

Sizewell C Project

Shadow HRA Report



COMBUSTION ACTIVITY PERMIT APPLICATION SHADOW HRA REPORT NOT PROTECTIVELY MARKED

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1. Introduction

- 1.1.1. NNB Generation (SZC) Company Ltd (SZC Co.) is proposing to build and operate a new nuclear power station, comprising two UK European Pressurised Reactors™ (EPRs), at Sizewell in Suffolk, north of the existing Sizewell B power station.
- 1.1.2. The proposed Sizewell C Project is likely to affect sites designated as being of European or international importance for nature conservation (hereafter referred to as 'European sites'). Consequently, SZC Co. needs to provide a Shadow Habitats Regulations Assessment (HRA) to support its Development Consent Order and environmental permit applications.
- 1.1.3. The two EPRs would be supported by up to twelve backup diesel generators, with an aggregated thermal input exceeding 50 thermal megawatts (MWth). An Environmental Permit is therefore required under Schedule 1, Part 2, Chapter 1, Section 1.1, Part A(1)(a) of the Environmental Permitting (England and Wales) Regulations 2016 (as amended) for the combustion activities (referred to as the 'combustion activity permit application'). The diesel generators comprise the combustion activity (referred to as the 'Installation') that is the subject of the combustion activity permit application.
- 1.1.4. This Shadow HRA report has been produced to support the combustion activity permit application and to provide the Environment Agency (the 'competent authority') with the information required to enable it to undertake 'Appropriate Assessment' for the combustion activity permit.
- 1.1.5. This report covers 'European site scoping' and 'likely significant effect' (LSE) screening for the combustion activities. It also provides information for Appropriate Assessment intended to enable the Environment Agency to determine whether the combustion activities would have an adverse effect on the integrity of European sites.
- 1.1.6. This Shadow HRA report provides the following:
- A summary description of the combustion activities **Section 2**.
 - A description of the HRA process (**Section 3**).
 - The European site scoping exercise and summary information on the European sites taken into the LSE screening stage (**Section 4**).
 - The findings of Stage 1 LSE Screening (**Section 5**).
 - Stage 2 Appropriate Assessment (**Section 6**).

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- Assessment of in-combination effects (**Section 7**).
- Conclusion (**Section 8**).
- References (**Section 9**).

1.1.7. This report considers all potential cause and effect pathways between the combustion activities and the qualifying features of relevant European sites (see **Section 4**), including potential effects on:

- Birds – qualifying features of Special Protection Areas (SPAs) and Ramsar sites, including rare and vulnerable birds (as listed on Annex I of the Birds Directive), regularly occurring migratory species and species forming designated assemblages;
- Qualifying features of Special Areas of Conservation (SACs); and,
- Habitats and species populations of Ramsar sites (that are not also designated as SPAs).

2. Description of Combustion Activities

2.1.1. The twelve diesel generators would comprise eight emergency diesel generators (EDGs), with an approximate thermal input rating of 23.25MW_{th} each, and four 7.5MW_{th} ultimate diesel generators (UDGs); providing a total aggregated thermal input rating for the combustion plant of, nominally, 216MW_{th}.

2.1.2. The two UK EPRs would have six installed diesel generators for each unit, which equates to four EDGs and two UDGs per EPR unit.

2.1.3. A full description of the combustion plant is provided in **Section 2 of the combustion activity permit application**. The diesel generators would be used during commissioning, routine testing operations and in the event of Loss Of Off-site Power (LOOP).

2.1.4. The assessed proposed commissioning and operating scenarios for the plant are described in **Section 4.1.2 of the combustion activity permit application**. In summary, the assessed scenarios (for air quality) comprise:

- Commissioning of EPR Unit 1 and Unit 2 (hourly and annual scenarios), including undertaking testing for a LOOP Event.
- Routine testing during operation (hourly and annual scenarios).

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- A LOOP Event (this represents emergency back-up operation only and, therefore, would only generate short-term (hourly) impacts).

2.1.5. For noise generated during the combustion activities, the worst-case sound levels (predicted by noise modelling) would occur during the LOOP Event. This scenario is, therefore, assessed in the Shadow HRA.



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3. The Habitats Regulations Assessment Process

3.1 The HRA Process

- 3.1.1. European Union (EU) obligations in respect of habitats and species are met through Council Directive 92/43/EEC (the Habitats Directive) on the conservation of natural habitats and of wild fauna and flora, which requires Member States to schedule important wildlife sites through the European Community as SACs and to give protection to habitats and species listed in the Directive as being threatened or of Community Interest.
- 3.1.2. The EU meets its obligations for birds through Directive 2009/147/EC (the Birds Directive) on the conservation of wild birds. This provides a framework for the conservation and management of wild birds in Europe. Of particular relevance is the requirement to identify and designate SPAs for rare or vulnerable species listed in Annex I of the Directive, as well as for all regularly occurring migratory species, paying particular attention to the protection of wetlands of international importance. Together with SACs, SPAs form a network of protected areas known as *Natura 2000*.
- 3.1.3. As a matter of policy, the UK Government also applies the HRA process to Ramsar sites.
- 3.1.4. The Habitats Directive is transposed into UK law by the Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017; hereafter referred to as the 'Habitats Regulations'. The Habitats Regulations incorporate all SPAs into the definition of European sites and, consequently, the protections afforded to European sites under the Habitats Directive apply to SPAs designated under the Birds Directive.
- 3.1.5. The HRA process helps meet the requirements of Article 6(3) of the Habitats Directive (replicated in Regulation 63(1) of the Habitats Regulations) which states that any plan or project, that is not directly connected with or necessary to the management of an European site, but would be likely to have a significant effect on such a site, either on its own or in-combination with other plans or projects, will be subject to an 'appropriate assessment' of its implications for the European site in view of its conservation objectives.
- 3.1.6. According to the Waddenzee judgement (Judgement of 7.9.2004 – Case C - 127/02) (paragraph 45) an appropriate assessment will be required if a LSE cannot be excluded on the basis of objective information. That is to say, if the plan or project is likely to undermine the site's conservation objectives, the assessment of that risk being made in the light inter alia of the characteristics and specific environmental conditions of the site concerned

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by such a plan or project (paragraph 49). The Sweetman Opinion (Opinion of Advocate General 22.10.2012 – Case C-258/11) (paragraph 46) states that the question is simply whether the plan or project concerned is capable of having an effect.

- 3.1.7. Subject to the provisions of Article 6(4) of the Habitats Directive, the ‘competent authority’ will agree to the plan or project only having ascertained that it will not adversely affect the integrity of the European site(s) concerned.
- 3.1.8. Where a real risk to the integrity of the European site exists, it must be considered (firstly) whether any alternative solutions exist that would be capable of delivering the same overall objective as the original proposal, but in a way that does not adversely affect the integrity of a European site. If so, then the alternative should be pursued. If not, then the competent authority must consider whether the plan or project must nevertheless be undertaken for imperative reasons of overriding public interest (IROPI).
- 3.1.9. Article 6(4) provides that if, in spite of a negative assessment of the implications for the European site, and in the absence of alternative solutions, the plan or project must nevertheless be undertaken for IROPI, compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected will need to be implemented.
- 3.1.10. There is no explicit definition of LSE in the legislation and in the context of HRA it is typically taken as any effect that may reasonably be predicted as a consequence of the project that may undermine the European site’s conservation objectives, excluding trivial or inconsequential effects (Ref. 3.1). That is, the term ‘likely’ infers the presence of a risk that a significant effect could occur. By definition, this assessment is based on the consideration of a number of factors, for example, the spatial extent and duration of an identified effect, and other considerations such as the availability of appropriate mitigation. When considering such effects, a precautionary approach is adopted.
- 3.1.11. In general, according the Planning Inspectorate’s Advice Note 10 (Ref. 3.2)), if a large amount of evidence and data gathering is necessary to determine LSE, it is assumed that a LSE could arise and ‘appropriate assessment’ is required.
- 3.1.12. The conservation status of a natural habitat, as defined in the Habitats Directive, means the “sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species within the territory referred to in Article 2”. The conservation objectives for a SAC or

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SPA are considered when identifying LSE. The conservation status of a natural habitat is taken as 'favourable' when:

- its natural range and area it covers within that range are stable or increasing;
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and,
- the conservation status of its typical species is favourable.

3.1.13. The HRA process typically follows a four-staged approach, as detailed in Advice Note 10 (Ref. 3.2):

- **Screening:** The process of identifying potentially relevant European sites, and whether the proposed project is likely to have a significant effect on the qualifying interest features of the European site, either alone or in-combination with other plans and projects. If it is concluded at this stage that there is no potential for LSE, there is no requirement to carry out subsequent stages of the HRA.
- **Appropriate Assessment:** Where a LSE for a European site(s) cannot be ruled out, either alone or in-combination with other plans and projects, assessment of the potential effects of the project on the integrity of the European site(s), in view of its qualifying interest features and associated conservation objectives, is required. Where it is concluded that there would be an adverse effect on site integrity (or where such an effect cannot be discounted) an assessment of mitigation options is carried out and mitigation measures (where available) are proposed to address the effects. If, having considered mitigation, the potential for adverse effect on integrity remains, the HRA must progress to Stages 3 and 4.
- **Assessment of Alternative Solutions:** Identifying and examining alternative ways of achieving the objectives of the project to establish whether there are solutions that would avoid, or have a lesser effect, on the European site(s).
- **Imperative reasons of overriding public interest:** Where no alternative solution exists, the next stage of the process is to assess whether the project is necessary for IROPI and, if so, the identification of compensatory measures needed to maintain site integrity or the overall coherence of the designated site network.

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- 3.1.14. In respect of Stage 1 (Screening), a recent ruling (April 2018) by the Court of Justice of the European Union referred to as *People Over Wind and Sweetman v Coillte Teoranta (C-323/17)* has provided a judgement that "...it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site".
- 3.1.15. In the context of the Screening of European sites, the phrase "...measures intended to avoid or reduce the harmful effects..." is interpreted as meaning any mitigation measures that are not clearly an intrinsic part of the Sizewell C Project design. As such, no mitigation measures (out with those that form a fundamental part of the Project's design) were taken into account when undertaking the LSE screening exercise.
- 3.1.16. In respect of Stage 2 (Appropriate Assessment), the integrity of a European site is defined as *"the coherence of the site's ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or populations of species for which the site has been designated"* (Ref. 3.3). An adverse effect on integrity, therefore, is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of designation.

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4. European Site Scoping

4.1 European sites 'scoped in'

- 4.1.1. In line with Defra and Environment Agency guidance¹, the potential air quality effects on European sites within 10km of the Installation boundary need to be included in the scope of this Shadow HRA. Based on the application of this guidance, ten European sites have been identified as requiring further assessment for the combustion activity permit application. **Table 4.1** and **Figure 4.1**, show the proximity of these European sites to the Installation boundary.

Table 4.1: List of European sites and approximate distance from the Installation boundary.

No.	Site Name	Designation	Approximate distance to Installation boundary
1	Alde-Ore and Butley Estuaries	SAC	5km
2	Alde-Ore Estuary	SPA	5km
3	Alde-Ore Estuary	Ramsar site	5km
4	Minsmere to Walberswick Heaths and Marshes	SAC	Adjacent
5	Minsmere-Walberswick	SPA	Adjacent
6	Minsmere-Walberswick	Ramsar site	Adjacent
7	Orfordness-Shingle Street	SAC	8km
8	Outer Thames Estuary	SPA	<1km
9	Sandlings	SPA	1km
10	Southern North Sea	SAC	<1km

- 4.1.2. In addition to potential air quality effects, noise generated during the combustion activities is a potential source of effect on European sites. However, the 10km zone defined above based on air quality effect is sufficient to capture all European sites potentially affected by noise.

- 4.1.3. **Table 4.2** sets out the qualifying features for each of the European sites listed in **Table 4.1**.

- 4.1.4. Bird count data has been obtained from 'The Status of UK SPAs in the 2000s: The Third Network Review' (Ref. 4.1). For those species not covered within

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

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the 'Third Review', data from the 'Second Review' (Ref. 4.2) has been used instead.

Figure 4.1: Proximity of European Sites to the Installation Boundary

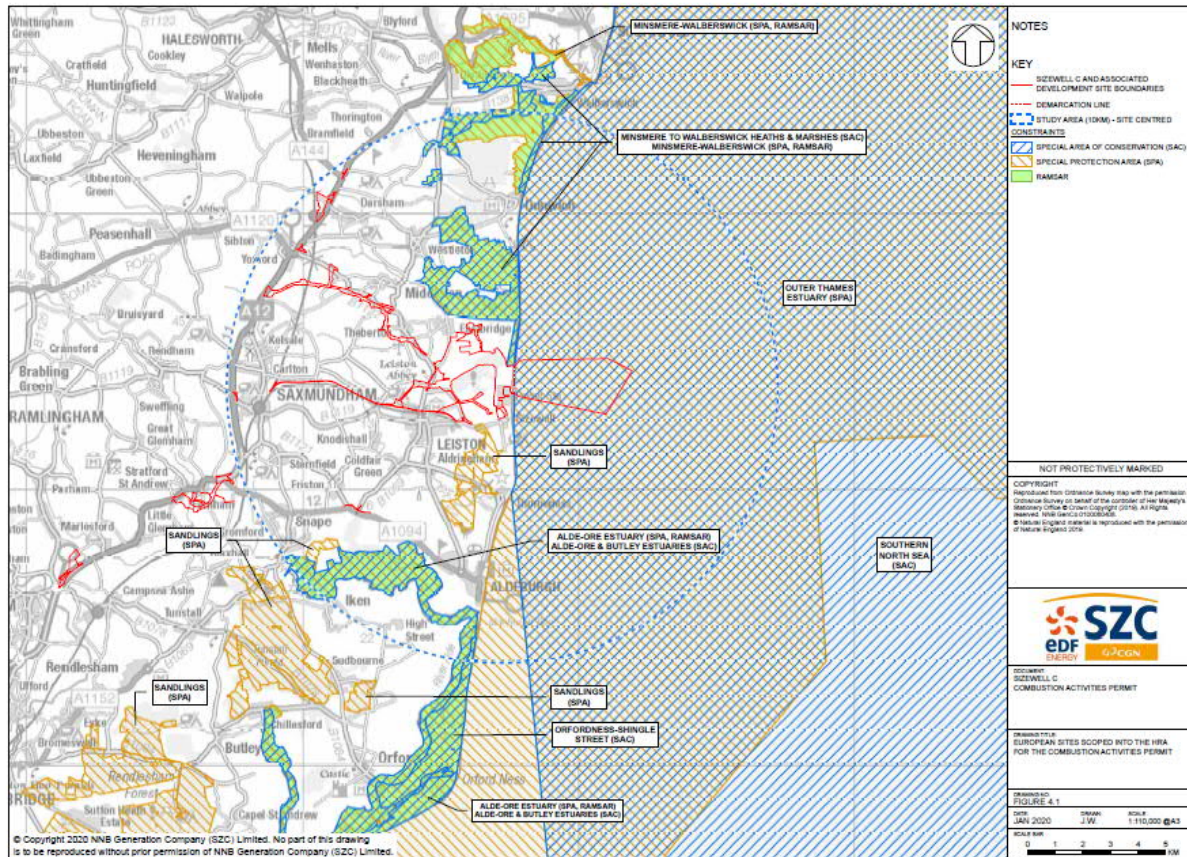


Table 4.2: List of European sites scoped into the Shadow HRA for the combustion activities permit application and their qualifying features.

No.	Site name	Description	Qualifying interest features
1	Alde-Ore and Butley Estuaries SAC	<p>The SAC covers an area of 1,633 ha and is made up of three rivers. It is the only bar-built estuary in the UK with a shingle bar. This bar has been extending rapidly along the coast since 1530, pushing the mouth of the estuary progressively south-westwards. The eastwards-running Alde River originally entered the sea at Aldeburgh, but now turns south along the inner side of the Orfordness shingle spit. It is relatively wide and shallow, with extensive intertidal mudflats on both sides of the channel in its upper reaches and saltmarsh accreting along its fringes. The Alde subsequently becomes the south-west flowing River Ore, which is narrower and deeper with stronger currents.</p> <p>The smaller Butley River has extensive areas of saltmarsh and a reed bed community that borders intertidal mudflats. It flows into the Ore shortly after the latter divides around Havergate Island. The mouth of the River Ore is still moving south as the Orfordness shingle spit continues to grow through longshore drift from the north. There is a range of littoral sediment and rock biotopes (the latter on sea defences) that are of high diversity and species richness for estuaries in eastern England. Water quality is excellent throughout. The area is relatively natural, being largely undeveloped by man and with very limited industrial activity. The estuary contains large areas of shallow water over subtidal sediments, and extensive mudflats and saltmarshes exposed at low water. Its diverse and species-rich intertidal sand and mudflat biotopes grade naturally along many lengths of the shore into vegetated or dynamic shingle habitat, saltmarsh, grassland and reed bed.</p>	<p>Annex 1 habitats that are a primary reason for selection of the site:</p> <ul style="list-style-type: none"> • Estuaries <p>Annex 1 habitats present as a qualifying feature, but not a primary reason for selection of this site:</p> <ul style="list-style-type: none"> • Mudflats and sandflats not covered by seawater at low tide • Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)

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No.	Site name	Description	Qualifying interest features
2	Alde-Ore Estuary SPA	<p>The SPA is located on the Suffolk coast between Aldeburgh to the North and Bawdsey to the South. The site includes Havergate Island and Orford Ness, as well as the estuaries of the rivers Alde, Butley and Ore.</p> <p>The SPA is composed of Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>), intertidal mudflats, shingle, coastal lagoons and estuarine fish communities. Bird usage of habitats within the SPA varies seasonally, with different areas being utilised for nesting and feeding at different times of the year.</p>	<p>This site qualifies under Article 4.1 of the Birds Directive (2009/147/EC) by supporting populations of European importance of the following species listed on Annex I of the Directive:</p> <p>During the breeding season;</p> <ul style="list-style-type: none"> • Avocet <i>Recurvirostra avosetta</i>, 64 pairs representing at least 4.3% of the breeding population in Great Britain (5 year mean, 2005-2009, UK Seabird Monitoring Programme (UK SMP)). • Little tern <i>Sternula albifrons</i>, 0 pairs representing at least 0% of the breeding population in Great Britain (Count as at 2009). • Marsh harrier <i>Circus aeruginosus</i>, 3 pairs representing at least 1.9% of the breeding population in Great Britain (5 year mean, 1993-1997). • Sandwich tern <i>Thalasseus sandvicensis</i>, 2 pairs representing at least 0.02% of the breeding population in Great Britain (Count as at 2009). <p>Over winter;</p> <ul style="list-style-type: none"> • Avocet <i>Recurvirostra avosetta</i>, 1,410 individuals representing at least 18.8% of the wintering population in Great Britain (5-year peak mean 2004/5 – 2009/10). <p>This site also qualifies under Article 4.2 of the Birds Directive (2009/147/EC) by supporting populations of European importance of the following migratory species:</p> <p>During the breeding season;</p>

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No.	Site name	Description	Qualifying interest features
			<ul style="list-style-type: none"> Lesser black-backed gull <i>Larus fuscus</i>, 6,000 pairs representing at least 5.5% of the breeding Western Europe / Mediterranean/Western Africa population (Count as at 2003) <p>Over winter;</p> <ul style="list-style-type: none"> Redshank <i>Tringa totanus</i>, 1,579 individuals representing at least 1.3% of the wintering Eastern Atlantic - wintering population (5-year peak mean 2005/6 – 2009/10). Ruff <i>Philomachus pugnax</i>. The 5-year peak mean (2009/10-2013/14) figure was 6 individuals (British Trust for Ornithology (Ref. 4.3). <p>Furthermore, the area qualifies under Article 4.2 of the Birds Directive (2009/147/EC) via;</p> <p>Sea bird assemblage of international importance – regularly supporting at least 20,000 seabirds. During the breeding season, the area regularly supports 59,118 individual seabirds (Count period ongoing) including: herring gull <i>Larus argentatus</i>, black-headed gull <i>Larus ridibundus</i>, lesser black-backed gull <i>Larus fuscus</i>, little tern <i>Sternula albifrons</i> and Sandwich tern <i>Thalasseus sandvicensis</i>.</p> <p>Wetland of international importance – regularly supporting at least 20,000 waterfowl. Over winter, the area regularly supports 24,962 individual waterfowl (5-year peak mean 1991/2 - 1995/6) including: black-tailed godwit <i>Limosa limosa islandica</i>, dunlin <i>Calidris alpina alpina</i>, lapwing <i>Vanellus vanellus</i>, shoveler <i>Anas clypeata</i>, teal <i>Anas crecca</i>, wigeon <i>Anas penelope</i>, shelduck <i>Tadorna tadorna</i>, white-fronted goose <i>Anser albifrons albifrons</i>, redshank <i>Tringa totanus</i> and avocet <i>Recurvirostra avosetta</i>.</p>

No.	Site name	Description	Qualifying interest features
3	Alde-Ore Estuary Ramsar site	The site comprises the estuary complex of the rivers Alde, Butley and Ore, including Havergate Island and Orfordness. There are a variety of habitats including, intertidal mudflats, saltmarsh, vegetated shingle (including the second-largest and best-preserved area in Britain at Orfordness), saline lagoons and grazing marsh. The Orfordness/Shingle Street landform is unique within Britain in combining a shingle spit with a cusped foreland. The site supports nationally-scarce plants, British Red Data Book invertebrates, and notable assemblages of breeding and wintering wetland birds.	<p>The site qualifies as a Ramsar for the following reasons:</p> <ul style="list-style-type: none"> Ramsar criterion 2 - the site supports a number of nationally-scarce plant species and British Red Data Book invertebrates. Ramsar criterion 3 - the site supports a notable assemblage of breeding and wintering wetland birds. Ramsar criterion 6 - species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation): <p>Species regularly supported during the breeding season:</p> <ul style="list-style-type: none"> Lesser black-backed gull, <i>Larus fuscus graellsii</i>: W Europe/Mediterranean/W Africa 5790 apparently occupied nests, representing an average of 3.9% of the breeding population (Seabird 2000 Census). <p>Species with peak counts in winter:</p> <ul style="list-style-type: none"> Avocet, <i>Recurvirostra avosetta</i>, Europe/Northwest Africa 1187 individuals, representing an average of 1.6% of the population (5 year peak mean 1998/9-2002/3). Common redshank, <i>Tringa totanus totanus</i>, 2368 individuals, representing an average of 2% of the GB population (5 year peak mean 1998/9-2002/3).
4	Minsmere to Walberswick Heaths and Marshes SAC	This site is one of two representatives of annual vegetation of drift lines on the east coast of England. It occurs on a well-developed beach strandline of mixed sand and shingle and is the best and most extensive example of this restricted geographical type. Species include those	<p>The site is designated as a SAC for the following features:</p> <p>Annex 1 habitats that are a primary reason for selection of this site:</p> <ul style="list-style-type: none"> Annual vegetation of drift lines European dry heaths

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No.	Site name	Description	Qualifying interest features
		<p>typical of sandy shores, such as sea sandwort <i>Honckenya peploides</i> and shingle plants such as sea beet <i>Beta vulgaris</i> ssp. <i>maritima</i>.</p> <p>Lowland European dry heaths occupy an extensive area of the site, which is at the extreme easterly range of heath development in the UK. The heathland is predominantly NVC type H8 <i>Calluna vulgaris</i> – <i>Ulex gallii</i> heath, usually more characteristic of western parts of the UK. This type is dominated by heather <i>Calluna vulgaris</i>, western gorse <i>Ulex gallii</i> and bell heather <i>Erica cinerea</i>.</p>	<p>Annex 1 habitats present as a qualifying feature, but not a primary reason for selection of this site:</p> <ul style="list-style-type: none"> Perennial vegetation of stony banks
5	Minsmere to Walberswick SPA	<p>The site comprises two large marshes, the tidal Blyth estuary and associated habitats. This composite coastal site contains a complex mosaic of habitats, notably areas of marsh with dykes, extensive reedbeds, mud-flats, lagoons, shingle, woodland and areas of lowland heath. It supports the largest continuous stand of common reed <i>Phragmites australis</i> in England and Wales and demonstrates the nationally rare transition in grazing marsh ditch plants from brackish to fresh water. There are nationally important numbers of breeding and wintering birds. In particular, the reedbeds are of major importance for breeding bittern <i>Botaurus stellaris</i> and marsh harrier <i>Circus aeruginosus</i>. A range of breeding waders (e.g. avocets <i>Recurvirostra avosetta</i>) and heathland birds occur in other areas of the SPA. The shingle beaches support important numbers of breeding little tern <i>Sternula albifrons</i>, which feed substantially outside the SPA in adjacent marine waters. The site is also important for wintering bitterns and raptors.</p>	<p>The site qualifies under Article 4.1 of the Birds Directive (2009/147/EC) by supporting populations of European importance of the following species listed on Annex 1 of the Directive:</p> <p>During the breeding season;</p> <ul style="list-style-type: none"> Avocet <i>Recurvirostra avosetta</i>, 126 pairs representing at least 8.4% of the breeding population in Great Britain (Rare Breeding Birds Panel (RBBP)) 5 year mean, 2005-2009) Bittern <i>Botaurus stellaris</i>, 7 individuals representing at least 35.0% of the breeding population in Great Britain (5 year mean, 1993-1997) Little tern <i>Sternula albifrons</i>, 30 pairs representing at least 1.6% of the breeding population in Great Britain (Count as at 2010) Marsh harrier <i>Circus aeruginosus</i>, 16 pairs representing at least 10.0% of the breeding population in Great Britain (5 year mean, 1993-1997) Nightjar <i>Caprimulgus europaeus</i>, 39 pairs representing at least 0.8% of the breeding population in Great Britain (Count as at 2004)

No.	Site name	Description	Qualifying interest features
			<ul style="list-style-type: none"> Woodlark <i>Lullula arborea</i>, 30 pairs representing at least 1.0% of the breeding population in Great Britain (Count as at 2006) <p>Over winter;</p> <ul style="list-style-type: none"> Avocet <i>Recurvirostra avosetta</i>, 542 individuals representing at peak mean 2004/5 – 2009/10) Bittern <i>Botaurus stellaris</i>, 14 individuals representing at least 14.0% of the wintering population in Great Britain (Count as at 1998) Hen harrier <i>Circus cyaneus</i>, 15 individuals representing at least 2.0% of the wintering population in Great Britain (5 year peak mean, 1985/6-1989/90) <p>This site also qualifies under Article 4.2 of the Birds Directive (2009/147/EC) by supporting populations of European importance of the following migratory species:</p> <p>During the breeding season;</p> <ul style="list-style-type: none"> Shoveler <i>Anas clypeata</i>, 23 pairs representing 2.3% of the breeding population in Great Britain (count as at 1990) Teal <i>Anas crecca</i>, 73 pairs representing 4.9% of the breeding population in Great Britain (count as at 1990). Gadwall <i>Anas strepera</i>, 24 pairs representing 4% of the breeding population in Great Britain (count as at 1990). <p>Over winter;</p> <ul style="list-style-type: none"> Gadwall <i>Anas strepera</i>, 93 individuals representing at least 1.1% of the population in Great Britain (5-year peak mean 1991/92-1995/96)

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No.	Site name	Description	Qualifying interest features
			<ul style="list-style-type: none"> Shoveler <i>Anas clypeata</i>, 98 individuals representing 1% of the population in Great Britain (5-year peak mean 1991/92-1995/96) White fronted goose <i>Anser albifrons albifrons</i>, 67 individuals representing 1.1% of the population in Great Britain (5-year peak mean 1991/92-1995/96)
6	Minsmere to Walberswick Ramsar site	<p>This Suffolk coastal site contains a complex mosaic of habitats, notably, areas of marsh with dykes, extensive reedbeds, mudflats, lagoons, shingle and driftline, woodland and areas of lowland heath. The site supports the largest continuous stand of reed in England and Wales and demonstrates the nationally rare transition in grazing marsh ditch plants from brackish to fresh water.</p> <p>The combination of habitats creates an exceptional area of scientific interest supporting nationally scarce plants, British Red Data Book invertebrates and nationally important numbers of breeding and wintering birds.</p>	<p>The site qualifies as a Ramsar under the following criteria:</p> <ul style="list-style-type: none"> Ramsar criterion 1 - the site contains a mosaic of marine, freshwater, marshland and associated habitats complete with transition areas in between. It also contains the largest continuous stand of reedbed in England and Wales, and rare transition in grazing marsh ditch plants from brackish to fresh water. Ramsar criterion 2 - this site supports nine nationally scarce plants and at least 26 red data book invertebrates. It supports a population of the mollusc narrow-mouthed whorl snail <i>Vertigo angustior</i> (Habitats Directive Annex II; British Red Data Book Endangered), recently discovered on the Blyth estuary river walls. <p>An important assemblage of rare breeding birds associated with marshland and reedbeds including: bittern <i>Botaurus stellaris</i>, gadwall <i>Anas strepera</i>, teal <i>Anas crecca</i>, shoveler <i>Anas clypeata</i>, marsh harrier <i>Circus aeruginosus</i>, avocet <i>Recurvirostra avosetta</i> and bearded tit <i>Panurus biarmicus</i>.</p>
7	Orfordness-Shingle Street SAC	<p>Orfordness is an extensive shingle structure and consists of a foreland, a 15 km-long spit and a series of recurves running from north to south on the Suffolk coast. This spit has been selected as it supports some of the largest and most natural sequences in the UK of shingle vegetation affected by salt spray. The southern end of the spit has a particularly</p>	<p>The site is designated as an SAC for the following features:</p> <p>Annex 1 habitats which are a primary reason for site selection:</p> <ul style="list-style-type: none"> Coastal Lagoons

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No.	Site name	Description	Qualifying interest features
		<p>fine series of undisturbed ridges, with zonation of communities determined by the ridge pattern. Pioneer communities with sea pea <i>Lathyrus japonicus</i> and false oat-grass <i>Arrhenatherum elatius</i> grassland occur. Locally these are nutrient-enriched by the presence of a gull colony, elsewhere they support rich lichen communities.</p> <p>Orfordness is one of two sites representing annual vegetation of drift lines on the east coast of England. In contrast to Minsmere to Walberswick Heaths and Marshes, drift-line vegetation occurs on the sheltered, western side of the spit, at the transition from shingle to saltmarsh, as well as on the exposed eastern coast. The driftline community is widespread on the site and comprises sea beet <i>Beta vulgaris</i> ssp. <i>maritima</i> and orache <i>Atriplex</i> spp. in a strip 2-5 m wide.</p> <p>A series of percolation lagoons have developed in the shingle bank adjacent to the shore at the mouth of the Ore estuary. The salinity of the lagoons is maintained by percolation through the shingle, although at high tides sea water can overtop the shingle bank. The fauna of these lagoons includes typical lagoon species, such as the cockle <i>Cerastoderma glaucum</i>, the ostracod <i>Cyprideis torosa</i> and the gastropods <i>Littorina saxatilis tenebrosa</i> and <i>Hydrobia ventrosa</i>. The nationally rare starlet sea anemone <i>Nematostella vectensis</i> is also found at the site.</p>	<ul style="list-style-type: none"> Annual vegetation of drift lines Perennial vegetation of stony banks
8	Outer Thames Estuary SPA	<p>The Outer Thames Estuary SPA consists of areas of shallow and deeper water, high tidal current streams and a range of mobile sediments. Large areas of mud, silt and gravelly sediments form the deeper water channels, the main ones of which form the approach route to the ports of London and as such are continually disturbed by shipping and maintenance dredging. Sand in the form of sandbanks separated by troughs predominates in the remaining areas and the crests of some of the banks are exposed at mean low water. In the northern part of the</p>	<p>The site qualifies under Article 4.1 of the Birds Directive (2009/147/EC) as it is used regularly by 1% or more of the Great Britain population of the following species listed in Annex I in any season:</p> <p>During the breeding season;</p> <ul style="list-style-type: none"> Little tern <i>Sternula albifrons</i>, representing 19.64% of the Great Britain population (2011 – 2015)

COMBUSTION ACTIVITY PERMIT APPLICATION SHADOW HRA REPORT NOT PROTECTIVELY MARKED

No.	Site name	Description	Qualifying interest features
		<p>site the main sandbanks are (north to south) Middle Cross Sand, Scroby Sands, Helm Sand, Newcombe Sand, Aldeburgh Napes, Aldeburgh Ridge, North Ship Head and Bawdsey Bank. In the southern part of the site the main sandbanks are Red Sand, Kentish Flats, West and East Barrow, Sunk Sand, Shingles, Long Sand, Margate Sand and Kentish Knock.</p> <p>The seabed along the coast of Norfolk and Suffolk coast is of a similar composition to that in the main estuary with large shallow areas of mud, sand, silt and gravelly sediments but, in the absence of main port areas within this area, there is less disturbance through shipping or dredging. The main sandbanks in this area are (from north to south) Dunwich Bank, Sizewell Bank, Aldeburgh Napes, Aldeburgh Ridge and Whiting Ridge.</p> <p>The seabed and waters of the site provide an important habitat in the non-breeding season for red-throated divers <i>Gavia stellata</i> which visit the area to feed on the fish populations.</p>	<ul style="list-style-type: none"> Common tern <i>Sterna hirundo</i> representing 2.66% of the Great Britain population (2011 – 2015) <p>Over winter;</p> <ul style="list-style-type: none"> Red-throated diver <i>Gavia stellata</i>, 6,466 individuals representing 38% of the Great Britain population (1989 – 2006/07)
9	Sandlings SPA	<p>The Sandlings SPA lies between the Deben Estuary and Leiston. In the 19th century, the area was dominated by heathland developed on glacial sandy soils. During the 20th century, large areas of heath were planted with blocks of commercial conifer forest and others were converted to arable agriculture. Lack of traditional management has resulted in the remnant areas of heath which have survived successional changes and the consequent spread of bracken <i>Pteridium aquilinum</i>, shrubs and trees. The recent conservation management work, however, is resulting in their restoration. The heaths support both acid grassland and heather-dominated plant communities with dependent invertebrate and bird communities of conservation value. Woodlark <i>Lullula arborea</i> and nightjar <i>Caprimulgus europaeus</i> have also adapted to breeding in the large blocks of conifer forest, using</p>	<p>The site qualifies under Article 4.1 of the Birds Directive (2009/147/EC) by supporting populations of European importance of the following species listed on Annex I of the Directive:</p> <p>During the breeding season;</p> <ul style="list-style-type: none"> Nightjar <i>Caprimulgus europaeus</i>, 81 pairs representing at least 1.8% of the breeding population in Great Britain (Count as at 2004) Woodlark <i>Lullula arborea</i>, 73 pairs representing at least 2.3% of the breeding population in Great Britain (Count as at 2006)

No.	Site name	Description	Qualifying interest features
		areas that have recently been felled and recent plantation, as well as areas managed as open ground.	
10	Southern North Sea SAC	<p>The Southern North Sea SAC lies along the east coast of England, predominantly in the offshore waters of the central and southern North Sea, from north of Dogger Bank to the Straits of Dover in the south. It covers an area of 3,695,054 ha, designated for the protection of harbour porpoise <i>Phocoena phocoena</i>. This area supports an estimated 17.5% of the UK North Sea Management Unit (MU) population. Approximately two thirds of the site, the northern part, is recognised as important for porpoises during the summer season, whilst the southern part support persistently higher densities during the winter.</p> <p>The SAC ranges in depth from Mean Low Water down to 75 m, with the majority of the site shallower than 40 m, and is characterised by its sandy, coarse sediments which cover much of the site. These physical characteristics are thought to be preferred by harbour porpoise, likely due to availability of prey.</p>	<p>The qualifying feature of the site is the Annex II species:</p> <ul style="list-style-type: none"> harbour porpoise <i>Phocoena phocoena</i>

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5. Stage 1 Likely Significant Effect Screening

5.1 Air quality

a) Environmental standards and site-specific Critical Loads

- 5.1.1. The LSE screening exercise for the combustion activity permit application requires assessment of the installation's process contribution (PC) (the modelled concentration of substances from the emission sources included in the assessment) in the context of the environmental standards for European sites (as set out in Defra and Environment Agency guidance referred to in **Section 4.1**).
- 5.1.2. To screen out a PC for any substance (i.e. to confirm that no further assessment is needed), the PC must meet both of the following criteria:
- the short-term (daily) process contribution is less than 10% of the short-term environmental standard; and,
 - the long-term (annual) process contribution is less than 1% of the long-term environmental standard.
- 5.1.3. If the above requirements are not met, the predicted environmental concentration (the process contribution plus the background concentration of the substance already present in the environment) needs to be compared to the environmental standard.
- 5.1.4. The predicted environmental concentration does not need to be calculated for short-term targets; but if the short-term process contribution exceeds the screening criteria, further detailed assessment is required.
- 5.1.5. If the long-term process contribution is greater than 1% but the predicted environmental concentration is less than 70% of the long-term environmental standard, the emissions are considered to be insignificant and do not need to be assessed further. If the predicted environmental concentration is greater than 70% of the long-term environmental standard, further assessment is required.
- 5.1.6. The environmental standards presented in **Table 5.1**, which are reproduced from the Defra and Environment Agency guidance, have been applied in this screening assessment.

Table 5.1: Environmental standards used in the screening process for European sites.

Substance	Target (mean)	Emission period
Sulphur dioxide	10µg/m ³ where lichens or bryophytes are present (Critical Level)	Annual
	20µg/m ³ where lichens or bryophytes are not present (Critical Level)	Annual
Nitrogen oxide (expressed as nitrogen dioxide)	30µg/m ³ (Critical Level)	Annual
	75µg/m ³ (Critical Level)	Daily
Nutrient nitrogen deposition	Depends on which European site is being considered and, therefore, the relevant qualifying features (see Table 5.2) (Critical Load)	Annual
Acid deposition	Depends on which European site is being considered and, therefore, the relevant qualifying features (see Table 5.2) (Critical Load)	Annual

5.1.7. For nutrient nitrogen deposition and acidity deposition, the Air Pollution Information System (APIS) defines site-specific Critical Loads relevant to each European site. These are presented in **Table 5.2** and **Table 5.3** for the sites scoped into this assessment. For SPAs, only those qualifying bird features that are identified by APIS as being sensitive due to nutrient nitrogen or acid deposition impacts on their habitats, and where the habitat is present within the European site, are included in **Table 5.2** and **Table 5.3**.

Table 5.2: Critical Loads for nutrient nitrogen deposition.

Site Name	Qualifying features	Relevant Nitrogen Critical Load Class (defined in APIS)	Critical Load (kg N/ha/yr) ^b
Alde-Ore and Butley Estuaries SAC; Alde-Ore Estuary Ramsar site	Estuaries	Pioneer, low-mid, mid-upper saltmarshes	20 - 30
	Mudflats/sand flats not covered by sea at low tide	No Critical Load for nutrient nitrogen	
	Atlantic salt meadow	Pioneer, low-mid, mid-upper saltmarshes	20 - 30
Alde-Ore Estuary SPA	Marsh harrier <i>Circus aeruginosus</i>	Rich Fens - fen, marsh and swamp	15 - 30

Site Name	Qualifying features	Relevant Nitrogen Critical Load Class (defined in APIS)	Critical Load (kg N/ha/yr) ^b
	<i>Avocet Recurvirostra avosetta</i>	Pioneer, low-mid, mid-upper saltmarshes	20 – 30
Minsmere to Walberswick Heaths and Marshes SAC; Minsmere-Walberswick Ramsar site	Annual vegetation of drift lines	Not sensitive to nitrogen	
	Perennial vegetation of stony banks	Coastal stable dune grasslands	8 - 15
	European dry heaths	Dry heath	10 - 20
	Coastal floodplain grazing marsh	Fen, marsh and swamp (rush pasture - moist & wet oligotrophic grassland)	15 - 25
	Reedbed	Rich Fens - fen, marsh and swamp (swamp, fen meadow & reedbeds)	15 - 30
Minsmere-Walberswick SPA	Nightjar <i>Caprimulgus europaeus</i>	Dry heath	10 - 20
	Little tern <i>Sternula albifrons</i>	Coastal stable dunes	8 - 15
	Bittern <i>Botaurus stellaris</i>	Rich Fens - fen, marsh and swamp (swamp, fen meadow & reedbeds)	15 - 30
	Marsh harrier <i>Circus aeruginosus</i>	Rich Fens - fen, marsh and swamp (swamp, fen meadow & reedbeds)	15 - 30
	<i>Avocet Recurvirostra avosetta</i>	Pioneer, low-mid, mid-upper saltmarshes	20 – 30
Orfordness-Shingle Street SAC	Perennial vegetation of stony banks	Coastal stable dune grasslands	8 - 15
	Annual vegetation of drift lines	Not sensitive to nitrogen	
	Coastal lagoons	Pioneer, low-mid, mid-upper saltmarshes	20 - 30
Outer Thames Estuary SPA	Red-throated diver <i>Gavia stellata</i>	Species' broad habitat (i.e. inshore sublittoral sediment) not sensitive to eutrophication	N/A

Site Name	Qualifying features	Relevant Nitrogen Critical Load Class (defined in APIS)	Critical Load (kg N/ha/yr) ^b
	Little tern <i>Sterna albifrons</i> ; common tern <i>Sterna hirundo</i>	The SPA protects the marine foraging areas for these species and, therefore, is not considered sensitive to nitrogen deposition	
Sandlings SPA	Nightjar <i>Caprimulgus europaeus</i> ; woodlark <i>Lullula arborea</i>	Coniferous Woodland	This woodland has been felled and, therefore, this habitat feature has not been assessed
		Dry Heath	10 - 20
Southern North Sea SAC	Harbour porpoise <i>Phocoena phocoena</i> ^a	Species' broad habitat not sensitive to eutrophication	N/A

a The Southern North Sea SAC is not currently included in APIS; this information is therefore taken from the Skerries and Causeway SAC which also includes Harbour porpoise *Phocoena phocoena* as a qualifying feature.

b The most stringent (i.e. lower) Critical Load from the range provided has been used in the assessment.

Table 5.3: Critical Loads for acid deposition.

Site Name	Qualifying features	Acidity class	MinCLMinN	MinCLMaxN	MinCLMaxS
Alde-Ore and Butley Estuaries SAC; Alde-Ore Estuary Ramsar site	None of the qualifying features of the SAC and Ramsar are deemed to be sensitive to acidity impacts.				
Alde-Ore Estuary SPA	None of the qualifying features of the SPA are deemed to be sensitive to acidity impacts on their broad habitat.				
Minsmere to Walberswick Heaths and Marshes SAC; Minsmere-Walberswick Ramsar site	Annual vegetation of drift lines	Not sensitive to acidification			
	Perennial vegetation of stony banks	Acid Grassland	0.223	0.568	0.215
	European dry heaths	Dwarf Shrub Heath	0.714	1.237	0.215
	Coastal floodplain grazing marsh	Acid Grassland	0.223	0.568	0.215
	Reedbed	Swamp, fen, reedbed	0.223	0.568	0.215

Site Name	Qualifying features	Acidity class	MinCLMinN	MinCLMaxN	MinCLMaxS
Minsmere-Walberswick SPA	None of the qualifying features of the SPA are deemed to be sensitive to acidity impacts on their broad habitat.				
Orfordness-Shingle Street SAC	Perennial vegetation of stony banks	Acid Grassland	0.223	4.353	4.120
	Annual vegetation of drift lines	Not sensitive to acidification			
	Coastal lagoons	Occurs >10km from the Installation			
Outer Thames Estuary SPA	None of the qualifying features of the SPA are deemed to be sensitive to acidity impacts on their broad habitat.				
Sandlings SPA	Nightjar <i>Caprimulgus europaeus</i> ; woodlark <i>Lullula arborea</i>	Dwarf Shrub Heath	0.714	1.372	0.480
		Coniferous Woodland	Neither of the two qualifying features of the SPA are deemed to be sensitive to acidity impacts on their broad habitat. Furthermore, this woodland has been felled.		
Southern North Sea SAC		The qualifying feature of the SAC is not deemed to be sensitive to acidity impacts.			

5.2 Noise

5.2.1. Unlike air quality, there are no definitive guidelines or thresholds for the assessment of the potential effects of noise generated by the combustion activities on ecological receptors.

5.2.2. Studies have been undertaken on the effects of construction noise on waterbirds; work by the Institute for Estuarine and Coastal Studies (IECS) has provided some data on the noise levels at which a behavioural response reaction from birds is elicited (Ref. 5.1; Ref. 5.2). This work categorises disturbance responses based on potential sources, with the following attributed to noise levels:

- Irregular piling noise (above 70dB): High to Moderate
- Regular piling noise (above 70dB): Moderate
- Irregular noise (50dB - 70dB): Moderate

- Regular noise (50dB - 70dB): Moderate to Low
- Noise below 50dB: Low

5.2.3. 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 responses to various noise levels reported by Mander and Cutts 2004 and IECS 2008. 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).

5.3 Screening for Likely Significant Effect

a) Air quality

5.3.1. The results of the detailed air quality modelling are presented in **Appendix 1**.

5.3.2. **Table 5.4** summarises the conclusions of the LSE screening exercise based on the modelling results and the assessment of those results against the relevant environmental standards for NO_x and SO₂ Critical Levels and site-specific nutrient nitrogen and acid deposition Critical Loads.

5.3.3. Note that this is an alone assessment only. That is, it does not consider the process contributions or the predicted environmental concentrations of the installation in conjunction with contributions from other plans and projects that may occur in the Installation's zone of influence. This is addressed in **Section 7**.

Table 5.4: LSE screening conclusions (conclusions apply to commissioning and routine testing scenarios unless otherwise stated)

Site Name	Designation	Critical Level			Critical Load	
		NO _x (long-term)	NO _x (short-term) (routine testing only)	SO ₂ (long-term)	Nutrient nitrogen deposition	Acid deposition
Alde-Ore and Butley Estuaries	SAC	✗	✗	✗	✗	✗
Alde-Ore Estuary	SPA	✗	✗	✗	✗	✗
Alde-Ore Estuary	Ramsar site	✗	✗	✗	✗	✗
Minsmere to Walberswick Heaths and Marshes	SAC	✓ ^a	✓	✗	✓	✓
Minsmere-Walberswick	SPA	✓ ^a	✓	✗	✓	✓
Minsmere-Walberswick	Ramsar site	✓ ^a	✓	✗	✓	✓
Orfordness-Shingle Street	SAC	✗	✗	✗	✗	✗
Outer Thames Estuary	SPA	✗	✗	✗	✗	✗
Sandlings	SPA	✗	✓	✗	✗	✗
Southern North Sea	SAC	✗	✗	✗	✗	✗

✓ LSE cannot be excluded

✗ LSE can be excluded

b) Noise

5.3.4. **Table 5-5** summarises the conclusions of the LSE screening exercise based on the predictions of the noise modelling of the combustion activities (LOOP Event) at each European site scoped into the Shadow HRA. Ambient (background) noise levels are presented for comparison.

Table 5.5: LSE screening conclusions (conclusions apply to LOOP Event, which is the worst-case scenario for the CA)

Site Name	Designation	Predicted sound level (L _{Aeq,T})	Ambient sound level (L _{Aeq,T})	Potential for LSE
Alde-Ore and Butley Estuaries	SAC	The predicted sound level at this European site would be below existing background sound levels (day or night), and would not be detectable or measureable. This European site is also designated for habitat features (i.e. no pathway for effect due to noise).		✗
Alde-Ore Estuary	SPA	The predicted sound level at this European site would be below existing background sound levels (day or night), and would not be detectable or measureable		✗
Alde-Ore Estuary	Ramsar site	The predicted sound level at this European site would be below existing background sound levels (day or night), and would not be detectable or measureable		✗
Minsmere to Walberswick Heaths and Marshes	SAC	45 dB	48 dB and 43 dB (for day and night respectively)	✗
Minsmere-Walberswick	SPA	45 dB	48 dB and 43 dB (for day and night respectively)	✗
Minsmere-Walberswick	Ramsar site	45 dB	48 dB and 43 dB (for day and night respectively)	✗
Orfordness-Shingle Street	SAC	The predicted sound level at this European site would be below existing background sound levels (day or night), and would not be detectable or measureable. This European site is also designated for habitat features (i.e. no pathway for effect due to noise).		✗
Outer Thames Estuary ¹	SPA	45 dB	48 dB and 43 dB (for day and night respectively)	✗
Sandlings	SPA	The predicted sound level at this European site would be below existing background sound levels (day or		✗

Site Name	Designation	Predicted sound level (L _{Aeq,T})	Ambient sound level (L _{Aeq,T})	Potential for LSE
		night), and would not be detectable or measureable		
Southern North Sea ¹	SAC	45 dB	48 dB and 43 dB (for day and night respectively)	✗

✓ LSE cannot be excluded

✗ LSE can be excluded

¹ The predictions for the Minsmere-Walberswick SPA have been assumed for these European sites

c) Summary

5.3.5. In summary, LSE can be excluded in all cases for the following European sites:

- Alde-Ore and Butley Estuaries SAC.
- Alde-Ore Estuary SPA.
- Alde-Ore Estuary Ramsar site.
- Orfordness-Shingle Street SAC.
- Outer Thames Estuary SPA.
- Southern North Sea SAC.

5.3.6. LSE cannot be excluded for the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar site and, therefore, these sites are carried through to Stage 2 Appropriate Assessment for the following reasons:

- The annual average (long-term) process contribution for NO_x during commissioning is predicted to be 13.5 µg/m³, or 45% of the Critical Level, and the PEC is predicted to be 71% of the Critical Level.
- The daily average (short-term) process contribution for NO_x during routine testing is predicted to be 303.6 µg/m³, or 405% of the Critical Level, and the predicted environmental concentrations is predicted to be 420% of the Critical Level.
- Coastal dune habitat, dry heath and fen/swamp are predicted to experience increases in nitrogen and acid deposition of more than 1% of the Critical Load and the PEC is predicted to exceed 70% of the Critical Load.

- 5.3.7. The Sandlings SPA is also carried through to Stage 2 Appropriate Assessment because the daily (short-term) average process contribution for NO_x during routine testing is predicted to be 25.4 µg/m³, or 34% of the Critical Level (i.e. the process contribution exceeds 10% of the Critical Level).
- 5.3.8. In summary, LSE cannot be excluded for the following European sites:
- Minsmere to Walberswick Heaths and Marshes SAC.
 - Minsmere-Walberswick SPA.
 - Minsmere-Walberswick Ramsar site.
 - Sandlings SPA.
- 5.3.9. LSE can be excluded for potential noise effects in all cases due to the minimal predicted change relative to ambient noise levels at the European sites and, in the case of SACs, the fact that there is no pathway for effect. When compared with the noise disturbance thresholds presented by Mander and Cutts 2004 and IECS 2008, the predicted noise levels from the combustion activities are well below the level where disturbance effects may be expected.

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6. Stage 2 Appropriate Assessment

6.1 Approach

6.1.1. The results of the detailed air quality modelling presented in **Appendix 1** underpin the Stage 2 Appropriate Assessment. For each European site that has been carried through to this stage, its conservation objectives are presented and the predicted effects of the CA, based on the detailed modelling, are presented.

6.1.2. The Stage 2 Appropriate Assessment is based on the:

- modelled increase in NO_x (long- and short-term), SO₂, nutrient nitrogen and acid deposition;
- sensitivity of each habitat type to the predicted effects of the combustion activities (taking into account Critical Levels for vegetation and Critical Loads); and,
- duration and frequency of the various assessed scenarios.

6.1.3. The following criteria are potential mechanisms through which the combustion activities may affect the qualifying features of the relevant European sites:

- Causing reduction in the area of qualifying habitat or of the European site.
- Causing indirect change to the physical quality of the qualifying habitat within the European site.
- Causing ongoing disturbance to qualifying features of the European site.
- Altering community structure (species composition).
- Altering the vulnerability of populations to other impacts.
- Affecting restoration of a feature where this is a conservation objective.

6.2 Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar site

a) Conservation Objectives

6.2.1. The following conservation objectives apply to the Minsmere to Walberswick Heaths and Marshes SAC:

- Subject to natural change, 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 of qualifying species;
 - the structure and function (including typical species) of qualifying natural habitats;
 - the structure and function of the habitats of qualifying species;
 - the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
 - the populations of qualifying species; and,
 - the distribution of qualifying species within the site.

6.2.2. The following conservation objectives apply to the Minsmere-Walberswick SPA (and, for the purposes of this assessment, have also been applied to the Ramsar site):

- Subject to natural change, 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;
 - the structure and function of the habitats of the qualifying features;
 - the supporting processes on which the habitats of the qualifying features rely;
 - the population of each of the qualifying features (individual species and/or assemblage of species); and,
 - the distribution of the qualifying features within the site.

b) **NO_x Critical Levels**

- 6.2.3. As summarised in Section 5.2, for NO_x during commissioning, the annual average process contribution is predicted to be 45% and the PEC is predicted to be 71% of the Critical Level (i.e. the Critical Level is not exceeded) at the SAC, SPA and Ramsar site. Given that Critical Levels are defined as concentrations of pollutants (at 100%) above which direct adverse effects may occur (Defra, 2007), it is not considered that these concentrations of NO_x would have an adverse effect on these European sites, as an exceedance is not predicted.
- 6.2.4. There are no commissioning scenarios which could lead to emissions from the diesel generators occurring over a 24-hour period and, therefore, potential effects in the context of the daily NO_x Critical Level are only relevant for routine testing operations.
- 6.2.5. Daily NO_x during routine testing (i.e. the only scenario relevant for daily NO_x) is predicted to exceed the Critical Level (where the process contribution for daily NO_x is predicted to be 405% and the PEC is predicted to be 420% of the Critical Level). However, the modelling scenario for daily NO_x assumes that one diesel generator is operational throughout the year. In reality, routine testing operations would only occur for 60 hours over the year (720 hours of operation on an annual basis for all generators combined). As there are 8,760 hours in a common year, generators would only operate for 8.2% of a full common year. The modelling results for this scenario, therefore, significantly over-estimate the predicted exceedance of the daily NO_x Critical Level, which would only occur for short periods. Furthermore, the modelling results predict that the zone of influence of any exceedance of daily NO_x would be confined to a relatively small area encompassing the southern end of the SAC, SPA and Ramsar site (see **Appendix C (Air Quality Modelling Report) of the combustion activity permit application**).
- 6.2.6. The daily mean for NO_x is of less importance than the annual mean, as vegetation exposed to levels of NO_x above the Critical Level are more likely to recover from a short duration exposure. A report from the Centre for Ecology and Hydrology (Ref. 6.1) states that:
- “The United Nations and Economic Committee for Europe (UN/ECE) Working Group on Effects strongly recommended the use of the annual mean value, as the long-term effects of NO_x are thought to be more significant than the short-term effects”.*
- 6.2.7. Given the highly conservative nature of the modelling scenario, the relatively small zone of influence of exceedance of the daily NO_x Critical Level and the

fact that longer term NO_x concentrations have greater potential to affect vegetation than short-term exceedances, it is concluded that there would not be an adverse effect on the integrity of the Minsmere to Walberswick Heaths and Marshes SAC or the SPA and Ramsar site due to daily NO_x exceedance of the Critical Level during routine testing.

c) Nitrogen and acid deposition Critical Loads

6.2.8. The SAC, SPA and Ramsar site are also predicted to experience increases in nitrogen and acid deposition of more than 1% of the Critical Load and the predicted environmental concentration is predicted to exceed 70% of the Critical Load due to the Installation (refer to detailed results in **Appendix 1**). However, it should be noted that the background levels of nutrient and acid deposition already exceed the Critical Load.

6.2.9. The predicted PCs associated with commissioning, routine testing and a LOOP Event would be short-term and temporary (especially during commissioning operations) and, given the background rates of high chronic deposition (see **Tables A1.4** and **A1.5** in **Appendix 1**), the process contributions are unlikely to result in significant changes in species composition or habitat condition. Consequently, it is very unlikely that the increases predicted would lead to significant changes in species composition or to noticeable damage to the constituent plants, including any lichens and bryophytes.

6.2.10. In light of the above, it is concluded that the conservation objectives of the SAC, SPA (and Ramsar site) would not be compromised and an adverse effect on the integrity of these European sites would not occur.

6.3 Sandlings SPA

6.3.1. The following conservation objectives apply to the Sandlings SPA:

- Subject to natural change, 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;
 - the structure and function of the habitats of the qualifying features;
 - the supporting processes on which the habitats of the qualifying features rely;
 - the population of each of the qualifying features; and,

- the distribution of the qualifying features within the site.

6.3.2. Although the process contributions exceeds 10% of the Critical Level for daily NO_x at the Sandlings SPA, the PEC is predicted to be 34% of the Critical Level (i.e. the Critical Level would not be exceeded).

6.3.3. As described in **Section 6.2** for the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar site, given the highly conservative nature of the modelling scenario for daily NO_x and the short-term nature of the effect, taken together with the prediction that the PEC would not exceed the Critical Level, it is concluded that there would not be an adverse effect on the integrity of the Sandlings SPA due to the Installation.

6.4 Conclusion

6.4.1. With reference to the potential effect criteria presented in **Section 6.1**, it is concluded that the combustion activities would not:

- Cause a reduction in the area of habitat or of any European site.
- Cause indirect change to the physical quality of the habitat within any European site.
- Cause ongoing disturbance to qualifying features of any European site.
- Alter community structure (species composition).
- Alter the vulnerability of populations to other impacts.
- Affect restoration of a feature where this is a conservation objective.

6.4.2. It is, therefore, concluded that the CA/Installation is not predicted to result in adverse effects on the integrity of the qualifying features of any European site.

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7. Assessment of in-combination effects

7.1 Introduction

7.1.1. Regulation 63 of the Habitats Regulations requires the competent authority to make an appropriate assessment of any plan or project which is likely to have a significant effect on a European site, either alone or in-combination with other plans or projects. In line with the Habitats Regulations, the term 'in-combination' is used herein to describe the potential for the Sizewell C Project (as a whole) to interact with other (non-SZC Co.) plans and projects. This equates to the use of 'cumulative effects' in the EIA Directive (2011/92/EU, as amended by 2014/52/EU) and Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

7.1.2. In their guidelines for EIA, the Institute of Environmental Management and Assessment (IEMA) (Ref. 7.1) defines cumulative impacts (in this case transposed to in-combination impacts in the context of the Habitats Regulations) as:

"...the impacts on the environment which result from incremental impacts of the action when added to other past, present and reasonably foreseeable future actions ..."

7.1.3. There is no legislation that outlines how in-combination (or cumulative) impact assessments should be undertaken and the relevant regulations do not define 'in-combination' or 'cumulative'. However, the Habitats and EIA Directives, and their associated regulations, require consideration of direct impacts and any indirect, secondary and cumulative effects of a project.

7.2 Potential for in-combination effects

7.2.1. The shadow HRA undertaken for the Sizewell C Project as a whole assessed the potential for in-combination effects between the Sizewell C Project (including the potential construction and operational phase effects) and other plans and projects. With respect to predicted air quality effects, the in-combination assessment concluded that there were no other plans or projects that had the potential to act in-combination with the effects of the Sizewell C project to result in a likely significant in-combination effect.

7.2.2. The above conclusion also applies when all other pathways for potential effect of the Sizewell C Project are assessed in-combination with the predicted effects of the CA.

8. Conclusion

8.1.1. The European site scoping exercise identified 10 European sites for inclusion in the Stage 1 LSE Screening assessment, as follows:

- Alde-Ore and Butley Estuaries SAC.
- Alde-Ore Estuary SPA.
- Alde-Ore Estuary Ramsar site.
- Minsmere to Walberswick Heaths and Marshes SAC.
- Minsmere-Walberswick SPA.
- Minsmere-Walberswick Ramsar site.
- Orfordness-Shingle Street SAC.
- Outer Thames Estuary SPA.
- Sandlings SPA.
- Southern North Sea SAC.

8.1.2. When the predicted effects of the combustion activity on NO_x, SO₂ and nitrogen and acid deposition are considered against the Critical Level and Critical Load assessment criteria, LSE cannot be excluded for the following European sites, which have been considered further as part of the Stage 2 Appropriate Assessment:

- Minsmere to Walberswick Heaths and Marshes SAC.
- Minsmere-Walberswick SPA.
- Minsmere-Walberswick Ramsar site.
- Sandlings SPA.

8.1.3. LSE can be excluded for potential noise effects in all cases due to the minimal predicted change relative to ambient noise levels at the European sites and, in the case of SACs, the fact that there is no pathway for effect.

8.1.4. The Stage 2 Appropriate Assessment presented herein concludes that there would be no adverse effects on the integrity of the above European sites when the modelled effects of the combustion activities (alone) are assessed in the context of the sensitivity of the qualifying features and/or supporting

habitats, taking into account the predicted zone of influence of the combustion activities and the duration of the potential effects.

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Appendix 1: Air Quality Modelling Results relevant to the Shadow HRA

Table A1.1: Predicted annual average (long-term) PCs for NO_x (highest result shown in bold)

RECEPTOR	CL (µg/m ³)	COMMISSIONING				ROUTINE TESTING			
		PC (µg/m ³)	PC / CL	BC (µg/m ³)	PEC / CL	PC (µg/m ³)	PC / CL	BC (µg/m ³)	PEC / CL
Alde-Ore and Butley Estuaries SAC; Alde-Ore Estuary SPA and Ramsar site	30	0.07	0.2%	7.6	26%	0.02	<0.1%	7.4	25%
Minsmere to Walberswick Heaths and Marshes SAC; Minsmere-Walberswick SPA and Ramsar site	30	13.5	45.0%	7.7	71%	3.9	12.9%	7.5	38%
Orfordness-Shingle Street SAC	30	0.05	0.2%	7.2	24%	0.01	<0.1%	7.0	24%
Sandlings SPA	30	0.5	1.8%	7.7	27%	0.2	0.5%	7.5	26%

CL = Critical Level (for the Protection of Vegetation and Ecosystems), PC = Process Contribution, BC = Background Concentration, PEC = Predicted Environmental Concentration

Table A1.2: Predicted daily average PCs for NO_x (highest result shown in bold)

RECEPTOR	CL (µg/m ³)	ROUTINE TESTING			
		PC (µg/m ³)	PC / CL	BC (µg/m ³) ¹	PEC / CL
Alde-Ore and Butley Estuaries SAC; Alde-Ore Estuary SPA and Ramsar site	75	4.8	6%	11.1	21%
Minsmere to Walberswick Heaths and Marshes SAC; Minsmere-Walberswick SPA and Ramsar site	75	303.6	405%	11.3	420%
Orfordness-Shingle Street SAC	75	3.3	4%	10.6	18%
Sandlings SPA	75	25.4	34%	11.3	49%

CL = Critical Level (for the Protection of Vegetation and Ecosystems), PC = Process Contribution, BC = Background Concentration, PEC = Predicted Environmental Concentration

Table A1.3: Predicted annual average PCs for SO₂ (highest result shown in bold)

RECEPTOR	CL (µg/m ³)	COMMISSIONING				ROUTINE TESTING			
		PC (µg/m ³)	PC / CL	BC (µg/m ³)	PEC / CL	PC (µg/m ³)	PC / CL	BC (µg/m ³)	PEC / CL
Alde-Ore and Butley Estuaries SAC; Alde-Ore Estuary SPA and Ramsar site	20	0.003	0.0%	2.2	11%	0.001	0.0%	2.2	11%
Minsmere to Walberswick Heaths and Marshes SAC; Minsmere-Walberswick SPA and Ramsar site	20	0.5	2.3%	4.0	22%	0.1	0.7%	4.0	21%
Orfordness-Shingle Street SAC	20	0.002	0.0%	2.5	13%	0.000	0.0%	2.5	13%

RECEPTOR	CL ($\mu\text{g}/\text{m}^3$)	COMMISSIONING				ROUTINE TESTING			
		PC ($\mu\text{g}/\text{m}^3$)	PC / CL	BC ($\mu\text{g}/\text{m}^3$)	PEC / CL	PC ($\mu\text{g}/\text{m}^3$)	PC / CL	BC ($\mu\text{g}/\text{m}^3$)	PEC / CL
Sandlings SPA	20	0.02	0.1%	2.7	1%	0.005	0.0%	2.7	14%

CL = Critical Level (for the Protection of Vegetation and Ecosystems), PC = Process Contribution, BC = Background Concentration, PEC = Predicted Environmental Concentration

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Table A1.4: Nitrogen deposition

Receptor	Critical Load Class	CLd RANGE		<u>BG N-DEP (kg N/ha/yr)</u>	<u>COMMISSIONING</u>				<u>ROUTINE OPERATION</u>			
					<u>NO₂ PC µg/m³</u>	<u>PC N-DEP (kg N/ha/yr)</u>	<u>PC / CLd¹</u>	<u>PEC / CLd¹</u>	<u>NO₂ PC µg/m³</u>	<u>PC N-DEP (kg N/ha/yr)</u>	<u>PC / CLd¹</u>	<u>PEC / CLd¹</u>
Alde-Ore and Butley Estuaries SAC; Alde-Ore Estuary SPA and Ramsar site	Pioneer, low-mid, mid upper saltmarshes	20 – 30		12.9	0.043	0.006	0.03%	65%	0.012	0.002	0.01%	65%
	Pioneer, low-mid, mid upper saltmarshes	20 – 30		12.9	0.049	0.007	0.04%	65%	0.014	0.002	0.01%	65%
	Rich Fens	15 - 30		11.2	0.032	0.005	0.04%	75%	0.009	0.001	0.01%	75%
Minsmere to Walberswick Heaths and Marshes SAC; Minsmere-Walberswick SPA and Ramsar site	Coastal stable dunes	8 – 15		13.1	3.1	0.44	5.5%	169%	0.88	0.13	1.6%	165%
	Dry heath	10 – 20		13.8	7.9	1.14	11.4%	142%	2.3	0.33	3.3%	141%
	Fen, marsh and swamp (rush pasture etc...)	15 – 25		13.1	7.6	1.09	7.3%	95%	2.2	0.31	2.1%	89%
	Fen, marsh and swamp (swamp and reedbeds)	15 – 30		13.1	0.49	0.071	0.5%	88%	0.14	0.02	0.1%	88%
Orfordness-Shingle Street SAC	Coastal stable dunes	8 – 15		8.3	0.034	0.005	0.06%	104%	0.009	0.001	0.02%	104%

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Receptor	Critical Load Class	CLd RANGE		<u>BG N-DEP (kg N/ha/yr)</u>	<u>COMMISSIONING</u>				<u>ROUTINE OPERATION</u>			
					<u>NO₂ PC µg/m³</u>	<u>PC N-DEP (kg N/ha/yr)</u>	<u>PC / CLd¹</u>	<u>PEC / CLd¹</u>	<u>NO₂ PC µg/m³</u>	<u>PC N-DEP (kg N/ha/yr)</u>	<u>PC / CLd¹</u>	<u>PEC / CLd¹</u>
Sandlings SPA	Dry heath	10 – 20		15.0	0.33	0.047	0.5%	150%	0.095	0.01	0.1%	150%

The most stringent Critical Load from the range provided has been used in the assessment.

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Table A1.5: Acid deposition

	<u>COMMISSIONING</u>							<u>ROUTINE OPERATION</u>					
	<i>PROCESS CONTRIBUTION</i>					<u><i>CRITICAL LOAD FUNCTION</i></u>		<i>PROCESS CONTRIBUTION</i>					<u><i>CRITICAL LOAD FUNCTION</i></u>
	<i>NO_x PC µg/m³</i>	<i>SO₂ PC µg/m³</i>	<i>N keq ha/yr</i>	<i>S keq ha/yr</i>	<i>PC/CLd %</i>	<i>Back'gd/ CLd %</i>	<i>PEC/CLd %</i>	<i>NO_x PC µg/m³</i>	<i>SO₂ PC µg/m³</i>	<i>N keq ha/yr</i>	<i>S keq ha/yr</i>	<i>PC/CLd %</i>	<i>PEC/CLd %</i>
Minsmere to Walberswick Heaths and Marshes SAC; Minsmere-Walberswick SPA and Ramsar site	3.1	0.15	0.03	0.02	5.3%	193.7%	198.9%	0.9	0.043	0.009	0.005	1.8%	195.4%
	7.9	0.39	0.08	0.05	10.5%	88.9%	99.4%	2.3	0.11	0.02	0.01	3.2%	92.2%
	7.6	0.37	0.08	0.04	21.1%	193.7%	214.8%	2.2	0.11	0.02	0.01	7.0%	200.70%
	0.49	0.024	0.005	0.003	1.8%	193.7%	195.4%	0.14	0.0070	0.001	0.0008	0.0%	193.7%
Orfordness-Shingle Street SAC	0.034	0.0017	0.0004	0.0002	0.0%	18.4%	18.4%	0.0098	0.00048	0.0001	0.00006	0.0%	18.4%
Sandlings SPA	0.33	0.12	0.003	0.01	1.5%	94.8%	96.2%	0.095	0.0047	0.001	0.0006	0.0%	94.8%