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HPC COMBUSTION ACTIVITY PERMIT VARIATION – AIR QUALITY MODELLING REPORT

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Executive Summary

Purpose of Report

Bureau Veritas has been commissioned by NNB Generation Company (HPC) Limited (NNB GenCo HPC) to undertake a dispersion modelling exercise assessing impacts at human health and ecological receptors from operational emission sources at the Hinkley Point C nuclear power station (HPC).

This assessment has been undertaken to support the Environmental Permit variation application for combustion activities during the operational period of the plant. It has used detailed dispersion modelling, using ADMS 6, to undertake an assessment of emissions produced from operational emission sources at the Site, which comprise emissions from on-site emergency power generators, which are diesel powered.

This report presents the methodology, model input parameters and results at human and ecological receptors for the following pollutants:

- Oxides of nitrogen (NO_x);
- Nitrogen dioxide (NO₂);
- Particulates (PM₁₀ and PM_{2.5});
- Sulphur dioxide (SO₂);
- Carbon monoxide (CO); and
- Deposition of nitrogen and acid components.

Through liaison with the Environment Agency (EA), a number of modelling scenarios were developed and run during 2022-25. This modelling report focuses on presenting the methodology and full results for the following scenarios:

- Scenario 1: Commissioning (inclusive of emissions arising from ongoing construction activities). This scenario assesses all potential releases to air from the back-up generators during the commissioning of the power station;
- Scenario 2: Routine Testing. This scenario presents the likely potential impacts to be expected as a result of the standard generator testing, which will be scheduled throughout the lifetime of the power station; and
- Scenario 3: Emergency Loss of Off-site Power. This scenario will cover a loss of off-site power (LOOP) situation where grid connection for both reactor units is lost, and the station is unable to operate under house load.

All modelling methodologies and assumptions have been developed to represent a reasonable worst case, conservative assessment. Consequently, actual concentrations at nearby receptors are likely to be less than those reported in this assessment.

Summary of Conclusions

Table 1.1 and Table 1.2 present a summary of exceedances of the relevant criteria for each scenario, for human health and ecological effects, respectively.



Table 1.1 – Summary of Exceedances of the Air Quality Standards, Objectives and Environmental Assessment Levels for Human Health Effects per Scenario.

Pollutant Averaging Period	Commissioning A – Unit 1	Commissioning A – Unit 2	Commissioning B – Unit 1	Commissioning B – Unit 2	Commissioning C – Unit 1	Commissioning C – Unit 2	Routine Testing	LOOP A	LOOP B
	Are there exceedances? (Y/N)								
NO ₂ Annual mean	N	N	N	N	N	N	N	N	N
NO ₂ 99.79 Percentile 1-hour mean	N	N	Y	Y	Y	Y	Y	Y	Y
PM ₁₀ Annual mean	N	N	N	N	N	N	N	N	N
PM ₁₀ 90.41 percentile 24-hour mean	N	N	N	N	N	N	N	N	N
PM _{2.5} Annual mean	N	N	N	N	N	N	N	N	N
CO Maximum 1-hour mean	N	N	N	N	N	N	N	N	N
CO Maximum 8-hour mean	N	N	N	N	N	N	N	N	N
SO ₂ 99.73 percentile 1-hour mean	N	N	N	N	N	N	N	N	N
SO ₂ 99.18 percentile 24-hour mean	N	N	N	N	N	N	N	N	N
SO ₂ 99.9 percentile 15-min mean	N	N	N	N	N	N	N	N	N
USA EPA AEGL 1 100 percentile 1-hour mean NO ₂	-	-	-	-	-	-	N	Y	Y



Pollutant Averaging Period	Commissioning A – Unit 1	Commissioning A – Unit 2	Commissioning B – Unit 1	Commissioning B – Unit 2	Commissioning C – Unit 1	Commissioning C – Unit 2	Routine Testing	LOOP A	LOOP B
	Are there exceedances? (Y/N)								
USA EPA AEGL 2 100 percentile 1-hour mean NO ₂	-	-	-	-	-	-	N	N	N
USA EPA AEGL 3 100 percentile 1-hour mean NO ₂	-	-	-	-	-	-	N	N	N

At human receptors:

- During the Commissioning scenarios, the results indicate that all long-term and the majority of short-term assessment metrics are below the relevant Air Quality Assessment Levels (AQALs) for both Unit 1 and Unit 2.
- A further probability analysis was then carried out for the Commissioning Scenario, taking into account a worst-case maximum run time. A run time of 192 hours was utilised in the hypergeometric distribution, to calculate the number of hours of exceedance. The probability of exceeding the objective more than the 18 allowed exceedances was less than 0.1%. Therefore, the results for the Commissioning Scenario can be considered not significant for human receptors.
- During the Routine Testing scenario, the results indicated that all long-term assessment metrics, and the majority of the short-term metrics are below the relevant AQALs. The 99.79th percentile of 1-hour mean NO₂ was predicted to exceed the relevant AQAL. However, there are no predicted exceedances of the US EPA AEGL 100th percentile 1-hour mean NO₂ concentrations.
- A further probability analysis was then carried out for the Routine Testing scenario, taking into account a worst-case maximum run time. A run time of 144 hours was utilised in the hypergeometric distribution, to calculate the number of hours of exceedance. The probability of exceeding the objective more than the 18 allowed exceedances was less than 0.1%. Therefore, the results for the Routine Testing can be considered not significant for human receptors.
- During the LOOP scenarios A and B, the results indicated that all long-term assessment metrics, and the majority of the short-term metrics are below the relevant AQALs. The 99.79th percentile of 1-hour mean NO₂ was predicted to exceed the relevant AQAL. Additionally, there are exceedances predicted for the maximum 1-hour mean NO₂ concentration at human receptors for both LOOP scenarios in regard to the US EPA AEGL 1. However, emergency operation of the plant is extremely unlikely to take place.
- A further probability analysis was then carried out for the LOOP scenarios, taking into account a worst-case maximum run time. The probability of exceeding the objective more than the 18 allowed exceedances was less than 0.1% for both scenarios. Therefore, the results for the LOOP Scenario A and B can be considered not significant for human receptors.



Table 1.2 - Summary of Exceedances of the Air Quality Standards, Objectives and Environmental Assessment Levels for Ecological Effects per Scenario

Pollutant Averaging Period	Commissioning A – Unit 1	Commissioning A – Unit 2	Commissioning B – Unit 1	Commissioning B – Unit 2	Commissioning C – Unit 1	Commissioning C – Unit 2	Routine Testing	LOOP A	LOOP B
	Are there exceedances? (Y/N)								
NO _x Annual mean	Y	N	Y	N	Y	N	N	N	N
NO _x 24-hour mean	Y	Y	Y	Y	Y	Y	Y	Y	Y
SO ₂ Annual mean	N	N	N	N	N	N	N	N	N
Nitrogen Deposition	Y	Y	Y	Y	Y	Y	Y	Y	Y
Acid Deposition	Y	Y	Y	Y	Y	Y	Y	Y	Y

At ecological receptors:

- The results for Nitrogen and Acid Deposition show exceedances at all ecological receptors considered in the assessment, in all scenarios. This is mainly due to the existing background concentrations at the receptors, however when the additional PC is considered, further assessment from an ecologist is required. This assessment has been undertaken by an appointed specialist ecologist, results of which are presented within Appendix C of the Permit Variation report¹.
- The results for annual mean NO_x at ecological receptors show exceedances of the AQAL in some of the Commissioning scenarios. Additionally, exceedances of the 24-hour NO_x AQAL are predicted in all of the scenarios. Further assessment is required at these receptors in all considered scenarios. This assessment has been undertaken by an appointed specialist ecologist, results of which are presented within Appendix C of the Permit Variation report¹.
- Further assessment of ecological impacts relative to Nitrogen and Acid Deposition, and annual mean and 24-hour NO_x concentrations, are required at the ecological designations. This assessment has been undertaken by an appointed specialist ecologist, results of which are presented within Appendix C of the Permit Variation report¹.

¹ Bureau Veritas, 2025. HPC Combustion Activity Environmental Permit Variation.

1 Introduction

Bureau Veritas has been commissioned by NNB Generation Company (HPC) Limited (NNB GenCo HPC) to undertake a dispersion modelling exercise assessing impacts at human health and ecological receptors from operational emission sources at the Hinkley Point C nuclear power station (HPC).

This assessment has been undertaken to support the Environmental Permit variation application for combustion activities during the operational phase of HPC. It has used detailed dispersion modelling, using ADMS 6 software, to undertake an assessment of emissions produced from operational emission sources at the Site, which comprise emissions from back-up diesel generators.

This report details the methodology, model parameters and input assumptions that have been used in the modelling exercise and presents the results at sensitive human and ecological receptors, relative to the relevant assessment criteria.

1.1 Scope of Study

This assessment evaluates emissions released from the HPC Site during the operational phase. The air quality impacts associated with the operational phase arise from emissions from fossil fuel combustion, primarily through the use of back-up diesel generators, which exist to provide power in the event that the nuclear power plant loses off-site power. This only occurs when the grid connection is lost, and the station is unable to operate under house load.

The Environmental Permit for combustion will regulate the emissions associated with the use of back-up diesel generators and these are, therefore, the focus of this report.

In addition, since Unit 1 operation is expected to commence prior to the finalisation of construction of Unit 2, construction emissions arising from Unit 2 activities have also been included within the assessment for completeness, in the knowledge that these activities will contribute to overall concentrations. It is important to note, however, that emissions from construction activities are regulated within a separate permit (EPR/WP3200PJ/A001) and so will not be regulated within the permit for operational activities.

In addition to the above, the adjacent sites Hinkley Point A (HPA) and Hinkley Point B (HPB) are expected to be non-operational at the point of any of the modelled HPC scenarios. Therefore, cumulative air quality impacts associated with the operation of diesel generators at the adjacent HPA and HPB site have not been considered. As there are no other significant combustion sources within 2 km of the HPC site, such potential cumulative air quality impacts are not considered further as part of this assessment.

The air pollutants covered by the assessment are as follows:

- Oxides of nitrogen (NO_x);
- Nitrogen dioxide (NO₂);
- Carbon monoxide (CO);
- Sulphur dioxide (SO₂);
- Particulate matter (PM₁₀ and PM_{2.5}); and
- Nitrogen and acid deposition.

Operational emissions at HPC have been assessed using detailed dispersion modelling of emissions to atmosphere. This report considers all modelled scenarios, comprising the following:

- Scenario 1: Commissioning (inclusive of emissions arising from ongoing construction activities).
- Scenario 2: Routine Testing.
- Scenario 3: Emergency Loss of Off-site Power.

Details of emissions from the modelled sources have been provided where available, however, a number of assumptions have had to be made based on gaps in the data available. An assumptions log and accompanying data register is provided in Appendix A.

Full details of the modelling methodology and associated model inputs are detailed in Section 2. In preparing this report, consideration has been given to guidance provided by the Environment Agency in relation to the content that must be included in an air dispersion modelling report associated with an environmental permit².

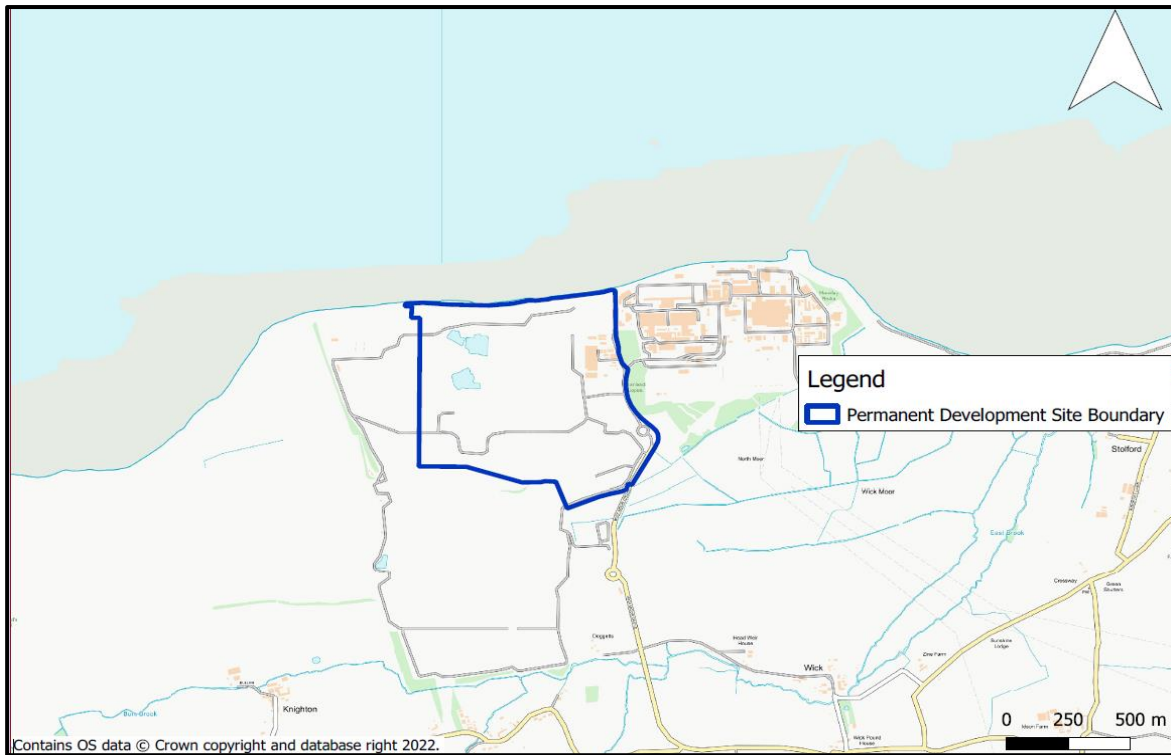
1.2 Site Description

HPC is located in Somerset England, adjacent to the existing power stations at Hinkley Point and approximately 12.5 km northwest of the town of Bridgwater. The existing land use around the site is primarily rural, with isolated residential properties and small villages to the east, south and west. The power stations of Hinkley Point A (now decommissioned) and Hinkley Point B (soon to be decommissioned) are located to the northeast of HPC, whilst to the north of site lies the Severn Estuary.

A site location map, showing the extent of the HPC Site and the surrounding land use, is shown in Figure 1.1.

² Environmental permitting: air dispersion modelling reports (<https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports>)

Figure 1.1 – Site Location



2 Methodology

The methodologies adopted for undertaking the emissions modelling assessment are outlined in the following sections.

2.1 Choice of Model

The atmospheric dispersion model to be used for assessment of construction emissions at the HPC Site will be ADMS 6 (version 6.0.2), developed by Cambridge Environmental Research Consultants (CERC).

ADMS 6 parameterises stability and turbulence in the Atmospheric Boundary Layer (ABL) by the Monin-Obukhov length and the boundary layer depth. This approach allows the vertical structure of the ABL to be more accurately defined than by the stability classification methods of earlier dispersion models such as R91 or ISCST3. In ADMS, the concentration distribution follows a symmetrical Gaussian profile in the vertical and crosswind directions in neutral and stable conditions. However, the vertical profile in convective conditions follows a skewed Gaussian distribution to take account of the inhomogeneous nature of the vertical velocity distribution in the Convective Boundary Layer (CBL).

Single or multiple sources of various types (point, area, volume, jet) can be modelled and advanced features such as the modelling of building downwash, atmospheric chemical reactions, wet and dry deposition, and the effects of the terrain or a coastline are available. ADMS 6 includes a meteorological pre-processor which calculates parameters such as LMO from the raw meteorological data.

The ADMS suite of models is the de facto choice for those undertaking air quality dispersion modelling in the UK and are widely accepted by regulatory bodies as a suitable model for studies of this nature. ADMS 6 has previously been used in the air quality assessments for all previous studies in relation to HPC and is therefore considered the most appropriate dispersion model to be used in this study.

2.2 Pollutants Assessed

The Industrial Emissions Directive – Best Available Techniques (BAT) Reference Document for Large Combustion Plants³ identifies the following pollutants as being the most important emissions from the combustion of combustible fuels; as such these have been considered within the modelling assessment:

- Oxides of nitrogen (NO_x and NO₂);
- Sulphur dioxide (SO₂);
- Carbon monoxide (CO); and
- Particulate matter (PM₁₀ and PM_{2.5}).

Predicted concentrations of the above pollutants at human receptors have been assessed against the relevant Air Quality Assessment Level (AQAL), which are Air Quality Standards (AQSs), Air Quality Objectives (AQOs) and Environmental Assessment Levels (EALs) as specified in the Environment Agency's Air Emission Risk Guidance⁴. These are detailed in Section 3 of this report,

³ Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control) Best Available Techniques (BAT) Reference Document for Large Combustion Plants (<http://eippcb.jrc.ec.europa.eu/reference/lcp.html>)

⁴ Air emissions risk assessment for your environmental permit (<https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>)

for human and ecological receptors, respectively. Model predicted nutrient nitrogen deposition and acid deposition will be assessed based on the location of the receptor using site relevant critical loads from the Air Pollution Information System (APIS) database⁵. Further information with regards to how nitrogen and acid deposition will be calculated can be found in Section 2.12.

The above assessment criteria for both human and ecological receptors will be used to benchmark the overall modelled concentrations to determine the likely risk of exceeding the relevant criteria. Specific consideration will also be made to the process contribution from the emissions to air associated with HPC activities to determine how significant the impacts of the resultant pollutant concentrations are in relation to the overall concentration at each assessed receptor location.

2.3 Background Concentrations

Annual mean background concentrations at the assessed human and ecological receptor locations have initially been derived from the Defra background maps for the 1 km grid square in which they are located. These background concentrations do not include the concentrations of pollutants which are anticipated to be emitted by site operations during the Unit 1 and Unit 2 construction phases. Therefore, the Defra background maps have been uplifted to include the on-site emissions during the construction phase.

The emissions to air associated with HPC construction activities have been previously modelled and assessed in support of the Combustion Activity Permit required for the construction phase. The results of this modelling are discussed elsewhere, however the process contributions associated with the predicted construction phase emissions have been utilised as the basis to uplift the background pollutant concentrations for this assessment. At the time the construction phase modelling work was undertaken, the assumed total aggregated on-site monthly generator capacity was 5,605 kW_{th} (calculated as a monthly average of a 12-month period). In 2027, when Unit 1 is being commissioned, it is estimated that there will be 8,242 kW_{th} total aggregated on-site monthly generator capacity (calculated as a monthly average of a 12-month period) related with the ongoing construction of Unit 2. This is a factor of 1.47 greater than the capacity assumed at the time that the construction phase modelling work was undertaken. A factor of 1.47 was therefore applied to the process contributions from the construction phase emissions model outputs and the scaled construction phase process contribution added to the 2027 Defra background map concentrations, which are detailed below in Table 2.1. This approach of uplifting the background concentrations was only applied to the Commissioning scenarios for Unit 1 (2027), as these are the only scenarios understood to coincide with the construction phase of Unit 2.

The annual average process contribution associated with each of the operational scenarios is added to the annual average background concentration to give a total concentration at each receptor location. This total concentration can then be compared against the relevant Air Quality Standard/Objective (AQS/O) and the likelihood of an exceedance determined.

It is not technically rigorous to add predicted short-term or percentile concentrations to ambient background concentrations not measured over the same averaging period, since peak contributions from different sources would not necessarily coincide in time or location. Without hourly ambient background monitoring data available it is difficult to make an assessment against the achievement or otherwise of the short-term AQS/O. For the current assessment, conservative short-term ambient levels have been derived by applying a factor of two to the annual mean background data as per the recommendation in Environment Agency guidance.

The background annual mean concentrations used in the assessment of the Commissioning Scenario are detailed in Table 2.1, with the background concentrations used for the Routine Testing and LOOP scenarios are detailed in Table 2.2.

⁵ Access online at: <http://www.apis.ac.uk/>

Table 2.1 – 2027 Defra Background Mapped Annual Mean Pollutant Concentrations used in the Commissioning Scenarios

Grid square (E, N)	2027 Defra Annual Mean Pollutant Concentrations ($\mu\text{g}/\text{m}^3$)					
	NO _x ^a	NO ₂ ^a	PM ₁₀ ^a	PM _{2.5} ^a	CO ^b	SO ₂ ^b
313500,135500	3.74	3.04	10.58	5.87	163.0	1.7
315500,141500	3.86	3.14	9.30	5.59	156.0	1.9
315500,142500	3.87	3.14	9.97	5.74	154.0	2.1
317500, 145500	3.54	2.88	9.05	5.46	161.0	2.7
318500, 145500	3.61	2.93	9.40	5.56	161.0	2.1
318500, 146500	3.63	2.95	8.93	5.44	161.0	2.7
319500, 143500	3.88	3.15	9.86	5.74	155.0	2.0
319500, 144500	3.83	3.11	9.53	5.64	153.0	2.1
319500, 145500	3.76	3.05	10.36	5.82	152.0	2.1
319500, 146500	3.63	2.95	8.93	5.44	161.0	2.7
320500, 143500	4.00	3.24	10.02	5.96	156.0	2.1
320500, 144500	3.96	3.21	10.03	5.90	155.0	2.2
320500, 145500	4.02	3.25	9.95	5.86	154.0	2.4
320500, 146500	3.79	3.07	9.04	5.61	161.0	2.7
321500, 143500	3.96	3.21	10.68	6.06	156.0	2.1
321500, 144500	4.14	3.35	10.44	6.00	155.0	2.2
321500, 145500	5.85	4.67	10.08	5.96	161.0	2.7
321500, 146500	4.07	3.30	9.09	5.65	161.0	2.7
322500, 144500	4.04	3.27	10.41	5.99	158.0	2.1
322500, 145500	4.31	3.49	10.11	5.94	157.0	2.6
322500, 146500	4.11	3.32	9.11	5.67	161.0	2.7
322500, 160500	4.12	3.34	8.75	5.68	161.0	2.7
323500, 143500	4.13	3.34	10.25	5.98	161.0	2.0
323500, 144500	4.03	3.27	9.74	5.84	159.0	2.1
323500, 145500	4.08	3.30	9.58	5.82	159.0	2.3
323500, 146500	3.96	3.21	9.07	5.66	161.0	2.7
323500, 147500	3.63	2.95	8.93	5.44	161.0	2.7
324500, 145500	3.98	3.23	9.18	5.70	161.0	2.7
324500, 147500	3.63	2.95	8.93	5.44	161.0	2.7
329500, 145500	4.57	3.69	9.93	6.11	181.0	2.0
329500, 147500	4.46	3.61	9.34	5.99	161.0	2.7
329500, 150500	4.43	3.58	9.32	6.02	161.0	2.1
329500, 159500	4.23	3.42	9.01	5.85	161.0	2.7

^a 2027 Annual mean background concentration of NO₂, NO_x, PM₁₀ and PM_{2.5} taken from Defra's UK Air Quality Archive (1 km x 1 km grid squares) prior to processing (2018 reference year background maps).
^b Background concentration of SO₂ taken from Defra's UK Air Quality Archive (1 km x 1 km grid squares) 2001 background maps prior to processing.

Table 2.2 – 2027 Defra Background Mapped Annual Mean Concentrations used in the Routine Testing and LOOP Scenarios

Grid square (E, N)	2028 Defra Annual Mean Pollutant Concentrations ($\mu\text{g}/\text{m}^3$)					
	NO _x ^a	NO ₂ ^a	PM ₁₀ ^a	PM _{2.5} ^a	CO ^b	SO ₂ ^b
313500,135500	3.68	2.99	10.57	5.87	163.0	1.7
315500,141500	3.79	3.07	9.30	5.59	156.0	1.9
315500,142500	3.79	3.08	9.97	5.74	154.0	2.1
317500, 145500	3.48	2.83	9.04	5.46	161.0	2.7
318500, 145500	3.55	2.89	9.40	5.56	161.0	2.1
318500, 146500	3.57	2.90	8.92	5.44	161.0	2.7
319500, 143500	3.82	3.10	9.85	5.74	155.0	2.0
319500, 144500	3.77	3.06	9.53	5.64	153.0	2.1
319500, 145500	3.70	3.00	10.35	5.82	152.0	2.1
319500, 146500	3.57	2.90	8.92	5.44	161.0	2.7
320500, 143500	3.93	3.19	10.02	5.96	156.0	2.1
320500, 144500	3.89	3.16	10.02	5.90	155.0	2.2
320500, 145500	3.95	3.20	9.94	5.86	154.0	2.4
320500, 146500	3.72	3.02	9.04	5.61	161.0	2.7
321500, 143500	3.89	3.16	10.68	6.06	156.0	2.1
321500, 144500	4.07	3.29	10.43	6.00	155.0	2.2
321500, 145500	5.77	4.61	10.07	5.96	161.0	2.7
321500, 146500	4.00	3.24	9.09	5.65	161.0	2.7
322500, 144500	3.97	3.22	10.40	5.99	158.0	2.1
322500, 145500	4.24	3.43	10.10	5.94	157.0	2.6
322500, 146500	4.04	3.27	9.11	5.67	161.0	2.7
322500, 160500	4.06	3.29	8.75	5.68	161.0	2.7
323500, 143500	4.06	3.29	10.25	5.98	161.0	2.0
323500, 144500	3.96	3.21	9.74	5.84	159.0	2.1
323500, 145500	4.01	3.25	9.57	5.82	159.0	2.3
323500, 146500	3.89	3.15	9.07	5.66	161.0	2.7
323500, 147500	3.57	2.90	8.92	5.44	161.0	2.7
324500, 145500	3.91	3.17	9.17	5.70	161.0	2.7
324500, 147500	3.57	2.90	8.92	5.44	161.0	2.7
329500, 145500	4.48	3.62	9.92	6.11	181.0	2.0
329500, 147500	4.38	3.54	9.33	5.99	161.0	2.7
329500, 150500	4.35	3.52	9.31	6.02	161.0	2.1
329500, 159500	4.16	3.37	9.00	5.85	161.0	2.7

^a 2028 Annual mean background concentration of NO₂, NO_x, PM₁₀ and PM_{2.5} taken from Defra's UK Air Quality Archive (1 km x 1 km grid squares) prior to processing (2018 reference year background maps).
^b Background concentration of SO₂ taken from Defra's UK Air Quality Archive (1 km x 1 km grid squares) 2001 background maps prior to processing.

2.4 Ecological Receptor Deposition Backgrounds

Estimated background deposition rates of nutrient nitrogen and total acid deposition for the UK are available via the Air Pollution Information Service (APIS) website (<http://www.apis.ac.uk>). This provides estimated deposition rates for the ecological receptors considered in this study, as obtained from the APIS website. It should be noted that the level of uncertainty associated with these modelled estimates is relatively high and the results are presented from the model across the UK on a 5 km grid square resolution. The background concentrations included within the Nitrogen and Acid deposition assessments are not inclusive of nitrogen or sulphur deposition associated with the construction phase of the Site, as these are considered to be short-term and reversible contributions.

Table 2.3 - Estimated Background Deposition Rates

Model Receptor ID	Site Name	Designation ^(a)	Background Nitrogen Deposition (kg N ha ⁻¹ y ⁻¹) ^(b)	Background Nitric Acid Deposition (keq ha ⁻¹ y ⁻¹) ^(b)	Background Sulphuric Acid Deposition (keq ha ⁻¹ y ⁻¹) ^(b)
DE_1	Huntspill River	NNR	25.20	3.00	0.30
DE_2	Berrow Dunes	SSSI	20.20	3.00	0.30
DE_3	Blue Anchor to Lilstock Coast	SSSI	25.20	3.00	0.30
DE_4	Brean Down	SSSI	19.40	3.00	0.30
DE_5	Ge-Mare Farm Fields	SSSI	17.70	1.30	0.10
DE_6	The Quantocks	SSSI	25.20	3.00	0.20
DE_7	Roebuck Meadows	SSSI	23.10	1.60	0.10
DE_8	Roebuck Meadows	SSSI	23.10	1.60	0.10
DE_9	Bridgwater Bay	SSSI	20.20	1.40	0.20
DE_10	Steep Holm	SSSI	11.30	3.00	0.30
DE_11	Somerset Wetlands	NNR	25.20	3.00	0.30
GE1 – GE4615	Severn Estuary	Ramsar, SPA	22.30	1.60	0.30

Notes:
^a National Nature Reserve (NNR), Site of Special Scientific Interest (SSSI), Special Protection Area (SPA).
^b Source: Air Pollution Information Service (APIS) website (<http://www.apis.ac.uk>)

2.5 Scenarios

This report contains the methodology and results for the following scenarios:

1. **Commissioning** – this scenario assesses all potential releases to air from the back-up generators during the commissioning of the power station, assuming the commissioning phase to be during a period of one calendar year. It is assumed that the commissioning of Unit 1 and Unit 2 would not occur during the same year. The following commissioning sub scenarios A/B/C for Unit 1 and Unit 2 would occur separately, not concurrently:
 - *Commissioning A* - 56 hours testing of all EDGs operating simultaneously at 50% load;
 - *Commissioning B* - 192 hours (8 days) testing of all EDGs operating simultaneously at 100% load; and
 - *Commissioning C* - 192 hours (eight days) testing of all EDGs and all UDGs operating simultaneously at 100% load.
2. **Routine Testing** – this scenario presents the likely potential impacts to be expected as a result of the standard generator testing, which will be scheduled throughout the lifetime of the power station; and
3. **LOOP** – this scenario will cover a loss of off-site power (LOOP) situation. This only occurs when grid connection for both reactor units is lost, and the station is unable to operate under house load.

In this scenario all eight EDGs would operate simultaneously alongside all other on-site generators (with the exception of the UDGs and SEGs) for a minimum of 24 hours.

- *LOOP A* - A scenario of a 24-hour LOOP event with all eight EDGs operating simultaneously has been assumed within this scenario. Probability analysis within the 2018 assessment⁶ indicated that short LOOP scenarios (up to two hours) represent more than 95% of possible LOOP scenarios and therefore would be a credible worst-case scenario to assess. However as 18 hourly exceedances of the NO₂ 1-hour AQS are permitted, this scenario would not result in non-compliance of this AQS. A 24-hour LOOP event scenario would take account of a potential scenario (however unlikely) whereby LOOP occurs for longer than a 2-hour period, in order to assess the impact on the NO₂ 1-hour AQS, as well as on those pollutants with averaging periods longer than the event duration (i.e., 24-hour and 8-hour AQSs). It has also been assumed that the EDGs are not immediately shut down when the LOOP event is over.
- *LOOP B* – A scenario of a 72-hour LOOP event with all eight EDGs operating simultaneously. This scenario has been considered due to 72 hours being the standard time recommended by UK Power Networks (UKPN) to cover the maximum period a black start recovery is expected to last.

Operational hours will be less than 500 hours a year for any of the scenarios.

Of the above assessment scenarios, LOOP represents the worst-case scenario due to the simultaneous operation of all on-site generators (with the exception of the UDGs and SEGs). This extent of simultaneous operation does not occur in any of the other detailed scenarios.

⁶ EDF Energy, NNB Generation Company. 2016. Site Specific Short and Long Loop Frequency Updates for HPC and SZC EPRs. Document reference: HPC-UKX-NNBOSL-U0-GEV-RET-100000
Bureau Veritas

It should be noted that all scenarios above are based primarily on technical specification sheets and a series of worst-case assumptions.

All assumptions made within the assessment are listed within Appendix A.

2.6 Emissions Parameters

Table 2.4 details the normalised emission rates calculated for the generators and Table 2.5 details the stack exhaust parameters. The emission rates input to the model for NO_x, PM (i.e., PM₁₀ and PM_{2.5}) and CO have been derived from the g/kWh or mg/m³ figures provided in the technical specification sheets where possible. Where these were not available from the specification sheets, the values have been assumed to be equal to the TA-Luft Standards⁷ as a conservative estimate. SO₂ emission rates have been calculated from the Sulphur content of the specified fuel “BS2869 Class A2”. The specification shows a maximum fuel Sulphur content of 0.002%⁸.

Process emissions data has not been made available for all generator types and therefore a number of assumptions have been made in the absence of actual emissions data. An assumptions register has been included in Appendix A.

Process emissions have been modelled under expected worst-case operation using the standard steady-state algorithms in ADMS. All emissions sources within the model have initially been run as operating 24/7, as fixed diurnal/seasonal operating profiles are not available. During the post-processing of the modelled results, where required, annual mean process contribution outputs have then been factored to the relevant number of operational hours per year for each operational scenario.

Technical specifications for the diesel generators are provided in Appendix B, where available. Calculations relating to derivations of emission rates are provided in Appendix C.

Table 2.4 – Generator Emission Rates

System	Building	Thermal Input (MW)	Rating (kW _e)	Number of Generators	NO _x (mg/Nm ³) ^e	PM (mg/Nm ³) ^e	CO (mg/Nm ³) ^e
EDGs	HD	23.11	9590	8	1900	50	150
UDGs	HDA	8.00	3600	4	1143	6.4	194
SEGs	HOR	0.47	142	6	9.1c (g/kWh)	0.5 (g/kWh)	5.0 (g/kWh)
HDU ^a	HUM	1.34	-	1	2000	80	650
SMDGs ^a	HHE	3.89	1750	3	2000	80	650
CWI Pumps ^a	HHE	0.10	45	2	2000	80	650
BDB Spare ^a	HHE	3.89	1750	1	2000	80	650
LLV	HBX	1.28	488	1	3.2 ^{b, c} (g/kWh)	0.1 ^{b, c} (g/kWh)	2.3 ^{b, c} (g/kWh)
ESS	HL ^d	0.14	53	19	5.7 ^{b, c} (g/kWh)	0.1 ^{b, c} (g/kWh)	0.7 ^{b, c} (g/kWh)
OLLI	HL	0.53	200	1	3.7 ^{b, c} (g/kWh)	0.2 ^{b, c} (g/kWh)	2.1 ^{b, c} (g/kWh)

⁷ Access online at: <https://www.gov.uk/guidance/emergency-backup-diesel-engines-on-installations-best-available-techniques-bat#:~:text=Build%20standards,-Engines%20must%20be&text=Combustion%20plant%20specification%20sheets%20that,obstructed%20by%20caps%20o,r%20cowl%20>

⁸ Access online at: <https://www.crownoil.co.uk/fuel-specifications/bs-2869/a2-gas-oil/>

System	Building	Thermal Input (MW)	Rating (kW _e)	Number of Generators	NO _x (mg/Nm ³) ^e	PM (mg/Nm ³) ^e	CO (mg/Nm ³) ^e
HBS	HBS	0.53	200	1	3.7 ^{b, c} (g/kWh)	0.2 ^{b, c} (g/kWh)	2.1 ^{b, c} (g/kWh)
HHA	HHA	0.53	200	1	3.7 ^{b, c} (g/kWh)	0.2 ^{b, c} (g/kWh)	2.1 ^{b, c} (g/kWh)
HZG	HUD	0.53	200	1	3.7 ^{b, c} (g/kWh)	0.2 ^{b, c} (g/kWh)	2.1 ^{b, c} (g/kWh)

^a Emission rate not provided within technical specification sheet. 2g TA-Luft assumed as a conservative estimate.

^b Emission rate not provided within technical specification sheet. Assumed to be in line with values from similarly rated generators within the HPC AQ Construction Modelling Assessment (Bureau Veritas, 9th April 2020, Hinkley Point C – Construction Modelling Specification and Results, Issue 10).

^c Emission rate not provided within technical specification sheet. g/kWh value utilised.

^d ESS is not allocated to a building on the site, however the ADMS model requires each emissions source to be attributed to a building for the purposes of dispersion calculation. Within the ADMS model, the 'Main' building is defined as HL, therefore the ESS emissions have been associated with the HL 'main' building within the ADMS model.

^e Reference conditions: 20°C, 101.3 kPa, dry gas, 5% O₂.

2.7 Stack diameter adjustment

For stacks with rain caps (EDGs and HDU), as well as for horizontal release stacks (SEGs), an assumed vertical efflux velocity of 0.1 m/s was assumed. In order to ensure that the volumetric flow of each of these emissions release points remained constant within the context of the model, it was necessary to adjust the modelled stack diameters to a theoretical stack diameter. The adjusted theoretical stack diameters included in the model are therefore greater than the actual physical stack diameters. In turn, stack downwash was turned off for these sources in line with the ADMS 6.0 user guide recommendations⁹. Point sources with larger diameters are subject to greater stack downwash, and thus stack downwash calculations for an adjusted theoretical stack diameter (required to accommodate an assumed vertical efflux velocity of 0.1 m/s) would not be representative of the source in question.

Table 2.5 – Stack Parameters

System	Stack Height (m)	Physical Stack Diameter (m)	Theoretical Stack Diameter (m)	Rain Cap	Vertical/ Horizontal	Volumetric Flow (m ³ /s)	Velocity (m/s)	Temperature (°C)
EDGs	27.2	1.8	22.1	Y	Vertical	38.3 ^a	0.10	355
UDGs	27.2	0.8	N/A	N	Vertical	6.3 ^b	12.6	545
SEGs	13.9	0.2	3.2	N	Horizontal	0.8 ^a	0.10	450
HDU	23.7	0.5	7.4	Y	Vertical	4.3 ^a	0.1	510
SMDGs	1.5	0.4	N/A	N	Vertical	1.4 ^b	11.1	125
CWI Pumps	1.5	0.4	N/A	N	Vertical	0.004 ^b	0.03	537
BDB Spare	1.5	0.4	N/A	N	Vertical	1.4 ^b	11.1	125
LLV	44.1	0.2	N/A	N	Vertical	0.4 ^a	12.4	568
ESS	13.9	0.2	N/A	N	Vertical	0.6 ^a	31.4	538
OLLI	13.9	0.2	N/A	N	Vertical	0.9 ^a	51.3	588
HBS	16.9	0.2	N/A	N	Vertical	0.9 ^a	51.3	588
HHA	19.9	0.2	N/A	N	Vertical	0.9 ^a	51.3	588

⁹ https://www.cerc.co.uk/environmental-software/assets/data/doc_userguides/CERC_ADMS_6_User_Guide.pdf

System	Stack Height (m)	Physical Stack Diameter (m)	Theoretical Stack Diameter (m)	Rain Cap	Vertical/ Horizontal	Volumetric Flow (m ³ /s)	Velocity (m/s)	Temperature (°C)
HZG	25.9	0.2	N/A	N	Vertical	0.9 ^a	51.3	588

^a Actual conditions. 12% O₂. Assumed dry gas, no correction for moisture.

^b Normalised to NTP (20°C, 1 atmosphere at 101.3 kPa, dry gas). 15% O₂.

Figure 2.1 presents the locations of the modelled emission sources, with their coordinates presented in Table 2.6.

Figure 2.1 – Locations of Emissions Sources

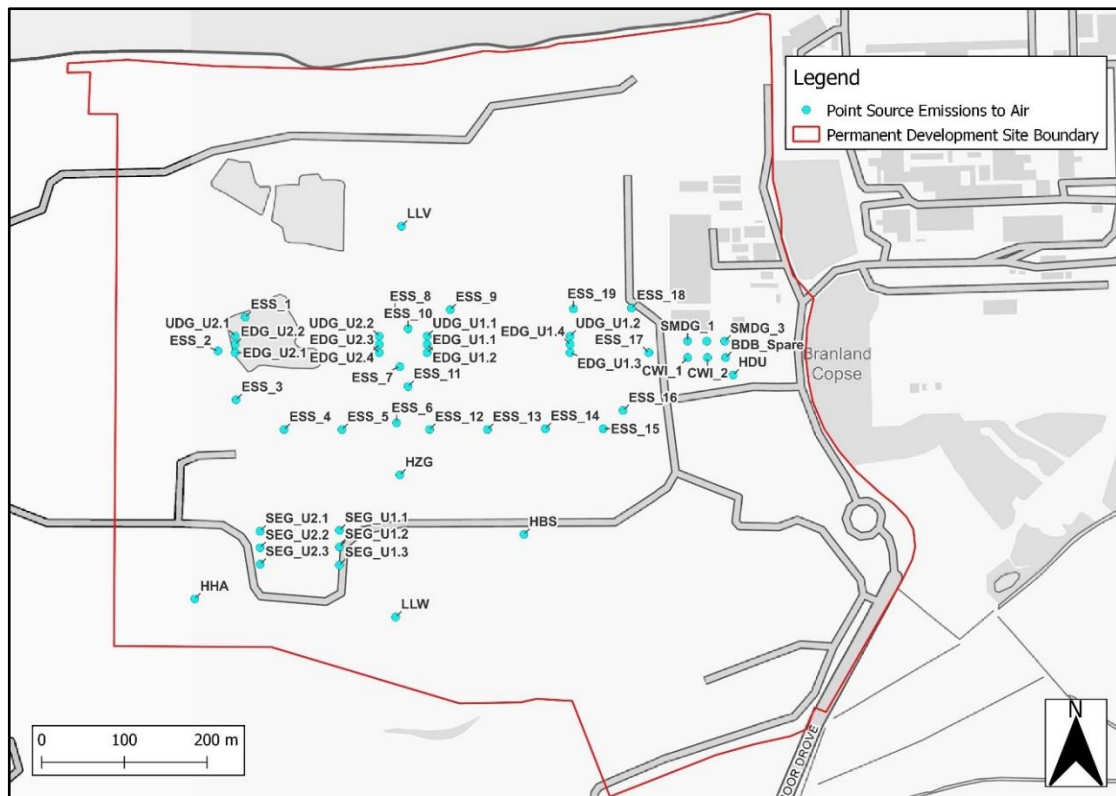


Table 2.6 – Stack Coordinates

Stack ID	Reference	X	Y
EDG_U1.1	A3	320285	145817
EDG_U1.2	A2	320285	145827
EDG_U1.3	A6	320458	145817
EDG_U1.4	A5	320458	145827
UDG_U1.1	A1	320285	145837
UDG_U1.2	A4	320458	145837
SEG_U1.1	A13	320179	145602
SEG_U1.2	A14	320179	145582
SEG_U1.3	A15	320179	145560
EDG_U2.1	A9	320053	145817
EDG_U2.2	A8	320053	145827

Stack ID	Reference	X	Y
EDG_U2.3	A12	320227	145817
EDG_U2.4	A11	320227	145827
UDG_U2.1	A7	320053	145837
UDG_U2.2	A10	320227	145837
SEG_U2.1	A16	320083	145601
SEG_U2.2	A17	320083	145581
SEG_U2.3	A18	320083	145561
HDU	A19	320655	145790
SMDG_1	A20	320600	145831
SMDG_2	A21	320623	145831
SMDG_3	A22	320645	145831
CWI_1	A23	320600	145811
CWI_2	A24	320624	145811
BDB_Spare	A25	320646	145811
LLV	A26	320254	145970
ESS_1	A27	320065	145860
ESS_2	A28	320032	145819
ESS_3	A29	320054	145760
ESS_4	A30	320112	145724
ESS_5	A31	320182	145724
ESS_6	A32	320248	145732
ESS_7	A33	320252	145800
ESS_8	A34	320246	145867
ESS_9	A35	320313	145869
ESS_10	A36	320262	145846
ESS_11	A37	320262	145776
ESS_12	A38	320288	145724
ESS_13	A39	320358	145724
ESS_14	A40	320428	145725
ESS_15	A41	320498	145725
ESS_16	A42	320522	145747
ESS_17	A43	320553	145817
ESS_18	A44	320532	145871
ESS_19	A45	320462	145870
LLW	A46	320247	145497
HBS	A47	320402	145597
HHA	A48	320004	145519
HZG	A49	320252	145669

2.8 Meteorological Data

Annual hourly sequential meteorological data for 2017 to 2021 generated using the United Kingdom Meteorological Office (UKMO) Numerical Weather Prediction (NWP) model has been sourced for use within the modelling study. The spatial resolution of the NWP data is 1.5 km, in line with Environment Agency guidelines of being 4 km or less. The data are provided in a text format file

containing 43,824 sequential hours of data (from 1 January 2017 to 31 December 2021), with the following parameters provided for each hour:

- Wind speed (at 10 m);
- Wind direction (degrees);
- Cloud amount (oktas);
- Temperature (°C);
- Sensible heat flux ($W m^{-2}$);
- Boundary layer depth (m);
- Precipitation rate ($mm h^{-1}$); and
- Relative humidity (percentage).

Wind-roses for each year between 2017 and 2021 are shown in Figure 2.2 to Figure 2.6 and Figure 2.7 shows the overall wind-rose for the years 2017 to 2021. The wind rose figures show the prevailing wind direction to be west-northwest.

The ADMS model has been run independently for each year of meteorological data in order to identify the year which produced the highest predicted concentrations, i.e., the worst-case scenario. The highest concentration at each receptor from any year of meteorological data will be reported.

Figure 2.2 – Wind Rose for 2017 (NWP Data)

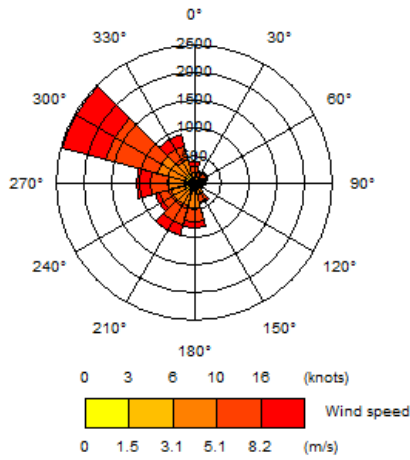


Figure 2.3 – Wind Rose for 2018 (NWP Data)

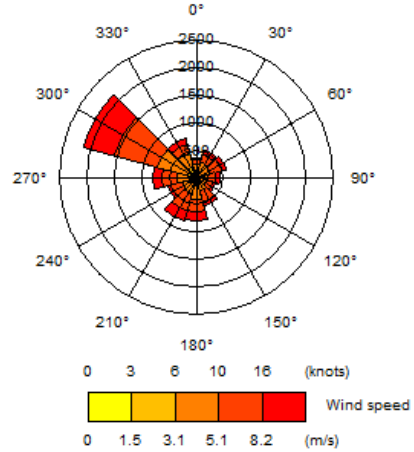


Figure 2.4 – Wind Rose for 2019 (NWP Data)

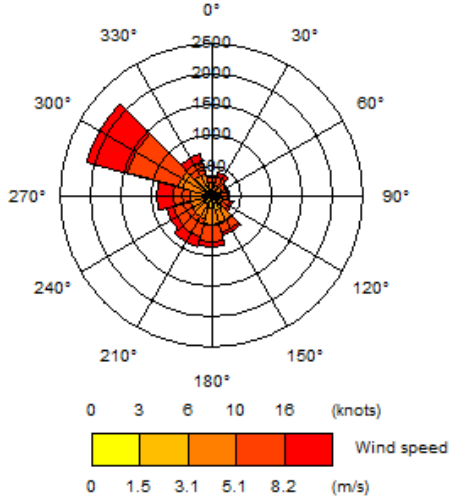


Figure 2.5 – Wind Rose for 2020 (NWP Data)

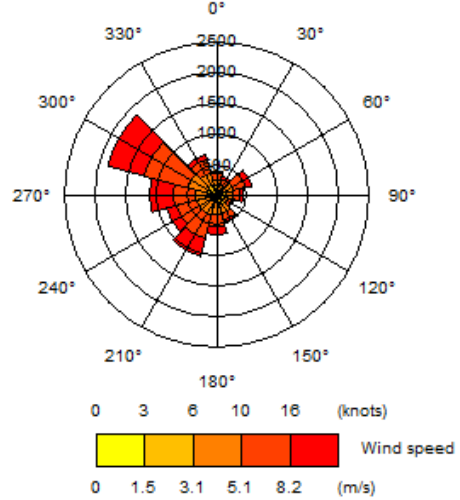


Figure 2.6 – Wind Rose for 2021 (NWP Data)

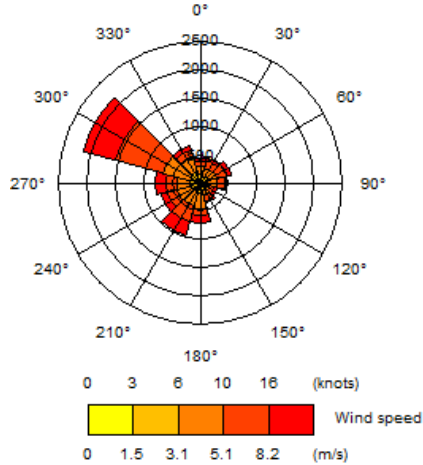
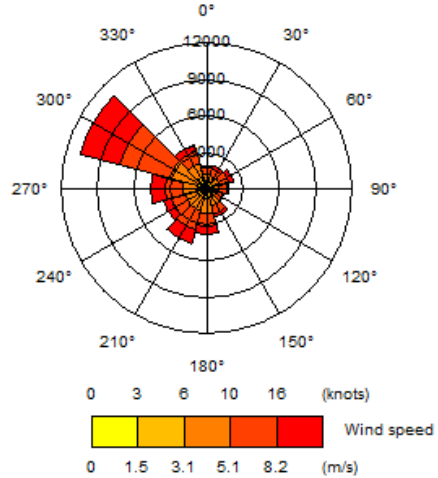


Figure 2.7 – Combined Wind Rose for 2017 – 2021



2.9 Building Effects

Local buildings can affect wind flow, and consequently dispersion, at two general scales. At the regional scale, buildings contribute to surface roughness, whilst at the local scale, buildings affect dispersion from an elevated release by inducing local turbulence that can draw down the pollutant released from a stack to ground level close to the stack.

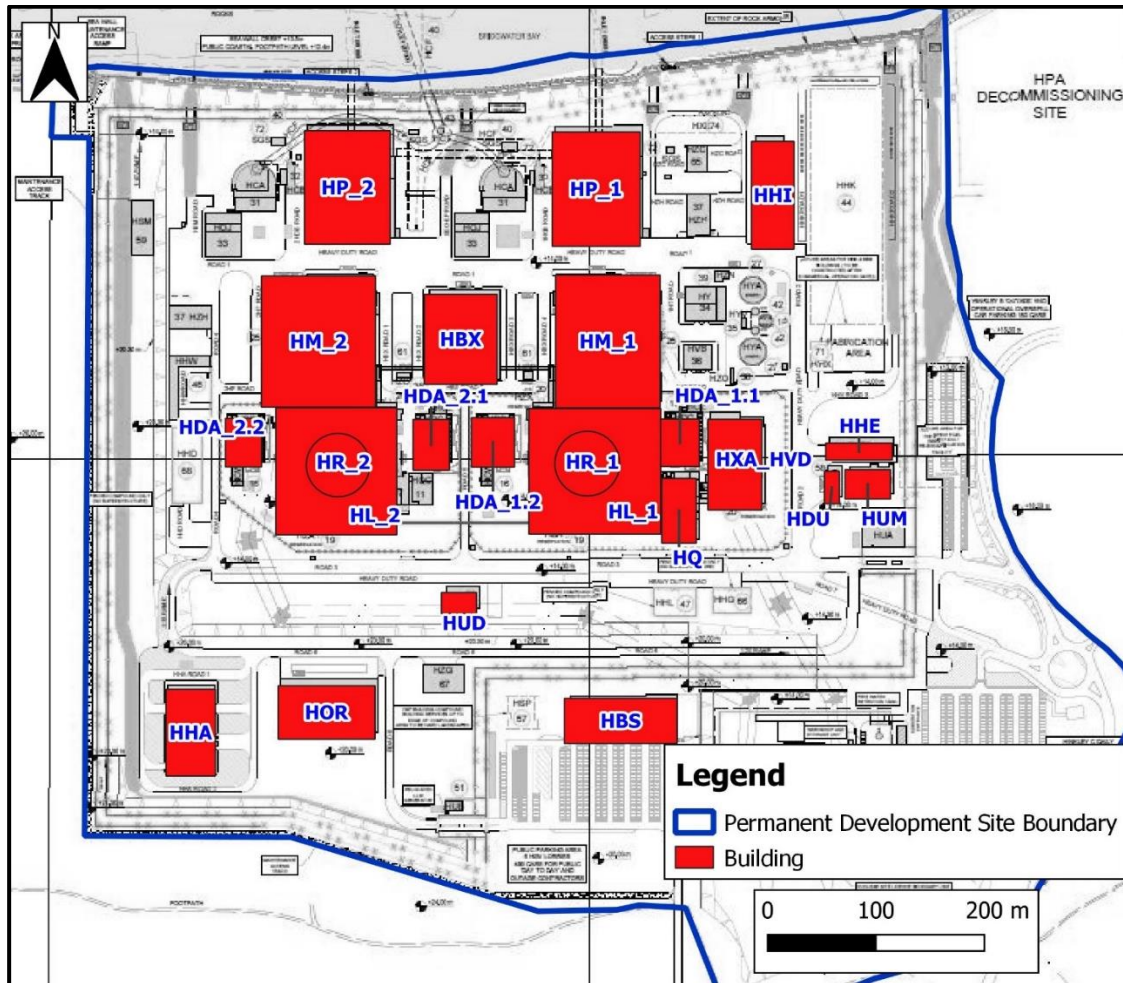
The effect of buildings on dispersion can be considered using the ADMS advanced 'Buildings' option. Parameters such as size, shape and position relative to the static generator stacks are used to model any relevant buildings on site. Buildings and structures situated close to a defined point source will likely have downwash effects. Where possible, therefore buildings should be considered within the model at locations if/where point sources exist.



Table 2.7 – Modelled Buildings

Building ID	Building Name	X	Y	Height (m)	Length/Diameter (m)	Width (m)	Angle (°)
HL_1	Safeguard Building	320379	145804	40.0	121.7	115.8	90
HL_2	Safeguard Building	320141	145804	40.0	111.6	117.1	90
HM_1	Turbine Hall	320391	145923	46.0	122.4	96.4	360
HM_2	Turbine Hall	320124	145923	46.0	121.0	105.2	360
HDA_1.1	Emergency Diesel Generator Building	320458	145830	25.3	35.8	43.7	90
HDA_1.2	Emergency Diesel Generator Building	320285	145830	25.3	45.6	39.7	360
HDA_2.1	Emergency Diesel Generator Building	320228	145828	25.3	33.5	46.8	90
HDA_2.2	Emergency Diesel Generator Building	320055	145830	25.3	44.8	33.4	0
HBX	Operational Service Centre	320255	145925	36.0	67.0	83.0	90
HP_1	Cooling Water Pump House	320380	146064	19.0	81.2	105.5	90
HP_2	Cooling Water Pump House	320151	146065	19.0	79.1	104.7	90
HUD	Auxiliary Administration Building	320254	145682	20.0	32.4	19.4	90
HDU	Emergency Response Energy Centre	320598	145789	9.0	13.7	29.9	90
HUM	Emergency Response Centre	320631	145792	6.0	41.9	27.1	90
HHA	Framatome Warehouse	320006	145563	14.0	45.6	80.0	90
HOR	Raw and Potable Water Storage and Supply	320132	145581	8.0	49.3	89.3	180
HBS	Simulator Training Centre	320403	145574	11.0	41.6	103.9	180
HHI	Intermediate Level Waste Storage	320543	146058	16.0	39.3	99.4	90
HXA_HVD	Effluent Tank, Hot Workshop, Hot Warehouse, Decontamination Facilities	320508	145810	16.0	49.7	83.6	90
HQ	Radioactive Waste Storage/Process Building	320457	145767	17.0	31.9	59.8	90
HHE	Back-up Emergency Equipment Store	320623	145822	13.0	61.4	15.8	90
HR_1	Reactor Building	320372	145811	64.0	59.9	-	-
HR_2	Reactor Building	320142	145809	64.0	58.6	-	-

Figure 2.8 – Modelled Buildings



2.10 Terrain

The surrounding terrain to the east, west and south of the site consists of gently undulating farmland interspersed with farms and small villages, whilst to the immediate north of the proposed development site lies the Bridgwater Bay Site of Special Scientific Interest (SSSI) and the Severn Estuary Special Protection Area (SPA).

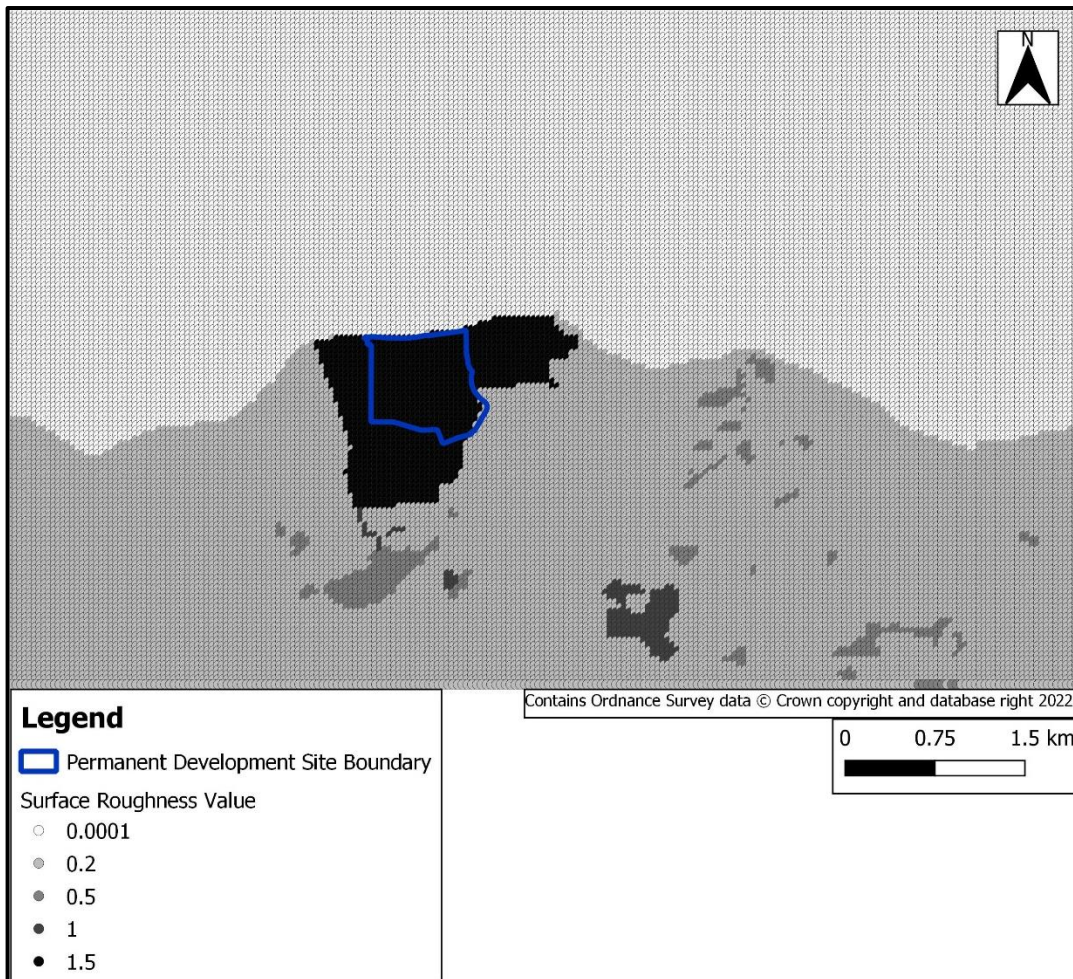
There are no significant terrain features in the area immediately surrounding the site, due to the estuarine environment, and so the consideration of complex terrain data has not been included within the model. This is in line with previous modelling assessments undertaken for the site.

2.11 Surface Roughness

The extent of mechanical turbulence (and consequently, mixing) in the lower boundary layer is affected by the roughness of the ground over which the air is passing. The area to the south of the HPC site is mainly rural with small hamlets, and to the north of the site is the Severn Estuary.

Consequently, it was considered that a variable surface roughness file should be used in the modelling, in order to represent these different areas. A visualisation of the surface roughness file used in the modelling is presented in Figure 2.9.

Figure 2.9 – Variable Surface Roughness File Visualisation



2.12 Receptors Location

Direction is provided in Schedule 1, Part 1, 2(a) through (c) of the Air Quality Standards Regulations 2010¹⁰ (as amended by the Air Quality Standards (Amendment) Regulations 2016¹¹) regarding locations where compliance with standards set to protect human health need not be assessed:

“Compliance with the limit values directed at the protection of human health does not need to be assessed at the following locations:

- a. any location situated within areas where members of the public do not have access and there is no fixed habitation;*
- b. on factory premises or at industrial locations to which all relevant provisions concerning health and safety at work apply;*
- c. on the carriageway of roads and on the central reservation of roads except where there is normally pedestrian access to the central reservation.”*

¹⁰ HMSO. SI 2010/1001: Environmental Protection - The Air Quality Standards Regulations 2010 (2010).

¹¹ HMSO. SI 2016/1184: Environmental Protection, England - The Air Quality Standards (Amendment) Regulations 2016 (2016).

In accordance with the above, an assessment of model predictions within the HPC site has not been undertaken as this would be representative of workplace exposure at an industrial location where members of the public do not have access. However, at the request of the Environment Agency, the HPC accommodation campus, located to the south of the development site and within the site boundary, has been considered as a discrete sensitive receptor within the modelling commissioning scenarios. It has been assumed that this accommodation will no longer be present following the commissioning stage of HPC.

Receptors have been represented within the dispersion model at specific identified locations (i.e., discrete receptors) and generic locations (i.e., gridded receptors), further details of which are discussed below.

2.12.1 Discrete Human Health Receptors

There are a number of local farms and residential properties close to the site where occupants may be exposed to emissions arising from activities at the HPC Site. All predicted pollutant concentrations have been output at a height of 1.5 m above ground level, which is representative of the approximate breathing zone height of an individual. Additionally, some human receptors have been modelled at higher receptor heights, representative of the worker accommodation building(s).

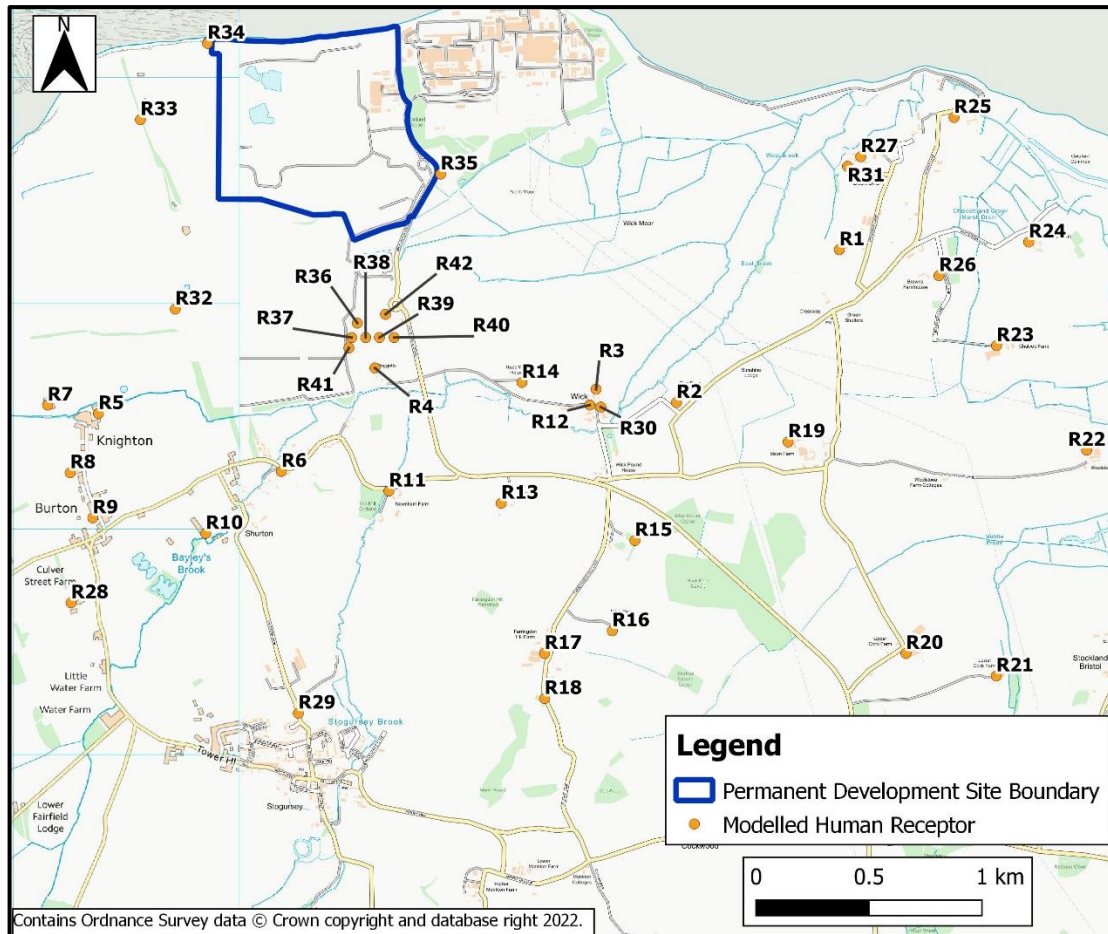
Farms and residences in close proximity to the Site have been considered. The locations of the farms, residences and villages were chosen based on inspection of maps, satellite imagery of the area and a visit to the Site and surrounding area. Furthermore, potential transient receptors at local public footpaths and the archaeological site of interest, Pixies Mound, have been included within the assessment. In addition to the surrounding farms and residences in close proximity to the Site, as mentioned above, the HPC accommodation campus, situated in the southeast corner within the Site boundary, has been considered within the dispersion modelling assessment. It is worth noting that discrete receptors representative of the HPC accommodation campus were also included at heights of 1.5 m and 4 m, in addition to 8 m, to represent locations of exposure at ground, first and second floor levels. Staff working at both the HPA and HPB sites are of an occupational nature and therefore the workplace exposure limits apply at these locations. On this basis, no discrete receptors at the HPA and HPB sites have been included in this assessment.

Details of receptor locations and their distances from the centre of the HPC Site are provided in Table 2.8 and illustrated in Figure 2.10.

Table 2.8 – Discrete Human Health Receptors

ID	Receptor	X (m)	Y (m)	Height (m)	Distance from Centre of Site (m)
R1	Trighern Farm	322655	145238	1.5	2439
R2	Zipe Farm	321934	144561	1.5	2063
R3	Wick Farm	321578	144620	1.5	1750
R4	Doggetts	320599	144714	1.5	1126
R5	Knighton Farm	319375	144512	1.5	1569
R6	Shurton village	320185	144256	1.5	1541
R7	Bullen Farm	319150	144550	1.5	1681
R8	Point south of Knighton	319250	144250	1.5	1856
R9	Burton village	319350	144050	1.5	1976
R10	Warren`s Farm	319850	143981	1.5	1863
R11	Newnham Bridge	320661	144169	1.5	1669
R12	Wick village	321550	144550	1.5	1778
R13	Gunter`s Grove	321158	144115	1.5	1895
R14	Point west of Wick	321250	144650	1.5	1500
R15	Caravan Park	321750	143950	1.5	2358
R16	Wick Park Cottage	321650	143550	1.5	2629
R17	Farringdon Hill Farm	321350	143450	1.5	2577
R18	Kennels south Farringdon	321350	143250	1.5	2760
R19	Idson Farm	322428	144387	1.5	2568
R20	Upper Cock Farm	322950	143450	1.5	3553
R21	Lower Cock Farm	323350	143350	1.5	3924
R22	Woolstone Farm	323750	144350	1.5	3758
R23	Chalcott Farm	323351	144813	1.5	3224
R24	Whitewick Farm	323493	145272	1.5	3255
R25	Stolford Farm	323163	145824	1.5	2883
R26	Browns Cottage	323096	145123	1.5	2895
R27	Little Dowdens Farm	322750	145650	1.5	2474
R28	Cole Pool	319254	143674	1.5	2355
R29	Stogursey	320260	143185	1.5	2609
R30	Wick House Farm	321599	144541	1.5	1819
R31	West End Cottage	322691	145607	1.5	2418
R32	Footpath - Benhole Lane South	319715	144975	1.5	995
R33	Footpath - Benhole Lane North	319561	145814	1.5	719
R34	Footpath - Coastal	319858	146152	1.5	554
R35	Pixies Mound	320890	145573	1.5	649
R36	Hinkley Accommodation Campus	320521	144913	1.5, 4, 8	Southeast of site, just outside the permitted site boundary
R37		320496	144849	1.5, 4, 8	
R38		320558	144849	1.5, 4, 8	
R39		320619	144849	1.5, 4, 8	
R40		320684	144849	1.5, 4, 8	
R41		320484	144803	1.5, 4, 8	
R42		320646	144952	1.5, 4, 8	

Figure 2.10 – Discrete Human Health Receptors



The relevant averaging periods, i.e., 1 hour/24 hour/annual mean periods, have been considered relative to the nature of the receptor being modelled and the likelihood of relevant public exposure over the mean averaging period, e.g., assessment of annual mean pollutant concentrations is not considered relevant at local public footpaths and the archaeological site of interest, Pixies Mound.

2.12.2 Discrete Ecological Receptors

The predominant route by which emissions will affect land in the vicinity of the operational activities is by deposition of atmospheric emissions. Potential ecological receptors can be sensitive to the deposition of pollutants, particularly nitrogen and sulphur compounds, which can affect the character of the habitat through eutrophication and acidification.

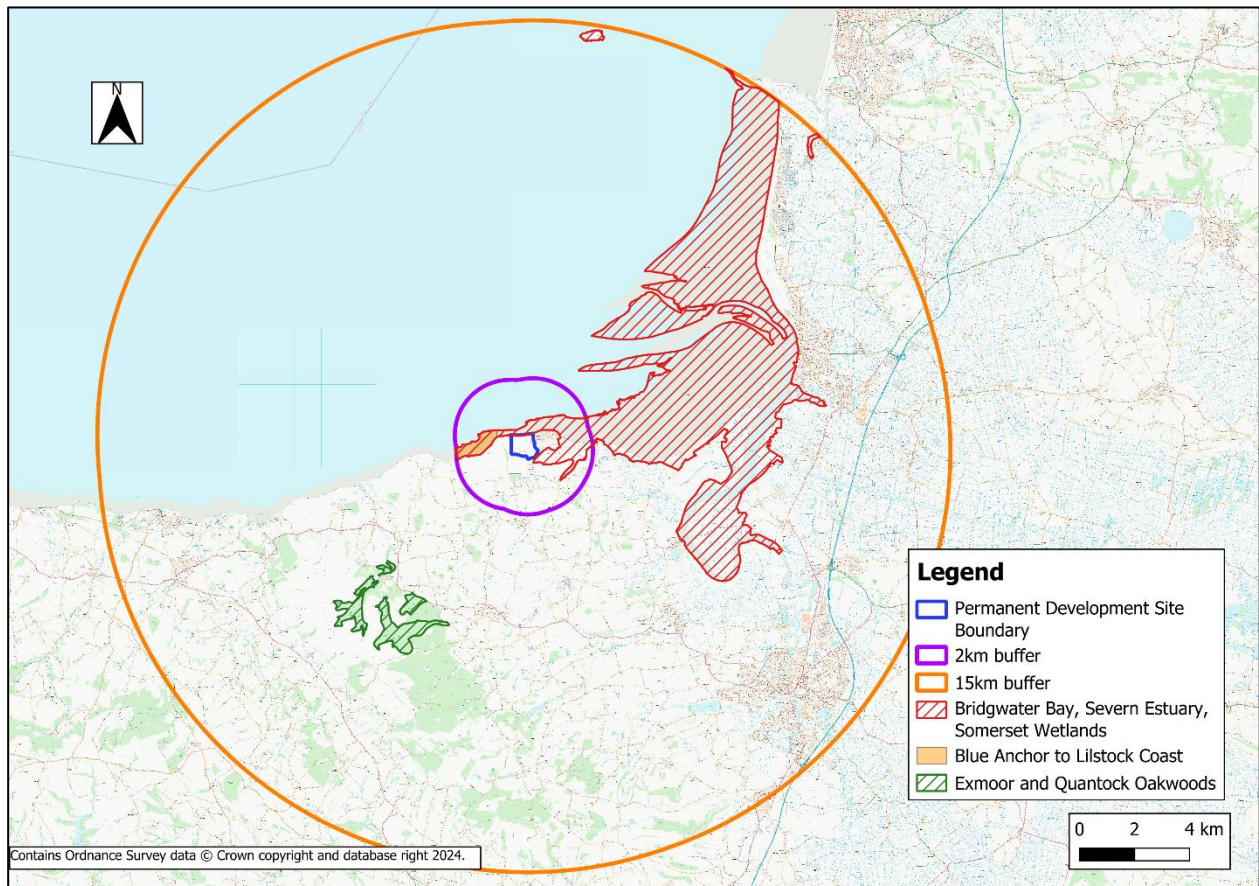
The Environment Agency's AER Guidance⁴ provides the following detail regarding consideration of ecological receptors:

- Check if there are any of the following within 10 km of your site (within 15 km if you operate a large electric power station or refinery):
 - Special Protection Areas (SPAs);
 - Special Areas of Conservation (SACs); and
 - Ramsar Sites (protected wetlands).

- Check if there are any of the following within 2 km of your site:
 - Sites of Special Scientific Interest (SSSIs); and
 - Local Nature Sites (ancient woods, local wildlife sites, Sites of Nature Conservation Importance (SNClIs) and national and local nature reserves).

The designated site locations around the HPC Site are provided in Figure 2.11 below.

Figure 2.11 – Designated Ecological Sites around the HPC Site



In line with the above criteria, the ecologically designated sites to be assessed are as follows:

- Severn Estuary (Ramsar, SPA, SAC);
- Bridgwater Bay (SSSI, NNR);
- Somerset Wetlands NNR; and
- Exmoor and Quantock Oakwoods SAC.

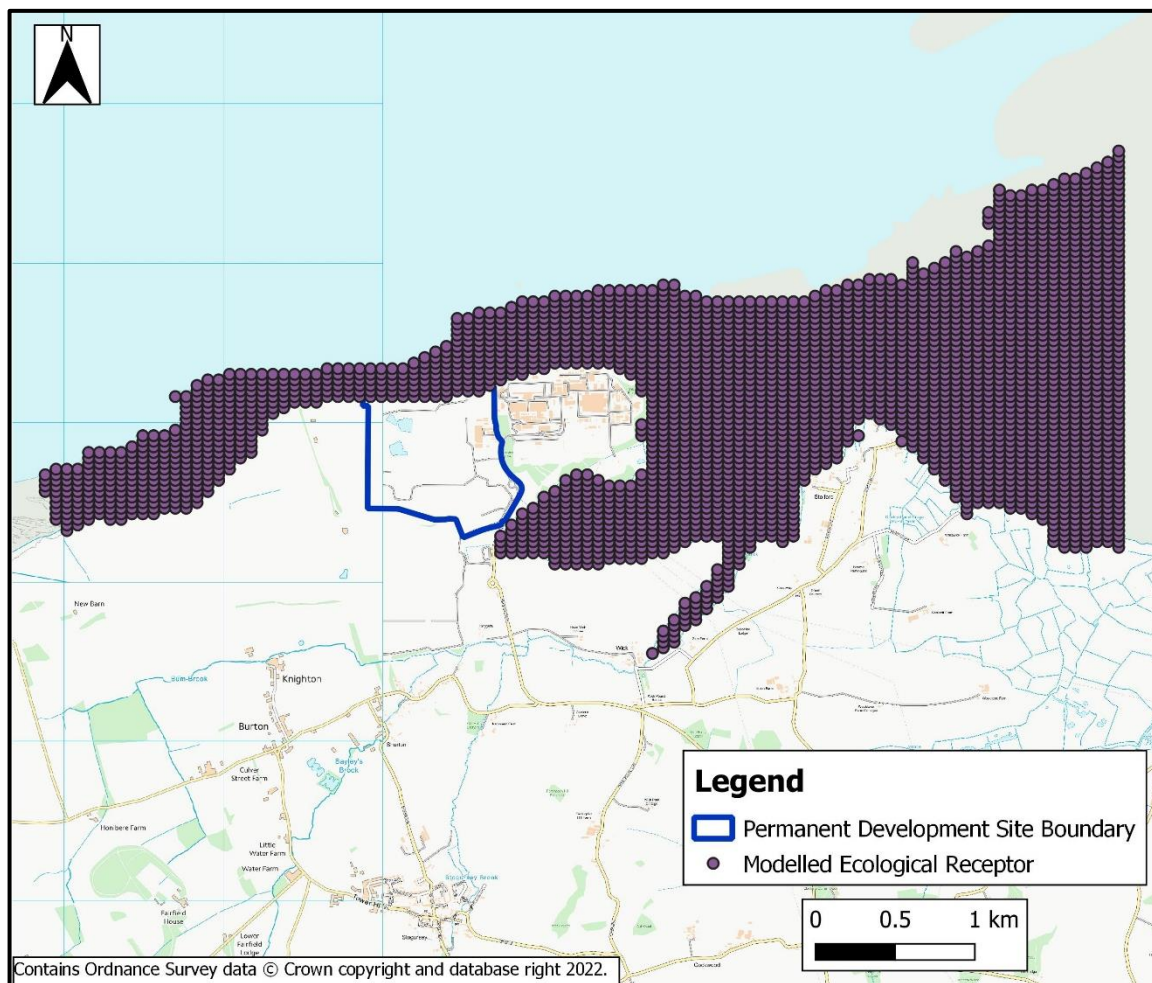
Whilst the Blue Anchor to Lillstock Coast SSSI is within 2 km of the Site boundary, it is designated in relation to geological features rather than ecological features and is therefore not sensitive to air pollution impacts. Consequently, it has been scoped out from further consideration within this assessment.

These designated sites have been used as the basis for the discrete modelled ecological receptors that have been included in the assessment. These are illustrated in Figure 2.12 below.

The discrete ecological receptors are based on the shapefiles from Defra's MAGIC Map¹² for the Bridgwater Bay SSSI/NNR and the Severn Estuary Ramsar/SPA. The discrete ecological receptors extend to the full spatial extent of these designations to the north and the west of HPC. To the east, the discrete receptors extend approximately 3.8 km from the HPC boundary.

With regard to the Severn Estuary SAC designation, which extends further to the north of HPC, into the water body itself, the focus of the assessment is on the mud/sand flats of the estuary, where deposition of pollutants to land may occur. Any potential impacts from operational activities on the water body itself relate to water quality, which is outside the scope of this report.

Figure 2.12 – Discrete Ecological Receptors



2.12.3 Gridded Receptors

To assess the impact of atmospheric emissions from the site on local air quality, pollutant concentrations were also output at heights of 0 m to a 4 km x 4 km Cartesian grid centred on HPC, with an approximate receptor resolution of 20 x 20 m. The gridded receptors are intended to supplement the modelled discrete receptors. The pollutant concentrations predicted at these

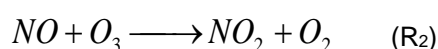
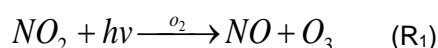
¹²

<https://magic.defra.gov.uk/MagicMap.aspx?startTopic=Designations&activelayer=sssiIndex&query=HYPERLINK%3D%271001145%27>

generic receptor locations have been principally used to generate pollutant contour plots to aid the visualisation of the predicted air quality impacts.

2.13 Conversion of NO to NO₂

Emissions of NO_x from combustion processes are predominantly in the form of nitric oxide (NO). Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to nitrogen dioxide (NO₂). NO_x chemistry in the lower troposphere is strongly interlinked in a complex chain of reactions involving Volatile Organic Compounds (VOCs) and Ozone (O₃). Two of the key reactions interlinking NO and NO₂ are detailed below:



Where hv is used to represent a photon of light energy (i.e. sunlight).

Taken together, reactions R₁ and R₂ produce no net change in O₃ concentrations, and NO and NO₂ adjust to establish a near steady state reaction (photo-equilibrium). However, the presence of VOCs and CO in the atmosphere offer an alternative production route of NO₂ for photolysis, allowing O₃ concentrations to increase during the day with a subsequent decrease in the NO₂:NO_x ratio.

However, at night, the photolysis of NO₂ ceases, allowing reaction R₂ to promote the production of NO₂, at the expense of O₃, with a corresponding increase in the NO₂:NO_x ratio. Similarly, near to an emission source of NO, the result is a net increase in the rate of reaction R₂, suppressing O₃ concentrations immediately downwind of the source, and increasing further downwind as the concentrations of NO begin to stabilise to typical background levels (Gillani and Pliem 1996).

Given the complex nature of NO_x chemistry, the Environment Agency's Air Quality Modelling and Assessment Unit (AQMAU) have adopted a pragmatic, risk based approach in determining the conversion rate of NO to NO₂ which dispersion model practitioners can use in their detailed assessments¹³. The AQMAU guidance advises that the source term should be modelled as NO_x (as NO₂) and then suggests a tiered approach when considering ambient NO₂:NO_x ratios:

- **Screening Scenario:** 50% and 100% of the modelled NO_x process contributions should be used for short-term and long-term average concentration, respectively. That is, 50% of the predicted NO_x concentrations should be assumed to be NO₂ for short-term assessments and 100% of the predicted NO_x concentrations should be assumed to be NO₂ for long-term assessments;
- **Worst Case Scenario:** 35% and 70% of the modelled NO_x process contributions should be used for short-term and long-term average concentration, respectively. That is, 35% of the predicted NO_x concentrations should be assumed to be NO₂ for short-term assessments and 70% of the predicted NO_x concentrations should be assumed to be NO₂ for long-term assessments; and
- **Case Specific Scenario:** Operators are asked to justify their use of percentages lower than 35% for short-term and 70% for long-term assessments in their application reports.

In line with the AQMAU guidance, this assessment has therefore used a NO_x to NO₂ ratio of 70% for long term average concentrations and 35% for short term concentrations.

¹³ http://www.environment-agency.gov.uk/static/documents/Conversion_ratios_for_NOx_and_NO2_.pdf

2.14 Nitrogen and Acid Deposition

As mentioned previously, impacts of nitrogen deposition and acid deposition (both nitrogen and sulphur components) have been assessed. This has been undertaken using information obtained from the APIS website (<http://www.apis.ac.uk/>) for each ecological site assessed, including details of relevant background contributions, critical levels and critical loads.

The Environment Agency guidance AQTAG06 (Environment Agency, 2015) recommends deposition velocities and dry deposition flux conversion factors for various pollutants. These values have been utilised within the assessment to determine the nitrogen and acid deposition rates of the ecological sites to be assessed. The AQTAG06 guidance states that wet deposition of SO₂ and NO₂ are not significant within a short range and will therefore not be considered within the assessment.

2.15 Special Treatments

ADMS is capable of modelling several specialised model treatments, including for short-term (puff) releases, coastal models, fluctuations or photochemistry. The majority of these were not applicable and, therefore, not used in the assessment. Details of the consideration of the coastal module is provided below.

2.15.1 Coastlines

To the immediate north of HPC is the Severn Estuary. ADMS includes a Coastline module to account for the effects of the coast on emissions from elevated point sources. Although the HPC Site is located in a Coastal area the Coastline Module will not be used for this study. This is deemed appropriate as the Coastline module, although included within ADMS, has not been independently validated.

2.16 Model Outputs

Model outputs are presented in tabular form for pollutant concentrations at specific receptors (human and ecological) as detailed above and as contour plots overlying OS maps for any pollutants assessed as significant, accompanying a discussion on the environmental significance of the results.

It should be noted that no annual operational factor was applied to the process contribution results for short-term averaging periods. This approach ensures a conservative assessment for short-term averaging periods, as all hours of the year are still modelled, whilst also ensuring that the modelled concentration outputs are as representative of actual existing and likely future operating profiles as possible.

2.17 Sensitivity Analysis and Data Justification

Wherever possible, this assessment has used reasonable worst-case parameters and/or conditions which will exaggerate the impact of emissions on the surrounding area, including assumptions on emissions rates, operational profile, meteorological dataset and surface roughness. The results of the model sensitivity analysis, with respect to changes in input variables relating to buildings and surface roughness, are provided below.

2.17.1 Meteorological data

The meteorological data analysis has considered two key variables:

- The variability between the NWP meteorological dataset (2010 – 2014) and the Hinkley Point B (HPB) meteorological data collected during the baseline monitoring (2011 - 2014); and

- A sensitivity analysis of the inter-year variability of the NWP dataset.

2.17.2 Meteorological Analysis 1 – Comparison of NWP and HPB Datasets

The key meteorological parameters used by the dispersion model are hourly measurements of:

- Wind speed;
- Wind direction;
- Cloud cover; and
- Temperature.

The on-site weather station at Hinkley Point B (HPB) records measurements of wind speed (at 10 m) and wind direction, which can be interpolated for use in the model. Generally, the preference for modelling is to use data collected from a site that is most representative of the site being modelled, usually the closest. Since there are no other meteorological stations recording data in a suitable format for the model within 25 km of the site, the on-site met data has been considered for use in the model. The principal downside to using this dataset is that cloud cover and temperature are not recorded, therefore these parameters would have to be substituted from a different, less site-specific dataset.

Alternatively, the United Kingdom Meteorological Office (UKMO) NWP Model, which has been modelled specifically for the HPC site and contains the following parameters:

- Wind speed (at 10 m);
- Wind direction (degrees);
- Cloud amount (oktas);
- Temperature (°C);
- Sensible heat flux ($W\ m^{-2}$);
- Boundary layer depth (m);
- Precipitation rate ($mm\ h^{-1}$); and
- Relative humidity (percentage).

Although the NWP data is modelled rather than monitored data, it is routinely used by air quality professionals as an alternative site-specific dataset, the other primary advantage being that there is 100% data capture.

This section provides for a comparison of the NWP dataset and the on-site dataset, with due regard given to wind direction, wind speed and data capture. Table 2.9 summarises this information.

Table 2.9 – NWP and HPB Meteorological Data Comparison

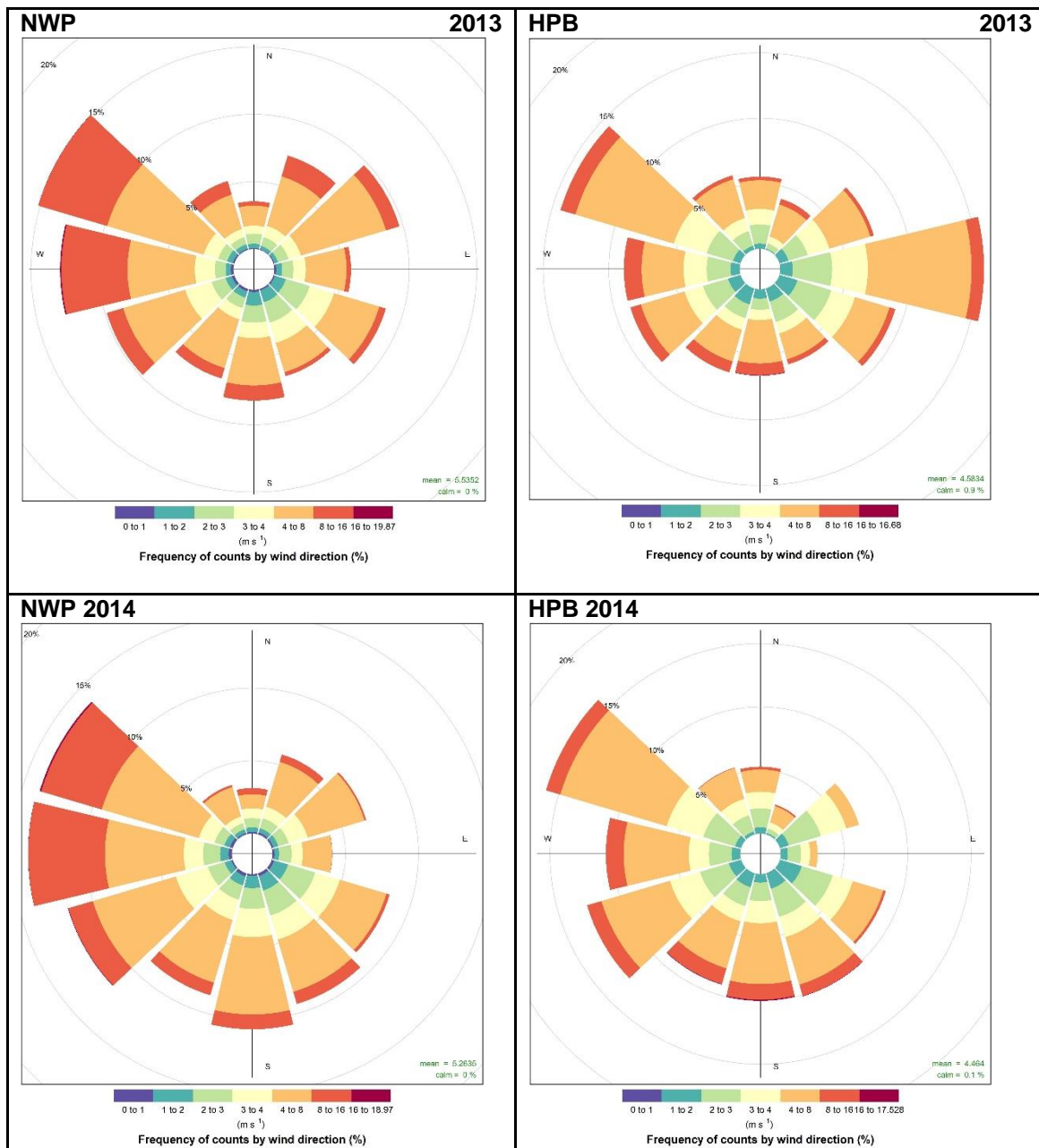
Parameter	NWP Data: 2010 - 2014	HPB (on-site) Data: 2011 - 2014
Maximum wind speed (m/s)	19.87	37.18
Average wind speed (m/s)	5.31	4.04
Most frequent wind direction (°)	290	300

Parameter	NWP Data: 2010 - 2014	HPB (on-site) Data: 2011 - 2014
Data capture (%)	100%	79%

Taking the data in Table 2.9, the average wind speed and most frequent wind direction are very similar between the two datasets. This is to be expected since the NWP data has been modelled for a similar area to where the HPB met station is located. The HPB data contains a higher maximum wind speed within the dataset compared to the NWP dataset. However, when looking at the wind roses, which take all available hours into account, the differences in wind speed appear minimal.

Since it is modelled data, the data capture for NWP is 100%, but for the HPB monitored data, it is at 79% for the 2011 – 2014 period. A higher data capture is preferred when undertaking dispersion modelling, since it allows the model to calculate output concentrations for more hours of the time period being assessed, which is particularly important when considering percentile concentrations representative of short-term criteria.

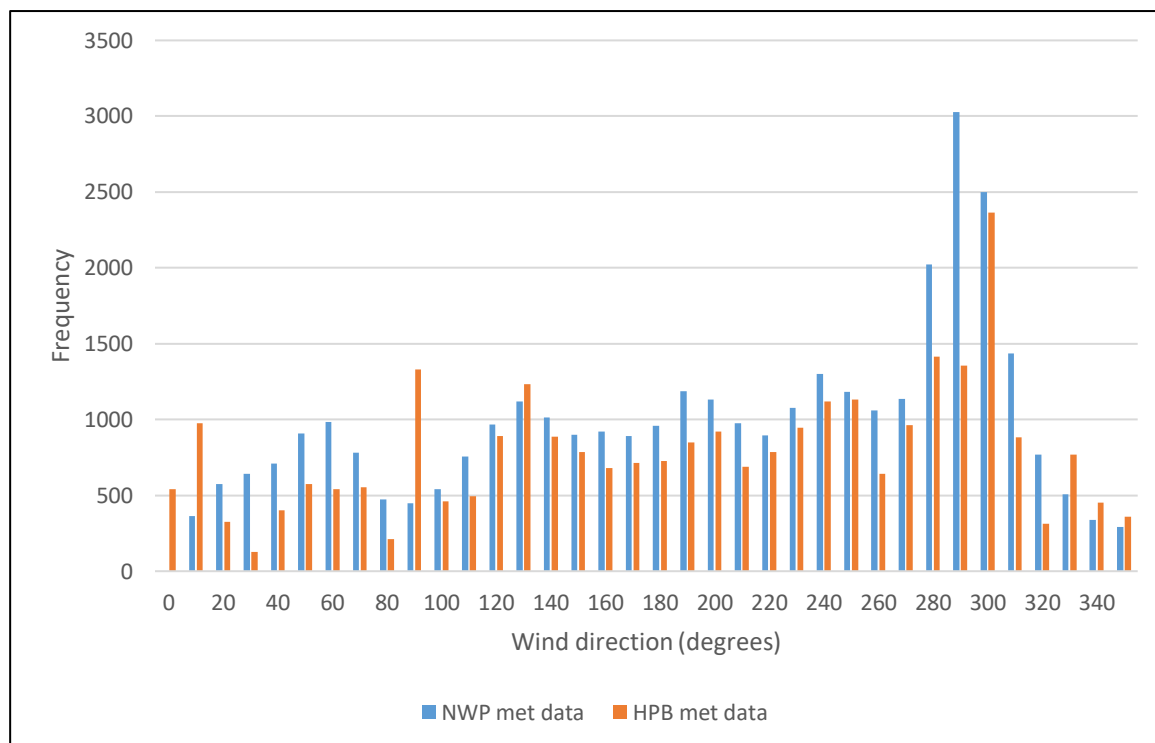
Figure 2.13 contains the wind roses for NWP and HPB during the time period for which the datasets overlap (2011 – 2014), displayed for comparison purposes. They show the frequency of hours with winds in a particular direction, with a colour scale to denote wind speed.



The figures show that, in general, the HPB data tends to have a larger proportion of higher wind speeds that for the NWP data. However, given that the primary sources in the dispersion models are area sources, it is considered that lower wind speeds overall provide for a more conservative assumption. This is because higher wind speeds can encourage dispersion. In this regard, therefore, use of the NWP data would seemingly provide for a more conservative assessment.

With regard to wind direction, although there are some differences between the two datasets, in general, they perform similarly. This pattern can be visualised more clearly in Figure 2.14.

Figure 2.14 – Histogram of Frequency of Wind Direction for NWP and HPB Data



The data in Figure 2.14 show similar peaks and troughs in terms of frequency of wind direction in both datasets for 2011 – 2014. Generally, the frequency of winds in a particular direction is lower for the HPB dataset; however, this may likely be a function of lower data capture. Perhaps of most importance is that the prevailing wind direction for both datasets is comparable, with the highest frequencies occurring between 280° and 300°.

In summary, the following points can be made regarding the comparison of datasets:

- Wind speed: although the average wind speed from the two datasets is similar (5 m/s for NWP and 4 m/s for HPB), this data indicates that the HPB data contains more hours at higher wind speeds. Given that higher wind speeds can encourage dispersion of pollutants, it is considered that the NWP data, with slightly lower wind speeds overall, will likely provide for a more conservative assessment;
- Wind direction: the most prevalent wind direction(s) are alike in both datasets. Given that these have been modelled/monitored for the same area this is expected;
- Data capture: being modelled data, the data capture for NWP is 100%, whilst the HPB monitored data capture is 79%. It is preferable to use datasets where the data capture is higher so that the model can calculate outputs for more hours in the year; and
- Other missing data: the NWP dataset provides all meteorological parameters required for the dispersion modelling, whereas the data from HPB only contains wind speed and wind direction. The HPB dataset, therefore, would have to be supplemented with temperature and cloud cover data from another meteorological station if it were to be used in a modelling assessment.

In line with the above conclusions, it is considered that the use of NWP data is appropriate for this assessment, given its relative similarity with the HPB monitored data, as well as a lack of missing data.

Since NWP data is the preferred meteorological data for the assessment, the second analysis of met data considers NWP data only.

2.17.3 Meteorological Analysis 2 – Comparison of Inter-Year Variability of the NWP Dataset

Results are presented in this assessment for the NWP meteorological year(s) resulting in the highest ground level concentration at each receptor location as a worst-case assumption. However, the impact of each meteorological year on predicted concentrations has been examined to determine the specific sensitivity of the model to inter-year variations in weather conditions.

Maximum long-term and short-term NO_x process contributions at any receptor location have been compared for each meteorological year. The results of the sensitivity analysis are provided in Table 2.10. Results have been normalised by the value obtained from the year of meteorological data resulting in the highest ground level concentration, i.e. a value of 0.9 would indicate concentrations during that year are 10% less than the year producing the highest concentration.

Table 2.10 – NWP Data Sensitivity Analysis

Year	Normalised Ground Level Concentration due to Process Emissions	
	NO ₂ Annual Mean	NO ₂ 99.79 percentile 1-hour Mean
2017	1.00	0.92
2018	0.78	0.90
2019	0.77	1.00
2020	0.68	0.94
2021	0.82	0.96

The results in Table 2.8 indicate that, in terms of NWP meteorological data, 2017 results in the highest concentrations for long-term concentrations and 2019 results in the highest concentrations for short-term concentrations. Note, this is for the receptor during each year at which the highest concentration is reported.

However, since there is evidence of inter-year variability, and given the large extent of the model domain, a worst-case approach has been adopted whereby all models have been run for all 5 years of meteorological data, with the highest concentration output from any one of those years being reported for each assessed receptor location.

2.17.4 Surface Roughness

Sensitivity analysis has been undertaken to identify how differing surface roughness lengths within the model domain may influence predicted concentrations. This was determined by running a version of the model with a variable surface roughness file (see Section 2.11) and without. The results of the sensitivity analysis for surface roughness are shown in Table 2.11. Results have been normalised by the value obtained from the model resulting in the highest ground level process contribution at modelled receptor locations.

Table 2.11 – Surface Roughness Sensitivity Analysis

Scenario	Normalised ground level concentration due to process emissions	
	NO ₂ Annual Mean (2017 – R35)	NO ₂ 99.79 percentile 1-hour Mean (2018 – R33)
With variable surface roughness file	0.83	1.00
With uniform surface roughness (0.3 m)	1.00	0.67

The data above demonstrates that for short term results, in order to maintain a worst-case assessment, a variable surface roughness file should be used, since the output concentrations with a variable surface roughness file are higher than those without. A variable surface roughness file is considered more representative of realistic conditions and has therefore been used for all assessment.

2.17.5 Buildings

Sensitivity analysis has been undertaken to identify how predicted concentrations may be impacted by the presence of buildings within the model domain. This was determined by running a version of the model with buildings (see Figure 2.8) and without.

The results of the sensitivity analysis for buildings are shown in Table 2.12 below. Results have been normalised by the value obtained from the model resulting in the highest process contribution at modelled human receptor locations.

Table 2.12 – Building Sensitivity Analysis

Scenario	Normalised ground level concentration due to process emissions	
	NO ₂ Annual Mean (2017 – R35)	NO ₂ 99.79 percentile 1-hour Mean (2018 – R33)
With Buildings	1.00	1.00
Without Buildings	0.66	0.60

From Table 2.12, it can be seen that removal of the buildings from the model domain results in a less conservative concentration for the long-term and short-term averaging periods. The model used in this assessment therefore included buildings in the model domain in order to represent the more conservative scenario.

2.17.6 Dispersion Code

Sensitivity analysis has been carried out using the AERMOD (version 22112) dispersion modelling kernel, with a comparison against ADMS version 6.0.2. The results of this analysis are provided in Table 2.13. Results have been normalised using the highest value obtained from either of the two model dispersion codes. The results demonstrate that the ADMS model results in lower concentrations at receptors. However, it is noted that the AERMOD kernel was used through ADMS version 6.0.2, which does have some limitations, e.g. the impact of buildings and variable surface roughness cannot be included as part of the AERMOD model runs. On this basis it is considered that ADMS dispersion code is suitable for this study.

Table 2.13 – Dispersion Code Sensitivity Analysis

Scenario	Normalised ground level concentration due to process emissions	
	NO ₂ Annual Mean (2017 – R35)	NO ₂ 99.79 percentile 1-hour Mean (2018 – R34)
Using ADMS v6.0.2	0.74	0.94
Using AERMOD v22112	1.00	1.00

2.18 Model Uncertainty

ADMS 6 is an advanced atmospheric dispersion model that has been developed and validated by Cambridge Environmental Research Consultants (CERC). A list of the available papers used for model validation are available on the CERC website¹⁴. The model is used extensively throughout

¹⁴ <https://www.cerc.co.uk/environmental-software/model-validation.html>

the UK for regulatory compliance purposes. It is accepted as an appropriate air quality modelling tool by the Environment Agency (EA) and local authorities.

As with all atmospheric dispersion modelling assessments using standard Gaussian methods, the following assumptions have to be made, and the limitations accepted:

- Conservation of mass. The entire mass of emitted pollutant remains in the atmosphere and no allowance is made for loss through chemical reaction or deposition processes (although ADMS does have the capability of being modified to include such processes);
- Eddy reflection. Portions of the plume reaching the ground are assumed to be dispersed back away from the ground by turbulent eddies;
- Steady state emissions. Emission rates are assumed to be constant and continuous over the time averaging period of interest; and
- Steady state meteorology. No variations in wind speed, direction or turbulent profiles occur during the transport of a pollutant to the receptor.

With regard to model uncertainties specific to the modelling of the HPC site, the following uncertainties have been identified:

- Data gaps relating to generators. Technical specifications (where available) are assumed correct and provide best available data that are plant specific. Where ELVs or similar are used to derive the pollutant emission, these are representative of the upper bound of permitted emissions. Where precise generator specifications are not available (e.g. for the smaller generators), information from the HPC construction modelling study has been used, where appropriate. Where technical specifications for a specific generator rating are not available, proxy data has been used drawing upon the technical library of emissions information for the HPC site. In such cases, data for a generator with a higher rating have been used, which is likely to be more polluting, thus representing a conservative assumption).; and
- Scheduling of generator testing. Whilst there is visibility regarding scheduling during generator commissioning and routine testing, the dates are somewhat subject to change and are not exact. Therefore, the model has been run assuming the generators run 24/7 throughout the year and results have been pro-rated during the post-processing stage, in order to account for reduced run times according to the hours defined in section 2.5. This is intended to provide a worst-case.

Although it is difficult to quantify the expanded uncertainty associated with the model concentration predictions as a consequence of the aspects outlined above, this assessment has incorporated a number of reasonable worst-case parameters/assumptions, which are likely to result in an overestimation of the predicted ground level pollutant concentrations from HPC activities. Consequently, the predicted results are considered to be towards the upper bound of model uncertainty. The actual predicted ground level concentration, therefore, would be expected to be lower than those reported in this assessment.

As a result of the above, whilst dispersion modelling is inherently uncertain, it is nonetheless a useful tool in plume footprint visualisation and the prediction of ground level concentrations. The use of dispersion models, specifically ADMS, has been widely adopted in the UK for both regulatory and compliance purposes for a number of years and is an accepted approach for this type of assessment. A log of assumptions made within the modelling are provided in Appendix A, along with a comment on uncertainty.

3 Relevant Legislation and Guidance

3.1 UK Legislation and Guidance

3.1.1 The Air Quality Standards Regulations 2010

The Air Quality Standards Regulations 2010 (the 'Regulations') came into force on the 11th of June 2010 and transpose the EU Directive 2008/50/EC into UK legislation. The Directive's limit values are transposed into the Regulations as 'Air Quality Standards' (AQS) with attainment dates in line with the Directive.

These standards are legally binding concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects of sensitive groups or on ecosystems.

The Regulations define ambient air as;

"...outdoor air in the troposphere, excluding workplaces where members of the public do not have regular access."

with direction provided in Schedule 1, Part 1, Paragraph 2 as to where compliance with the AQS' does not need to be assessed:

"Compliance with the limit values directed at the protection of human health does not need to be assessed at the following locations:

- a) any location situated within areas where members of the public do not have access and there is no fixed habitation;*
- b) on factory premises or at industrial locations to which all relevant provisions concerning health and safety at work apply;*
- c) on the carriageway of roads and on the central reservation of roads except where there is normally pedestrian access to the central reservation."*

3.1.2 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

The 2007 Air Quality Strategy for England, Scotland Wales and Northern Ireland provides a framework for improving air quality at a national and local level and supersedes the previous strategy published in 2000.

Central to the Air Quality Strategy are health-based criteria for certain air pollutants; these criteria are based on medical and scientific reports on how and at what concentration each pollutant affects human health. The objectives derived from these criteria are policy targets often expressed as a maximum ambient concentration not to be exceeded, without exception or with a permitted number of exceedances, within a specified timescale. At paragraph 22 of the 2007 Air Quality Strategy, the point is made that the objectives are:

"...a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except where they mirror any equivalent legally binding limit values..."

The AQOs, based on a selection of the objectives in the Air Quality Strategy, were incorporated into UK legislation through the Air Quality Regulations 2000, as amended.

Paragraph 4(2) of The Air Quality (England) Regulations 2000 states:

“The achievement or likely achievement of an air quality objective prescribed by paragraph (1) shall be determined by reference to the quality of air at locations –

- a) which are situated outside of buildings or other natural or man-made structures above or below ground; and*
- b) where members of the public are regularly present*

Consequently, compliance with the AQOs should focus on areas where members of the general public are present over the entire duration of the concentration averaging period specific to the relevant objective.

A revised 2023 Air Quality Strategy for England¹⁵, sets out the actions that Defra expects local authorities to take in support of long-term air quality goals, including new PM_{2.5} targets. It provides a framework to enable local authorities to make the best use of their powers and make improvements for their communities.

3.1.3 The Environment Act 2021

The Environment Act 2021 came into force on 9th November 2021, with Part 4 of the Act (and associated Schedules 11 and 12) reserved for matters pertaining to air quality.

The Environment Act 2021 includes amendments to Environment Act 1995 (further detail in Section 4.2) the Clean Air Act 1993 to give Local Authorities more power. It also requires the Secretary of State to set at least one long-term target in relation to air quality and, in addition, a short-term legally binding target to reduce PM_{2.5}.

3.1.4 Environmental Permitting Regulations (EPR)

The Environmental Permitting Regulations (England and Wales)¹⁶, came into force on 6 April 2010 (as amended 2016), and are inclusive of the requirements of the Industrial Emissions Directive (IED) for large combustion plants.

The EPR provides a single regulatory framework transposing EU Directives (including the Industrial Emissions Directive) into UK legislation, by defining the permitting and compliance system for industrial installations, including large combustion plant.

The EPR aims to prevent and control emissions from large combustion plants, in order to protect human health and the environment from the harmful effects of air pollution. Under the EPR, operators of large combustion plants (with a total rated thermal input of 50 MW_{th} or more) must obtain an environmental permit from the relevant regulatory authority (e.g. the Environment Agency in England).

An environmental permit includes emission limit values and monitoring requirements for key pollutants such as those included as part of this assessment, i.e. NO_x, SO₂, PM and CO. The emission limit values for these pollutants are set in line with the requirements of the IED and the use of Best Available Techniques (BAT) to minimise emissions.

Operators must demonstrate compliance with the permit conditions through regular monitoring and reporting. The regulatory authorities have the power to take enforcement action against operators who fail to meet the permit requirements.

¹⁵ Defra (2023) Air Quality Strategy - Framework for local authority delivery.

¹⁶ The Environmental Permitting (England and Wales) Regulations 2016.

3.2 Local Air Quality Management

Part IV of the Environment Act 1995 requires that Local Authorities periodically review air quality within their individual areas. As previously discussed, this Act has now been amended and supplemented by the Environment Act 2021 Schedule 11. Defra have said: “Responsibility for tackling local air pollution will now be shared with designated relevant public authorities, all tiers of local government and neighbouring authorities.”

This process of Local Air Quality Management (LAQM) is an integral part of delivering the Government’s AQOs.

To carry out an air quality Review and Assessment under the LAQM process, the Government recommends a three-stage approach. This phased review process uses initial simple screening methods and progresses through to more detailed assessment methods of modelling and monitoring in areas identified to be at potential risk of exceeding the objectives in the Regulations.

Review and assessments of local air quality aim to identify areas where national policies to reduce vehicle and industrial emissions are unlikely to result in air quality meeting the Government’s air quality objectives by the required dates.

For the purposes of determining the focus of Review and Assessment, Local Authorities should have regard to those locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective.

Where the assessment indicates that some or all of the objectives may be potentially exceeded, the Local Authority has a duty to declare an Air Quality Management Area (AQMA). The declaration of an AQMA requires the Local Authority to implement an Air Quality Action Plan (AQAP), to reduce air pollution concentrations so that the required AQOs are met.

3.2.1 Local Authority Monitoring Data

The Site is located within the jurisdiction of Somerset West and Taunton Council (SWTC), approximately 3 km west of the border with Sedgemoor District Council (SDC). Whilst SDC does not have any AQMAs, SWTC has two AQMAs, both declared in 2003 for exceedances of the annual mean AQO for NO₂ due to road traffic emissions. Both of these AQMAs are located more than 20 km south of the HPC permanent development site boundary.

The most recent publicly available monitoring data is provided in the Somerset West and Taunton Council 2021 Annual Status Report (ASR)¹⁷ and the Sedgemoor District Council ASR¹⁸. The closest monitoring to the HPC Site is located within SDC’s jurisdiction, in the village of Cannington. However, due to the distance from the HPC Site (approximately 8 km), the concentrations monitored in this location cannot be considered representative of concentrations in the vicinity of the Site, and have therefore not been presented within this assessment.

3.3 Other Guideline Values

In the absence of statutory standards for the other prescribed substances that may be found in the emissions, there are several sources of applicable air quality guidelines.

¹⁷ Somerset West and Taunton ASR 2021, available at <https://www.somersetwestandtaunton.gov.uk/environmental-health/environmental-protection/air-quality/>

¹⁸ Sedgemoor District Council ASR 2021, available at <https://www.sedgemoor.gov.uk/article/1014/Air-Quality-in-Sedgemoor>

3.3.1 Air Quality Guidelines for Europe, the World Health Organisation (WHO)

The aim of the WHO Air Quality Guidelines for Europe (WHO, 2000) is to provide a basis for protecting public health from adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. These guidelines are intended to provide guidance and information to international, national and local authorities making risk management decisions, particularly in setting air quality standards.

3.3.2 Environmental Assessment Levels (EALs)

The Environment Agency's AER Guidance provides methods for quantifying the environmental impacts of emissions to all media. The AER guidance contains long and short-term Environmental Assessment Levels (EALs) and Environmental Quality Standards (EQS) for releases to air derived from a number of published UK and international sources. For the pollutants considered in this study, these EALs and EQS are equivalent to the AQS and AQOs set in force by the Air Quality Strategy for England, Scotland Wales and Northern Ireland.

3.3.3 Acute Exposure Guideline Levels (AEGLs)

The US EPA provides exposure guidelines designed to help responders deal with emergencies involving chemical spills or other catastrophic events where members of the general public are exposed to a hazardous airborne chemical. AEGL "levels" are dictated by the severity of the toxic effects caused by the exposure, with Level 1 being the least and Level 3 being the most severe. Effects are described as follow¹⁹:

- Level 1: Notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure;
- Level 2: Irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape; and
- Level 3: Life-threatening health effects or death.

3.4 Air Quality Impacts of the Process

A brief description of the effects of the pollutants of primary concern to the local environment is provided in Table 3.1.

¹⁹ US EPA. About Acute Exposure Guideline Levels (AEGLs). Available at: <https://www.epa.gov/aeql/about-acute-exposure-guideline-levels-aepls>

Table 3.1 – Summary of the Pollutants Assessed

Pollutant	Description and effect on human health and the environment	Principal Sources
Oxides of Nitrogen (NO _x) ^{A, B, C}	Nitrogen dioxide (NO ₂) and Nitric oxide (NO) are both collectively referred to as oxides of Nitrogen (NO _x). It is NO ₂ that is associated with adverse effects on human health. Most atmospheric emissions are in the form of NO which is converted to NO ₂ in the atmosphere through reactions with Ozone. The oxidising properties of NO ₂ theoretically could damage lung tissue, and exposure to very high concentrations of NO ₂ can lead to inflammation of lung tissue, affect the ability to fight infection. The greatest impact of NO ₂ is on individuals with asthma or other respiratory conditions, but consistent impacts on these individuals is at levels of greater than 564 µg m ⁻³ , much higher than typical UK ambient concentrations.	All combustion processes produce NO _x emissions, and the principal source of NO _x is road transport, which accounted for 32% of total UK emissions in 2008. Emissions from power stations contributed a further 20%.
Carbon Monoxide (CO) ^{B, C}	The toxicity of CO results in it binding avidly to haemoglobin and thus reducing the oxygen carrying capacity of the blood. In very high doses, the restriction of oxygen to the brain and heart can be fatal. At lower concentrations, CO can affect higher cerebral function, heart function and exercise capacity.	The principal source of CO is emissions from petrol vehicles, accounting for 54% of total UK emissions in 2008.
Particulate Matter (PM ₁₀ and PM _{2.5}) ^D	Particulate matter is the term used to describe all suspended solid matter. Particulate matter with an aerodynamic diameter of less than 10 µm (PM ₁₀) is the subject of health concerns because of its ability to penetrate and remain deep within the lungs. Particles in the PM _{2.5} size range are able to travel deeper into the respiratory tract, reaching the lungs. Exposure to fine particles can cause short-term health effects such as eye, nose, throat and lung irritation, coughing, sneezing, runny nose and shortness of breath. They can also affect lung function and worsen medical conditions such as asthma and heart disease.	Road transport, industrial processes and electricity generation. Other pollutants, including NO ₂ and SO ₂ , have the potential to form secondary particulates which are often smaller than PM ₁₀ .
Sulphur Dioxide (SO ₂) ^B	At high concentrations SO ₂ is a potent bronchoconstrictor, and asthmatic individuals are more susceptible. It is likely that SO ₂ contributes to respiratory symptoms, reduced lung function and rises in hospital admissions.	The principal source of SO ₂ is the combustion of fossil fuels containing sulphur. In the UK, this is primarily through the combustion of coal in power stations, oil refining and solid fuel manufacturing, accounting for 57% of total UK SO ₂ emissions in 2008.
A	Defra, 2009, Part IV of the Environment Act 1995 Local Air Quality Management: Technical Guidance LAQM.TG(09).	
B	Harrison, R.M., <i>Air Pollution: Sources, Concentrations and Measurements</i> . In: Harrison, R.M., 2000, <i>Pollution: Causes, Effects and Controls</i> , 4 th Edition Royal Society of Chemistry.	
C	Walters, S. and Ayers, J., <i>The Health Effects of Air Pollution</i> . In: Harrison, R.M., 2000, <i>Pollution: Causes, Effects and Controls</i> , 4 th Edition Royal Society of Chemistry.	
D	Defra, 2007, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland	

3.6 Criteria Appropriate to the Assessment

Table 3.2 sets out those AQS, AQOs and EALs that are relevant to the assessment with regard to human receptors.

Table 3.2 – Air Quality Standards, Objectives and Environmental Assessment Levels

Pollutant	AQS/AQO	Averaging Period	Value ($\mu\text{g m}^{-3}$)
Nitrogen dioxide (NO_2)	AQS	Annual mean	40
	AQS	1-hour mean, not more than 18 exceedances a year (equivalent of 99.79 Percentile)	200
	USA EPA AEGL 1	1-hour mean (100 percentile)	956
	USA EPA AEGL 2	1-hour mean (100 percentile)	22,950
	USA EPA AEGL 3	1-hour mean (100 percentile)	38,250
Carbon monoxide (CO)	AQS	8-hour mean	10,000
	EAL	1-hour mean	30,000
Particulate matter (PM_{10})	AQS	Annual mean	40
	AQS	24-hour mean, not more than 35 exceedances per year (90.41 percentile)	50
Particulate matter ($\text{PM}_{2.5}$)	EAL	Annual Mean	20
Sulphur dioxide (SO_2)	AQS	1-hour mean not to be exceeded more than 24 times a year (equivalent to 99.73 percentile)	350
	AQS	24-hour mean, not to be exceeded more than 3 times a year (equivalent to 99.18 percentile)	125
	AQO	15-min mean, not to be exceeded more than 35 times a year (equivalent to 99.9 percentile)	266

3.7 Critical Levels and Critical Loads Relevant to the Assessment of Ecological Receptors

A summary of the relevant AQS and EAL that apply to the emissions from the plant and their impact on ecological receptors are given in Table 3.3.

Table 3.3 – Summary of Relevant Air Quality Standards and Environmental Assessment Levels for Ecological Receptors

Pollutant	AQS/EAL	Averaging Period	Value ($\mu\text{g m}^{-3}$)
Oxides of nitrogen (NO_x)	AQS	Annual mean	30
Oxides of nitrogen (NO_x)	EAL	Daily mean	75
Sulphur dioxide (SO_2)	AQS	Annual mean	20

The APIS website provides specific information on the potential effects of nitrogen deposition and acid deposition on various habitats and species. The information collected from APIS and used in the assessment is presented in Table 3. Although there are a number of sensitive ecologically designated sites within the modelled area, they are all covered by both the Severn Estuary

SPA/Ramsar site and Bridgwater Bay SSSI/NNR, therefore all APIS input data used within the data processing relates to the worst-case critical load data from the ecological sites.

Table 3.3.4 – Nitrogen and Acid Deposition Information

Ecological Site	Minimum nitrogen critical load (kg N/ha/yr)	Nitrogen deposition (kg N/ha/yr)	Acid deposition of nitrogen equivalent s (keq/ha/yr)	Acid deposition of sulphur equivalent s (keq/ha/yr)	CL _{max} S (keq/ha/yr)	CL _{min} N (keq/ha/yr)	CL _{max} N (keq/ha/yr)
Severn Estuary SPA/Ramsar	10	17.9	1.3	0.3	No critical load available for this feature		
Bridgwater Bay SSSI/NNR	5	11.9	1.2	0.2	0.16	0.32	0.48
Somerset Wetlands NNR	5	24.4	1.7	0.3	4.00	1.07	5.07
Exmoor and Quantock Oakwoods SAC	5	27.2	2.0	0.2	0.21	0.14	0.87

4 Dispersion Modelling Results

This section contains the modelling results for all modelled scenarios. The following tables contain the results for those human and ecological receptors that experience the maximum Process Contribution (PC) and Predicted Environmental Concentration (PEC)²⁰ for each pollutant modelled. It should be noted that the reported maximum PC and PEC results provided in the following results tables may not necessarily relate to the same receptor, due to individual receptors having a different background concentration for some pollutants. For the ecological receptors, this means the relevant AQAL at the location of the maximum PC and maximum PEC may differ; where relevant, this is detailed in the results tables below.

Full modelled results are presented in Appendix D. Contour plots of concentrations for key pollutants, overlain on base maps, are provided in Appendix E. Model files are provided in Appendix F.

A column including the percentage of the assessed receptors exhibiting exceedances of the relevant AQS/AQO/EAL has also been included within each table. Please note, this only relates to the discrete receptors considered in the modelling.

4.1 Human Health Effects – Commissioning Scenario A

Commissioning Scenario A consists of 56 hours of testing. The maximum results for human receptors for the Commissioning Scenario A for the separate Units 1 and 2 are presented in the following tables.

²⁰ The PEC is the sum of the PC and the background pollutant concentration.

Table 4.1 – Impact Assessment at Worst-case Human Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario A – Unit 1

Pollutant Averaging Period	AQS/AQO/EAL	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of AQS/AQO/EAL	% Max PEC of AQS/AQO/EAL	% Receptors with exceedances (where applicable)
NO ₂ Annual mean	40	0.05	9.41	0.1	23.5	-
NO ₂ 99.79 Percentile 1-hour mean	200	114.19	145.09	57.1	72.5	-
PM ₁₀ Annual mean	40	<0.01	10.71	<0.1	26.8	-
PM ₁₀ 90.41 percentile 24-hour mean	50	3.61	24.23	7.2	48.5	-
PM _{2.5} Annual mean	20	<0.01	6.40	<0.1	32.0	-
CO Maximum 1-hour mean	30,000	27.89	974.90	0.1	3.2	-
CO Maximum 8-hour mean	10,000	25.47	972.48	0.3	9.7	-
SO ₂ 99.73 percentile 1-hour mean	350	30.85	38.91	8.8	11.1	-
SO ₂ 99.18 percentile 24-hour mean	125	22.56	29.50	18.1	23.6	-
SO ₂ 99.9 percentile 15-min mean	266	35.21	42.22	13.2	15.9	-

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances use the PEC

Percentage exceedances based on discrete receptors

Table 4.2 – Impact Assessment at Worst-case Human Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario A – Unit 2

Pollutant Averaging Period	AQS/AQO/EAL	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of AQS/AQO/EAL	% Max PEC of AQS/AQO/EAL	% Receptors with exceedances (where applicable)
NO ₂ Annual mean	40	0.31	3.65	0.8	9.1	-
NO ₂ 99.79 Percentile 1-hour mean	200	160.61	166.50	80.3	83.3	-
PM ₁₀ Annual mean	40	0.01	10.69	<0.1	26.7	-
PM ₁₀ 90.41 percentile 24-hour mean	50	2.11	22.00	4.2	44.0	-
PM _{2.5} Annual mean	20	0.01	6.06	0.1	30.3	-
CO Maximum 1-hour mean	30,000	38.36	985.38	0.1	3.3	-
CO Maximum 8-hour mean	10,000	33.62	980.64	0.3	9.8	-
SO ₂ 99.73 percentile 1-hour mean	350	43.07	51.13	12.3	14.6	-
SO ₂ 99.18 percentile 24-hour mean	125	29.37	37.43	23.5	29.9	-
SO ₂ 99.9 percentile 15-min mean	266	48.26	54.44	18.1	20.5	-

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances use the PEC

Percentage exceedances based on discrete receptors



4.2 Ecological Effects – Commissioning Scenario A

The maximum results for ecological receptors for the Commissioning Scenario A – Unit 1 are presented in the following table.

Table 4.3 – Impact Assessment at Worst-case Ecological Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario A – Unit 1

Pollutant Averaging Period	CL _e /CL/CL _{minN}	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of CL _e /CL/CL _{minN}	% Max PEC of CL _e /CL/CL _{minN}	% Receptors with exceedances (where applicable)
NO _x Annual mean	30	0.30	40.30	1.0	134.3	0.2
NO _x 24-hour mean	75	386.78	422.43	515.7	563.2	28.1
SO ₂ Annual mean	10 ^A	0.03	9.82	0.3	98.2	-
Nitrogen Deposition	10 ^B /5 ^C	0.04	27.24	0.4	544.7	100.0
Acid Deposition	1.07 ^B /0.14 ^C	<0.01	2.20	<0.1	1,547.2	100.0

Notes:

^AAQAL for locations with Lichens and Bryophytes

^BMinimum CL for location of max PC

^CMinimum CL for location of max PEC

CL_e = Critical Level

CL = Critical Load

CL_{minN} = Minimum Critical Load for Nitrogen

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances for concentrations in air use PEC. Percentage exceedances based on discrete receptors.



Table 4.4 – Impact Assessment at Worst-case Ecological Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario A – Unit 2

Pollutant Averaging Period	CL _e /CL/CL _{min} N	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of CL _e /CL/CL _{min} N	% Max PEC of CL _e /CL/CL _{min} N	% Receptors with exceedances (where applicable)
NO _x Annual mean	30	1.87	7.13	6.2	23.8	-
NO _x 24-hour mean	75	381.24	388.81	508.3	518.4	24.3
SO ₂ Annual mean	10 ^A	0.15	9.87	1.5	98.7	-
Nitrogen Deposition	10 ^B /5 ^C	0.27	27.24	2.7	544.8	100.0
Acid Deposition	1.07 ^B /0.14 ^C	<0.01	2.20	0.3	1,547.5	100.0

Notes:

^AAQAL for locations with Lichens and Bryophytes

^BMinimum CL for location of max PC

^CMinimum CL for location of max PEC

CL_e = Critical Level

CL = Critical Load

CL_{min}N = Minimum Critical Load for Nitrogen

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances for concentrations in air use PEC. Percentage exceedances based on discrete receptors

4.3 Human Health Effects – Commissioning Scenario B

Commissioning Scenario B consists of eight days of testing the EDGs at 100% load. The maximum results for human receptors for the Commissioning Scenario B for the separate units 1 and 2 are presented in the following tables.

Table 4.5 – Impact Assessment at Worst-case Human Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario B – Unit 1

Pollutant Averaging Period	AQS/AQO/EAL	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of AQS/AQO/EAL	% Max PEC of AQS/AQO/EAL	% Receptors with exceedances (where applicable)
NO ₂ Annual mean	40	0.30	9.54	0.7	23.8	-
NO ₂ 99.79 Percentile 1-hour mean	200	228.38	259.28	114.2	129.6	5.4
PM ₁₀ Annual mean	40	0.01	10.71	<0.1	26.8	-
PM ₁₀ 90.41 percentile 24-hour mean	50	7.23	27.84	14.5	55.7	-
PM _{2.5} Annual mean	20	0.01	6.41	0.1	32.0	-
CO Maximum 1-hour mean	30,000	55.77	1,002.79	0.2	3.3	-
CO Maximum 8-hour mean	10,000	50.94	997.96	0.5	10.0	-
SO ₂ 99.73 percentile 1-hour mean	350	61.70	69.76	17.6	19.9	-
SO ₂ 99.18 percentile 24-hour mean	125	45.13	52.07	36.1	41.7	-
SO ₂ 99.9 percentile 15-min mean	266	70.41	77.35	26.5	29.1	-

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances use the PEC

Percentage exceedances based on discrete receptors

Table 4.6 – Impact Assessment at Worst-case Human Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario B – Unit 2

Pollutant Averaging Period	AQS/AQO/EAL	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of AQS/AQO/EAL	% Max PEC of AQS/AQO/EAL	% Receptors with exceedances (where applicable)
NO ₂ Annual mean	40	0.30	3.64	0.7	9.1	-
NO ₂ 99.79 Percentile 1-hour mean	200	228.38	234.27	114.2	117.1	5.4
PM ₁₀ Annual mean	40	0.01	10.69	<0.1	26.7	-
PM ₁₀ 90.41 percentile 24-hour mean	50	7.23	27.84	14.5	55.7	-
PM _{2.5} Annual mean	20	0.01	6.06	0.1	30.3	-
CO Maximum 1-hour mean	30,000	22.77	1,002.79	0.2	3.3	-
CO Maximum 8-hour mean	10,000	50.94	997.96	0.5	10.0	-
SO ₂ 99.73 percentile 1-hour mean	350	61.70	69.76	17.6	19.9	-
SO ₂ 99.18 percentile 24-hour mean	125	45.13	52.07	36.1	41.7	-
SO ₂ 99.9 percentile 15-min mean	266	70.41	77.35	26.5	29.1	-

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances use the PEC

Percentage exceedances based on discrete receptors



4.4 Ecological Effects – Commissioning Scenario B

The maximum results for ecological receptors for the Commissioning Scenario B – Unit 1 and Unit 2 are presented in the following tables.

Table 4.7 – Impact Assessment at Worst-case Ecological Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario B – Unit 1

Pollutant Averaging Period	CLe/CL/CL _{min} N	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of CLe/CL/CL _{min} N	% Max PEC of CLe/CL/CL _{min} N	% Receptors with exceedances (where applicable)
NO _x Annual mean	30	2.02	40.74	6.7	135.8	<0.1
NO _x 24-hour mean	75	773.57	809.21	1,031.4	1,078.9	51.6
SO ₂ Annual mean	10 ^A	0.19	9.86	1.9	98.6	-
Nitrogen Deposition	10 ^B /5 ^C	0.29	27.24	2.9	544.8	100.0
Acid Deposition	1.07 ^B /0.14 ^C	<0.01	2.20	0.3	1,547.5	100.0

Notes:

^AAQAL for locations with Lichens and Bryophytes

^BMinimum CL for location of max PC

^CMinimum CL for location of max PEC

Cle = Critical Level

CL = Critical Load

CL_{min}N = Minimum Critical Load for Nitrogen

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances for concentrations in air use PEC. Percentage exceedances based on discrete receptors



Table 4.8 – Impact Assessment at Worst-case Ecological Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario B – Unit 2

Pollutant Averaging Period	CL _e /CL/CL _{min} N	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of CL _e /CL/CL _{min} N	% Max PEC of CL _e /CL/CL _{min} N	% Receptors with exceedances (where applicable)
NO _x Annual mean	30	2.02	7.49	6.7	25.0	-
NO _x 24-hour mean	75	773.57	781.14	1,031.4	1,041.5	51.23
SO ₂ Annual mean	10 ^A	0.19	9.86	1.9	98.6	-
Nitrogen Deposition	10 ^B /5 ^C	0.29	27.24	2.9	544.8	100.0
Acid Deposition	1.07 ^B /0.14 ^C	<0.01	2.20	0.3	1,547.5	100.0

Notes:

^AAQAL for locations with Lichens and Bryophytes

^BMinimum CL for location of max PC

^CMinimum CL for location of max PEC

CL_e = Critical Level

CL = Critical Load

CL_{min}N = Minimum Critical Load for Nitrogen

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances for concentrations in air use PEC. Percentage exceedances based on discrete receptors

4.5 Human Health Effects – Commissioning Scenario C

Commissioning Scenario C consists of eight days of testing the EDGs and UDGs at 100% load. The maximum results for human receptors for the Commissioning Scenario C for the separate units 1 and 2 are presented in the following tables.

Table 4.9 – Impact Assessment at Worst-case Human Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario C – Unit 1

Pollutant Averaging Period	AQS/AQO/EAL	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of AQS/AQO/EAL	% Max PEC of AQS/AQO/EAL	% Receptors with exceedances (where applicable)
NO ₂ Annual mean	40	0.34	9.56	0.8	23.9	-
NO ₂ 99.79 Percentile 1-hour mean	200	266.58	297.48	133.3	148.7	5
PM ₁₀ Annual mean	40	0.01	10.71	<0.1	26.8	-
PM ₁₀ 90.41 percentile 24-hour mean	50	7.45	28.06	14.9	56.1	-
PM _{2.5} Annual mean	20	0.01	6.41	0.1	32.0	-
CO Maximum 1-hour mean	30,000	76.76	1,023.78	0.3	3.4	-
CO Maximum 8-hour mean	10,000	68.53	1,015.55	0.7	10.2	-
SO ₂ 99.73 percentile 1-hour mean	350	61.79	69.85	17.7	20.0	-
SO ₂ 99.18 percentile 24-hour mean	125	45.18	52.12	36.1	41.7	-
SO ₂ 99.9 percentile 15-min mean	266	70.51	77.45	26.5	29.1	-

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances use the PEC

Percentage exceedances based on discrete receptors

Table 4.10 – Impact Assessment at Worst-case Human Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario C – Unit 2

Pollutant Averaging Period	AQS/AQO/EAL	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of AQS/AQO/EAL	% Max PEC of AQS/AQO/EAL	% Receptors with exceedances (where applicable)
NO ₂ Annual mean	40	0.34	3.69	0.8	9.2	-
NO ₂ 99.79 Percentile 1-hour mean	200	266.58	272.48	133.3	136.6	5.0
PM ₁₀ Annual mean	40	0.01	10.69	<0.1	26.7	-
PM ₁₀ 90.41 percentile 24-hour mean	50	7.45	27.34	14.9	54.7	-
PM _{2.5} Annual mean	20	0.01	6.06	0.1	30.3	-
CO Maximum 1-hour mean	30,000	76.76	1,023.78	0.3	3.4	-
CO Maximum 8-hour mean	10,000	68.53	1,015.55	0.7	10.2	-
SO ₂ 99.73 percentile 1-hour mean	350	61.79	69.85	17.7	20.0	-
SO ₂ 99.18 percentile 24-hour mean	125	45.18	52.12	36.1	41.7	-
SO ₂ 99.9 percentile 15-min mean	266	70.51	77.45	26.5	29.1	-

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances use the PEC

Percentage exceedances based on discrete receptors



4.6 Ecological Effects – Commissioning Scenario C

The maximum results for ecological receptors for the Commissioning Scenario C – Unit 1 and Unit 2 are presented in the following tables.

Table 4.11 – Impact Assessment at Worst-case Ecological Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario C – Unit 1

Pollutant Averaging Period	CL _e /CL/CL _{minN}	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of CL _e /CL/CL _{minN}	% Max PEC of CL _e /CL/CL _{minN}	% Receptors with exceedances (where applicable)
NO _x Annual mean	30	2.30	40.83	7.7	136.1	<0.1
NO _x 24-hour mean	75	888.82	924.46	1,185.1	1,232.6	55.5
SO ₂ Annual mean	10 ^A	0.19	9.86	1.9	98.6	-
Nitrogen Deposition	10 ^B /5 ^C	0.33	27.24	3.3	544.8	100.0
Acid Deposition	1.07 ^B /0.14 ^C	<0.01	2.20	0.3	1,547.5	100.0

Notes:

^AAQAL for locations with Lichens and Bryophytes

^BMinimum CL for location of max PC

^CMinimum CL for location of max PEC

CL_e = Critical Level

CL = Critical Load

CL_{minN} = Minimum Critical Load for Nitrogen

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances for concentrations in air use PEC. Percentage exceedances based on discrete receptors



The maximum results for ecological receptors for the Commissioning Scenario C –Unit 2 are presented in the following table.

Table 4.12 – Impact Assessment at Worst-case Ecological Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Commissioning Scenario C – Unit 2

Pollutant Averaging Period	CLe/CL/CL _{min} N	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of CLe/CL/CL _{min} N	% Max PEC of CLe/CL/CL _{min} N	% Receptors with exceedances (where applicable)
NO _x Annual mean	30	2.30	7.73	7.7	25.8	-
NO _x 24-hour mean	75	888.82	896.39	1,185.1	1,195.2	55.1
SO ₂ Annual mean	10 ^A	0.19	9.86	1.9	98.6	-
Nitrogen Deposition	10 ^B /5 ^C	0.33	27.24	3.3	544.8	100.0
Acid Deposition	1.07 ^B /0.14 ^C	<0.01	2.20	0.3	1,547.5	100.0

Notes:

^AAQAL for locations with Lichens and Bryophytes

^BMinimum CL for location of max PC

^CMinimum CL for location of max PEC

CLe = Critical Level

CL = Critical Load

CL_{min}N = Minimum Critical Load for Nitrogen

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances for concentrations in air use PEC. Percentage exceedances based on discrete receptors

4.7 Human Health Effects – Routine Testing Scenario

During the Routine Testing Scenario, the EDGs, CWI Pumps, BDB Spare and LLV could run concurrently for 144 hours as a worst case scenario. The maximum results for human receptors for the Routine Testing Scenario are presented in the following tables.

Table 4.13 – Impact Assessment at Worst-case Human Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Routine Testing Scenario

Pollutant Averaging Period	AQS/AQO/E AL	PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of AQS/AQO/E AL	% Max PEC of AQS/AQO/EAL	% Receptors with exceedances (where applicable)
NO ₂ Annual mean	40	0.14	3.49	0.4	8.7	-
NO ₂ 99.79 Percentile 1-hour mean	200	485.59	491.59	242.8	245.8	5.4
PM ₁₀ Annual mean	40	0.03	10.68	0.1	26.7	-
PM ₁₀ 90.41 percentile 24-hour mean	50	11.50	31.38	23.0	62.8	-
PM _{2.5} Annual mean	20	0.03	4.31	0.1	21.6	-
CO Maximum 1-hour mean	30,000	326.05	1,231.89	1.1	4.1	-
CO Maximum 8-hour mean	10,000	112.33	1,046.43	1.1	10.5	-
SO ₂ 99.73 percentile 1-hour mean	350	128.13	134.31	36.6	38.4	-
SO ₂ 99.18 percentile 24-hour mean	125	80.08	88.14	64.1	70.5	-
SO ₂ 99.9 percentile 15-min mean	266	157.57	163.75	59.2	61.6	-
US EPA AEGL 1 100 percentile 1-hour mean NO ₂	956	559.72	562.72	58.5	58.9	-
US EPA AEGL 2 100 percentile 1-hour mean NO ₂	22,950	559.72	562.72	2.4	2.5	-
US EPA AEGL 3 100 percentile 1-hour mean NO ₂	38,250	559.72	562.72	1.5	1.5	-

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances use the PEC

Percentage exceedances based on discrete receptors



4.8 Ecological Effects – Routine Testing Scenario

The maximum results for ecological receptors for the routine testing scenario are presented in the following tables.

Table 4.14 – Impact Assessment at Worst-case Ecological Receptor by Pollutant ($\mu\text{g m}^{-3}$) – Routine Testing Scenario

Pollutant Averaging Period	CLe/CL/CL _{min} N	PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of CLe/CL/CL _{min} N	% Max PEC of CLe/CL/CL _{min} N	% Receptors with exceedances (where applicable)
NO _x Annual mean	30	0.84	6.49	2.8	21.6	-
NO _x 24-hour mean	75	1,179.46	1,186.90	1,572.6	1,582.5	90.9
SO ₂ Annual mean	10 ^A	0.06	9.83	0.6	98.3	-
Nitrogen Deposition	10 ^B /5 ^C	0.12	27.24	1.2	340.5	100.0
Acid Deposition	1.07 ^B /0.14 ^C	<0.01	2.20	<0.1	1,547.3	100.0

Notes:

^AAQAL for locations with Lichens and Bryophytes

^BMinimum CL for location of max PC

^CMinimum CL for location of max PEC

CLe = Critical Level

CL = Critical Load

CL_{min}N = Minimum Critical Load for Nitrogen

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances for concentrations in air use PEC. Percentage exceedances based on discrete receptors

4.9 Human Health Effects – LOOP Scenario A

Under the LOOP Scenario A operation, all generators would fire concurrently except the UDGs and SEGs. All generators would run for 24 hours, with an additional hour of operation for the EDGs only. The maximum results for human receptors for the LOOP Scenario A are presented in the following tables.

Table 4.15 – Impact Assessment at Worst-case Human Receptor by Pollutant ($\mu\text{g m}^{-3}$) – LOOP Scenario A

Pollutant Averaging Period	AQS/AQO/EAL	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of AQS/AQO/EAL	% Max PEC of AQS/AQO/EAL	% Receptors with exceedances (where applicable)
NO ₂ Annual mean	40	0.08	3.46	0.2	8.7	-
NO ₂ 99.79 Percentile 1-hour mean	200	499.85	522.43	249.9	261.2	7.1
PM ₁₀ Annual mean	40	0.02	10.68	<0.1	26.7	-
PM ₁₀ 90.41 percentile 24-hour mean	50	13.59	33.47	27.2	66.9	-
PM _{2.5} Annual mean	20	0.02	4.31	0.1	21.6	-
CO Maximum 1-hour mean	30,000	972.82	1,889.56	3.2	6.3	-
CO Maximum 8-hour mean	10,000	373.48	1,329.92	3.7	13.3	-
SO ₂ 99.73 percentile 1-hour mean	350	128.82	134.49	36.7	38.4	-
SO ₂ 99.18 percentile 24-hour mean	125	80.08	88.14	64.1	70.5	-
SO ₂ 99.9 percentile 15-min mean	266	156.94	163.20	59.0	61.4	-
US EPA AEGL 1 100 percentile 1-hour mean NO ₂	956	1,044.59	1,081.50	109.3	113.1	1.8
US EPA AEGL 2 100 percentile 1-hour mean NO ₂	22,950	1,044.59	1,081.50	4.6	4.7	-
US EPA AEGL 3 100 percentile 1-hour mean NO ₂	38,250	1,044.59	1,081.50	2.7	2.8	-

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances use the PEC

Percentage exceedances based on discrete receptors



4.10 Ecological Effects – LOOP Scenario A

The maximum results for ecological receptors for the LOOP scenario are presented in the following tables.

Table 4.16 – Impact Assessment at Worst-case Ecological Receptor by Pollutant ($\mu\text{g m}^{-3}$) – LOOP Scenario A

Pollutant Averaging Period	CL _e /CL/CL _{min} N	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of CL _e /CL/CL _{min} N	% Max PEC of CL _e /CL/CL _{min} N	% Receptors with exceedances (where applicable)
NO _x Annual mean	30	0.48	6.18	1.6	20.6	-
NO _x 24-hour mean	75	1,261.52	1,310.56	1,682.0	1,747.4	97.4
SO ₂ Annual mean	10 ^A	0.04	9.83	0.4	49.1	-
Nitrogen Deposition	10 ^B /5 ^C	0.07	27.24	0.7	544.7	100.0
Acid Deposition	1.07 ^B /0.14 ^C	<0.01	2.20	<0.1	1,547.3	100.0

Notes:

^AAQAL for locations with Lichens and Bryophytes

^BMinimum CL for location of max PC

^CMinimum CL for location of max PEC

CL_e = Critical Level

CL = Critical Load

CL_{min}N = Minimum Critical Load for Nitrogen

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances for concentrations in air use PEC. Percentage exceedances based on discrete receptors

4.11 Human Health Effects – LOOP Scenario B

Under the LOOP Scenario B operation, all generators would fire concurrently except the UDGs and SEGs. All generators would run for 72 hours. The maximum results for human receptors for the LOOP Scenario B are presented in the following tables.

Table 4.17 – Impact Assessment at Worst-case Human Receptor by Pollutant ($\mu\text{g m}^{-3}$) – LOOP Scenario B

Pollutant Averaging Period	AQS/AQO/EAL	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of AQS/AQO/EAL	% Max PEC of AQS/AQO/EAL	% Receptors with exceedances (where applicable)
NO ₂ Annual mean	40	0.24	3.54	0.6	8.8	-
NO ₂ 99.79 Percentile 1-hour mean	200	499.85	522.43	249.9	261.2	7.1
PM ₁₀ Annual mean	40	0.04	10.68	0.1	26.7	-
PM ₁₀ 90.41 percentile 24-hour mean	50	13.59	33.47	27.2	66.9	-
PM _{2.5} Annual mean	20	0.04	4.32	0.2	21.6	-
CO Maximum 1-hour mean	30,000	972.82	1,889.56	3.2	6.3	-
CO Maximum 8-hour mean	10,000	373.48	1,329.92	3.7	13.3	-
SO ₂ 99.73 percentile 1-hour mean	350	128.82	134.49	36.7	38.4	-
SO ₂ 99.18 percentile 24-hour mean	125	80.08	88.14	64.1	70.5	-
SO ₂ 99.9 percentile 15-min mean	266	156.94	163.20	59.0	61.4	-
US EPA AEGL 1 100 percentile 1-hour mean NO ₂	956	1044.59	1081.50	109.3	113.1	1.8
US EPA AEGL 2 100 percentile 1-hour mean NO ₂	22,950	1044.59	1081.50	4.6	4.7	-
US EPA AEGL 3 100 percentile 1-hour mean NO ₂	38,250	1044.59	1081.50	2.7	2.8	-

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances use the PEC



4.1 Ecological Effects – LOOP Scenario B

The maximum results for ecological receptors for the LOOP scenario B are presented in the following tables.

Table 4.17 – Impact Assessment at Worst-case Ecological Receptor by Pollutant ($\mu\text{g m}^{-3}$) – LOOP Scenario B

Pollutant Averaging Period	CLe/CL/CL _{min} N	Max PC ($\mu\text{g m}^{-3}$)	Max PEC ($\mu\text{g m}^{-3}$)	% Max PC of CLe/CL/CL _{min} N	% Max PEC of CLe/CL/CL _{min} N	% Receptors with exceedances (where applicable)
NO _x Annual mean	30	1.40	6.95	4.7	23.2	-
NO _x 24-hour mean	75	1,261.52	1,310.56	1,682.0	1,747.4	97.4
SO ₂ Annual mean	10 ^A	0.12	9.85	1.2	49.3	-
Nitrogen Deposition	10 ^B /5 ^C	0.20	27.24	2.0	544.8	100.0
Acid Deposition	1.07 ^B /0.14 ^C	<0.1	2.20	<0.1	1,547.4	100.0

Notes:

^AAQAL for locations with Lichens and Bryophytes

^BMinimum CL for location of max PC

^CMinimum CL for location of max PEC

CLe = Critical Level

CL = Critical Load

CL_{min}N = Minimum Critical Load for Nitrogen

PC = Process contribution

PEC = Predicted environmental concentration (= PEC + background)

Exceedances for concentrations in air use PEC. Percentage exceedances based on discrete receptors

5 Discussion of Results

5.1 Commissioning Scenario

5.1.1 Human Receptors

The results indicate that the concentrations for the long-term assessment metrics are below the relevant AQAL for all commissioning scenarios for both Unit 1 and Unit 2.

The results indicate that most of the concentrations for the short-term assessment metrics are below the relevant AQAL for the commissioning scenarios. The relevant AQAL for 1-hour mean NO₂ is predicted to be exceeded in commissioning Scenarios B and C at both units. Therefore, further probability analysis has been undertaken to investigate whether these are 'true' exceedances, given that the metric for short-term NO₂ allows for up to 18 exceedances in a year.

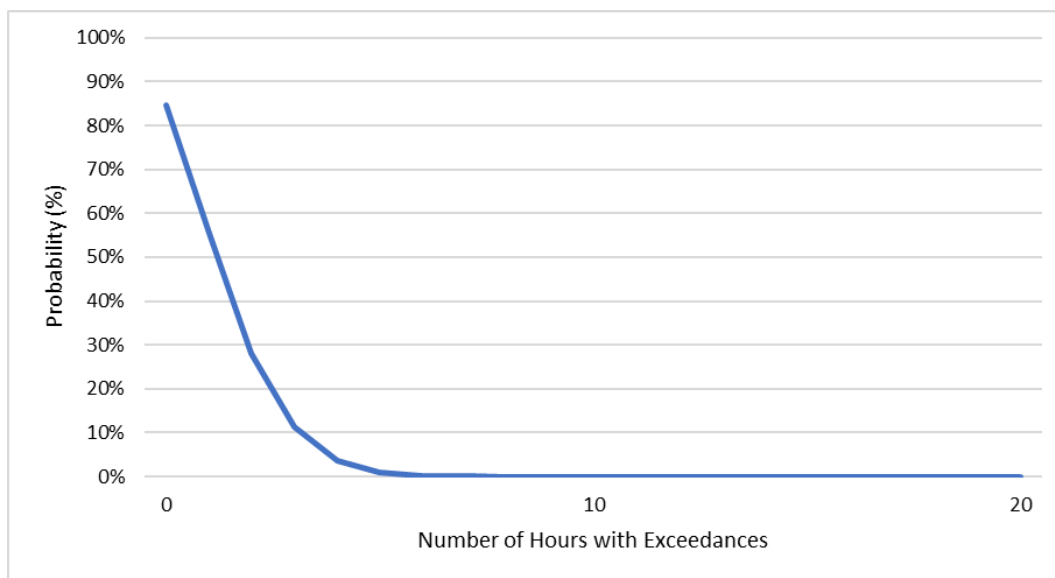
5.1.2 Probability Analysis

The PEC is predicted to exceed the 99.79 percentile 1-hour mean for NO₂ with predicted values at receptors up to 148.7% of the AQS for the Commissioning Scenario C for Unit 1. Under the Commissioning Scenario C, the worst-case operations would occur where the EDGs and UDGs operate concurrently for up to 192 hours at 100% load.

The worst-case receptor for the Commissioning Scenario was R34, located to the west of the Site. This probability analysis has used the exceedance data output from the worst-case gens for a full hour, in order to demonstrate a worst-case assessment.

The model has predicted the greatest number of exceedances at the assessed receptors to be 84 of the 8,760 meteorological lines assessed for the year. The hypergeometric distribution has then been used to calculate the probability of those lines coinciding with the hours of operation to cause an exceedance. Figure 5.1 shows the probability of Scenario C for Unit 1 resulting in a specific number of exceedances using the hypergeometric distribution. If Commissioning Scenario C ran for 192 hours, the probability of exceeding the objective more than the 18 allowed exceedances is less than 0.1%. Therefore, it is considered that there is no risk of adverse effects from any of the Commissioning operations.

Figure 5.1 – Hypergeometric Distribution, Commissioning Scenario C – Unit 1



5.1.3 Ecological Receptors

The results indicate that the concentrations for the long-term assessment metrics of SO₂ are below the relevant AQALs in all the Commissioning Scenarios. The NO_x annual mean AQAL is predicted to be exceeded in all the Commissioning Scenarios, except for Commissioning Scenario A - Unit 2, and Commissioning Scenario C - Unit 2.

Further assessment is required for Nitrogen and Acid Deposition as 100% of the assessed ecological receptors are predicted to exceed the relevant AQAL as a result of the Commissioning Scenario operations. The NO_x 24-hour mean AQAL is also predicted to be exceeded in each of the Commissioning Scenarios. This assessment has been undertaken by an appointed specialist ecologist, results of which are discussed elsewhere.

5.2 Routine Testing Scenario

5.2.1 Human Receptors

The results indicate that the concentrations for the long-term assessment metrics are below the relevant AQALs.

The results indicate that the concentrations for the majority of short-term assessment metrics are below the relevant AQALs. Exceedances of the NO₂ 1-hour mean AQAL are predicted.

With regard to human receptors, since the total annual operating hours for the routine testing scenario could last for a predicted 144 hours annually, a probability analysis has been undertaken below for the 99.79 percentile of 1-hour mean NO₂. The worst-case 144 hours of the year have been utilised within this scenario to account for the potential concurrent operation of the EDGs, CWI Pumps, BDB Spare and LLV.

There were no exceedances predicted for the maximum 1-hour mean NO₂ concentration at human receptors in regard to the US EPA AEGL 1, 2 or 3.

5.2.2 Probability Analysis

The PEC is predicted to exceed the 99.79 percentile 1-hour mean for NO₂ with predicted values at receptors up to 245.8% of the AQS for the Routine Testing Scenario. Under the Routine Testing

Scenario, the worst-case operations would occur where the EDGs, CWI Pumps, BDB Spare and LLV operate concurrently for up to 144 hours.

The worst-case receptor for the Routine Testing Scenario was R33, located to the west of the Site. This probability analysis has used the exceedance data output from the worst-case gens for the full hour, in order to demonstrate a worst-case assessment.

The model has predicted the greatest number of exceedances at the assessed receptors to be 116 of the 8,760 meteorological lines assessed for the year. The hypergeometric distribution has then been used to calculate the probability of those lines coinciding with the hours of operation to cause an exceedance, in the worst-case scenario where the EDGs, CWI Pumps, BDB Spare and LLV could run concurrently for 144 hours. The probability of exceeding the objective more than the 18 allowed exceedances is less than 0.1%. Therefore, it is considered that there is no risk of adverse effects from the routine testing scenario.

Figure 5.2 – Hypergeometric Distribution, Routine Testing Scenario



5.2.3 Ecological Receptors

The results indicate that the concentrations for the long-term assessment metrics of NO_x and SO₂ are below the relevant AQALs.

Further assessment is required for Nitrogen and Acid Deposition as 100% of the assessed ecological receptors are predicted to exceed the relevant AQAL as a result of the Routine Testing Scenario operations. The NO_x 24-hour mean is also predicted to be exceeded. This assessment has been undertaken by an appointed specialist ecologist, results of which are discussed elsewhere.

5.3 LOOP Scenario

5.3.1 Human Receptors

The results indicate that the concentrations for the long-term assessment metrics are below the relevant AQALs for both LOOP Scenario A and B.

The results indicate that the concentrations for the majority of short-term assessment metrics are below the relevant AQALs. Exceedances of the NO₂ 1-hour mean AQAL are predicted.

There are exceedances predicted for the maximum 1-hour mean NO₂ concentration at human receptors for both LOOP Scenarios in regard to the US EPA AEGL 1 (underlined within the tables). However, emergency operation of the plant is extremely unlikely to take place. Additionally, US EPA AEGL 1 represents the least severe health effects, which are transient and reversible upon cessation of exposure. Maximum 1-hour mean NO₂ concentrations are well below the AEGL 2 and 3.

With regard to human receptors, since the total annual operating hours for the LOOP Scenario A is 24 hours annually, a probability analysis has been undertaken below for the 99.79 percentile of 1-hour mean NO₂. The worst-case 24 hours of the year have been utilised within this scenario to account for the potential concurrent operation of all generators except the UDGs and SEGs. It is understood that the UDGs and the SEGs would only operate if there are any failures with the EDGs.

For LOOP Scenario B, a further probability analysis has been undertaken below for the 99.79 percentile of 1-hour mean NO₂ utilising the worst-case 72 hours of the year.

5.3.2 Probability Analysis

For both LOOP Scenarios, the PEC is predicted to exceed the 99.79 percentile 1-hour mean for NO₂ with predicted values at receptors up to 261.2% of the AQS. Under LOOP Scenario A operation, all generators would fire concurrently except the UDGs and SEGs. All generators would run for 24 hours, with an additional hour of operation for the EDGs only. For LOOP Scenario B operation, all generators would run for 72 hours.

The worst-case receptor for both LOOP Scenarios was R33, located to the west of the Site. This probability analysis has used the exceedance data output from the worst-case gens for a full hour, in order to demonstrate a worst-case assessment.

The model has predicted the greatest number of exceedances at the assessed receptors to be 698 of the 8,760 meteorological lines assessed for the year. The hypergeometric distribution has then been used to calculate the probability of those lines coinciding with the hours of operation to cause an exceedance.

If the emergency scenario ran for a 24-hour period, the probability of exceeding the objective more than the 18 allowed exceedances is less than 0.1% (Figure 5.3).

Additionally, if the emergency scenario ran for a 72-hour period, the probability of exceeding the objective more than the 18 allowed exceedances is also less than 0.1% (Figure 5.4). Therefore, it is considered that there is no risk of adverse effects from the LOOP scenario A or B.

Figure 5.3 – Hypergeometric Distribution, LOOP Scenario A

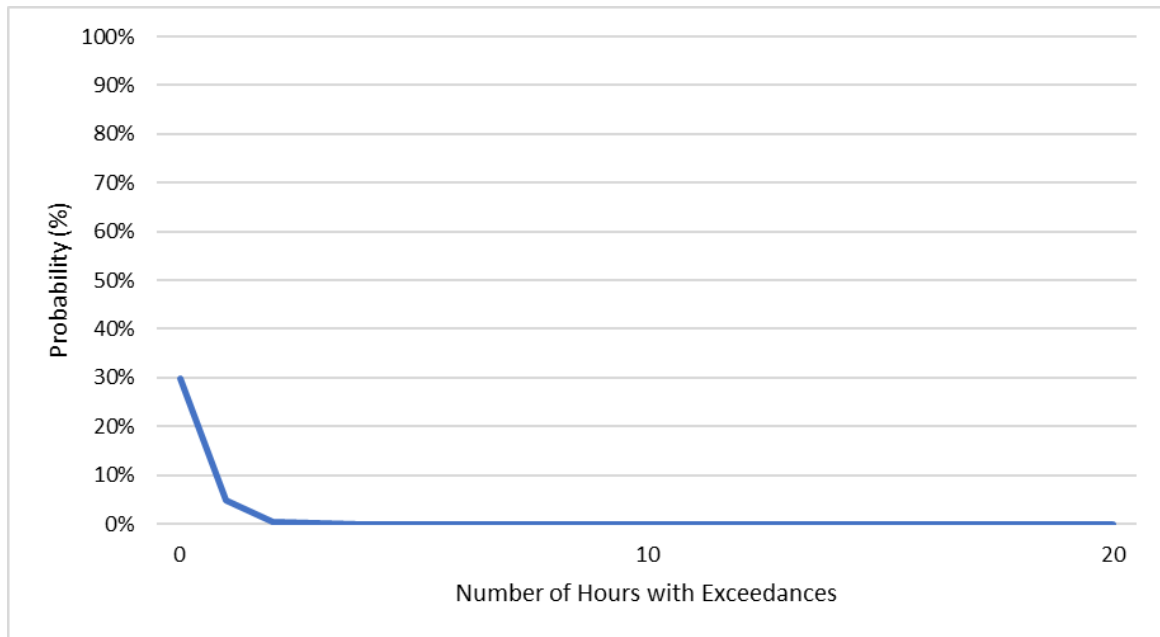
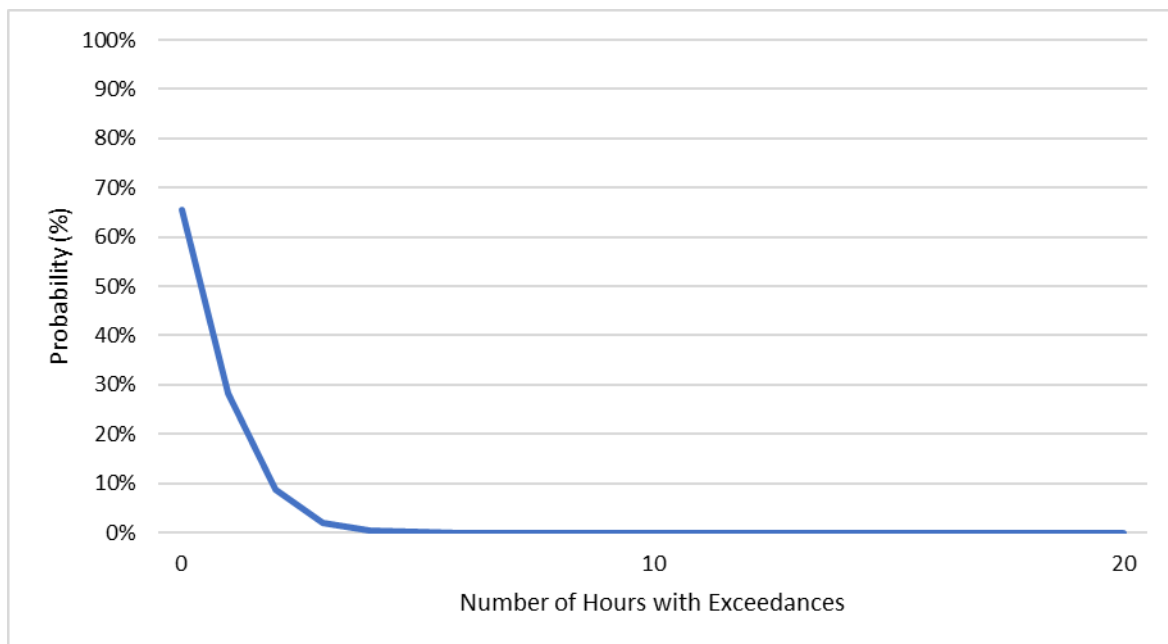


Figure 5.4 - Hypergeometric Distribution, LOOP Scenario B



5.3.3 Ecological Receptors

The results indicate that the concentrations for the long-term assessment metrics of NO_x and SO₂ are below the relevant AQALs under LOOP Scenarios A and B.

Further assessment is required for Nitrogen and Acid Deposition as ecological receptors are predicted to exceed the relevant AQAL as a result of the LOOP Scenario operations. The NO_x 24-hour mean is also predicted to be exceeded. This assessment has been undertaken by an appointed specialist ecologist, results of which are discussed elsewhere.

6 Conclusions

This assessment has been undertaken to investigate the impacts on air quality as a result of the operational emission sources at HPC, in order to support the Environmental Permit variation application. It has used detailed dispersion modelling, using ADMS 6, to undertake an assessment of emissions produced from the proposed on-site emergency power generators.

All modelling methodologies and assumptions have been developed to represent a worst case, conservative assessment, therefore the pollutant concentration results presented in this report are intended to be the upper bound of results and, in reality, concentrations at receptors are likely to be less than those reported.

A summary of the findings for human health and ecological impacts are presented on the following pages. Table 6.1 and Table 6.2 present a summary of exceedances of the relevant criteria for each scenario, for human health and ecological effects, respectively



Table 6.1 - Summary of Exceedances of the Air Quality Standards, Objectives and Environmental Assessment Levels for Human Health Effects per Scenario

Pollutant Averaging Period	Commissioning A – Unit 1	Commissioning A – Unit 2	Commissioning B – Unit 1	Commissioning B – Unit 2	Commissioning C – Unit 1	Commissioning C – Unit 2	Routine Testing	LOOP A	LOOP B
	Are there exceedances? (Y/N)								
NO ₂ Annual mean	N	N	N	N	N	N	N	N	N
NO ₂ 99.79 Percentile 1-hour mean	N	N	Y	Y	Y	Y	Y	Y	Y
PM ₁₀ Annual mean	N	N	N	N	N	N	N	N	N
PM ₁₀ 90.41 percentile 24-hour mean	N	N	N	N	N	N	N	N	N
PM _{2.5} Annual mean	N	N	N	N	N	N	N	N	N
CO Maximum 1-hour mean	N	N	N	N	N	N	N	N	N
CO Maximum 8-hour mean	N	N	N	N	N	N	N	N	N
SO ₂ 99.73 percentile 1-hour mean	N	N	N	N	N	N	N	N	N
SO ₂ 99.18 percentile 24-hour mean	N	N	N	N	N	N	N	N	N
SO ₂ 99.9 percentile 15-min mean	N	N	N	N	N	N	N	N	N
USA EPA AEGL 1 100 percentile 1-hour mean NO ₂	N/A	N/A	N/A	N/A	N/A	N/A	N	Y	Y

Hinkley Point C

Combustion Activity Environmental Permit Variation



Pollutant Averaging Period	Commissioning A – Unit 1	Commissioning A – Unit 2	Commissioning B – Unit 1	Commissioning B – Unit 2	Commissioning C – Unit 1	Commissioning C – Unit 2	Routine Testing	LOOP A	LOOP B
	Are there exceedances? (Y/N)								
USA EPA AEGL 2 100 percentile 1-hour mean NO ₂	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N
USA EPA AEGL 3 100 percentile 1-hour mean NO ₂	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N

At human receptors:

- During the Commissioning scenarios, the results indicate that all long-term and the majority of short-term assessment metrics are below the relevant AQALs for both Unit 1 and Unit 2.
- A further probability analysis was then carried out for the Commissioning Scenario, taking into account a worst-case maximum run time. A run time of 192 hours was utilised in the hypergeometric distribution, to calculate the number of hours of exceedance. The probability of exceeding the objective more than the 18 allowed exceedances was less than 0.1%. Therefore, the results for the Commissioning Scenario can be considered not significant for human receptors.
- During the Routine Testing scenario, the results indicated that all long-term assessment metrics, and the majority of the short-term metrics are below the relevant AQALs. The 99.79th percentile of 1-hour mean NO₂ was predicted to exceed the relevant AQAL however there are no predicted exceedances of the US EPA AEGL 100th percentile 1-hour mean NO₂ concentrations.
- A further probability analysis was then carried out for the Routine Testing scenario, taking into account a worst-case maximum run time. A run time of 144 hours was utilised in the hypergeometric distribution, to calculate the number of hours of exceedance. The probability of exceeding the objective more than the 18 allowed exceedances was less than 0.1%. Therefore, the results for the Routine Testing can be considered not significant for human receptors.
- During the LOOP scenarios A and B, the results indicated that all long-term assessment metrics, and the majority of the short-term metrics are below the relevant AQALs. The 99.79th percentile of 1-hour mean NO₂ was predicted to exceed the relevant AQAL. Additionally, there are exceedances predicted for the maximum 1-hour mean NO₂ concentration at human receptors for both LOOP scenarios and the US EPA AEGL 1. However, emergency operation of the plant is extremely unlikely to take place.
- A further probability analysis was then carried out for the LOOP scenarios, taking into account a worst-case maximum run time. The probability of exceeding the objective more than the 18 allowed exceedances was less than 0.1% for both scenarios. Therefore, the results for the LOOP Scenario A and B can be considered not significant for human receptors.



Table 6.2 - Summary of Exceedances of the Air Quality Standards, Objectives and Environmental Assessment Levels for Ecological Effects per Scenario

Pollutant Averaging Period	Commissioning A – Unit 1	Commissioning A – Unit 2	Commissioning B – Unit 1	Commissioning B – Unit 2	Commissioning C – Unit 1	Commissioning C – Unit 2	Routine Testing	LOOP A	LOOP B
	Are there exceedances? (Y/N)								
NO _x Annual mean	Y	N	Y	N	Y	N	N	N	N
NO _x 24-hour mean	Y	Y	Y	Y	Y	Y	Y	Y	Y
SO ₂ Annual mean	N	N	N	N	N	N	N	N	N
Nitrogen Deposition	Y	Y	Y	Y	Y	Y	Y	Y	Y
Acid Deposition	Y	Y	Y	Y	Y	Y	Y	Y	Y

At ecological receptors:

- The results for Nitrogen and Acid Deposition show exceedances at all ecological receptors considered in the assessment, in all Scenarios. This is mainly due to the existing background concentrations at the receptors, however when the additional PC is considered, further assessment from an ecologist is required. This assessment has been undertaken by an appointed specialist ecologist, results of which are presented within Appendix C of the Permit Variation report²¹.
- The results for annual mean NO_x at ecological receptors show exceedances of the AQAL in some of the Commissioning Scenarios. Additionally, exceedances of the 24-hour mean NO_x AQAL are predicted in all of the Scenarios. Further assessment is required at these receptors in all considered scenarios. This assessment has been undertaken by an appointed specialist ecologist, results of which are presented within Appendix C of the Permit Variation report²¹.
- Further assessment of ecological impacts for Nitrogen and Acid Deposition and annual mean and 24-hour NO_x concentrations, are required at the ecological designations. This assessment has been undertaken by an appointed specialist ecologist, results of which are presented within Appendix C of the Permit Variation report²¹.

²¹ Bureau Veritas, 2025. HPC Combustion Activity Environmental Permit Variation.
Bureau Veritas

7 Glossary

ADMS	Atmospheric Dispersion Modelling System
AADT	Annual Average Daily Traffic flows
APIS	Air Pollution Information System
AQMA	Air Quality Management Area
AQAL	Air Quality Assessment Level
AQO	Air Quality Objective
AQS	Air Quality Standard
BDAE	Built Development Area East
BDAW	Built Development Area West
BDB	Beyond Design Basis
CERC	Cambridge Environmental Research Consultants (developers of the ADMS model)
CL	Critical Load
Cle	Critical Level
CO	Carbon monoxide
CWI Pumps	Cooling Water Injection Pumps (diesel driven pumps)
Defra	Department for Environment, Food and Rural Affairs
Diffusion Tube	A type of passive sampler consisting of a tube, open at one end, with an absorbent at the other (closed) end for absorption of a specific pollutant from the surrounding air
DF	Dispersion Factor
EA	Environment Agency
EAL	Environmental Assessment Level
EDG	Emergency Diesel Generator
EHO	Environmental Health Officer
EPR	European Pressurised Reactor
EQS	Environmental Quality Standards
ESS	External Site Systems
EU	European Union
HBS	Simulator Training Centre
HHA	Framatome Warehouse
HDU	Emergency Response Training Centre
HPC	Hinkley Point C
HZG	Oil and Grease Storage
kVA	Kilo-volt ampere
LAQM	Local Air Quality Management
LLV	HBX Building backup power supply
L _{MO}	Monin-Obukhov length
MVA	Mega-volt ampere
MW	Megawatt
NNB	Nuclear New Build Generation Company Ltd

NO	Nitric oxide
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides; a collective term used to represent nitric oxide (NO) and nitrogen dioxide (NO ₂)
NRMM	Non-Road Mobile Machinery
NWP	Numerical Weather Prediction
O ₃	Ozone
PC _{air}	Process Contribution to air – pollutant concentration arising from the process
PEC	Predicted Environmental Concentration – the PC plus the existing background
PM ₁₀	The fraction of particles with aerodynamic diameters equal to, or less than, 10 µm.
PM _{2.5}	The fraction of particles with aerodynamic diameters equal to, or less than, 2.5 µm.
RR	Release Rate
SEG	Diversified Ultimate Cooling Water Supply System Generators (diesel driven pumps)
SMDG	Small Mobile Diesel Generator
SPA	Special Protection Area
SO ₂	Sulphur dioxide
SSSI	Site of Special Scientific Interest
UDG	Ultimate Diesel Generator
UKMO	United Kingdom Meteorological Office
ULSD	Ultra-Low Sulphur Diesel
Z ₀	Surface roughness
OLLI	HUB Distribution Board



Appendix A: Assumptions Log and Data Register

See supporting Excel file: Appendix A Assumptions Register_090924.xlsx



Appendix B: Diesel Generator Information

See supporting technical specification data sheets.

Appendix C: Emission Rate Calculations

Table C.7.1 – Example Emissions Calculation - EDGs

Parameter	Parameter ID	Value	Calculation Method
Operational Hours per Year	A	8,760	N/A
Energy Output (kW)	B	9,590	Data from Technical Specification Sheet
Efficiency (%)	C	41.5	Data from Technical Specification Sheet
Thermal Inputs (MW)	D	23.11	Assumed from Sizewell C Information
Stack Discharge Diameter (mm)	E	1800 (theoretical diameter: 22100)	$\sqrt{((R/S)*(1/PI()))*2*1000}$
Net CV Fuel Oil (gas oil) (MJ/unit of supply)	F	44.5	Calorific Value of Diesel Fuels
Fuel Oil Required to provide energy input (kg/s)	G	0.52	D/F
Total Fuel Oil (Unit of Supply/Year)	H	16376350	G*A*3600
Sulphur Content of Fuel (%)	I	0.002	Data from Fuel Specification Sheet
Exhaust Conditions			
Actual O ₂ (%)	J	12	Assumed based on proxy data
Actual Temperature (°C)	K	355	Data from Technical Specification Sheet
Reference O ₂ (%)	L	15	Data from Technical Specification Sheet
CO ₂ Density (kg/m ³)	M	1.86	Library figure
Waste Gas from Fuel (m ³ /Unit of Supply)	N	12.55	Library figure
CO ₂ in Waste Gas (m ³ /kg)	O	1.57	Library figure
Total Waste Gas @ 15C 0% O ₂ (m ³ /s)	P	6.517	N*G
@ 0C 15% O ₂ (Reference Conditions) (m ³ /s)	Q	21.884	$((P/(273+15))*273)*(20.9/(20.9-L))$
@ Actual Conditions (m/s)	R	38.26	Data from Technical Specification Sheet
Efflux Velocity (m/s)	S	0.1	Assumed on the basis of rain cap
Emission Concentrations (at Reference O₂)			
NO _x (mg/m ³)	T	1900	Data from Technical Specification Sheet
CO (mg/m ³)	U	150	Data from Technical Specification Sheet
VOC (mg/m ³)	V	0	Data from Technical Specification Sheet
NMVOG (mg/m ³)	W	0	Data from Technical Specification Sheet
CO ₂ (mg/m ³)	X	69295	Data from Technical Specification Sheet
SO _x (mg/m ³)	Y	182	Data from Technical Specification Sheet
Particulates (mg/m ³)	Z	50	Data from Technical Specification Sheet
Mass Emission Rate			
NO _x (g/s)	AA	41.58	T/1000*Q
CO (g/s)	AB	3.28	U/1000*Q
VOC (g/s)	AC	0.00	V/1000*Q
NMVOG (g/s)	AD	0.00	W/1000*Q
CO ₂ (g/s)	AE	1516.43	X/1000*Q
SO _x (g/s)	AF	0.0208	Y/1000*Q
Particulates (g/s)	AG	1.09	Z/1000*Q

Table C.7.2 – Modelled Emissions Rates

Generator Reference	Mass Emission Rate (g/s)					
	NO _x	CO	VOC and NMVOC	CO ₂	SO _x	Particulates
EDG	41.58	3.28	0.00	1516.43	0.02	1.09
UDG	8.66	1.47	0.00	525.26	0.007	0.05
SEG	0.36	0.197	0.00	31.08	0.0004	0.02
HDU	0.79	0.26	0.00	73.54	0.001	0.03
BDB SMDGs	2.73	0.89	0.00	255.34	0.004	0.11
BDB CWI Pumps	0.009	0.003	0.00	0.00	0.00009	0.0004
BDB Spare	0.009	0.003	0.00	0.00	0.00009	0.0004
LLV	0.51	0.36	0.00	0.00	0.0014	0.02
ESS	0.08	0.01	0.00	0.00	0.0001	0.002
OLLI	0.21	0.12	0.00	0.00	0.0005	0.01
HBS	0.21	0.12	0.00	0.00	0.0005	0.01
HHA	0.21	0.12	0.00	0.00	0.0005	0.01
HZG	0.21	0.12	0.00	0.00	0.0005	0.01



Appendix D: Full Modelled Results

See supporting Excel result files.

Appendix E: Contour Plots

See supporting contour plot image files.

Figure E-1 – Contour Plot 99.79th Percentile 1-hour NO₂ PC - Commissioning C Unit 1

1 hour mean NO₂ PC contour plots for the Commissioning C Unit 1 Scenario.

Figure E-2 - Contour Plot 99.79th Percentile 1-hour NO₂ PC - Commissioning C Unit 2

1 hour mean NO₂ PC contour plots for the Commissioning C Unit 2 Scenario.

Figure E-3 – Contour Plot 99.79th Percentile 1-hour NO₂ PC - Routine Testing.png

1 hour mean NO₂ PC contour plots for the Routine Testing Scenario.

Figure E-4 – Contour Plot 99.79th Percentile 1-hour NO₂ PC – LOOP

1 hour mean NO₂ PC contour plots for the LOOP Scenario (A and B).

Figure E-5 – Contour Plot 24-hr NO₂ PC - Commissioning A Unit 1

24 hour mean NO₂ PC contour plots for the Commissioning A Unit 1 Scenario.

Figure E-6 – Contour Plot 24-hr NO₂ PC - Commissioning B Unit 1

24 hour mean NO₂ PC contour plots for the Commissioning B Scenario Unit 1.

Figure E-7 – Contour Plot 24-hr NO₂ PC - Commissioning C Unit 1

24 hour mean NO₂ PC contour plots for the Commissioning C Scenario Unit 1.

Figure E-8 – Contour Plot 24-hr NO₂ PC - Routine Testing

24 hour mean NO₂ PC contour plots for the Routine Testing Scenario.

Figure E-9 – Contour Plot 24-hr NO₂ PC - LOOP

24 hour mean NO₂ PC contour plots for the LOOP Scenario (A and B).

Figure E-10 – Nitrogen Deposition PC - Commissioning A Unit 2

Annual mean nitrogen deposition PC for the Commissioning A Unit 2 Scenario.

Figure E-11 – Nitrogen Deposition PC - Commissioning B Unit 1

Annual mean nitrogen deposition PC for the Commissioning B Unit 1 Scenario.



Figure E-12 – Nitrogen Deposition PC - Commissioning C Unit 1

Annual mean nitrogen deposition PC for the Commissioning C Unit 1 Scenario.

Figure E-13 – Nitrogen Deposition PC - LOOP B

Annual mean nitrogen deposition PC for the LOOP B Scenario.



Appendix F: Model Input Files

See supporting ADMS model input files.