It is therefore possible to conclude **no adverse effect** on the features of the functionally linked land for bittern and marsh harrier at Sizewell Marshes SSSI and Minsmere-Walberswick Heaths and Marshes SSSI from the short-term effects of NOx due to a LOOP event.

Appropriate assessment of nutrient enrichment alone

Background levels of nutrient nitrogen within the functionally linked land already exceed the minimum critical load for dwarf shrub heath habitat, and coastal stable dunes, whereas background deposition is below the minimum critical load for the fen, marsh and swamp feature.

Commissioning

For commissioning, the Schedule 5 response (NNB GenCo, 2021a) states that "The model has been run assuming that all DGs are operational continuously, and the emission rate has been factored for the anticipated commissioning hours for the EDGs of 242.5 each (242.5/8760 = 2.8%) and for the UDGs 738 hours each (738/8760 = 8.4%). Commissioning of Unit 1 DGs and Unit 2 DGS are anticipated to occur in separate years, and therefore all Unit 1 DGs have been assessed operating together, and all Unit 2 DGs have been assessed as operating together. The worst-case results from Unit 1 and Unit 2 have then been reported."

The results of the detailed, more realistic modelling for modelling point E2d (Minsmere-Walberswick Heaths and Marshes SSSI), E5a and E5b (Sizewell Marshes SSSI) is

provided in Table 44. Background levels of nutrient-nitrogen as predicted by Defra for 2028 have been used to inform this assessment of commissioning impacts.

Table 44 Detailed assessment of nutrient enrichment, functionally linked land, 12 diesel generators factored for commissioning hours

Modelling point	PC kgN/ha/yr	PC % minimum critical load	Background kgN/ha/yr	PEC kgN/ha/yr	PEC % minimum critical load
E2d	0.39	3%	13.1	13.49	90%
E5a	0.17	1%	12.0	12.17	82%
E5b	0.25	2%	12.0	12.25	83%

The critical loads to support the features within the functionally linked land will not be exceeded as a result of the commissioning of SZC CA.

It is therefore possible to conclude **no adverse effect alone** from nutrient enrichment on the functionally linked land for the bittern and marsh harrier within the Sizewell Marshes SSSI (modelling point E5a and E5b) and Minsmere-Walberswick Heaths and Marshes SSSI (modelling point E2d) during the commissioning of SZC.

An in-combination assessment is required.

Routine testing

For the routine testing of SZC CA, the Schedule 5 response (NNB GenCo, 2021a) provides the following, “the routine operation assessment was based on the assumption of one EDG operating continuously throughout the year, with pro-rata emissions based on 720 hours of annual operation.

The twelve DGs are spread over a relatively large area, with approximately 500m between the most northerly positioned DGs and the most southerly positioned DGs. The DGs that are closest to a specific receptor will result in the maximum impacts at that receptor, whilst the DGs furthest away will result in lower impacts at the same receptor.

The assessment presented in Appendix C of the Environmental Permit application (NNB GenCo, 2020a) reported impacts at each receptor based on the operation of the EDG that resulted in the highest impact at that receptor (i.e., the closest EDG, as detailed above), rather than taking into account that the operation of that EDG would only actually be for 60 hours, and operation of EDGs leading to lower results would account for a large proportion of the testing hours.

In addition, no consideration was given in the assessment to the fact that the four smaller Ultimate Diesel Generators (UDGs) have much lower emissions of NOx. Therefore, of the

720 hours of annual operation for the routine testing scenario, 480 hours would be associated with EDG operation, but 240 hours would be associated with UDG operation and therefore would result in considerably lower impacts due to the much lower NOx emissions of these units."

The applicant carried out further modelling to represent the most realistic scenario during the operational lifetime of SZC, the results are presented in Table 45.

Table 45 Detailed assessment of nutrient enrichment, functionally linked land, 12 diesel generators factored for routine testing of back-up generators

Modelling point	PC kgN/ha/yr	PC % minimum critical load	Background kgN/ha/yr	PEC kgN/ha/yr	PEC % minimum critical load
E2d	0.12	1%	13.1	13.22	88%

The applicant did not reassess deposition at E5b as its original modelling concluded that deposition would be 0.9% of the relevant critical load.

The critical loads that protect the features within the functionally linked land will not be exceeded as a result of the commissioning of SZC CA.

It is therefore possible to conclude **no adverse effect alone** from nutrient enrichment on the functionally linked land within the Sizewell Marshes SSSI (modelling point E5b) and Minsmere-Walberswick Heaths and Marshes SSSI (modelling point E2d) during the routine testing of SZC CA.

An in-combination assessment is required.

Appropriate assessment of nutrient enrichment in-combination

An in-combination assessment is required to determine if there are other PPP that could result in an adverse effect on the functionally linked land for the bittern and marsh harrier within Minsmere-Walberswick Heaths and Marshes SSSI (modelling point E2d) and Sizewell Marshes SSSI (modelling point E5a and E5b).

Commissioning

The following in-combination assessment will consider deposition of nutrient nitrogen from other PPP, that have the potential for an overlapping, additive in-combination effect.

Environment Agency permits

The Environment Agency's mapping tool, Easimap was accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of the modelling points E2 and E5 within the functionally linked land.

There are 4 Environment Agency permits within 10km of these modelling points that have associated aerial emissions and are consistent with those provided in . However, they are already accounted for in background levels at the European sites and therefore in the predicted PEC. There are no further permits to consider within 10km of Sizewell SSSI or the area of Minsmere-Walberswick Heaths and Marshes SSSI that does not form part of the European site.

It is therefore possible to conclude **no adverse effect** in-combination with other Environment Agency permits.

Within project in-combination: SZC construction

Table 3-5 of the Desalination Plant Air Impact Assessment (NNB GenCo, 2021c) provides the predicted N-deposition from the associated diesel generators on all European sites within 10km of SZC. The PC is predicted to be:

- 0.134kg N/ha/yr at modelling point E2d Fen marsh and swamp, or 0.9% of the minimum critical load
- 0.041kg N/ha.yr at modelling point E5a Fen marsh and swamp, or 0.3% of the minimum critical load
- 0.062kg N/ha.yr at modelling point E5b Fen marsh and swamp, or 0.4% of the minimum critical load

Plate 4.1 of the report (reproduced in Figure 8) shows the isopleth lines as a percentage of the minimum critical for the protection of the European dry heaths feature of 10kg N/ha/yr (blue line). While heathlands aren't a feature of the functionally linked land, it does illustrate how localised the effect is from the desalination plant.

This localised effect, which is predominantly over Goodram's Fen (Figure 9), an area that will be lost to the SZC development, coupled with the PCs predicted to be below the significance decision-making threshold of 1%, allows for a conclusion of no in-combination residual effect between the desalination plant diesel generators and the commissioning of SZC CA.

An assessment of nutrient nitrogen deposition from the operation of the CHP plant is provided in the Campus Combined Heat and Power Emissions Assessment (NNB GenCo, 2020e). Table 12F.4 of this report predicts that the maximum nitrogen deposition from the CHP plant will be 0.01kg N/ha/yr. Taking a precautionary approach and assuming that this maximum occurs within the functionally linked land, this equates to 0.07% of the minimum critical load for the supporting habitat of the bittern and marsh harrier.

While the CHP plant will be operational during the commissioning of SZC CA, the maximum deposition of nitrogen is predicted to be inconsequential and would not have the potential for an in-combination effect.

Within project in-combination: SZC construction traffic

The applicant carried out modelling of road and rail transport impacts as part of its DCO application (NNB GenCo, 2020e) including the following scenarios:

- baseline 2018 scenario (2018 BC) to enable model verification
- early year 2023 reference case scenario (2023 RC), that is, without the proposed development
- early year 2023 typical day scenario (2023 AD), that is, with some elements of the associated developments under construction
- peak year 2028 reference case scenario (2028 RC), that is, without the proposed development
- peak year 2028 typical day scenario (2028 AD), that is, with the peak construction of the proposed development
- peak year 2028 busiest day scenario (2028 BD), that is, with the peak construction of the proposed development
- operational year 2034 reference case scenario (2034 RC), that is, without the proposed development
- operational year 2034 typical day scenario (2034 AD), that is, with the proposed development in place

Information provided in the following tables within the environmental statement will be used to inform this commissioning impacts appropriate assessment:

- Table 1.28 (NNB GenCo, 2020e) provides the maximum modelled rail and road contribution of pollutants for a 2028 average day scenario relative to the 2028 reference case
- Table 1.29 (NNB GenCo, 2020e) provides the maximum modelled rail and road contribution of pollutants for a 2028 busiest day scenario relative to the 2028 reference case

The busiest day scenario for 2028 is predicted to result in a PC of 0.945kg N/ha/yr within Minsmere-Walberswick Heaths and Marshes SSSI and 0.398kg N/ha/yr within Sizewell Marshes SSSI, while the average day scenario is predicted to result in 0.124kg N/ha/yr and 0.064kg N/ha/yr respectively.

Conclusion

There is the potential for an in-combination effect between the traffic associated with the construction phase of the SZC project and the commissioning of SZC CA prior to operation on the supporting habitat of the bittern and marsh harrier within the functionally linked land.

The PCs to consider in-combination at modelling point E2, functionally linked land within Minsmere-Walberswick Heaths and Marshes SSSI are as follows:

- SZC CA commissioning PC: 0.39kg N/ha/yr
- construction traffic PC: 0.945kg N/ha/yr (busiest), 0.124kg N/ha/yr (average)
- background: 13.8kg N/ha/yr

The PCs to consider in-combination at modelling point E5, functionally linked land within Sizewell Marshes SSSI are as follows:

- SZC CA commissioning PC: 0.25kg N/ha/yr
- construction traffic PC: 0.945kg N/ha/yr (busiest), 0.124kg N/ha/yr (average)
- background: 13.8kg N/ha/yr

The worst-case PEC, based on best available information at the time of this appropriate assessment, is predicted to be 15kg N/ha/yr or 100% of the critical load for the functionally linked land.

When considering the average transport effects, the PEC is reduced to 14.4kg N/ha/yr, or 93% of the critical load, with 8% related to the construction and commissioning of SZC CA.

This overlap between construction traffic and the commissioning of SZC units 1 and 2 is unlikely to occur, as the majority of the construction work will have completed.

It is possible to conclude no adverse effect in-combination for the commissioning phase of SZC CA, based on best available worst-case modelling scenarios. The critical load is not predicted to be exceeded.

Routine testing

The following in-combination assessment will consider deposition of nutrient nitrogen from other PPP that have the potential for an overlapping, additive in-combination effect.

Environment Agency permits

The Environment Agency's mapping tool, Easimap was accessed on 14 October 2021 to identify all permitted installations with aerial emissions within 10km of the modelling points E2 and E5 within the functionally linked land.

There are 4 Environment Agency permits within 10km of these modelling points that have associated aerial emissions and are consistent with those provided in Table 17. However, they are already accounted for in background levels at the European sites and, therefore, in the predicted PEC. There are no further permits to consider within 10km of Sizewell SSSI or the area of Minsmere-Walberswick Heaths and Marshes SSSI that does not form part of the European site.

It is therefore possible to conclude **no adverse effect** in-combination with other Environment Agency permits.

Within project in-combination: SZC construction

The in-combination assessment for the commissioning of SZC CA above has demonstrated that the 3-year operation of diesel boilers associated with the desalination plant does not have the potential for a residual effect within the functionally linked land. There is therefore no potential for an in-combination effect with the routine testing of SZC CA.

An assessment of nutrient nitrogen deposition from the operation of the CHP plant is provided in the Campus Combined Heat and Power Emissions Assessment (NNB GenCo, 2020e). Table 12F.4 of this report predicts that the maximum nitrogen deposition from the CHP plant will be 0.01kg N/ha/yr. Taking a precautionary approach and assuming that this maximum occurs within the functionally linked land, this equates to 0.07% of the minimum critical load for the supporting habitat of the bittern and marsh harrier.

While the CHP plant will be operational during the routine testing of SZC CA, the maximum deposition of nitrogen is predicted to be inconsequential and would not have the potential for an in-combination effect.

The applicant carried out modelling of road and rail transport impacts as part of its DCO application (NNB GenCo, 2020e) including the following scenarios:

- baseline 2018 scenario (2018 BC) to enable model verification
- early year 2023 reference case scenario (2023 RC), that is, without the proposed development
- early year 2023 typical day scenario (2023 AD), that is, with some elements of the associated developments under construction
- peak year 2028 reference case scenario (2028 RC), that is, without the proposed development
- peak year 2028 typical day scenario (2028 AD), that is, with the peak construction of the proposed development
- peak year 2028 busiest day scenario (2028 BD), that is, with the peak construction of the proposed development
- operational year 2034 reference case scenario (2034 RC), that is, without the proposed development
- operational year 2034 typical day scenario (2034 AD), that is, with the proposed development in place

Information provided in the following tables within the environmental statement will be used to inform this commissioning impacts appropriate assessment:

- Table 1.30 (NNB GenCo, 2020e) provides the maximum modelled rail and road contribution of pollutants for a 2034 average day scenario relative to the 2034 reference case

Deposition at the functionally linked land is predicted to be 0.001kg N/ha/yr within Minsmere-Walberswick Heaths and Marshes SSSI and 0.017kg N/ha/yr with Sizewell Marshes SSSI. The maximum deposition within Sizewell Marshes SSSI is 0.1% of the critical load for the protection of the supporting habitat of the bittern and marsh harrier.

This level of deposition is inconsequential and does not have the potential to act in-combination with the routine testing of SZC CA.

Conclusion

It is possible to conclude no adverse effect in-combination for the routine testing of SZC CA, based on best available worst-case modelling scenarios.

4.4.3. Outer Thames Estuary SPA

A likely significant effect was identified for effects listed below and an appropriate assessment is required both alone and in combination:

- direct toxic effect of NOx (long-term) – commissioning
- direct toxic effect of NOx (short-term) – commissioning and routine testing
- nutrient enrichment – commissioning and routine testing
- acidification – commissioning and routine testing

An appropriate assessment will also be carried out on the LOOP scenario which wasn't assessed as part of the permit application.

The following relevant conservation objectives will be considered when carrying out this appropriate assessment:

For Outer Thames Estuary SPA, the objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring the:

- extent and distribution of the habitats of the qualifying features
- structure and function of the habitats of the qualifying features

The SACO for the Outer Thames Estuary SPA sets a target to "restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for the feature's supporting habitat on the Air Pollution Information System."

The applicant did not model emissions and deposition at the Outer Thames Estuary SPA, so the results from the Minsmere-Walberswick SPA appropriate assessment will be used to inform this assessment.

Appropriate assessment of the long-term effects of NOx alone

A likely significant effect was identified alone for the long-term effects of NOx during the commissioning phase of SZC CA at the Outer Thames Estuary SPA.

The LSE assessment predicted that the PC would be 13.5µg/m³, 45% of the CL of 30µg/m³. The PEC was calculated using the maximum background level for the SPA and provided for in APIS, for the period 2017 to 2019. This was 10.06µg/m³, resulting in a maximum PEC of 23.56 µg/m³ or 79% CL (Table 15 Minsmere-Walberswick SPA).

SZC won't be commissioned until at least 2028, the applicant has therefore used Defra predicted NOx emissions for 2028[5] to forecast the prevailing environmental conditions that could be present at the time of commissioning.

Background levels of NOx in the area are predicted to be 7.7µg/m³ in 2028. This is consistent with the falling levels of NOx within the Outer Thames Estuary SPA experienced since 2010, as shown in Figure 10.

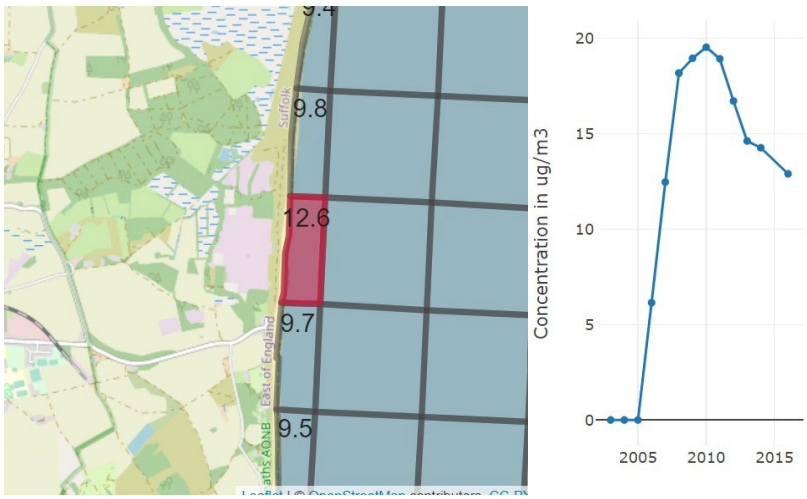

Figure 10 Trend in NOx emissions for the closest 1km grid squares within the Outer Thames Estuary SPA

The advice package on conserving and restoring site features for the Outer Thames Estuary SPA provide a target to "restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for the feature's supporting habitat on the Air Pollution Information System."

This target will be met alone, when considering the prevailing environmental conditions within the SPA.

It is therefore possible to conclude **no adverse alone** on the features and supporting habitats of the Outer Thames Estuary SPA from the long-term toxic effects of NOx emissions.

Consideration is therefore required of the commissioning of SZC CA in combination with other plans and projects.

[5] http://uk-air.defra.gov.uk

Appropriate assessment of the long-term effects of NOx in-combination: commissioning

An in-combination assessment is required to determine if there are other plans, permissions or projects that could result in an exceedance of the critical level for the protection of vegetation during the commissioning of SZC CA.

The applicant did not carry out an assessment within the Outer Thames Estuary SPA, therefore we have relied on modelling carried out at the adjacent Minsmere-Walberswick SPA to inform our appropriate assessment. The findings of the in-combination assessment for the long-term emissions of NOx during the commissioning of SZC CA can therefore be inferred for the Outer Thames Estuary SPA.

It was possible to conclude no adverse effect in-combination with emissions from NOx, other PPP issued by the Environment Agency, and within project effects associated with the construction of SZC and traffic emissions.

The full assessment can be found in the section of this HRAR titled ‘Appropriate assessment of the long-term effects of NOx in-combination: commissioning’.

Appropriate assessment of the short-term effects of NOx

A likely significant effect was identified for the short-term effects of NOx during the commissioning phase and routine testing of diesel generators at SZC at the Outer Thames Estuary SPA. This assessment is informed by the results of modelling within the adjacent Minsmere-Walberswick SPA.

The applicant assessed the short-term effects of NOx against the critical level of 75µg/ m^3 as part of its permit application. This indicated that under worst-case modelling scenarios the short-term CL of 75µg/ m^3 would be exceeded over an area of the Outer Thames Estuary SPA as shown in Figure 5.

Guidance on the assessment of the short-term effects of NOx emissions (Holman and others, 2020) states that:

“the relative importance of the long term mean compared to the short term mean is reflected in several studies which state that the ‘UNECE Working Group on Effects strongly recommended the use of the annual mean value, as the long term effects of NOx are thought to be more significant than the short term effects’. This guidance, therefore, recommends that only the annual mean NOx concentration is used in assessments unless specifically required by a regulator; for instance, as part of an industrial permit application where high, short term peaks in emissions, and consequent ambient concentrations, may occur.”

It is therefore appropriate to give some consideration to the short-term effects of NOx, the probability of them occurring, and the area over which they will occur.

Commissioning and routine testing

The applicant has proposed that its PCs predicted for routine testing be used for commissioning as well. The worst-case scenario during commissioning involves simulating a LOOP event, whereby 4 EDGs are tested simultaneously for a 3-hour period. This scenario emits less NO_x over a 24-hour period compared to the worst-case scenario during routine testing, which involves testing a single generator for 24 hours following a maintenance outage. Therefore, using routine testing PCs for commissioning is likely to be more conservative.

The applicant has calculated the probability of exceedances actually happening (NNB GenCo, 2021a), stating that: “This found that (assuming 100% operation of an Emergency Diesel Generator (EDG)) the daily NOx Critical Level is exceeded up until the 80th percentile for the worst-case year of met data, and therefore an exceedance of the Critical Level could only occur for 20% of the time. As the DGs are only operational for 8% of hours (720 ÷ 8760) for planned annual routine operation, this results in a probability of the unfavourable met conditions and the DG operation occurring at the same time having a 1.6% chance of actually occurring (20% x 8% = 1.6%).”

However, AQMAU (Environment Agency, 2021b) considers that this is incorrect because an exceedance of the daily critical level could occur if one or more exceedance days coincides with any of the 30 operational days. Based on the consultant’s 73 exceedance days per year with 30 operational events per year, AQMAU calculates the probability of one or more exceedances to be approximately 99.9%.

The PC for routine testing of DGs is predicted to be a maximum of 303.6µg/m³ at modelling point E2. The PC will reduce with distance from the emission points, as illustrated in Figure 5.

While an exceedance of the critical level is expected during any given year of operation, it is unlikely its scale within the terrestrial component of the SPA and its short-term nature, will result in direct toxic effects on the features of the Outer Thames Estuary SPA. The Outer Thames Estuary SPA is a vast site covering an area of 392,451.66ha, the majority of which is open water and not sensitive to emissions of NOx.

It is therefore possible to conclude **no adverse effect** to the features of the Outer Thames Estuary SPA from the short-term effects of NOx during the commissioning and routine testing of SZC CA.

Appropriate assessment of the loss of operational power (LOOP) scenario

The applicant provided an assessment of the LOOP scenario at the Minsmere-Walberswick SPA in section 2.2.2 of its Schedule 5 Notice response (NNB GenCo, 2021b), which is used as best available information for the Outer Thames Estuary SPA. An assessment was not made in the permit application as “…an exact period of operation under such a scenario cannot be specified. Such an event is not intended to occur at all, is statistically unlikely to occur more than once in the plant design life and in such an event is likely to last for well under 24-hours. The daily NOx Critical Level is also intended to

protect habitat sites from concentrations occurring at that level each day, not to qualify a potential single 24-hour event occurring over the entire design life of an operational facility."

The applicant has predicted that, based on the modelled assumption that 8 EDGs are operational concurrently, continuously throughout the year (ensuring that the assessment takes account of the meteorological conditions that result in the worst-case impacts) the PC will be 875.8µg/m³. This is 1,168% of the daily CL of 75µg/m³ and 438% of the daily 200µg/m³.

While these exceedances are extreme, the LOOP scenario is not expected to happen during the lifetime of the plant. The applicant predicted in its Schedule 5 response (NNB GenCo, 2021b) that:

- "a short LOOP (i.e. less than 2 hours) event has a predicted frequency of 3.72×10^{-2} per reactor year, therefore assuming the SCZ site is operational for 60 years, a short LOOP event is predicted to occur up to 4 times (2 times per reactor) during the site's operational lifetime
- a long LOOP event between 2 – 24 hours is predicted to occur 4.99×10^{-3} times per reactor year, therefore in terms of the SZC site it is predicted to occur 0.6 times during the site's 60-year operational lifetime (taking into account the 2 reactors). Such an event is therefore not likely to occur at all"

It is therefore possible to conclude **no adverse effect** on the features of the Outer Thames Estuary SPA from the short-term effects of NOx due to a LOOP event.

Appropriate assessment of nutrient enrichment alone

Background levels of nutrient nitrogen within the SAC, SPA and Ramsar already exceed the minimum critical load for dwarf shrub heath habitat, and coastal stable dunes, whereas background deposition is below the minimum critical load for the fen, marsh, and swamp feature.

The supplementary advice package for Minsmere-Walberswick SPA sets a target to "restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for the feature's supporting habitat on the Air Pollution Information System".

Commissioning

For commissioning, the Schedule 5 response (NNB GenCo, 2021b) states that, "the model has been run assuming that all DGs are operational continuously, and the emission rate has been factored for the anticipated commissioning hours for the EDGs of 242.5 each (242.5/8760 = 2.8%) and for the UDGs 738 hours each (738/8760 = 8.4%). Commissioning of Unit 1 DGs and Unit 2 DGS are anticipated to occur in separate years, and therefore all Unit 1 DGs have been assessed operating together, and all Unit 2 DGs have been assessed as operating together. The worst-case results from Unit 1 and Unit 2 have then been reported."

The results of the detailed, more realistic modelling for Minsmere-Walberswick SPA will be used as best available information. Background levels of nutrient-nitrogen as predicted by Defra for 2028 have been used to inform this assessment of commissioning impacts at modelling point E2b.

The assessment will be made against the minimum critical load for the coastal stable dunes grassland supporting habitat, which at 8kg N/ha/yr is more stringent than the critical load of 10kg N/ha/yr for the shifting coastal dunes.

The PC is predicted to be 0.18kg N/ha/yr, or 2% of the minimum critical load, with the PEC at 13.28kg N/ha/yr or 166% of the minimum critical load.

Coastal stable dunes are included in APIS as representative of the 'supralittoral sediment' supporting habitat of the breeding common tern and little tern populations of the Outer Thames Estuary SPA, including intertidal sand and muddy sands (Conservation Advice for Marine Protected Areas).

The more realistic modelling scenario has resulted in a reduction of the predicted PC from 6% of the minimum critical load at modelling point E2b to 2%.

It is not expected that an additional maximum modelled nutrient-nitrogen contribution of 2% of the critical load for coastal stable dunes ("quite reliable" critical load) alone will lead to an adverse effect on the common tern population of the SPA over the limited commissioning period of two years. In addition, the predicted deposition will not be experienced over the entire site, but will be localised, reducing beyond the modelling points.

An in-combination assessment is required.

Routine testing

For the routine testing of SZC CA, the Schedule 5 response (NNB GenCo, 2021b) provides the following, "the routine operation assessment was based on the assumption of one EDG operating continuously throughout the year, with pro-rata emissions based on 720 hours of annual operation.

The twelve DGs are spread over a relatively large area, with approximately 500m between the most northerly positioned DGs and the most southerly positioned DGs. The DGs that are closest to a specific receptor will result in the maximum impacts at that receptor, whilst the DGs furthest away will result in lower impacts at the same receptor.

The assessment presented in Appendix C of the Environmental Permit application (NNB GenCo, 2020a) reported impacts at each receptor based on the operation of the EDG that resulted in the highest impact at that receptor (i.e., the closest EDG, as detailed above), rather than considering that the operation of that EDG would only actually be for 60 hours, and operation of EDGs leading to lower results would account for a large proportion of the testing hours.

In addition, no consideration was given in the assessment to the fact that the four smaller Ultimate Diesel Generators (UDGs) have much lower emissions of NOx. Therefore, of the 720 hours of annual operation for the routine testing scenario, 480 hours would be associated with EDG operation, but 240 hours would be associated with UDG operation and therefore would result in considerably lower impacts due to the much lower NOx emissions of these units."

The results of this detailed, more realistic modelling at Minsmere-Walberswick SPA provided will be used as best available information at modelling point E2b.

The assessment will be made against the minimum critical load for the coastal stable dunes supporting habitat, which at 8kg N/ha/yr is more stringent than the critical load of 10kg N/ha/yr for the shifting coastal dunes.

The PC is predicted to be 0.06kg N/ha/yr, or 0.8% of the minimum critical load.

Coastal stable dunes are included in APIS as representative of the 'supralittoral sediment' supporting habitat of the breeding little tern common tern populations of the Outer Thames Estuary SPA, including intertidal sand and muddy sands (Conservation Advice for Marine Protected Areas).

The more realistic modelling scenario has resulted in a reduction of the predicted PC to 0.8% of the critical load, which is below the significance decision-making threshold and is the expected maximum deposition for breading little tern supporting habitat.

As maximum deposition is predicted to be below the 1% decision making threshold and will decrease rapidly as shown in Figure 7, there is no requirement for an in-combination assessment with other plans and project.

It is possible to conclude **no adverse effect alone and in-combination** on the coastal stable dunes broad habitat, which is representative of the supralittoral sediment supporting habitat of the little tern and common tern populations of the Outer Thames Estuary SPA, in the context of prevailing environmental conditions.

Appropriate assessment of nutrient enrichment in-combination: commissioning

It has been possible to conclude no adverse effect alone for the supporting habitat of the little tern population of the Outer Thames Estuary SPA. An in-combination assessment is therefore required.

The applicant did not carry out an assessment within the Outer Thames Estuary SPA, therefore we have relied on modelling carried out at the adjacent Minsmere-Walberswick SPA to inform our appropriate assessment. The findings of the in-combination assessment for nutrient enrichment during the commissioning of SZC CA can therefore be inferred for the Outer Thames Estuary SPA.

It was possible to conclude no adverse effect in-combination with deposition from other PPP issued by the Environment Agency and within project effects associated with the construction of SZC and traffic emissions resulting in nutrient enrichment.

The full assessment can be found in the section titled ‘Appropriate assessment of nutrient enrichment in-combination: commissioning’ of this HRAR.

Appropriate assessment of acidification alone

Acidification was re-modelled by the applicant to represent more realistic scenarios at modelling point E2b, E2c and E2e.

Commissioning

For commissioning, the Schedule 5 Notice response (NNB GenCo, 2021b) states that, “the model has been run assuming that all DGs are operational continuously, and the emission rate has been factored for the anticipated commissioning hours for the EDGs of 242.5 each (242.5/8760 = 2.8%) and for the UDGs 738 hours each (738/8760 = 8.4%). Commissioning of Unit 1 DGs and Unit 2 DGS are anticipated to occur in separate years, and therefore all Unit 1 DGs have been assessed operating together, and all Unit 2 DGs have been assessed as operating together. The worst-case results from Unit 1 and Unit 2 have then been reported.”

Background levels of acidification as predicted by Defra for 2028 have been used to inform this assessment of commissioning impacts at modelling point E2b. The results of the detailed, more realistic modelling are as follows.

- PC: 0.013keq N/ha/yr and 0.006keq S/ha/yr, 3% critical load function
- background 1keq N/ha/yr and 0.1keq S/ha/yr, 197% critical load function

The maximum PC predicted at modelling point E2b is 3% of the minimum critical load function for acid grassland acidity class used to represent the supralittoral sediment broad supporting habitat of the common tern.

Conclusion

The conclusion for the commissioning phase of SZC CA is precautionary, based on the modelling scenario for the routine testing of SZC CA. The worst-case scenario that will occur during commissioning involves simulating a LOOP event, whereby 4 EDGs are tested simultaneously for a 3-hour period. This scenario emits less NO_x over a 24-hour period compared to the worst-case scenario during routine testing, which involves testing a single generator for 24 hours following a maintenance outage. Therefore, using routine testing PCs for commissioning is likely to be more conservative, with emissions and resultant deposition being lower than modelled for the purposes of this assessment.

When considering the prevailing environmental conditions, it is possible to conclude that there would be no measurable effect from the addition of 3% of the critical load function over a 2-year period, with background at approximately double the critical load function.

It is possible to conclude **no adverse effect alone** on the Outer Thames Estuary SPA from the commissioning of SZC CA. An assessment in-combination with other plans and projects is required.

Routine testing

For the routine testing of SZC CA, the Schedule 5 response (NNB GenCo, 2021a) provides the following, “The routine operation assessment was based on the assumption of one EDG operating continuously throughout the year, with pro-rata emissions based on 720 hours of annual operation.

The twelve DGs are spread over a relatively large area, with approximately 500m between the most northerly positioned DGs and the most southerly positioned DGs. The DGs that are closest to a specific receptor will result in the maximum impacts at that receptor, whilst the DGs furthest away will result in lower impacts at the same receptor.

The assessment presented in Appendix C of the Environmental Permit application (NNB GenCo, 2020a) reported impacts at each receptor based on the operation of the EDG that resulted in the highest impact at that receptor (i.e., the closest EDG, as detailed above), rather than taking into account that the operation of that EDG would only actually be for 60 hours, and operation of EDGs leading to lower results would account for a large proportion of the testing hours.

In addition, no consideration was given in the assessment to the fact that the four smaller Ultimate Diesel Generators (UDGs) have much lower emissions of NOx. Therefore, of the 720 hours of annual operation for the routine testing scenario, 480 hours would be associated with EDG operation, but 240 hours would be associated with UDG operation and therefore would result in considerably lower impacts due to the much lower NOx emissions of these units.”

The applicant carried out further modelling to represent the most realistic scenario during the operational lifetime of SZC, the results are as follows:

- PC: 0.004keq N/ha/yr and 0.002keq S/ha/yr, 1% critical load function
- background 1keq N/ha/yr and 0.1keq S/ha/yr, 195% critical load function

The maximum PC predicted at modelling point E2b is 1% of the minimum critical load function for acid grassland acidity class used to represent the supralittoral sediment broad supporting habitat of the common tern.

Conclusion

The conclusion for the routine testing of SZC CA is based on a more realistic modelling assumption than the one used in the assessment of likely significant effect.

The maximum PC is predicted to be 1% of the critical load function for the common tern supporting habitat, which is in the context of background acidification at nearly double the critical load function.

It is possible to conclude **no adverse effect alone** on the Outer Thames Estuary SPA. An assessment in-combination with other plans and projects is required.

Appropriate assessment of acidification in-combination: commissioning and routine testing

It has been possible to conclude no adverse effect alone for the supporting habitat of the common tern population of the Outer Thames Estuary SPA. An in-combination assessment is therefore required.

The applicant did not carry out an assessment within the Outer Thames Estuary SPA, therefore we have relied on modelling carried out at the adjacent Minsmere-Walberswick SAC to inform our appropriate assessment. The findings of the in-combination assessment for acidification during the commissioning of SZC CA can therefore be inferred for the Outer Thames Estuary SPA.

The critical load function for the protection of the supporting habitat of the common tern is slightly different to that of the perennial vegetation of drift lines feature of the SAC. However, results of the PC as a percentage of the critical load functions is the same.

It was possible to conclude no adverse effect in-combination with deposition from other PPP issued by the Environment Agency and within-project effects associated with the construction of SZC and traffic emissions resulting in nutrient enrichment.

4.4.4. Sandlings SPA

A likely significant effect was identified for the following effect and an appropriate assessment is required:

- direct toxic effect of NOx (short-term) – commissioning and routine testing

An appropriate assessment will also be carried out on the LOOP scenario which wasn't assessed as part of the permit application.

The following relevant conservation objectives will be considered when carrying out this appropriate assessment:

"Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring the:

- extent and distribution of the habitats of the qualifying features
- structure and function of the habitats of the qualifying features"

Appropriate assessment of the short-term effects of NOx

A likely significant effect was identified for the short-term effects of NOx during the commissioning phase and routine testing of diesel generators at SZC at the Sandlings SPA.

The applicant assessed the short-term effects of NOx against the critical level of 75µg/m³ as part of its permit application. This indicated that, under worst-case modelling scenarios, the PC at Sandlings SPA would be 34% of the short-term CL of 75µg/m³ (Table 32) triggering the need for an appropriate assessment.

While “the long term effects of NOx are thought to be more significant than the short term effects” (Holman and others, 2020), it is appropriate to give some consideration to the short-term effects of NOx, the probability of them occurring, and the area over which they will occur.

Commissioning and routine testing

The applicant has proposed that its PCs predicted for routine testing be used for commissioning as well. The worst-case scenario during commissioning involves simulating a LOOP event, whereby 4 EDGs are tested simultaneously for a 3-hour period. This scenario emits less NO_x over a 24-hour period compared to the worst-case scenario during routine testing, which involves testing a single generator for 24 hours following a maintenance outage. Therefore, using routine testing PCs for commissioning is likely to be more conservative.

The PC for routine testing of DGs is predicted to be a maximum of 25.4µg/m³ at modelling point E4 (Figure 2). This is 34% of the short-term critical level of 75µg/m³.

It should also be noted that this assessment is based on the worst-case operational scenario, without factoring the 60 hours of operation for each generator, and that short-term emissions of NOx are likely to be lower than those predicted.

It is therefore possible to conclude **no adverse effect** to the features of the Sandlings SPA from the short-term effects of NOx during the commissioning and routine testing of SZC CA.

Appropriate assessment of the loss of operational power (LOOP) scenario

The applicant provided an assessment of the LOOP scenario at the Sandlings SPA in section 2.2.2 of its Schedule 5 Notice response (NNB GenCo, 2021b). An assessment was not made in the permit application as “…an exact period of operation under such a scenario cannot be specified. Such an event is not intended to occur at all, is statistically unlikely to occur more than once in the plant design life and in such an event is likely to last for well under 24-hours. The daily NOx Critical Level is also intended to protect habitat sites from concentrations occurring at that level each day, not to qualify a potential single 24-hour event occurring over the entire design life of an operational facility.”

The applicant has predicted that, based on the modelled assumption that 8 EDGs are operational concurrently, continuously throughout the year (ensuring that the assessment takes account of the meteorological conditions that result in the worst-case impacts), the PC will be 99.9µg/m³. This is 133% of the daily CL of 75µg/m³.

While an exceedance of the 75µg/m³ CL is predicted, the LOOP scenario is not expected to happen during the lifetime of the plant. The applicant predicted in its Schedule 5 response (NNB GenCo, 2021b) that:

- "a short LOOP (i.e. less than 2 hours) event has a predicted frequency of 3.72 x 10^{-2} per reactor year, therefore assuming the SCZ site is operational for 60 years, a short LOOP event is predicted to occur up to 4 times (2 times per reactor) during the site's operational lifetime
- a long LOOP event between 2 – 24 hours is predicted to occur 4.99 x 10^{-3} times per reactor year, therefore in terms of the SZC site it is predicted to occur 0.6 times during the site's 60-year operational lifetime (taking into account the 2 reactors). Such an event is therefore not likely to occur at all"

It is therefore possible to conclude **no adverse effect** on the features of the Sandlings SPA from the short-term effects of NOx due to a LOOP event.

4.4.5. Alde-Ore and Butley Estuaries SAC and Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar

An appropriate assessment will be carried out on the LOOP scenario which wasn't assessed as part of the permit application.

The following relevant conservation objectives will be considered when carrying out this appropriate assessment:

"For the Alde-Ore and Butley Estuaries SAC, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the favourable conservation status of its qualifying features, by maintaining or restoring the:

- extent and distribution of qualifying natural habitats and habitats
- structure and function of qualifying natural habitats"

"For the Alde-Ore Estuary SPA, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring the:

- extent and distribution of the habitats of the qualifying features
- structure and function of the habitats of the qualifying features"

Appropriate assessment of the loss of operational power (LOOP) scenario

The applicant has predicted that, based on the modelled assumption that 8 EDGs are operational concurrently, continuously throughout the year (ensuring that the assessment takes account of the meteorological conditions that result in the worst-case impacts), the PC will be 22.5µg/m³ at the Alde-Ore and Butley Estuaries SAC and Alde-Ore Estuary SPA (NNB GenCo, 2021b). This equates to:

- 30% of the 75µg/m³ critical level
- 11% of the 200µg/m³ critical level

The modelled scenarios do not exceed the short-term critical levels for NOx, therefore it is possible to conclude **no adverse effect** on the features of the Alde-Ore and Butley Estuaries SAC and Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar from a LOOP event.

4.4.6. Orfordness-Shingle Street SAC

An appropriate assessment will be carried out on the LOOP scenario which wasn't assessed as part of the permit application.

The following relevant conservation objectives will be considered when carrying out this appropriate assessment:

"For the Orfordness-Shingle Street SAC, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the favourable conservation status of its qualifying features, by maintaining or restoring the:

- extent and distribution of qualifying natural habitats and habitats
- structure and function of qualifying natural habitats"

Appropriate assessment of the loss of operational power (LOOP) scenario

The applicant has predicted that, based on the modelled assumption that 8 EDGs are operational concurrently, continuously throughout the year (ensuring that the assessment takes account of the meteorological conditions that result in the worst-case impacts), the PC will be 18.7µg/m³ at the Orfordness–Shingle Street SAC (NNB GenCo, 2021b). This equates to:

- 25% of the 75µg/m³ critical level
- 9% of the 200µg/m³ critical level

The modelled scenarios do not exceed the short-term critical levels for NOx, therefore it is possible to conclude **no adverse effect** on the features of the Orfordness-Shingle Street SAC from a LOOP event.

4.4.7. Dew's Pond SAC

An appropriate assessment will be carried out on the LOOP scenario which wasn't assessed as part of the permit application.

The following relevant conservation objectives will be considered when carrying out this appropriate assessment:

"For the Dew's Pond SAC, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the favourable conservation status of its qualifying features, by maintaining or restoring the:

- extent and distribution of qualifying natural habitats and habitats
- structure and function of qualifying natural habitats"

Appropriate assessment of the loss of operational power (LOOP) scenario

The applicant did not include Dew's Pond SAC in its modelling scenarios. However, the site is the most distant at 9km from SZC. When considering the results for Orfordness-Shingle Street SAC at 8km from SZC, it is also possible to conclude **no adverse effect** on the features of Dew's Pond SAC from a LOOP event.

4.5. Conclusion of the appropriate assessment of aerial emissions and deposition

It has been possible to conclude no adverse effect for all European sites, relevant features and risks associated with the operational CA permit application for the commissioning and routine testing of SZC.

The results of this appropriate assessment and the assessment of impacts from noise associated with the operational SZC CA permit will be considered in the integrity test of this HRAR.

5. Disturbance (noise) impact assessment

5.1. Screening for likely significant effects methodology

The permit application supporting document, SZC CA Appendix E – Noise Assessment (NNB GenCo, 2020c) and section 5.2 of the Shadow HRA sets out the applicant's methodology used for the assessment of disturbance from noise.

AQMAU has audited the modelling that was used by the applicant and consider that the applicant's conclusions can be used for permit determination.

The modelling scenarios for the DGs at SZC are described in section 0, and summarised as follows:

- during commissioning there will only be a single generator operating at a time, each unit will be commissioned separately for one year for a total of 2,446 hours per year
- routine testing will take place during daytime hours, for a period of 720 hours of testing per year, or 8% operational hours per year
- the LOOP scenario has the potential to generate the most noise as DGs would be on full power until the off-site power is restored, or longer-term power provision has been made. However, this event is unlikely to occur. The noise assessment carried out by the applicant was based on a LOOP event as a worst-case scenario. No modelling of the noise levels from commissioning or routine testing was undertaken, therefore the results of the LOOP assessment will be used to inform a full assessment of the operation of SZC CA

The applicant identified the primary sound sources used in the sound level model (NNB GenCo, 2020c) as:

- exhaust stacks on roof at a height of 34.5m (for dispersion of generator combustion gases). Three stacks per building, one per generator
- two fresh-air intakes at mid-level, one either side of the building (per generator), therefore a total of six per generator building
- two fresh-air in/warm air out louvres per generator at higher level, therefore a total of six per generator building

Information supplied by the applicant will be referred to, together with Natural England commissioned guidance on noise assessments (Drewitt and others, 2018).

The applicant's approach to screening for likely significant effects is set out in paragraph 5.2.3 of its Shadow HRA (NNB GenCo, 2020d), and states that:

"The approach adopted in this Shadow HRA is to compare the modelled effect of noise generated by the combustion activities against background noise levels at the European sites, having some regard to the disturbance to various noise levels ... As this research is focussed on waterbirds, it is only relevant to SPAs and bird features of Ramsar sites. However, it can be concluded that habitat or marine mammal features of the SACs are not

sensitive to noise generated by the combustion activities (i.e. there is no pathway for effect)."

Natural England's guidance on the effects of noise on birds provides the following guidance when assessing for impacts:

"Generic guidelines at present suggest that birds begin to react (heads-up, alarm calls) to a noise level of above 50dB and that moderate to high disturbance (birds moving away) occurs above 70 dBA ... Although potentially a useful rule of thumb, the authors recognise that this is a relatively simplistic approach as it does not take into account the type of disturbance nor the sensitivity and prior experience of the birds.

It also states that it is likely that the more wide-ranging effects of noise on birds and other wildlife are indirect. For example, noise can have significant interference or masking effects on communication signals, it can reduce foraging efficiency and thus food-intake rates and it can result in behavioural changes such as increased vigilance and walking or flying away from the noise source."

When assessing whether a source of noise could be significant, "consideration should be given to the duration of the noise, its timing (time of day, season, state of tide where relevant) and its proximity to areas of particular value to birds. The potential for disturbance should also be considered in the context of existing noise levels and other sources of acoustic and visual disturbance. It should also include consideration of the type of potential effect (masking of acoustic signals by road noise, adverse behavioural changes and displacement from important habitats due to loud, sporadic noises, etc.) and the potential sensitivity of the receptor birds depending on their activities (breeding, foraging, roosting), numbers, species and likelihood of habituation."

The applicant presented its modelled results in Table 5.5 of the Shadow HRA (NNB GenCo, 2020d).

5.1.1. Minsmere-Walberswick SPA, Minsmere-Walberswick Ramsar and Outer Thames Estuary SPA

The same modelling results were presented by the applicant for Minsmere-Walberswick SPA, Minsmere-Walberswick Ramsar and the Outer Thames Estuary SPA, and will therefore be assessed together.

Noise from the diesel generators is not expected to have an impact on the bird features of the SPAs and Ramsar in the long term due to their intermittent operation and location within concrete buildings.

The applicant's modelling has predicted a sound level at the European sites of 45dB resulting from a LOOP event. For the worst-case LOOP event the duration of the noise could be for a period of 72 hours. However, the applicant stated in the Schedule 5 Notice response that 'such an event is likely to last for well under 24-hours' and that a long LOOP scenario is only expected to occur 0.6 times during the operational lifetime of SZC.

During commissioning, each of the 8 EDGs are tested for 242.5 hours and each of the 4 UDGs are tested for 738 hours. Unit 1 will undergo commissioning first and unit 2 will undergo commissioning the following year. Therefore, each year, 4 EDGs and 2 UDGs are tested, which aggregates to 2,446 hours of testing per year. While unit 2 is undergoing commissioning, unit 1 will begin undergoing routine operational testing.

Routine testing of DGs will involve testing each EDG and UDG individually for a total of 60 hours a year for an aggregated total of 720 hours of testing per year. This equates to DGs being operational for 8% of hours (720 ÷ 8,760) for planned annual routine operation.

Background levels of 48dB (day) and 43dB (night) were measured at Minsmere-Walberswick Heaths SPA and Ramsar and the Outer Thames Estuary SPA. Worst-case operational noise levels (experienced during a LOOP scenario) are expected to be consistent with background levels experienced at the site, with a modelled level of 45dB. A ground-level (1.5m) noise contour map is provided in Figure 11.

The applicant concluded in the Shadow HRA (NNB GenCo, 2020d) that “LSE can be excluded for potential noise effects in all cases due to the minimal predicted change relative to ambient noise levels.”

We accept the applicant’s conclusions and agree that noise, either prolonged or intermittent, will not result in a likely significant effect on the designated bird populations alone or in-combination.

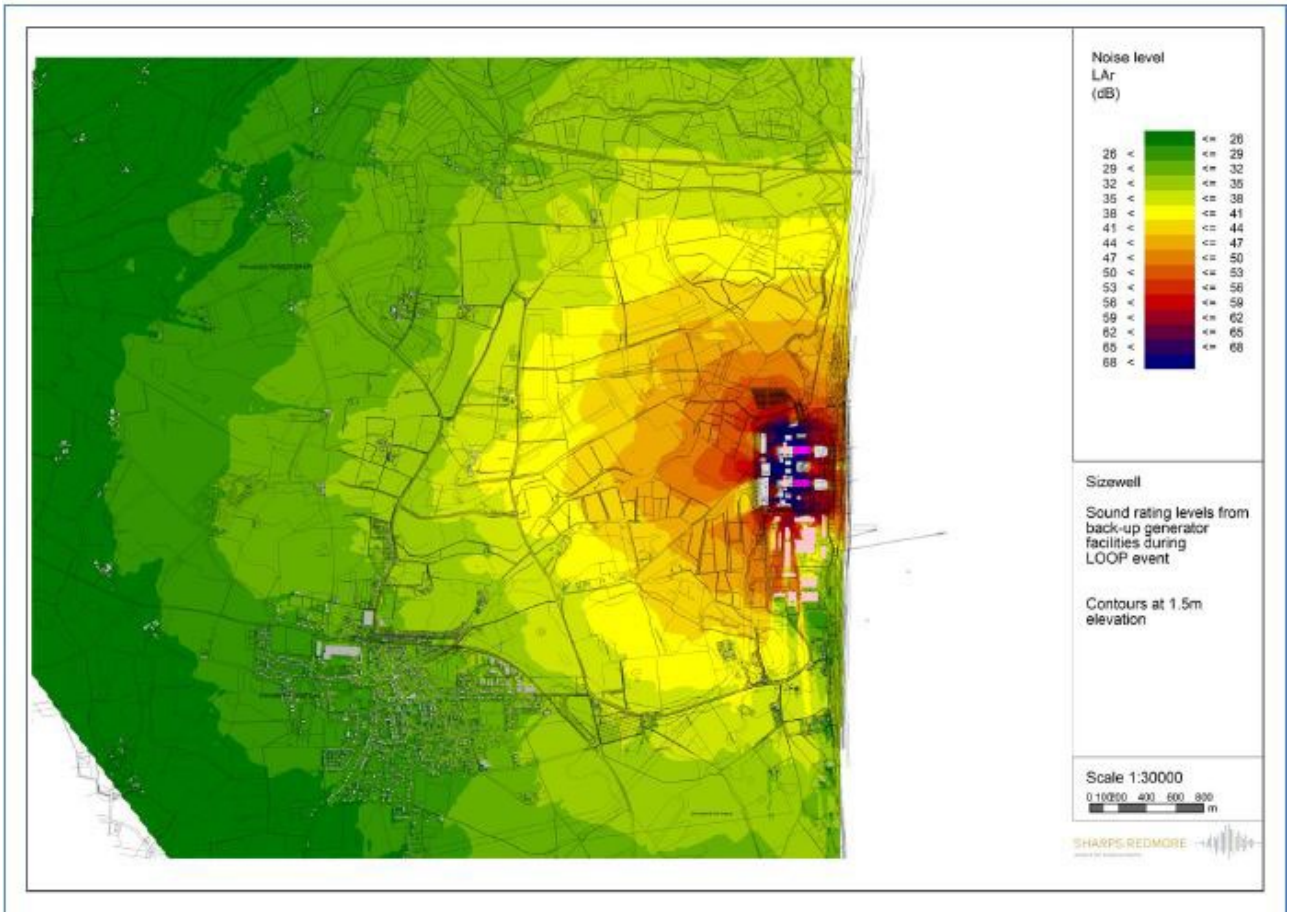

Figure 11 Heat map of sound rating levels from back-up generator facilities during a LOOP event. Purple represents the highest noise levels, dark green the lowest. Taken from SZC CA Appendix E - Noise Assessment (NNB GenCo, 2020c)

Conclusion

It has been possible to conclude **no likely significant effect** on the individual bird species and assemblages of birds of Minsmere-Walberswick SPA and Ramsar and Outer Thames Estuary SPA, from noise generated during the commissioning and routine operation of EDGs and UDGs, and LOOP scenario at SZC.

While there are aerial pathways of effect from the commissioning and routine testing of the DGs, and LOOP scenario at SZC, and sensitive receptors within the SPAs and Ramsar, it has been determined in this assessment that the potential scale or magnitude of any effect would not give rise to a likely significant effect.

5.1.2. Functionally linked land

The applicant did not carry out an assessment of noise levels on Sizewell Marshes SSSI. A qualitative assessment will therefore be completed for this SSSI as functionally linked land.

The assessment for Minsmere-Walberswick SPA and Ramsar has demonstrated that noise levels from a LOOP scenario are within ambient noise levels. This would also be expected to be the scenario within the Sizewell Marshes SSSI and Minsmere-Walberswick Heaths and Marshes SSSI (where it occurs outside of the SPA), as indicated by modelling of noise levels submitted by the applicant to support its CA permit application (NNB GenCo, 2020c). The area of the Sizewell Marshes SSSI subject to the highest predicted noise levels is in the location of Goodram's Fen, the location of which is indicated in Figure 9. Goodram's Fen will be lost during the construction of SZC, alternative habitat has therefore been created >2km from SZC.

Indicative modelled noise levels are shown in Figure 11.

Conclusion

It has been possible to conclude **no likely significant effect** on the bird species and assemblages of birds of Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar that use the Sizewell Marshes SSSI and Minsmere-Walberswick Heaths and Marshes SSSI as functionally linked land, from noise generated during the commissioning and routine operation of EDG and UDG, and during a LOOP scenario at SZC.

5.1.3. Sandlings SPA, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar

The applicant predicts that the sound level at the Sandlings Forest SPA and Alde-Ore Estuary SPA and Ramsar "would be below existing background sound levels (day or night) and would not be detectable or measurable."

This is confirmed when referring to the sound rating levels in Figure 11. Any intermittent noise associated with SZC CA will be very localised.

5.2. Likely significant effect conclusion

It has been possible to conclude **no likely significant effect** on the bird species and assemblages of birds of Sandlings SPA and Alde-Ore Estuary SPA and Ramsar, from noise generated during the commissioning and routine operation of EDG and UDG, and LOOP scenario at SZC.

There is no requirement for an appropriate assessment.

6. Integrity test

6.1. Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar

This integrity test is concluded with regard to the conservation objectives provided in section 4.4 Appropriate Assessment and in Annex 2 of this HRAR (Environment Agency, 2022b).

Full consideration will be given to the target provided in the supplementary advice packages for the European sites to “restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values” (Natural England, 2019, Minsmere-Walberswick SPA supplementary advice).

The assessment of disturbance (noise) did not pass to the appropriate assessment stage as noise associated with the commissioning and routine operation of SZC CA was predicted to be below the ambient noise levels within the SPA and Ramsar.

This appropriate assessment has determined that, for those aspects of the permit where a likely significant effect from aerial emissions was identified, the operation of SZC CA will not lead to an exceedance of the relevant critical level, alone and in-combination for the following:

- long-term effects of NOx during the commissioning of SZC CA
- acid deposition at modelling point E2c, European dry heaths, during the routine operation of SZC CA

A conclusion of no adverse effect was made alone and in-combination for the following designated features and supporting habitats:

- European dry heaths: nutrient enrichment during the commissioning and routine operation of SZC CA and acidification during the routine operation of SZC CA
- European nightjar: nutrient enrichment during the commissioning and routine operation of SZC CA
- perennial vegetation of stony banks: nutrient enrichment and acidification during the commissioning and routine operation of SZC CA
- little tern: nutrient enrichment during the commissioning and routine operation of SZC CA
- wetland plant assemblages: acidification during commissioning

A conclusion of no adverse effect alone was made for the following:

- direct toxic effect of NOx (short-term) on vegetation during the commissioning and routine operation of SZC CA

An appropriate assessment was also carried out on the LOOP scenario, which resulted in a conclusion of no adverse effect. The LOOP scenario is not expected to happen during the lifetime of the plant.

Conclusions of no adverse effect in-combination were based on the best available information from the applicant for within-project effects from the construction of SZC. Full in-combination assessments will be carried out when applications are made for mobile plant and associated diesel generators, CHP plant and the desalination plant.

Background levels of nitrogen currently exceed the minimum critical loads for the perennial vegetation of stony banks (8kg N/ha/yr) and European dry heaths (10kg N/ha/yr) and are predicted to still be exceeded when SZC CA is commissioned and operational. This is largely due to inputs from non-regulated sources, including those from Europe (Figure 12).

Figure 12 Sources ranked by total nitrogen deposition (KgN/ha/yr) from combined UK sources (source: APIS, Percentage of Nitrogen Deposition by apportionment, 2018 data)

Total nitrogen deposition and percentage deposition contribution by apportionment for the categories shown in Figure 12 are as follows:

- Europe import: 4.88kg N/ha/yr, 35%
- livestock: 3.94kg N/ha/yr, 28.3%
- fertiliser application: 1.21kg N/ha/yr, 8.71%
- international shipping: 1.18kg N/ha/yr, 8.51%
- road transport: 0.62kg N/ha/yr, 4.5%
- others: 2.08kg N/ha/yr, 14.9%

In contrast, SZC CA is modelled to contribute a maximum of 0.44kg N/ha/yr during commissioning of SZC CA at modelling point E2c and 0.14kg N/ha/yr during its routine

operation. Modelling point E2c is located at the European site boundary closest to SZC, with deposition rapidly reducing to below the significance decision-making threshold within a short distance as shown in Figure 7.

Acidification within the European site will also be dominated by these largely non-regulated contributors, with non-regulated sources also dominating sulphur deposition.

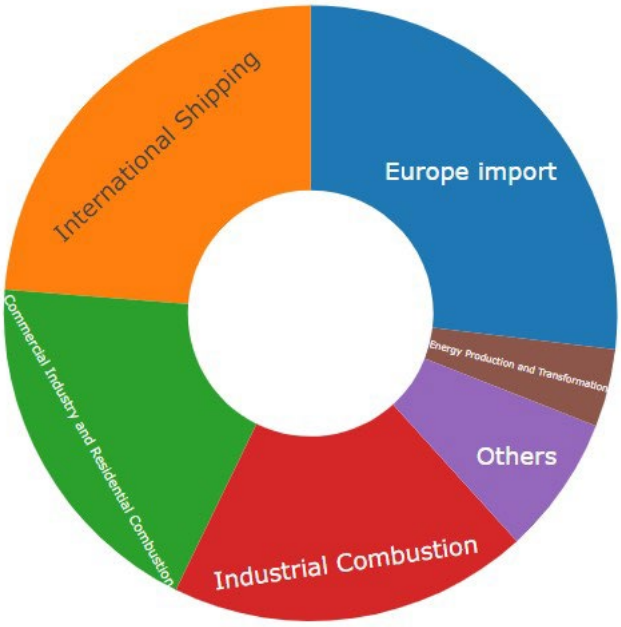

Figure 13 Sources ranked by total sulphur deposition (KgS/ha/yr) from combined UK sources (source: APIS Percentage of Sulphur Deposition by apportionment, 2018 data)

Total sulphur deposition and percentage deposition contribution by apportionment for the categories shown in Figure 13 are as follows:

- Europe import: 0.856kg S/ha/yr, 39.7%
- international shipping: 0.5088kg S/ha/yr, 23.6%
- commercial industry and residential combustion: 0.2336kg S/ha/yr, 10.9%
- industrial combustion: 0.1616kg S/ha/yr, 7.54%
- others: 0.064kg S/ha/yr, 18.3%

More realistic modelling predicted that there would be no contribution to acidification at modelling point E2e, representative of the wetland plant assemblages Ramsar.

The highest contribution to acidification from SZC CA is predicted to be 3% of the critical load function for the perennial vegetation of drift lines feature of the SAC during commissioning, and 3% of the critical load function for the European dry heaths during the routine operation of SZC CA. The European dry heaths are located approximately 3km from modelling point E2c, acidification will be significantly lower at the heathland habitat.

Figure 14 puts the contribution of acid deposition during the commissioning of SZC CA at modelling point E2b into context. Background and PEC contributions are overlapping, indicating that contributions from SZC CA are inconsequential in the context of prevailing environmental conditions.

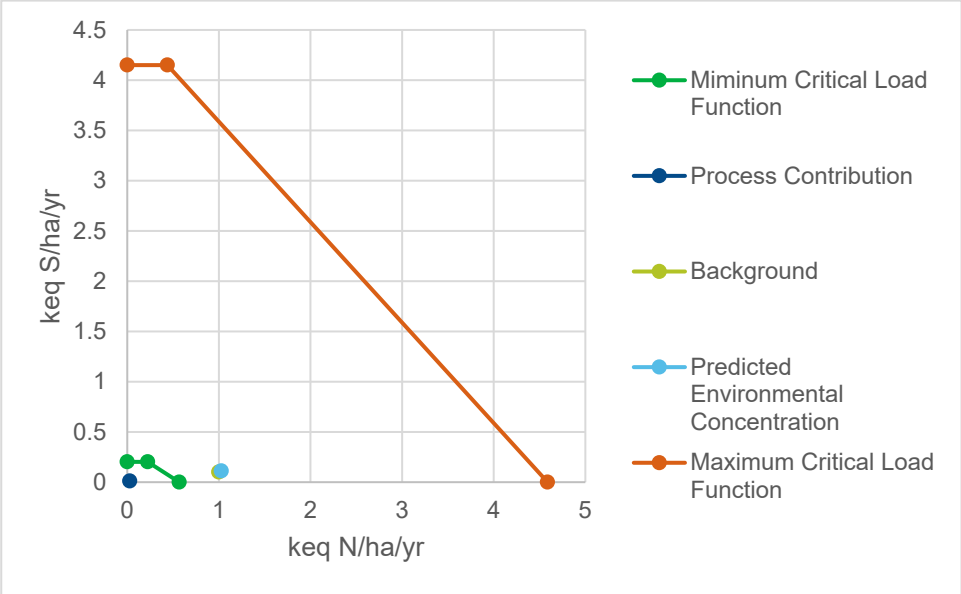

Figure 14 PC, background and PEC in relation to the critical load functions at modelling point E2b during the commissioning of SZC

For short-term effects of NOx emissions, we were able to conclude no adverse effect. While an exceedance of the critical level is expected during any given year of operation, it is unlikely its scale within the SAC, SPA and Ramsar and short-term nature, would result in direct toxic effects on the features of Minsmere to Walberswick Heaths and Marshes SAC, and supporting habitats of Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar.

In order for the conservation objectives to be met for both the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA, action must be taken to reduce nitrogen deposition primarily from non-regulated sources. We have concluded that the predicted worst-case deposition from SZC CA will not prevent the conservation objectives from being met alone or in-combination with other PPP.

Managing Natura advice (EEC, 2018) explains the concept of the “integrity of the site” in section 4.6.4 as the “coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated.”

We do not believe that the operational CA permit will impact upon the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar’s ecological structure, function and ecological processes across its whole area.

We were able to reach this conclusion due to the modelling results confirming that the effects identified would be low-impact, too small, and for the commissioning of SZC CA too short-lived, to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in-combination with other PPP.

6.2. Functionally linked land

This integrity test is concluded with regard to the conservation objectives for the Minsmere-Walberswick SPA and Alde-Ore Estuary SPA provided in Annex 2 of this HRAR (Environment Agency, 2022b)

Full consideration will be given to the target provided in the supplementary advice packages for the European site to “restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values”.

The assessment of disturbance (noise) did not pass to the appropriate assessment stage as noise associated with the commissioning and routine operation of SZC CA was predicted to be below the ambient noise levels within the functionally linked land.

This appropriate assessment has determined that, for those aspects of the permit where a likely significant effect from aerial emissions was identified, the operation of SZC CA will not lead to an exceedance of the relevant critical load alone and in-combination for the following:

- nutrient enrichment at modelling points E2d, E5a and E5b

A conclusion of no adverse effect alone was made for the following:

- direct toxic effect of NOx (short-term) on vegetation during the commissioning and routine operation of SZC CA

An appropriate assessment was also carried out on the LOOP scenario, which resulted in a conclusion of no adverse effect. The LOOP scenario is not expected to happen during the lifetime of the plant.

Conclusions of no adverse effect in-combination were based on the best available information from the applicant for within-project effects from the construction of SZC CA. Full in-combination assessments will be carried out when applications are made for mobile plant and associated diesel generators, CHP plant and the desalination plant.

For short-term effects of NOx emissions, we were able to conclude no adverse effect. While an exceedance of the critical level is expected during any given year of operation, it is unlikely its scale within the functionally linked land and short-term nature, would result in direct toxic effects on the supporting habitats of the great bittern and marsh harrier within the functionally linked land.

We do not believe that the operational CA permit will impact upon the functionally linked land's ecological structure, function and ecological processes across its whole area (EEC, 2018).

We were able to reach this conclusion due to the modelling results confirming that the effects identified would be low-impact, too small, and for the commissioning of SZC CA too short-lived, to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in-combination with other PPP.

6.3. Outer Thames Estuary SPA

This integrity test is concluded with regard to the conservation objectives provided in Annex 2 of this HRAR (Environment Agency, 2022b).

Full consideration will be given to the target provided in the supplementary advice packages for the European site to "restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values." (Marine site detail (naturalengland.org.uk))

This appropriate assessment has determined that, for those aspects of the permit where a likely significant effect from aerial emissions was identified, the operation of SZC CA will not lead to an exceedance of the relevant critical level, in-combination for the following:

- long-term effects of NOx during the commissioning of SZC CA

A conclusion of no adverse effect was made alone and in-combination for the following designated features and supporting habitats:

- common tern: acidification during the commissioning and routine operation of SZC CA
- little tern and common tern: nutrient enrichment during the commissioning and routine operation of SZC CA

A conclusion of no adverse effect alone was made for the following:

- direct toxic effect of NOx (short-term) on vegetation during the commissioning and routine operation of SZC CA

An appropriate assessment was also carried out on the LOOP scenario, which resulted in a conclusion of no adverse effect. The LOOP scenario is not expected to happen during the lifetime of the plant.

Conclusions of no adverse effect in-combination were based on the best available information from the applicant for within-project effects from the construction of SZC CA. Full in-combination assessments will be carried out when applications are made for mobile plant and associated diesel generators, CHP plant and the desalination plant.

Background levels of nitrogen currently exceed the minimum critical load for supporting habitat of the common tern and little tern breeding population (8kg N/ha/yr) and are

predicted to still be exceeded when SZC CA is commissioned and operational. This is largely due to inputs from non-regulated sources, including those from Europe (Figure 15).

Figure 15 Sources ranked by total nitrogen deposition (KgN/ha/yr) from combined UK sources (source: APIS, Percentage of Nitrogen Deposition by apportionment, 2018 data)

The Outer Thames Estuary is a large site extending from the North Kent coast to north of Great Yarmouth, total nitrogen deposition and percentage deposition contribution by apportionment for the categories shown in Figure 15 reflect the scale of the site and are as follows:

- Europe import: 6.73kg N/ha/yr, 30.1%
- livestock: 4.13kg N/ha/yr, 18.5%
- road transport: 1.82kg N/ha/yr, 8.15%
- international shipping: 1.72kg N/ha/yr, 7.75%
- fertiliser application: 1.51kg N/ha.yr, 6.76%
- other transport: 1.36kg N/ha/yr, 6.06%
- non-agricultural, non-abatable: 0.98kg N/ha/yr, 4.37%
- non-agricultural, abatable: 0.67kg N/ha/yr, 2.98%
- others: 2.07kg N/ha/yr, 22.65%

In contrast, SZC CA is modelled to contribute a maximum of 0.18kg N/ha/yr during commissioning of SZC CA and 0.06kg N/ha/yr during its routine operation at modelling point E2b. Modelling point E2b is located at the European site boundary closest to SZC, with deposition rapidly reducing to below the significance decision-making threshold within a short distance, as shown in Figure 7. The limited area, over which any measurable inputs from SZC within the SPA will be experienced, will be inconsequential in comparison to the scale of the coastal extent of the site.

Acidification within the European site will also be dominated by these largely non-regulated contributors, with non-regulated sources also dominating sulphur deposition.

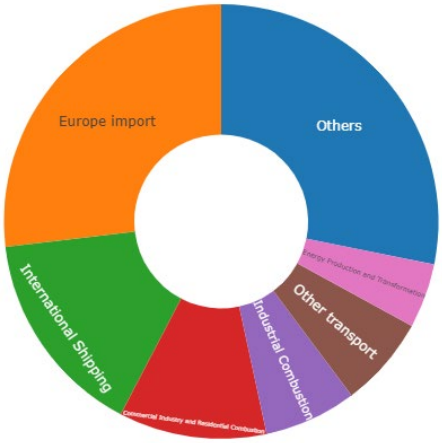

Figure 16 Sources ranked by total sulphur deposition (KgS/ha/yr) from combined UK sources (source: APIS Percentage of Sulphur Deposition by apportionment, 2018 data)

Total sulphur deposition and percentage deposition contribution by apportionment for the categories shown in Figure 16 reflect the scale of the site and are as follows:

- Europe import: 1.624kg S/ha/yr, 26.9%
- international shipping: 0.936kg S/ha/yr, 15.5%
- commercial industry and residential combustion: 0.664kg S/ha/yr, 11%
- industrial combustion: 0.4144kg S/ha/yr, 6.89%
- other transport: 0.408kg S/ha/yr, 6.79%
- energy production and transformation: 0.2896kg S/ha/yr, 4.8%
- others: 0.1056kg S/ha/yr, 28.2%

The highest localised contribution to acidification from SZC CA is predicted to be 3% of the critical load function for the perennial vegetation of drift lines feature of the SAC during commissioning, and 3% of the critical load function for the European dry heaths during the routine operation of SZC CA. The European dry heaths are located approximately 3km from modelling point E2c, acidification will be significantly lower at the heathland habitat.

Only the common tern is expected to be negatively affected due to impacts on its supporting habitat within the Outer Thames Estuary.

Figure 17 puts the contribution of acid deposition during the commissioning of SZC CA at modelling point E2b into context. Background and PEC contributions are overlapping, indicating that contributions from SZC CA are inconsequential in the context of prevailing environmental conditions.

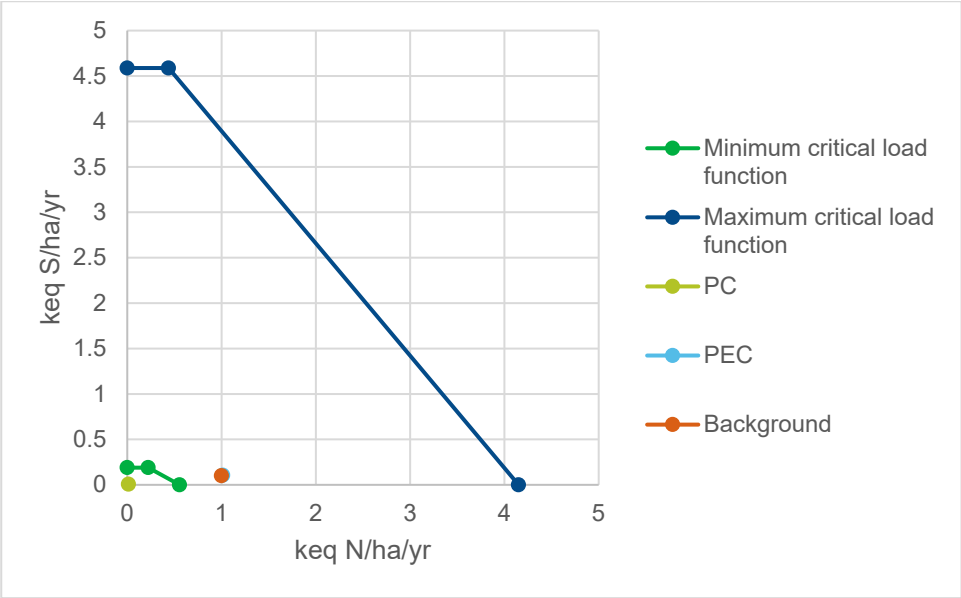

Figure 17 PC, background and PEC in relation to the critical load functions at modelling point E2b during commissioning of SZC

For short-term effects of NOx emissions, we were able to conclude no adverse effect. While an exceedance of the critical level is expected during any given year of operation, it is unlikely its scale within the SPA and short-term nature, would result in direct toxic effects on the supporting habitats of the designated features of the Outer Thames Estuary SPA.

In order for the conservation objectives to be met for the Outer Thames Estuary SPA, action must be taken to reduce nitrogen deposition primarily from non-regulated sources. We have concluded that the predicted worst-case deposition from SZC CA will not prevent the conservation objectives from being met alone or in-combination with other PPP.

We do not believe that the operational CA permit will impact upon the Outer Thames Estuary SPA's ecological structure, function and ecological processes across its whole area (EEC, 2018). There will be no adverse effect on site integrity from the operational CA permit.

We were able to reach this conclusion due to the modelling results confirming that the effects identified above would be low-impact, too small, and for the commissioning of SZC CA too short-lived, to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in-combination with other PPP.

6.4. Sandlings SPA

This integrity test is concluded with regard to the conservation objectives provided in Annex 2 of this HRAR (Environment Agency, 2022b).

The assessment of disturbance (noise) did not pass to the appropriate assessment stage as noise associated with the commissioning and routine operation of SZC CA was predicted to be below the ambient noise levels within the SPA.

A likely significant effect was identified due to the potential for direct toxic effects from the short-term effects of NOx emissions on the SPA. We have concluded that this will not lead to an adverse effect on the site's designated features.

While an exceedance of the critical level is expected during any given year of operation, it is unlikely its scale within the SPA and short-term nature, would result in direct toxic effects on the supporting habitats of Sandlings SPA.

An appropriate assessment was also carried out on the LOOP scenario, which resulted in a conclusion of no adverse effect. The LOOP scenario is not expected to happen during the lifetime of the plant.

We do not believe that the operational CA permit will impact upon the Sandlings SPA's ecological structure, function and ecological processes across its whole area (EEC, 2018). There will be no adverse effect on site integrity from the operational CA permit.

We were able to reach this conclusion due to the modelling results confirming that the effects identified above would be low-impact, too small, and for the commissioning of SZC CA too short-lived, to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in-combination with other PPP.

6.5. Alde, Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar

This integrity test is concluded with regard to the conservation objectives provided in Annex 2 of this HRAR (Environment Agency, 2022b).

An appropriate assessment was also out on the LOOP scenario, which resulted in a conclusion of no adverse effect. The LOOP scenario is not expected to happen during the lifetime of the plant.

All other aspects of the permit application were screened out at the LSE stage.

We do not believe that the operational CA permit will impact upon the Alde, Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA and Alde-Ore Estuary Ramsar's ecological structure, function and ecological processes across its whole area (EEC, 2018). There will be no adverse effect on site integrity from the operational CA permit.

We were able to reach this conclusion due to the modelling results confirming that the effects identified above would be low-impact, too small, and for the commissioning of SZC CA too short-lived, to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in-combination with other PPP.

6.6. Orfordness-Shingle Street SAC

This integrity test is concluded with regard to the conservation objectives provided in Annex 2 of this HRAR (Environment Agency, 2022b).

An appropriate assessment was also out on the LOOP scenario, which resulted in a conclusion of no adverse effect. The LOOP scenario is not expected to happen during the lifetime of the plant.

All other aspects of the permit application were screened out at the LSE stage.

We do not believe that the operational CA permit will impact upon the Orfordness-Shingle Street SAC's ecological structure, function and ecological processes across its whole area (EEC, 2018). There will be no adverse effect on site integrity from the operational CA permit.

We were able to reach this conclusion due to the modelling results confirming that the effects identified above would be low-impact, too small, and for the commissioning of SZC CA too short-lived, to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in-combination with other PPP.

6.7. Dew's Pond SAC

This integrity test is concluded with regard to the conservation objectives provided in Annex 2 of this HRAR (Environment Agency, 2022b).

An appropriate assessment was also out on the LOOP scenario, which resulted in a conclusion of no adverse effect. The LOOP scenario is not expected to happen during the lifetime of the plant.

All other aspects of the permit application were screened out at the LSE stage.

We do not believe that the operational CA permit will impact upon the Dew's Pond SAC's ecological structure, function and ecological processes across its whole area (EEC, 2018). There will be no adverse effect on site integrity from the operational CA permit.

We were able to reach this conclusion due to the modelling results confirming that the effects identified above would be low-impact, too small, and for the commissioning of SZC CA too short-lived, to undermine the achievement of the conservation objectives. Site

integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in-combination with other PPP.

References

Chapman C., and Tyldesley D., 2016. Functional linkage: how area that are functionally linked to European sites have been considered when they may be affected by plans and projects - a review of authritative decisions. Natural England Commissioned Reports, Number 207.

CIEEM, 2021. Advice on Ecological Assessment of Air Quality Impacts. Winchester, UK: Chartered Institute of Ecology and Environmental Management.

Drewitt, A., Hawthorne, E., Saunders, R. and Anthony, S., 2018. A review of the effects of noise on birds. Version 1. Natural England.

EEC, 2018. Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC Commission Notice C(2018) 7621 final. Brussels.

Environment Agency, 2012a. Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation. Operational Instruction 66_12. Available on request from the Permitting and Support Centre environmentalpermitting@environment-agency.gov.uk

Environment Agency, 2012b. Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation. Operational Instruction 67_12. Available on request from the Permitting and Support Centre environmentalpermitting@environment-agency.gov.uk

Environment Agency, 2021a. Sizewell C Nuclear New Build, AQMAU_C2106_RP_01. Environment Agency. Available on request from the Permitting and Support Centre environmentalpermitting@environment-agency.gov.uk

Environment Agency, 2021b. Sizewell C Nuclear New Build. Audit of Air Quality Assessment Schedule 5 response. AQMAU_C2193_WD01. Environment Agency. Available on request from the Permitting and Support Centre environmentalpermitting@environment-agency.gov.uk

Environment Agency, 2021c. Sizewell C Nuclear New Build. Audit of Air Quality Assessment. AQMAU_C2104_RP01. Environment Agency. Available on request from the Permitting and Support Centre environmentalpermitting@environment-agency.gov.uk

Environment Agency, 2022a. Annex 1 Relevant Site Plans for Proposed Sizewell C Nuclear Power Station. Bristol: Environment Agency.
Information regarding three new environmental permit applications for the proposed Sizewell C power station – Environment Agency – Citizen Space

Environment Agency, 2022b. Annex 2 Relevant Site Details for Proposed Sizewell C Nuclear Power Station. Bristol: Environment Agency.
Information regarding three new environmental permit applications for the proposed Sizewell C power station – Environment Agency – Citizen Space

Environment Agency, 2022c. Book 2 Operational Water Discharge Activity HRAR for proposed Sizewell C nuclear power station. Bristol: Environment Agency.
Information regarding three new environmental permit applications for the proposed Sizewell C power station – Environment Agency – Citizen Space

Environment Agency, 2022d. Habitats Regulations Assessment Report Environment Agency Permits for Proposed Sizewell C Nuclear Power Station. Bristol: Environment Agency.
Information regarding three new environmental permit applications for the proposed Sizewell C power station – Environment Agency – Citizen Space

Holman, C., Barrowcliffe, R., Harker, G., Hawkings, C., Horrocks, S., and Prismall, F., 2020. A guide to the assessment of air quality impacts on designated nature conservation sites - Version 1.1. London: Institute of Air Quality Management.

Natural England, 2014. Improvement Programme for England's Natura 2000 Sites (IPENS) Planning for the Future. Site Improvement Plan Minsmere to Walberswick Heaths and Marshes. Accessed January 2022.

Natural England, 2019. European Site Conservation Objectives: Supplementary advice on conserving and restoring site features Minsmere to Walberswick Heaths and Marshes Special Area of Conservation (SAC) Site code: UK0012809. Accessed July 2021.

NNB Generation Company (SZC) Limited (NNB GenCo), 2020a. The Sizewell C project combustion activity permit application: Appendix C, Air quality modelling. NNB GenCo (SZC) Ltd, London. Report No: 100200192, Revision 02.

NNB Generation Company (SZC) Limited (NNB GenCo), 2020b. The Sizewell C project combustion activity permit application: Appendix D, Shadow HRA report. NNB GenCo (SZC) Ltd, London. Document 100207664, Revision 01.

NNB Generation Company (SZC) Limited (NNB GenCo), 2020c. The Sizewell C project combustion activity permit application: Appendix E, Noise assessment. NNB GenCo (SZC) Ltd, Report No: 100207665, Revision 01.

NNB Generation Company (SZC) Limited (NNB GenCo), 2020d. The Sizewell C project Shadow Habitats Regulations Assessment Volume 1: Screening and appropriate assessment. NNB GenCo (SZC) Ltd, London. EN010012, Revision 1.0. Available via Planning Inspectorate website.

NNB Generation Company (SZC) Limited (NNB GenCo), 2020e. Sizewell C project Environmental Statement Volume 2: Main development site, Chapter 12 Air quality. NNB GenCo (SZC) Ltd, London. EN010012, Revision 1.0. Available via Planning Inspectorate website.

NNB Generation Company (SZC) Limited (NNB GenCo), 2021a. Sizewell C project combustion activity permit application: Response to Schedule 5 Air quality assessment. NNB GenCo (SZC) Ltd, London. Project number: 60578253.

NNB Generation Company (SZC) Limited (NNB GenCo), 2021b. Sizewell C project combustion activity permit application: Response to Schedule 5 No. 5. NNB GenCo (SZC) Ltd, London.

NNB Generation Company (SZC) Limited (NNB GenCo), 2021c. The Sizewell C project: Desalination plant air quality impact assessment. NNB GenCo (SZC) Ltd, London. EN010012, Revision 2.0.

NNB Generation Company (SZC) Limited (NNB GenCo), 2021d. The Sizewell C project construction phase – diesel generators. Email correspondence, 7 January 2021.

PINS, 2017. Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects. Planning Inspectorate. Republished November 2017, version 8.

List of abbreviations

Term	Meaning
AD	Average day
ADMS	Air Dispersion Modelling Software
AOD	Above Ordnance Datum
APIS	Air Pollution Information System
AQMAU	Air Quality Modelling and Assessment Unit
BC	Baseline case
BD	Busiest day
CEH	Centre for Ecology and Hydrology
CHP	Combined heat and power
CL	Critical level
CLmaxN	Maximum critical load for nitrogen (acidification)
CLmaxS	Maximum critical load for sulphur (acidification)
CLminN	Minimum critical load for nitrogen (acidification)
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
DG	Diesel generator
EPR	Environmental Permitting Regulations
ES	Environmental statement

Term	Meaning
HRA	Habitats Regulations Assessment
HRAR	Habitats Regulations Assessment Report
LOOP	Loss of operational power
LSE	Likely significant effect
LT	Long-term
MW_{th}	Megawatt of thermal output
NGR	National Grid reference
NO_2	Nitrogen dioxide
NOx	Nitrous oxides
PC	Process contribution
PEC	Predicted environmental concentration
PINS	Planning Inspectorate
PPP	Permissions, plans or projects
Ramsar	Wetland site of international importance
RSA	Radioactive substances activity
RSR	Radioactive Substances Regulations
SAC	Special Area of Conservation
SACO	Supplementary advice on conservation objectives
sHRA	Shadow Habitats Regulations Assessment

Term	Meaning
SIP	Site improvement plan
SO_2	Sulphur dioxide
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
ST	Short-term
SZB	Sizewell B
WDA	Water discharge activity

Glossary

Term	Meaning
Acidification or Acid deposition	Represents the mix of air pollutants that deposit from the atmosphere, leading to acidification of soils and freshwater. It mainly consists of pollutants emitted by the combustion of fossil fuels. (Source: Acid deposition | Air Pollution Information System (apis.ac.uk)).
Activity	A generic title for the practices or operations which require to be permitted (unless exempted from the need for a permit).
Air Pollution Information System	A searchable database and information on pollutants and their impacts on habitats and species. Air Pollution Information System | Air Pollution Information System (apis.ac.uk).
Applicant	The party applying for the combustion activity permit, (NNB Generation Company (SZC) Limited). Responsible for carrying out the necessary preparatory work in support of the application to enable the Environment Agency as competent authority to carry out its duties.
Commissioning	Where all of the generators are tested for reliability and performance prior to the start of nuclear activities. Unit 1 will undergo commissioning first and unit 2 will undergo commissioning the following year. While unit 2 is undergoing commissioning, unit 1 will begin undergoing routine operational testing.
Critical levels	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". Critical level is the gaseous concentration of a pollutant in the air. (Source: https://www.icpmapping.org/Definitions_and_abbreviations).
Critical load function	Critical loads for acidification are presented as a critical load function comprising of the maximum critical load for sulphur (CLmaxS), minimum critical load for nitrogen (CLminN) and maximum critical load for nitrogen (CLmaxN). When compared with deposition data for sulphur and nitrogen, they can be used to assess critical load exceedances.

Term	Meaning
Critical loads	Defined as " a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge". Relates to the quantity of the pollutant deposited from air to the ground. (Source: https://www.icpmapping.org/Definitions_and_abbreviations).
Commissioning	The process by which a nuclear power station/reactor is inspected, checked and tested in order to allow it to begin operation.
Competent authority	Decision maker under the Habitats Regulations. For the CA permit it is the Environment Agency.
Conservation objectives	A site's conservation objectives provide information on what is needed to: • conserve the site • restore the site • prevent deterioration or significant disturbance of its qualifying features
Direct toxic effect of the pollutants	Exposure to toxic pollutant concentrations in the atmosphere. Assessment of the direct toxicity to air pollutants is generally assessed by comparing measured pollutant air concentrations with 'critical levels', which are set for a range of air pollutants.
European sites	Sites designated in accordance with the statutory definition in the Habitat Regulations including, for the purposes of this HRAR: • Special Areas of Conservation • Special Protection Areas Ramsar sites are also included in line with government policy.
Eutrophication	The increase in primary productivity and subsequent impacts on an ecosystem that arise as a result of inputs of nutrients (which can be anthropogenic) raising ambient nutrient concentrations.
Functionally linked land	'Functional linkage' refers to "the role or 'function' that land or sea beyond the boundary of a European site might fulfil in terms of ecologically supporting the populations for which the site was

Term	Meaning
	designated or classified. Such land is therefore 'linked' to the European site in question because it provides an important role in maintaining or restoring the population of qualifying species at favourable conservation status." (Chapman and others, 2016).
Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (as amended).
Habitats Regulations	The Conservation of Habitats and Species Regulations 2017 (as amended).
Loss of operational power	A LOOP event involves running all 8 EDGs for the duration of the event. It is not easily determined how often a LOOP event is likely to occur or how long it will last.
Microgram µg	A unit of mass equal to one thousandth of a milligram, and one millionth of a gram (1µg = 0.001 mg).
Nutrient enrichment or nitrogen (N) deposition	Describes the input of reactive nitrogen from the atmosphere to the biosphere both as gases, dry deposition and in precipitation as wet deposition. (Source: Nitrogen deposition | Air Pollution Information System (apis.ac.uk)).
Qualifying features	The features for which the European sites is designated and is to be protected and managed for conservation.
Routine testing	Ongoing testing of the generators to make sure they are available to perform their role, as a critical nuclear safety function, should a LOOP event occur.
Schedule 5 request	A formal instruction to the applicant to provide further information to provide clarification on points made in the permit application or to address gaps in that application.
Scrape	This is the name for a series of shallow pools studded with islands within the Minsmere to Walbersiwck Heaths and Marshes SAC, Minsmere-Walberswick SPA and Minsmere-Walberswick Ramsar.
Shadow HRA	The applicant is required to provide the competent authority with the information they need in order to carry out a Habitats Regulations

Term	Meaning
	Assessment. This information may be provided in the format of an HRAR which would be referred to as the applicant's shadow HRA.
Special Areas of Conservation	A protected area designated under the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales, or the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) for UK offshore areas. A Special Area of Conservation is part of a network of import high-quality conservation sites that will make a contribution to conserving the habitats and species identified in Annexes I and II, respectively of European Council Directive 92/43/EEC, the Habitats Directive.
Special Protection Area	Special Protection Areas are protected areas for birds classified under the Wildlife & Countryside Act 1981 (as amended), the Conservation (Natural Habitats, & c.) Regulations 2010 (as amended) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended).
Supplementary advice on conservation objectives	The supplementary advice on conservation objectives provide more detailed and site-specific information on the European site's conservation objectives.

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