The Sizewell C Project

9.117 Sizewell C Desalination Plant Air Quality Impact Assessment

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Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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1 DESALINATION AIR IMPACT ASSESSMENT

1.1 Introduction

1.1.1 SZC Co. has continued to engage with relevant stakeholders to help inform the final Water Supply Strategy for the Sizewell C Project ('Proposed Development'). This work and the outputs from ongoing technical studies have identified the need for further flexibility in provision of water during the construction phase of the Proposed Development.

1.1.2 As such, the addition of a construction-phase desalination plant has been accepted as a change to the DCO Application, which would help to provide a dependable supply of water. This would be required to support construction of the Proposed Development before the principal supply of water from Northumbrian Water Limited (NWL) comes online.

1.1.3 The temporary desalination plant will initially be located within the main platform of the Proposed Development. During the later stages of construction, the desalination plant will be moved to the Temporary Construction Area (TCA). This is shown in **Figure 1-1** Phase 1 and Phase 2 (the desalination plant is shown as a yellow rectangle).

1.1.4 For Phase 1, when the desalination plant is initially located within the main platform of the Proposed Development, the power supply will be provided by two 800kW diesel generators. However, by Phase 2 when the desalination plant would be moved to the TCA, the power supply for the desalination plant will be provided from the main development site supply following completion of a new 132/11kV Substation.

1.1.5 Regulation of emissions from the diesel generators will be through an Environmental Permit(s) required from the Environment Agency. The application for a permit will be made by the operator and will include an assessment of air quality effects on both human and habitat receptors. Natural England are a consultee to the permit application determination. Further, the Conservation of Habitats and Species Regulations 2017 apply to the permitting determination and the Environment Agency can only grant a permit where they conclude beyond reasonable scientific doubt that there will be no adverse effect on the integrity of any European Site. A range of measures could be applied at the permitting stage to control or reduce environmental effects, including the siting of the generators away from sensitive receptors.

1.1.6 SZC Co. has set out further detail on the interplay between the DCO and permitting regime in its Written Submissions Responding to Actions Arising from ISH15: Proposed Temporary Desalination Plant (Doc Ref. 9.122).

1.1.7 Notwithstanding the above, an indicative air quality impact assessment has been undertaken to demonstrate that significant adverse effects from the diesel generators (and adverse effects on the integrity of European sites) can readily be avoided through the use of controls typical of those imposed through the environmental permitting process, recognising that the final control measures to be applied will be determined and secured through that process rather than via the DCO.

1.1.8 In order to carry out a worst case assessment it has been assumed that the required two 800kW diesel generators would be operational on the main platform site for a maximum period of two years, however it is anticipated that the actual duration of their operation would be less than this.

1.1.9 This report details the air impact assessment that has been carried out to assess the potential effects of the diesel generators on European sites, in response to the consultation response provided by Natural England to the 4th ES addendum.

1.1.10 Natural England's most recent comments on this potential effect were provided in the Statement of Common Ground received on 11 October 2021. This confirms that Natural England's only remaining concern with respect to air quality effect is the cumulative impact of all diesel generators (including those required for the desalination plant) and any other sources of NOx on the Minsmere to Walberswick Heath and Marshes SAC, Minsmere- Walberswick SPA and Minsmere- Walberswick Ramsar site.

1.1.11 The assessment has been updated from the original version issued on 30th September 2021 [REP9-026] to include a slightly higher stack for the desalination generators (increased from 3m to 4m), which reduces the ammonia impacts at receptor location E2 – Minsmere to insignificant levels (see Section 3.4) and also reduces NOx concentrations and nutrient nitrogen and acid deposition, as reported in Section 3.

1.1.12 In addition, the assessment has also been updated to include the combined effects on the Minsmere to Walberswick Heath and Marshes SAC, Minsmere- Walberswick SPA and Minsmere- Walberswick Ramsar site from other air emission sources that could be operational at the same time as the desalination plant generators, primarily the Campus CHP and the construction plant operating on the Main Develoment Site (Section 4), thereby addressing Natural England's concerns detailed in Paragraph 1.1.10.

1.2 Significance criteria for ecological receptors

1.2.1 The assessment of the potential effects requires assessment of the Process Contribution (PC) (the modelled concentration of substances from the emission sources included in the assessment) in the context of the critical levels for European sites (as set out in guidance from Defra and Environment Agency[1]).

1.2.2 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) PC is less than 10% of the short-term critical level; and
- the long-term (annual) PC is less than 1% of the long-term critical level.

1.2.3 If the above requirements are not met, the predicted environmental concentration (PEC) (the PC plus the background concentration of the substance already present in the environment) needs to be compared to the critical level. The PEC does not need to be calculated for short-term targets; but if the short-term PC exceeds the screening criteria, further detailed assessment is required.

1.2.4 If the long-term PC is greater than 1% but the PEC is less than 70% of the long-term critical level, the emissions are considered to be insignificant and do not need to be assessed further. If the PEC is greater than 70% of the long-term critical level, further assessment is required.

1.2.5 In terms of the assessment against relevant critical loads (depositional impacts) no definitive guidance has been published for determining the significance of impacts, however it is generally accepted by the Environment Agency and Natural England that PCs less than 1% of the relevant critical load can be considered to be insignificant. Further consideration to the significance of potential effects should be given where the PC is greater than 1% and the PEC exceeds the critical load.

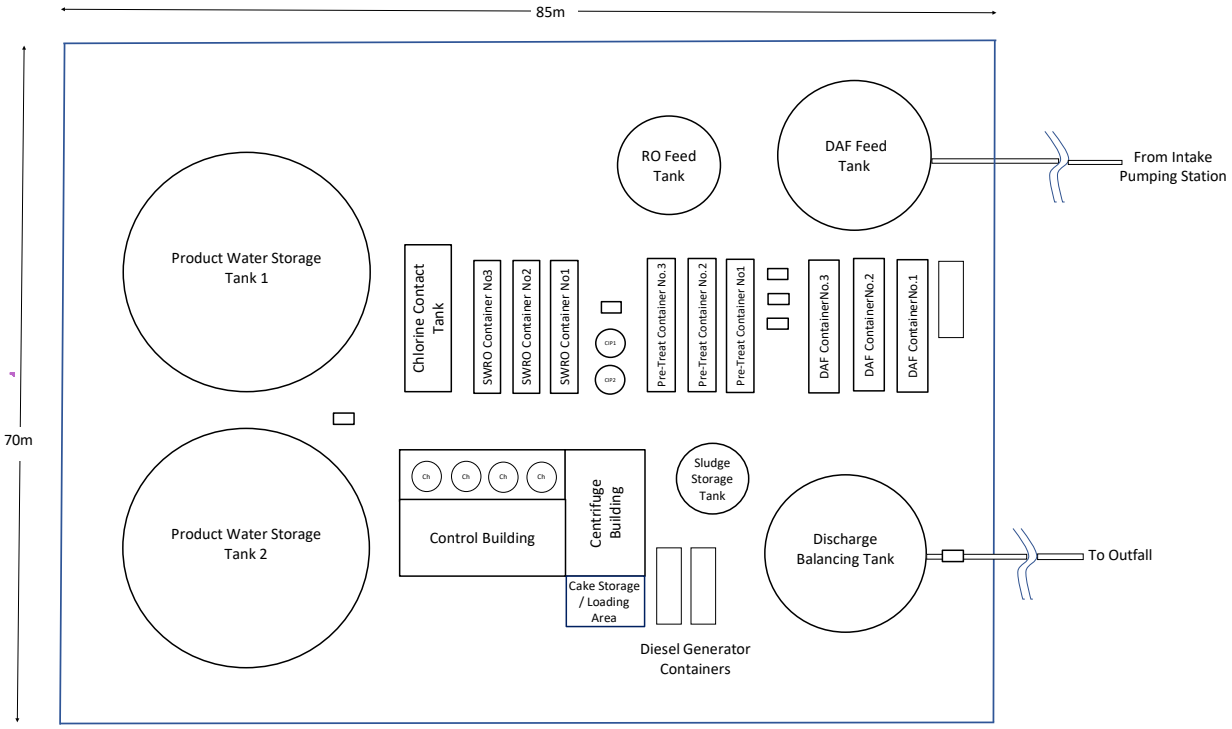
[1] Defra and Environment Agency. Guidance: Air emissions risk assessment for your environmental permit, 2016. (Online). Available from: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

2 THE DIESEL GENERATORS

2.1 Generator Information

2.1.1 The diesel generators are anticipated to comprise two 800kW containerised units, that will be located within the temporary desalination plant. An indicative plant layout for the desalination plant, showing the location of the diesel generators, is provided in **Plate 2-1**.

Plate 2.1 Indicative Desalination Plant Layout



2.1.2 Although the exact diesel generators have not been selected at this stage of the project, suitable emission parameters have been estimated for the units, based on similar sized units (where available), or scaled down from larger units, as appropriate.

2.1.3 As the aggregated thermal input of the units will be greater than 1MW but less than 50MW, it is likely that the diesel generators will fall under the requirements of the Medium Combustion Plant Directive (MCPD). An Environmental Permit to operate would be required for a 'Specified Generator' under Schedule 25B of the Environmental Permitting (England and Wales) Regulations 2016 (as amended). This means that the oxides of nitrogen (NOx) emission from the units will need to comply with the

Emission Limit Values (ELVs) for specified generator plant i.e. 190mg/Nm^3 (at standard reference conditions and 15% oxygen). To achieve NOx emissions of this order, it is possible that the diesel generators will need to be fitted with Selective Catalytic Reduction (SCR) abatement, and an additional emission of ammonia (NH_3) may therefore occur; as a worst case assumption this has been considered in this assessment.

2.1.4 The diesel fuel used in the generators is also likely to contain sulphur, however, as with all comparable diesel generators in use in the UK, ultra-low sulphur diesel (gas oil) will be used to minimise any emissions of sulphur dioxide (SO_2).

2.1.5 The Environmental Permitting (England and Wales) Regulations 2016 (as amended) do not contain ELVs for SO_2 from gas oil-fired engines, as these are considered to be at such low concentrations that no significant effects would occur. However, SO_2 emissions have been considered, in order to ensure a conservative assessment has been carried out.

2.2 Assessed Emissions

2.2.1 To determine the potential impacts of the diesel generators on the nearby habitat receptors (including the Minsmere European sites), dispersion modelling has been undertaken for the two desalination plant diesel generators.

2.2.2 **Table 2-1** shows the modelled emissions from the desalination plant generators based on typical diesel generator performance, and Plate 2-2 shows the modelled location of the diesel generator stacks to be used in Phase 1. The emission characteristics modelled (air flow and temperature) are considered to be representative and conservative but the actual emission conditions may differ from these values slightly, depending on the units installed.

Table 2-1: Desalination Plant Diesel Generators Emissions Inventory

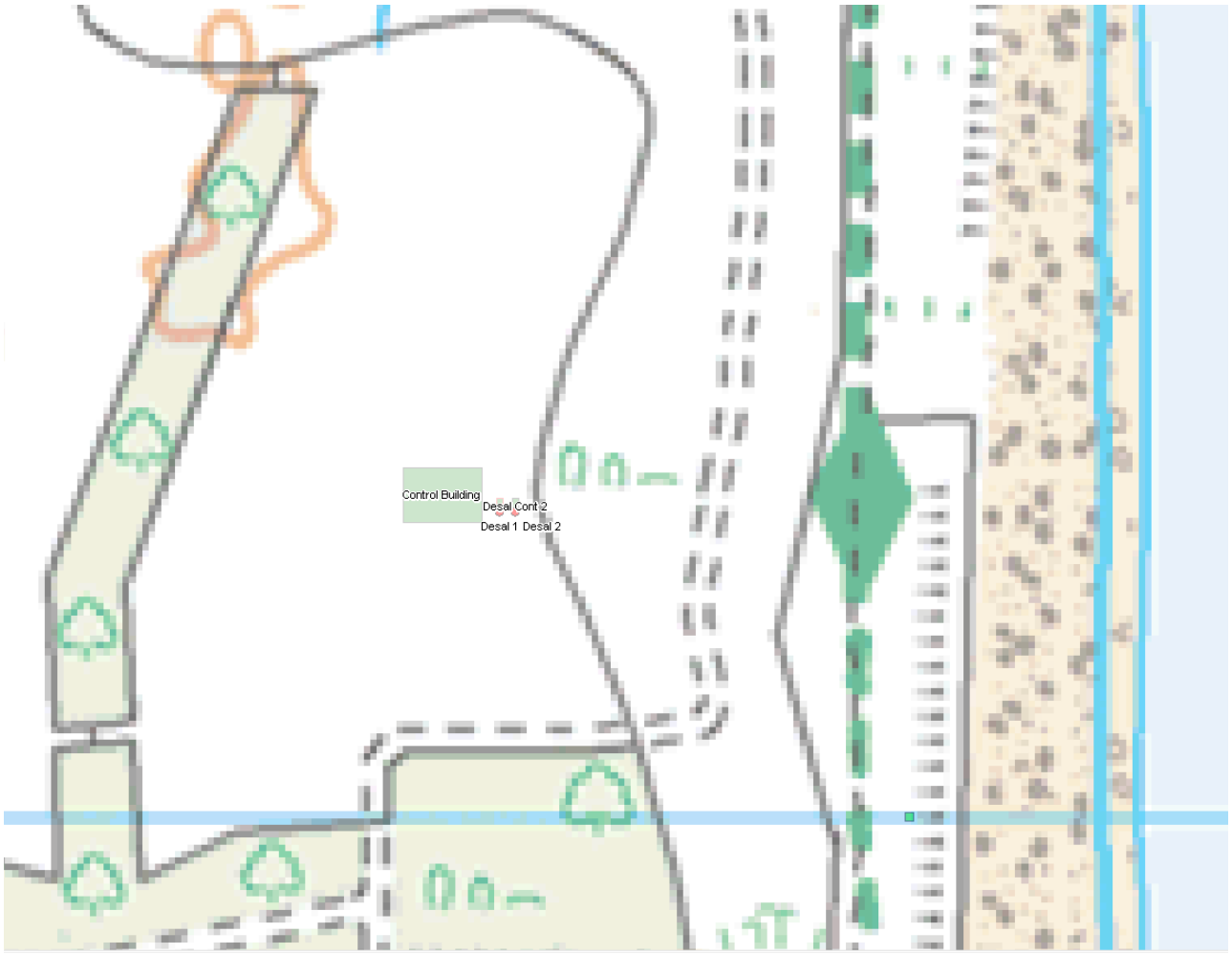
SOURCE REF.	GRID REF (X, Y)	STACK HEIGHT (m)	STACK DIAMETER (m)	VOLUME FLOW (Nm^3/s)[1]	ACTUAL FLOW (Am^3/s)	EFFLUX VELOCITY (m/s)	TEMP (°C)	SUBSTANCE	RELEASE CONC (mg/Nm^3)	RELEASE RATE (g/s)
DG 1 DG 2	647443, 264117 647449, 264117	4	0.39	1.55	3.14	26.3	490	NOx	190	0.29
								NH_3	2.2[2]	0.003
								SO_2	10[3]	0.016

[1] Normalisation based on actual flows at 12% oxygen and 8% H_2O. Normalised to standard temperature and pressure, dry gas at 15% oxygen reference conditions.

[2] Based on an actual emission of 5ppm, and normalised to reference conditions

[3] Assumes ultra-low sulphur fuel used.

Plate 2.2 Indicative Desalination Generator Location



2.2.3 The modelling has been carried out to determine the ecological impacts at the various habitat receptors in the vicinity of the desalination plant, as described in the DCO application (Environmental Statement, Chapter 12, Appendix C Combustion Activities [APP-214]).

2.2.4 The impacts have been assessed against the annual and daily critical levels for NOx, and the annual critical levels for SO_2 and NH_3. In addition, the depositional impacts of nutrient nitrogen (from NO_2 and NH_3) and acid deposition (from NO_2, NH_3 and SO_2) have also been assessed.

3 DESALINATION PLANT DIESEL GENERATOR RESULTS

3.1 Annual Average NOx Impacts – Critical Levels

3.1.1 The two desalination plant generators have been modelled in isolation, and assumed to be operating continuously throughout the year. The predicted annual average ground level NOx concentrations at the relevant habitat sites (i.e. those previously assessed in the Environmental Statement, Chapter 12, Appendix C Combustion Activities [APP-214]) are detailed in Table 3-1.

Table 3-1: Predicted annual average PCs for NO_x from the Desalination Plant Diesel Generators

Receptors	CL (µg/m³)	PC (µg/m³)	PC / CL	BC (µg/m³)	PEC / CL
E1 Alde Ore	30	0.01	0.0%	7.6	25%
E2 Minsmere	30	1.19	4.0%	7.7	30%
E3 Orfordness	30	0.01	0.0%	7.2	24%
E4 Sandlings	30	0.07	0.0%	7.7	26%
E5 Sizewell Marshes	30	0.33	1.1%	7.5	26%
E6 Leiston and Aldeburgh, E8 and E9 Dower House	30	0.04	0.1%	7.5	25%
E7 Leiston Common	30	0.08	0.3%	7.8	26%
E10 Suffolk Beaches	30	0.81	2.7%	9.5	34%
E11 Reckham Pits Wood	30	0.15	0.5%	7.7	26%
E12 Sizewell Levels	30	0.97	3.2%	7.7	29%
E13 Minsmere South Levels	30	0.29	1.0%	7.7	27%

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

3.1.2 Table 3-1 shows that the predicted concentrations from the desalination plant are insignificant (<1% of the critical level) at the majority of habitat sites. Only four sites are predicted to experience impacts over 1% of the

critical level, however in combination with the background concentration, the PECs at these sites all represent less than 70% of the critical level for annual NOx, and therefore, in accordance with the Defra/EA Risk Assessment guidance can be considered not to be significant.

3.2 Daily NO_x Impacts – Critical Levels

3.2.1 The two desalination plant generators have been modelled in isolation, and assumed to be operating continuously throughout the year. The predicted daily ground level NOx concentrations at the relevant habitat sites are detailed in Table 3-2.

Table 3-2: Predicted daily average PCs for NO_x from the Desalination Plant Diesel Generators

Receptors	CL (µg/m³)	PC (µg/m³)	PC / CL	BC (µg/m³)[1]	PEC / CL
E1 Alde Ore	75	0.2	0.3%	11.1	15%
E2 Minsmere	75	11.5	15.3%	11.3	30%
E3 Orfordness	75	0.2	0.2%	10.6	14%
E4 Sandlings	75	1.4	1.9%	11.3	17%
E5 Sizewell Marshes	75	7.5	10.0%	11.0	25%
E6 Leiston and Aldeburgh, E8 and E9 Dower House	75	1.1	1.4%	11.0	16%
E7 Leiston Common	75	2.2	2.9%	11.4	18%
E10 Suffolk Beaches	75	13.5	17.9%	14.0	37%
E11 Reckham Pits Wood	75	3.6	4.8%	11.3	20%
E12 Sizewell Levels	75	11.5	15.4%	11.3	30%
E13 Minsmere South Levels	75	5.1	6.8%	11.3	22%

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

3.2.2 Table 3-2 shows that the majority of sites have predicted daily PCs that are less than 10% of the daily critical level and, according to the Defra/ EA Risk

Assessment guidance, the impacts of the desalination plant diesel generators are considered to be insignificant. For the three sites where the PC/ CL exceeds 10%, the PEC remains well below the daily critical level. According to the Defra /EA Risk Assessment guidance, the predicted effect is therefore not considered to be significant on that basis.

3.2.3 It is also of note that the short-term (24 hour) mean for NO_x is of less importance to habitat than the annual mean, as vegetation exposed to levels of NO_x above the critical level will be more likely to recover from that exposure if the exceedance is for a short duration. Authors from the Centre for Ecology and Hydrology in a recent book on nitrogen, NO_x concentrations and vegetation, states that *'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*[2].

3.3 Annual Average SO_2 Impacts – Critical Levels

3.3.1 The predicted annual average ground level SO_2 concentrations at the relevant habitat sites for the desalination plant diesel generators are detailed in Table 3-3.

Table 3-3: Predicted annual average PCs for SO_2 from the Desalination Plant Diesel Generators

Receptors	CL (µg/m^3)	PC (µg/m^3)	PC / CL	BC (µg/m^3)[1]	PEC / CL
E1 Alde Ore	10	0.00	0.0%	2.2	22%
E2 Minsmere	10	0.06	0.6%	4.0	41%
E3 Orfordness	10	0.00	0.0%	2.5	25%
E4 Sandlings	10	0.00	0.0%	2.7	27%
E5 Sizewell Marshes	10	0.02	0.2%	2.7	27%
E6 Leiston and Aldeburgh, E8 and E9 Dower House	10	0.00	0.0%	3.1	31%
E7 Leiston Common	10	0.00	0.0%	2.5	25%

[2] Sutton MA, Howard CM, Erisman JW, Billen G, Bleeker A, Grennfelt P, van Grinsven H, Grizzetti B. 2013. The European Nitrogen Assessment: Sources, Effects and Policy Perspectives. Page 414. Cambridge University Press. 664pp. ISBN-10: 1107006120

Receptors	CL ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC / CL	BC ($\mu g/m^3$)[1]	PEC / CL
E10 Suffolk Beaches	10	0.04	0.4%	2.4	24%
E11 Reckham Pits Wood	10	0.01	0.1%	3.0	30%
E12 Sizewell Levels	10	0.05	0.5%	4.0	41%
E13 Minsmere South Levels	10	0.02	0.2%	4.0	40%

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

3.3.2 The predicted concentrations of SO_2 at the habitat sites are all less than 0.6% of the lower critical level for SO_2 and are considered to be insignificant in accordance with the Defra /EA Risk Assessment guidance.

3.4 Annual Average NH_3 Impacts – Critical Levels

3.4.1 The desalination plant generators could potentially require abatement to achieve the Specified Generator ELV for NOx and therefore could give rise to ammonia emissions. The predicted impacts of the ammonia emissions have been compared against the relevant critical levels for the habitat sites, taken from the APIS website (www.apis.ac.uk). The results are presented in Table 3-4.

Table 3-4: Predicted annual average PCs for NH_3 from the Desalination Plant Diesel Generators

Receptors	CL ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC / CL	BC ($\mu g/m^3$)[1]	PEC / CL
E1 Alde Ore	3	0.000	0.00%	1.65	55%
E2 Minsmere	1	0.014	1.4%	1.39	140%
E3 Orfordness	3	0.000	0.00%	1.85	62%
E4 Sandlings	3	0.001	0.03%	1.39	46%
E5 Sizewell Marshes	3	0.004	0.13%	1.39	47%
E6 Leiston and Aldeburgh, E8 and E9 Dower House	1	0.000	0.05%	1.39	139%

Receptors	CL ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC / CL	BC ($\mu g/m^3$)[1]	PEC / CL
E7 Leiston Common	3	0.001	0.03%	1.39	46%
E10 Suffolk Beaches	3	0.009	0.31%	1.39	47%
E11 Reckham Pits Wood	3	0.002	0.06%	1.39	47%
E12 Sizewell Levels	3	0.011	0.37%	1.39	47%
E13 Minsmere South Levels	3	0.003	0.11%	1.39	47%

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

3.4.2 For all but one habitat sites, the annual average PC of ammonia can be seen to be <1% of the relevant critical levels and can be considered to be insignificant.

3.4.3 The predicted impacts at E2 Minsmere are only slightly over the 1% threshold of insignificance at 1.4%. However, the 2020 guidance from the IAQM[3] clarifies that the 1% threshold is not intended to be precise to a set number of decimal places but to the nearest whole number (paragraph 5.5.2.6). It is therefore considered that the impacts at E2 are not significant based on application of this guidance.

3.5 Deposition Results

Nutrient Nitrogen Deposition

3.5.1 The nutrient nitrogen deposition from the operation of the desalination generators has also been predicted, taking into account the nitrogen from both the NOx and NH_3 emissions. The results are shown in Table 3-5.

[3] IAQM. (2020). A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites

Table 3-5: Predicted N-Deposition from the Desalination Plant Diesel Generators

	Critical Load Class	CLd Range (kg N/ha/yr)	BG N-Dep (kg N/ha/yr)	PC N-Dep (kg N/ha/yr)	PC / CLd[1]	PEC / CLd[1]
E1a	Pioneer, low-mid, mid upper saltmarshes	20 – 30	12.9	0.001	0.01%	65%
E1c	Pioneer, low-mid, mid upper saltmarshes	20 – 30	12.9	0.001	0.01%	65%
E1d	Rich fens	15 - 30	11.2	0.001	0.04%	75%
E2b	Coastal stable dunes	8 – 15	13.1	0.075	0.9%	165%
E2c	Dry heath	10 – 20	13.8	0.181	1.8%	133%
E2d	Fen, marsh and swamp (rush pasture etc…)	15 – 25	13.1	0.134	0.9%	88%
E2e	Fen, marsh and swamp (swamp and reedbeds)	15 – 30	13.1	0.012	0.1%	87%
E3a	Coastal stable dunes	8 – 15	8.3	0.001	0.01%	104%
E4a	Dry heath	10 – 20	15.0	0.009	0.1%	150%
E5a	Fen, marsh and swamp (fen meadow)	15 – 30	12.0	0.041	0.3%	80%
E5b	Fen, marsh and swamp (rush pasture etc…)	15 – 25	12.0	0.062	0.4%	80%
E6a	Dry heath	10 – 20	11.5	0.009	0.1%	115%
E7a	Dwarf shrub heath	10 – 20	12.0	0.014	0.1%	121%
E8a	Dwarf shrub heath	10 – 20	12.0	0.006	0.1%	120%
E10a	Coastal stable dunes – acid type	8 – 10	12.0	0.131	1.6%	152%
E11a	Broadleaved, mixed and yew woodland	10 – 20	21.4	0.028	0.3%	214%
E12a	Coniferous woodland	5 – 15	21.4	0.228	4.6%	433%
E12b	Broadleaved, mixed and yew woodland	10 – 20	21.4	0.031	0.3%	214%
E13a	Dwarf shrub heath	10 – 20	12.0	0.046	0.5%	121%

Notes: [1]The most stringent Critical Load from the range provided has been used in the assessment

CLd = Critical Load, PC = Process Contribution, BG = Background Nitrogen Deposition rate

3.5.2 With the exception of three sites, the PC from the desalination generators at all the habitat sites is predicted to be less than 1% of the critical load. The predicted deposition at those sites can therefore be considered to be imperceptible based purely on the Defra/ EA screening criteria.

3.5.3 Only one of the three sites (E2 – Minsmere) with a PC over the 1% threshold is a European site. Within that site, only receptor habitat E2c (Dry heath) is predicted to experience a PC over 1% of the critical load.

3.5.4 The 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 (further analysis of the spatial extent of effect is provided in Section 4 which discusses in-combination effects). The impacts from the desalination generators over the vast majority of the Minsmere European site therefore would be screened as insignificant on purely numerical grounds.

3.5.5 For the small area that is predicted to experience predicted deposition over the 1% threshold, the PC represents a maximum of 1.8% of the critical load. Therefore, the dose of additional nitrogen deposition is considered to be small (generally defined as less than 5% of the Critical Load). The relevant critical load class/ habitat type predicted to experience this magnitude of deposition is 'Dry heath', with no other habitat types predicted to experience deposition exceeding 1% of the critical load.

Minsmere to Walberswick Heaths and Marshes SAC

3.5.6 With regard to the Minsmere to Walberswick Heaths and Marshes SAC, the Site Improvement Plan for the Minsmere to Walberswick Heaths and Marshes (which includes the SAC and the Minsmere-Walberswick SPA) explicitly lists nitrogen deposition as a threat to the European dry heaths qualifying feature of the SAC.

3.5.7 The conservation objectives for the SAC are as follows[4]:

> "*Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the*

[4] Available at: http://publications.naturalengland.org.uk/publication/5360166388105216

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 supporting processes on which qualifying natural habitats and the habitats of qualifying species rely".*

3.5.8 The European dry heaths qualifying feature, however, is not present within the 0.1 kgN/ha/yr (1% of the critical load) contour line) and, as noted above, no other habitat types are predicted to experience deposition exceeding 1% of the critical load On this basis, and with specific reference to the conservation objectives of the SAC, it can be concluded that there would not be an adverse effect on the integrity of the SAC due to nitrogen deposition due to the desalination plant (alone).

Minsmere-Walberswick Ramsar site (and SPA)

3.5.9 The qualifying features of the Ramsar site (as summarised in Natural England's Designated Sites View) are:

- Mosaic of marine, freshwater, marshland and associated habitats.
- Wetland invertebrate and plant assemblage.
- Wetland breeding bird assemblage (associated with marshland and reedbeds).

3.5.10 Natural England has not developed specific conservation advice for the Minsmere-Walberswick Ramsar site. Natural England's Designated Sites View notes that it considers the conservation advice packages for the overlapping European Marine Site designations are, in most cases, sufficient to support the management of the Ramsar interests. Consequently, reference has been made to the Site improvement Plan (SIP) for the Minsmere to Walberswick Heaths and Marshes, which covers the Minsmere to Walberswick Heaths and Marshes SAC and the Minsmere-Walberswick SPA.

3.5.11 The SIP makes specific reference to SPA qualifying bird features potentially affected by nitrogen deposition being breeding and non-breeding gadwall,

shoveler and avocet, breeding nightjar, non-breeding white-fronted goose. The Ramsar criteria only includes breeding wetland birds, but there is substantial overlap between the qualifying bird interests of the SPA and the Ramsar site and, as noted above, Natural England considers the conservation advice packages relevant to the Ramsar site.

3.5.12 The conservation objectives for the SPA are as follows[5]:

> "*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;*
- *the structure and function of the habitats of the qualifying features;*
- *the supporting processes on which the habitats of the qualifying features rely;*
- *the populations of each of the qualifying features;*
- *the distribution of qualifying features within the site".*

3.5.13 The area of predicted effect due to nitrogen deposition within the Ramsar site largely coincides with the southern part of unit 112 of the Minsmere-Walberswick Heaths and Marshes SSSI, which is primarily sand dune and sparsely vegetated shingle. The relevant critical load habitat class included in the air quality modelling is coastal stable dunes as this is the proxy critical load range provided on APIS for several littoral habitats including both sand dunes and coastal vegetated shingle. Note that in practice the lowest part of this range is highly precautionary because, as stated on APIS, in practice different types of sand dune and vegetated shingle may have sensitivities comparable to other habitats that have higher critical load ranges. However, as noted in Table 3-5, the process contribution is less than 1% of the critical load for this habitat type and is, therefore, below the threshold of imperceptibility.

3.5.14 The Ramsar site does not have an explicit 'restore' target for air quality effects (as is the case for SAC qualifying habitats). However, if such a target is assumed to apply for the Ramsar site, given the process

[5] Available at Marine site detail (naturalengland.org.uk)

contribution is below the threshold of imperceptibility and the precautionary nature of using the minimum part of the critical load range for coastal stable dunes as a reference threshold for the habitats, it can be concluded that the predicted effect would not compromise achievement of a 'restore' objective with respect to nitrogen deposition and integrity of the Ramsar site would not be adversely affected.

3.5.15 The bird qualifying features of the SPA are not directly affected by air quality effects; it is the potential effect on their supporting habtiats that is relevant.

3.5.16 In light of the predicted effects on habitats discussed above, and with specific reference to the conservation objectives of the SPA listed above, it can be concluded that the extent, distribution, structure and function of the habitats on which the qualifying features rely, and supporting processes on which the habitsts of the qualifying features rely, would be maintained. Furthermore, the achievement of a 'restore' objective would not be compromised. It is concluded, therefore, that an adverse effect on the bird qualifying features of the SPA can be excluded.

3.5.17 Nothwithstanding the above conclusions, existing nitrogen deposition already far exceeds the minimum critical load for this habitat type, such that additional nitrogen would have a limited effect as there is likely to already be ample nitrogen for more competitive plants to respond. Therefore, any botanical effect, would be expected to be significantly less than it might be if background nitrogen deposition rates were lower. This is supported by Natural England Commissioned Report 210[6], Table 21 and Appendix 5 of which show that the scale of change in various parameters from adding a given dose of nitrogen is smaller when the existing deposition rates are higher.

3.5.18 Finally, the critical load system assumes decades of continuous exposure[7]. Over the short term a slight elevation in nitrogen deposition is unlikely to result in changes in vegetation communities over the temporary period the desalination generators are proposed to be operational (up to two years)

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[6] Caporn, S., Field, C., Payne, R., Dise, N., Britton, A., Emmett, B., Jones, L., Phoenix, G., S Power, S., Sheppard, L. & Stevens, C. 2016. Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance. Natural England Commissioned Reports, Number 210.

[7] '*Typically, critical loads relate to the potential effects over periods of decades… critical loads provide the long-term deposition* [emphasis added] *below which we are sure that adverse ecosystem effects will not occur'*, source: page 220, World Health Organization. 2000. Air Quality Guidelines for Europe. WHO Regional Publications, European Series, No. 91. Second Edition

taking into account the considerable variation in background nitrogen deposition that is likely to occur normally over short time periods (for example the UK Air Pollution Information System reports background nitrogen deposition for Minsmere-Walberswick Heaths and Marshes SAC which shows that between 2005 and 2010 background nitrogen deposition to short vegetation varied annually by as much as 0.7 kgN/ha/yr). Considering all of the above, effects from the desalination plant diesel generators are considered to be not significant at the habitat site.

Acid Deposition

3.5.19 The acid deposition impacts from the operation of the desalination generators have been considered, taking into account the nitrogen from both the NOx and NH_3 emissions and the sulphur from the SO_2 emission. The results are shown in Table 3-6.

Table 3-6: Predicted Acid-Deposition from the Desalination Plant Diesel Generators

Critical Load Class		CRITICAL LOAD FUNCTION				
		N keq ha/yr	S keq ha/yr	PC/CLd %	Back'gd/ CLd %	PEC/CLd %
E2b	Coastal stable dunes	0.005	0.003	1.4%	93%	93%
E2c	Dry heath	0.013	0.007	1.6%	89%	91%
E2d	Fen, marsh and swamp (rush pasture etc…)	0.928	0.005	1.8%	194%	195%
E2e	Fen, marsh and swamp (swamp and reedbeds)	0.001	0.000	0.0%	194%	194%
E3a	Coastal stable dunes	0.0001	0.000	0.0%	18%	18%
E4a	Dry heath	0.0007	0.0000	0.0%	95%	95%
E5a	Fen, marsh and swamp (fen meadow)	0.003	0.000	0.0%	154%	154%
E5b	Fen, marsh and swamp (rush pasture etc…)	0.004	0.000	1.4%	154%	156%
E6a	Dry heath	0.0007	0.000	0.0%	73%	73%
E7a	Dwarf shrub heath	0.001	0.0001	0.0%	4%	4%
E8a	Dwarf shrub heath	0.0004	0.0000	0.0%	37%	37%

	Critical Load Class	CRITICAL LOAD FUNCTION				
		N keq ha/yr	S keq ha/yr	PC/CLd %	Back'gd/ CLd %	PEC/CLd %
E10a	Coastal stable dunes – acid type	0.018	0.0005	0.3%	11%	11%
E11a	Broadleaved, mixed and yew woodland	0.002	0.0001	0.0%	39%	39%
E12a	Coniferous woodland	0.015	0.0010	0.6%	52%	52%
E12b	Broadleaved, mixed and yew woodland	0.002	0.0001	0.0%	140%	140%
E13a	Dwarf shrub heath	0.003	0.0002	0.1%	8%	8%

3.5.20 Most sites are predicted to experience acid deposition of 1% of the critical load or less when applying the IAQM Guidance, except E2c and E2d, which show impacts slightly over 1.5% of the critical load.

Minsmere to Walberswick Heaths and Marshes SAC

3.5.21 As noted above, E2c (Dry heath) is predicted to experience a PC over 1% of the critical load. However, in combination with the background deposition (i.e. PEC/CLd), the critical load is not exceeded, and therefore the impacts can be considered to be not significant on this habitat. Furthermore, as described above for nutrient nitrogen deposition, the European dry heaths qualifying feature of the SAC is not present in the affected area. It can therefore be concluded, with specific reference to the conservation objectives of the SAC, that there would not be an adverse effect on the integrity of the SAC due to acid deposition due to the desalination plant.

Minsmere-Walberswick Ramsar site (and SPA)

3.5.22 Location E2d already has a background acid deposition that exceeds the critical load. The habitat at E2d is identified as fen, marsh and swamp, which can be assumed to form part of the 'mosaic of marine, freshwater, marshland and associated habitats' qualifying criteria of the Ramsar site.

3.5.23 With regard to fen, marsh and swamp habitats, APIS (http://www.apis.ac.uk/acid-deposition-fen-marsh-and-swamp) states that *'There is a paucity of data on acid deposition effects on this habitat type but it can be assumed that where non vascular plants are present these might be sensitive, especially to N enrichment.'*

3.5.24 The fen, marsh and swamp habitat type is dominated by reedbeds, grazing marsh and woodland, which are vascular plants. Given that the APIS website states that there is no evidence of acid deposition effects on vascular plants in this habitat, other factors are far more likely to influence the botanical composition of the sward. In addition, as the critical load is already so far exceeded, further acid deposition from the operation of the desalination generators, only just over the threshold of imperceptibility, is not considered significant.

3.5.25 As noted above for nutrient nitrogen deposition, the Ramsar site does not have a 'restore' target for air quality effects. However, if such a target is assumed to apply for the Ramsar site, given the process contribution is only just over the threshold of imperceptibility, it can be concluded that the predicted effect would not compromise achievement of a 'restore' objective with respect to nitrogen deposition and integrity of the Ramsar site would not be adversely affected.

3.5.26 As noted above, the bird qualifying features of the SPA are not directly affected by air quality effects. In light of the predicted effects on habitats discussed above, and having specific regard to the conservation objectives of the SPA, adverse effect on the bird qualifying features of the SPA can be excluded.

3.6 Additional control measures

3.6.1 The diesel generators supplying the desalination plant will be controlled through an environmental permit, which will specify the emission levels to be met as well as the control measures to be applied.

3.6.2 This assessment has been based on generic generator data, rather than the specific plant which will be assessed at the time of environmental permit application submission. It has also been undertaken based on an indicative stack height of 4m; generator siting or a higher stack height could be used to reduce impacts, if this was considered necessary in light of impacts predictions based on an assessment of the specific plant details at the time of environmental permit application submission.

3.6.3 The generators will also only be installed and operated for up to two years before the desalination plant is relocated and supplied from the site electrical supply, as secured through the Construction Method Statement.

4 OVERALL CONSTRUCTION PHASE EFFECT

4.1.1 The combined effects of the desalination plant generators with the impacts from other construction air emissions sources, primarily the Campus CHP and the construction plant on the Main Development Site have been considered, given that these are the main quantifiable emission sources that have the potential to be operational as the same time as the desalination generators.

4.1.2 Given that the impacts from the desalination generators are imperceptible at the majority of sites, and that the only European site where deposition is predicted to be greater than imperceptible, on purely numerical grounds, is the E2 (Minsmere to Walberswick Heath and Marshes SAC, Minsmere-Walberswick SPA and Ramsar site), the overall construction phase assessment has concentrated on the impacts at these sites. Furthermore, as stated in Section 1, Natural England has confirmed that its only remaining concern with respect to air quality effect is on these European sites.

4.1.3 The annual average NOx concentration from the Campus CHP and the construction plant in-combination with the impacts from the desalination generators would result in an annual average PC of 1.4µg/m^3, representing 4.7% of the annual NOx critical level. As the exisiting background concentration is well below the critical level, the overall impact of the construction phase would be 30% of the critical level and therefore well below the threshold for potential significance of 70% of the critical level. Consequently, in accordance with the Defra/ EA Risk Assessment, this is considered to be not significant.

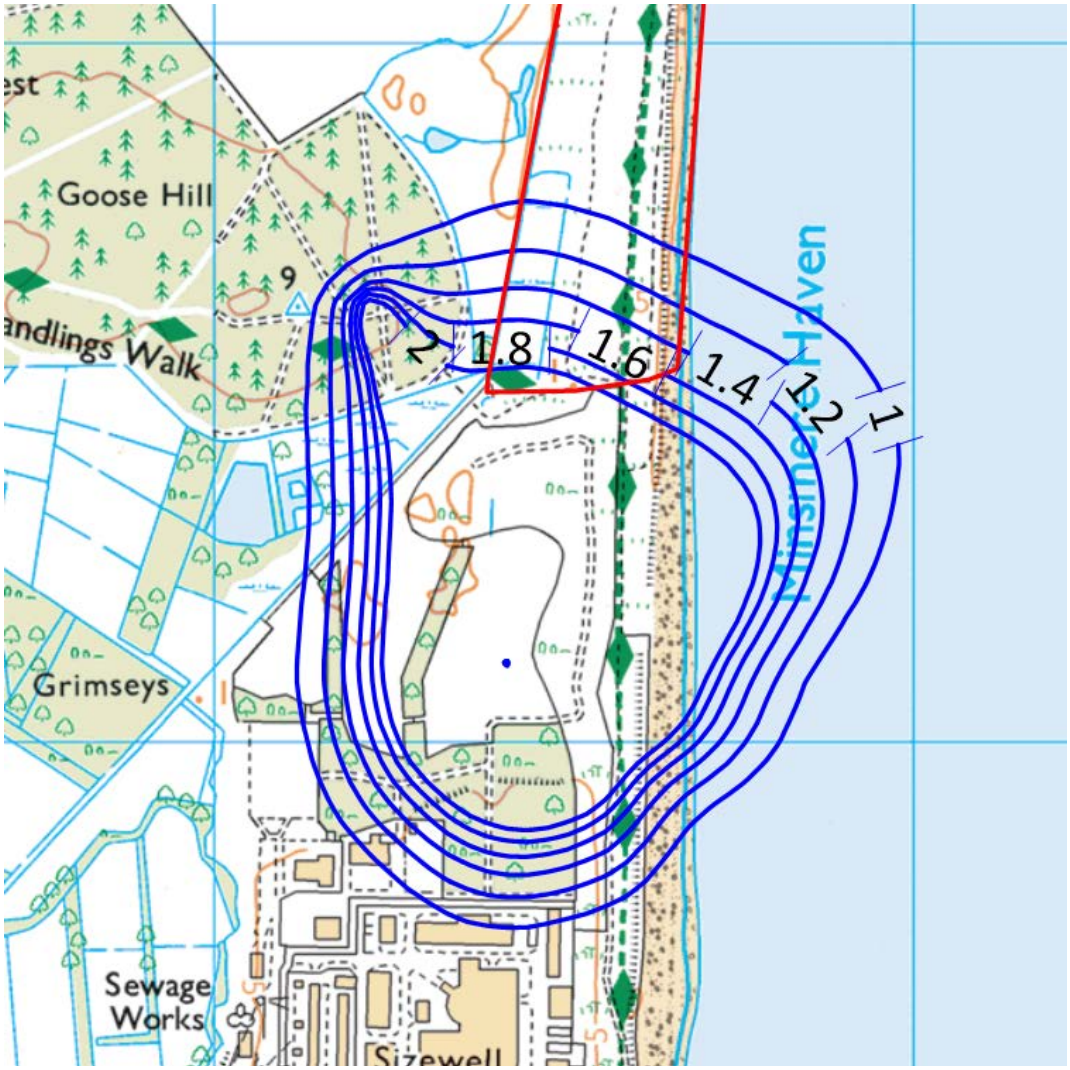
4.1.4 There would be no emissions of SO_2 and NH_3 from the Campus CHP or the construction plant.

4.1.5 When the overall construction phase N-deposition is calculated, the predicted N-deposition increases from 0.9% to 1.1% at the E2b habitat (coastal stable dunes) and from 1.8% to 2.0% at the E2c habitat (dry heath). These very small increases compared to the predictions for the generators for the desalination plant alone (amounting to an increase of 0.2% of the critical load) are considered to be the worst case impacts, as they result from the meteorological data that leads to the highest concentrations from each source, and this is a different year for the different emission sources. In addition, this is the result at the worst case location of the Minsmere to Walberswick Heath and Marshes SAC, Minsmere-

Walberswick SPA and Ramsar site, which is the receptor point that is closest to the desalination generator source.

4.1.6 The impacts occur over a very small area of the sites, and this is demonstrated by Plate 4-1 and Figure 4-1. Plate 4-1 shows the isopleth lines as a percentage of the critical load of 10kg N/ha/yr in blue, and the boundary of the southern end of the European site is shown bordered in red. Plate 4-1 shows the very localised spatial extent of effect, being confined to the extreme southern end of the sites. Figure 4-1 shows the same result in the context of the European sites as a whole.

Plate 4.1 Isopleths of the N-deposition, as a percentage of a critical load of 10kg N/ha/yr



4.1.7 The area of the European site that is predicted to experience N-deposition over 1% of the critical load is approximately 200m x 200m, and therefore represents an area of 0.04km^2, or 4 hectares. The area of the Minsmere-Walberswick SPA and Ramsar site is 2,019 ha[8] (and is shown in Figure 4-1), and therefore the area where the overall construction phase impacts are greater than 1% of the critical load of 10kg N/ha/hr represents 0.2% of the SPA and Ramsar site.

4.1.8 In light of the above predicitons, when considered with the other evidence provided in this report on the sensitivity of the location and sensitivity of the qualifying features of the European sites, demonstrates that the overall construction phase impacts are not significant and adverse effect on the integrity of the European sites can be excluded.

4.1.9 Due to the very small impacts of NOx from the Campus CHP and the construction vehicles at the habitat site (and there being no additional NH_3 or SO_2), the acid deposition remains unchanged from those detailed in Section 3 for the overall construction phase.

5 HUMAN HEALTH IMPACTS – DESALINATION GENERATORS

5.1.1 The human health receptors that could be impacted by emissions from the desalination generators are located at a greater distance from the site than the habitat sites assessed above, and therefore the predicted concentrations of NO_2, SO_2 and NH_3 at the receptors would be lower than those presented above. The closest residential receptor lies 1km to the south west of the site.

5.1.2 As can be seen from Plate 4-1, the emissions from the desalination generators fall off rapidly with distance from the generators; this is because the stacks are relatively low (4 m high). Predicted concentrations reach background (imperceptible) levels within 600m of the source and therefore they will have no adverse effect on human health receptors.

8 https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK9009101&SiteName=minsmere&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&HasCA=1&NumMarineSeasonality=12&SiteNameDisplay=Minsmere-Walberswick%20SPA

5.1.3 To further emphasize this point, the desalination plant generators being of 800kW capacity are significantly smaller than the emergency diesel generators associated with the SZC operational site (around 9MW output each). The impact assessment carried out for for emergency diesel generators concluded that there were no significant impacts at any human health receptors for emissions of NO_2, SO_2, carbon monoxide or particulates (as PM_{10} and $PM_{2.5}$) and therefore as the emissions from the desalination generators are considerably lower, and the stacks are also lower, the associated impacts on human health impacts would also be considerably less.

6 SUMMARY

6.1.1 Based on the assessment undertaken, the proposed desalination diesel generators in their proposed location are not predicted to give rise to significant effects on any human health or habitat sites, particularly when considering that they will only be installed for a maximum of two years. Nor are they predicted to give rise to any adverse impact on the integrity of any European Site. As such, there is no good reason why it should not be expected that the relevant permit will be granted by the Environment Agency.

FIGURES