Virtus Holdco Ltd.

VIRTUS DATA CENTRES STOCKLEY PARK CAMPUS

Addendum Air Quality Assessment: Ammonia

AQ03
JULY 2022

CONFIDENTIAL

Virtus Holdco Ltd.

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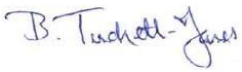
Signature				
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TABLES

EXECUTIVE SUMMARY

The impacts of ammonia emissions associated with the use of SCR to reduce NO_X emissions from the backup generators on Stockley Park Campus are insignificant.

SCR is installed on 7 generators on the campus.

Impacts are insignificant in relation to both human health and ecological impacts, including on the South West London Waterbodies SPA.

1 INTRODUCTION

1.1 ADDENDUM BACKGROUND

1.1.1. WSP was commissioned by Virtus HoldCo Ltd (the 'Applicant') to carry out an air quality assessment in support of an application for variation of Environmental Permit EPR/AP3903PD for the site referred to as Stockley Park Campus, Prologis Park West London, off Horton Road, hereafter referred to as the 'Site'.

1.1.2. Detailed air quality modelling was undertaken in relation to the routine testing of the generators on the Site and their use for backup power generator during a site-wide power outage (Virtus Data Centres Stockley Park Campus - Air Quality Assessment, WSP, May 2022. Report No 70091579-AQ02). This report is hereafter referred to as Report AQ02.

1.1.3. Report AQ02 focussed on the impacts of emissions of nitrogen oxides. In reviewing the permit application, Environment Agency (EA) requested that additional assessment work be undertaken to consider the impact of ammonia emissions from generators fitted with SCR, typically termed 'ammonia slip'.

1.2 SCOPE

1.2.1. The scope of the air quality assessment is as follows:

- Dispersion modelling of the impact of the operation of the generators on local air quality (NH_3 and nitrogen deposition) at sensitive human and ecological receptor locations for the following scenarios:
  - Routine testing
  - A theoretical 72 hours outage scenario.

1.3 ASSESSMENT CRITERIA

1.3.1. Environment Agency guidance[1] provides the following Environmental Assessment Levels for ammonia:

- Annual Mean: 180µg/m^3
- Hourly Mean: 2500µg/m^3

1.3.2. The APIS website provides the following critical level and critical loads for ammonia and nitrogen deposition:

- Critical Level – Annual Mean: 3µg/m^3
- Critical Loads
  - 20kgN/ha/yr (meadow habitats within South West London Waterbodies SPA)

[1] Environment Agency: Air Emissions Risk Assessment for your Environmental Permit, available at Air emissions risk assessment for your environmental permit - GOV.UK (www.gov.uk) [Accessed July 2022]

- 10kgN/ha/yr (generic heathland and woodland habitats across all local wildlife sites)

1.3.3. In addition to the annual mean, critical levels for ammonia have previously been defined, but not routinely assessed, at shorter averaging periods[2], namely:

- Hourly Mean: 3,300µg/m^3
- Daily Mean: 270µg/m^3
- Monthly Mean: 23µg/m^3

1.3.4. Given the short term and intermittent nature of the emissions from the generators, the critical metrics are short term impacts. As such, the impacts on ecology are assessed both in relation to the standard annual mean critical level and against the short term EAL (2,500µg/m^3) which is lower than the hourly mean critical level and hence provides a protective and conservative assessment.

[2] J.N.Cape et al, 2009, Critical Levels for Ammonia, DOI: 10.1007/978-1-4020-9121-6_22

2 OPERATIONAL SCENARIOS

2.1 INSTALLED GENERATORS

2.1.1. Details of the 74 generators installed on the Site are summarised in **Table 2-1**.

2.1.2. As noted in Report AQ02, seven generators within the LON8 DC have SCR fitted and are shown in bold in **Table 2-1**.

Table 2-1 – Summary of Installed Generators. Generators fitted with SCR shown in bold.

Data Centre	Engine	No Installed (Swing Engines)	Capacity (kW)	Emission Concentration at 100% (mg/Nm^3, @5% O2, dry)	SCR Fitted	Load during backup generation (Swing Engines)
LON5	3516C	21 (3)	2200	2350	No	86% (5%)
LON6	3516E	5 (1)	2400	3580	No	94% (6%)
	3516B	10 (2)	2000	2920	No	80% (5%)
LON7	3516C	24 (3)	2200	2350	No	88% (5%)
LON8	3516E	7 (1)	2400	3580	No	86% (5%)
	3516E	**7 (1)**	**2400**	**72**	**Yes**	**86% (5%)**

2.2 ASSESSMENT SCENARIOS

2.2.1. The operation of the generators will be limited to monthly testing and emergency situations. Consequently, the assessment of impacts presented in Report AQ02 was based on the following operational scenarios:

- **Routine testing:**
  - **Virtus Test 1**: representative of a 15 minute “switch on” offload test; to be carried out on monthly basis in eleven months of the year. In reality this will be limited to approximately 5 minutes.
  - **Virtus Test 2:** representative of a full service onload test consisting of an initial 20 minutes at 100% load immediately followed by 120 minutes at 75% load; to be carried out once per year in the 12th month of the year.
- **Theoretical 72hr Outage:**
  - **Virtus Emergency 2:** Theoretical complete mains electricity failure of 72 hours duration. In this scenario there is an initial period of 20-30 minutes where generators are required to run at 100% load, to recharge the UPS battery array, before dropping to the actual building load required, designed to be around 80 - 90% (as set out in **Table 2-1**).

2.2.2. Emergency scenario 2 is an Environment Agency specified scenario.

2.2.3. As noted in Report AQ02, the operator calculated average annual operation emergency scenario assumed a power outage occurs once in every five or six years for 24 hours. This was based on Ofgem grid operator outage data and on-site outage worst case estimates. Generator operation was assumed to be required for an initial 20-minute start-up load and 220-minute subsequent stable operation. The Environment Agency's 72 hour outage is, therefore, highly conservative and should be considered a theoretical scenario only.

2.2.4. SCR use requires a minimum exhaust temperature (~320°C). It will not, therefore, be operational during the offload testing (Virtus Test Scenario 1) in which the exhaust temperature remains low. Without SCR, there is no potential for ammonia emissions and, as such, this scenario is scoped out of the modelling undertaken for this addendum.

2.2.5. Under Virtus Test 2, the test cycle is 2 hours and 20 minutes long in total. It is assumed that the generator exhaust will reach the minimum temperature within 10minutes and, therefore, ammonia emissions are possible for 2 hours and 10 minutes for each generator (7 in total with SCR fitted) – a total of just over 15 hours of operation per year.

3 BASELINE

3.1 INTRODUCTION

3.1.1. The Site is located within the Hillingdon Air Quality Management Area that was designated by the LBH in 2003 for exceedances of the annual mean NO_2 AQS[3]. The AQMA was declared as a broad area from the southern boundary of LBH to a northern border defined by, the A40 corridor from the western borough boundary, east to the intersection with the Yeading Brook north until its intersection with the Chiltern-Marylebone railway line.

3.1.2. The principal sources of ammonia emissions in the UK relate to agricultural activities. There is limited farming undertaken within the study area and the nearest activities are over 1.5km from the site.

3.2 BACKGROUND POLLUTANT CONCENTRATIONS AND DEPOSITION

3.2.1. The APIS[4] website provides mapped pollutant concentration and deposition data for the UK. **Table 3-1** shows the NH_3 and nitrogen deposition data for the ecological sites within the study area.

3.2.2. Background NH_3 concentrations are within the critical level of 3µg/m^3 and the EAL of 180µg/m^3 everywhere.

3.2.3. Nitrogen deposition is below the lower critical load (20kgN/ha/yr) over the South West London Waterbodies, and for meadow habitats. However, it exceeds the lower critical load for all woodland vegetation and heathland (10kgN/ha/yr).

3.2.4. Acid deposition is above the lower critical load within the South West London Waterbodies (CLmaxN: 1.093keq/ha/yr, acid grassland) and the Local Wildlife Sites (CLmaxN: 1.308keq/ha/yr, acid grassland; 2.047keq/ha/yr, broadleaved woodland).

Table 3-1 – Mapped background concentrations and deposition over human receptors and ecological sites

Site	Designation	EAL / Critical Level (µg/m^3)	NH_3 (µg/m^3)	Critical Load (kgN/ha/yr)	N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)
All Sensitive Human Receptors / Point of Maximum Impact		180	1.9	NA		

[3] Defra (2022) *AQMAs Declared by London Borough of Hillingdon* [online]. Available at: https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=342 [Accessed April 2022].
[4] www.apis.ac.uk [Accessed July 2022]

Site	Designation	EAL / Critical Level (µg/m^3)	NH_3 (µg/m^3)	Critical Load (kgN/ha/yr)	N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)
South West London Waterbodies	SPA/ Ramsar/ SSSI	3	1.8	20-30	17.5	1.45
Lower Colne	LWS		1.8	10 – 20 for Deciduous Woodland 10 – 20 for Northern Wet Heath / Dry Heaths 20 – 30 for Low and Medium Altitude Hay Meadows	31.36 Woodland 18.06 Heath / Meadows	2.59 Woodland 1.57 Heath / Meadows
St. George's Meadow			1.9			
Wall Garden Farm			1.9			
Stockley Rough Road			1.9			
Iron Bridge Road Railsides			1.9			
Stockley Business Park			1.9		31.78 Woodland 17.92 Heath / Meadows	2.40 Woodland 1.38 Heath / Meadows
Bolingbroke Way			1.9			
Lake Farm Country Park			1.9			
Stockley Park Country Park			1.9			
River Pinn & Manor Farm Pastures			1.9			
Little Britain			1.9			
The Grove			1.9			

4 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

4.1 AIR DISPERSION MODELLING

4.1.1. Atmospheric dispersion modelling software (ADMS) version 5.2.4[5] developed by Cambridge Environmental Research Consultants (CERC) was used for the assessment. This is the same model as used for the May 2022 assessment, reported in Report AQ02.

4.1.2. The overarching modelling methodology i.e. meteorological data, building downwash, surface parameters, receptors and model output grid, is the same as that set out in Report AQ02.

4.2 MODEL INPUTS

STACK PARAMETERS

4.2.1. The full set of flue parameters used in the dispersion modelling for each scenario were provided in **Appendix C**, **Table C-1, Table C-2, Table C-3** and **Table C-4** of Report AQ02, and are not repeated here**.**

Routine Testing Scenarios

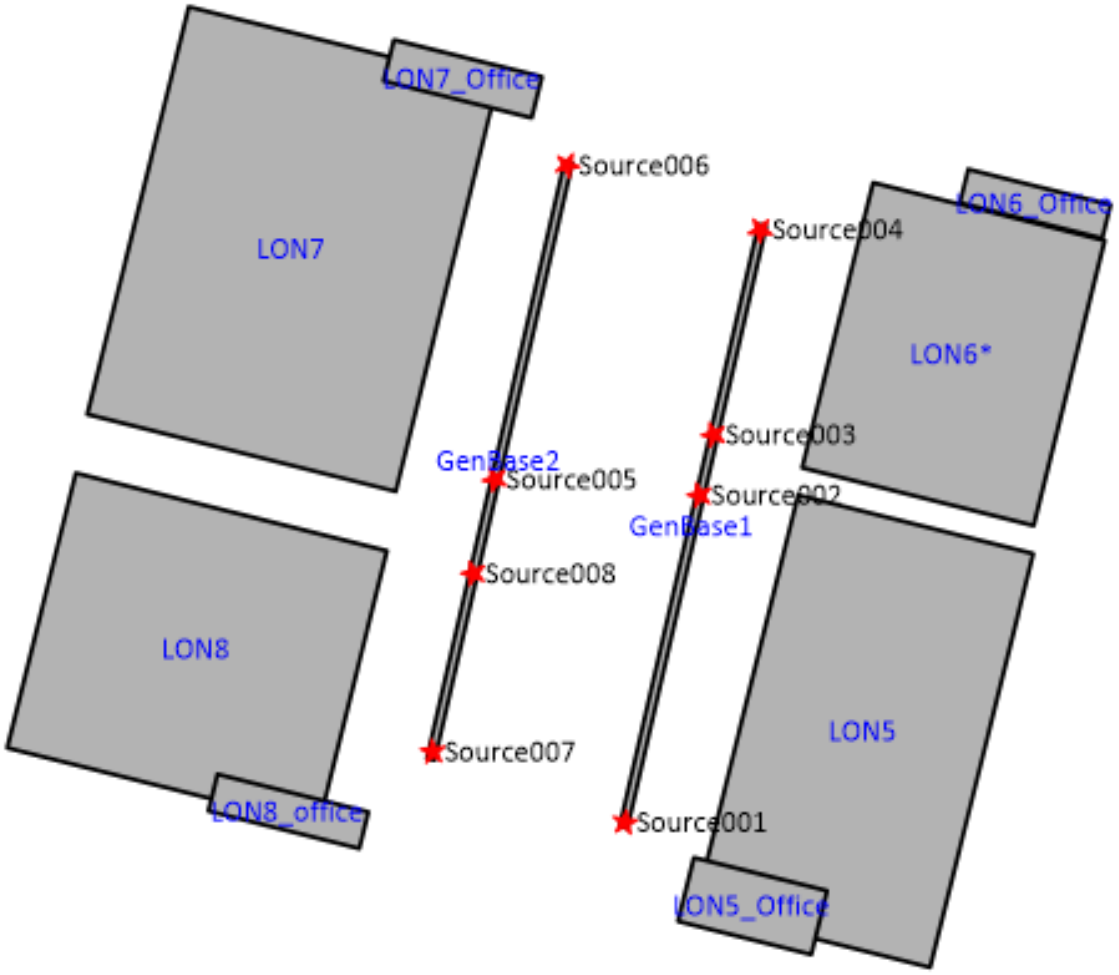
4.2.2. The exact sequencing of the generators during the monthly testing is unknown and may be variable, but it is possible that adjacent generators will be tested within a single hour. Offsite impacts from the use of generators that are located close to each other will be very similar, although impacts at individual receptors from generators at the extremes of the generator banks will be different.

4.2.3. Therefore, following the original assessment, it is not possible to explicitly model any testing scenario and a pragmatic approach was adopted in which the emissions from indicative generator locations were modelled and then the output analysed to assess the statistical likelihood of exceedance of the AQS if all hours of testing were to occur at each generator location individually.

4.2.4. The indicative generator locations were taken to be those positioned on the northern and southern extremes of each of the banks of generators and at central locations to ensure that the closest generators to the sensitive human health receptors were represented (**Schematic 7-1**). Given the location of the SCR-enabled generators (LON8 only), indicative locations Source7 and Source8 were used for the ammonia modelling.

4.2.5. For each receptor, the impact was taken to be the maximum impact across the two modelled locations.

[5] CERC (2022) *ADMS 5* [online]. Available at: http://www.cerc.co.uk/environmental-software/ADMS-model.html [Accessed March 2022].



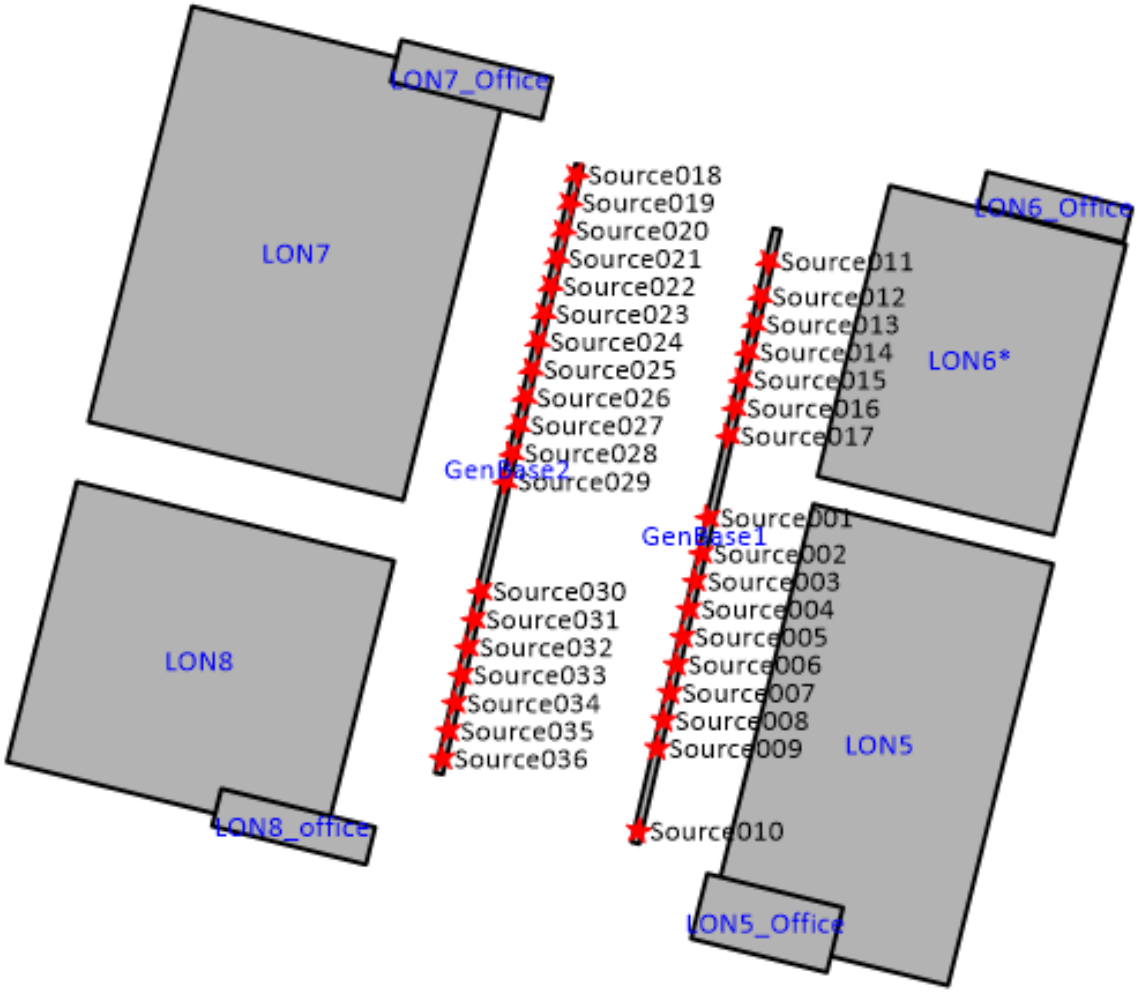
Schematic 7-1. Modelled sources for Routine Testing Scenarios. Source007 and Source008 used for the ammonia modelling

Emergency Scenario 2

4.2.6. For the emergency scenario, the concurrent operation of all ammonia emission sources is modelled for the 4 sources - Source033 (1 SCR enabled only), Source034, Source035, Source036 (all 2No SCR enabled) shown in **Schematic 7-2**. As for Report AQ02, the generators are modelled as groups of 2 merged generators, but with ammonia emissions from the SCR-enabled generators only

4.2.7. For each generator, the bulk exhaust parameters are modelled for the specific generator model (3516E with /without SCR) at the DC-specific loads set out in **Table 2-1**. For each DC-specific load, the exhaust parameters are interpolated from the load-specific data available in the manufacturers technical data sheets (10 – 100% load, at 10% intervals). The DC-specific loads are set on the basis of the installed IT capacity.

4.2.8. This approach follows that set out in Report AQ02.



Schematic 7-2. Modelled sources for Emergency Scenario

Ammonia Emissions

4.2.9. The ammonia emissions from the SCR-enabled generators are assessed on a highly conservative basis, namely:

- Emissions occur at the upper limit of the BAT-AEL for gas oil fired generators set out in the 2017 BAT Conclusions for Large Combustion Plant i.e. 15mg/Nm^3, at STP 15% O2, dry and
- Emissions calculated at 100% operating load, irrespective of the proposed operating load specified in **Table 3-1**.

4.2.10. SCR is fitted to the 3516E generators in LON8. This generator model has an exhaust gas mass flow rate of 14,084kg/hr at 100% load, with a moisture content of ~8.7% (technical specification sheet) and estimated O_2 content of 9.5% (dry). The actual flow rate for the engine is ~465m^3/min at actual conditions (assumed 450°C, prior to mixing with cooling air), or ~312m^3/min when corrected to STP and 15% O_2, dry. This gives an emission rate of:

- 0.078g/s per generator

4.2.11. This emission rate is applied to both testing and emergency scenarios.

4.3 POST PROCESSING OF RESULTS

ANNUAL MEAN IMPACTS

4.3.1. For the assessment of annual mean impacts on ecological and human receptors, the model outputs assuming continuous operation were scaled by the assumed hours of operation, namely:

- Virtus Test 2: 1 month with 2hrs and 10mins testing of each SCR-enabled generator: 15.2hrs per year
- Virtus Emergency Scenario 2: 72hrs of running of all 7 SCR-enabled generators: 72 hrs

POLLUTANT DEPOSITION

4.3.2. The deposition of NO_2 to ecological receptors was modelled for Report AQ02 using the following deposition velocities:

- Grassland/Meadows: 1.5mm/s
- Woodland: 3.0mm/s

4.3.3. These model results were carried through to this Addendum and nitrogen deposition was assessed as the sum of nitrogen deposition arising from both NO2 and NH3.

4.3.4. The deposition of NH_3 to ecological receptors was modelled using the following deposition velocities:

- Grassland/Meadows: 20mm/s
- Woodland: 30mm/s

4.3.5. Plume deposition for NH_3 was included within the model at the grassland deposition velocity (20mm/s). Deposition over the ecological sites was, however, calculated in post-processing using the habitat specific deposition velocity.

4.4 SIGNIFICANCE CRITERIA

4.4.1. With regard to the significance of predicted long term impacts, the EA's guidance for undertaking air emissions risk assessment in support of environmental permit applications says that PC's can be screened out as insignificant at human health receptors if the following criterion is met:

- The long-term PC is less than 1% of the long-term environmental standard and
- The short-term PC is less than 10% of the short-term environmental standard

4.4.2. Emissions that affect LWS are insignificant if they meet the following criteria:

- The short-term PC is less than 100% of the short-term environmental standard; and
- The long-term PC is less than 100% of the long-term environmental standard.

5 HUMAN HEALTH ASSESSMENT RESULTS

5.1 OVERVIEW

5.1.1. For this addendum report, the key metrics for the human receptors relate to:

- Hourly mean NH_3 concentrations, assessed against an EAL of 2500µg/m^3, and
- Annual mean NH_3 concentrations, assessed against an EAL of 180µg/m^3

5.2 NH_3 CONCENTRATIONS

Hourly Means

5.2.1. **Table 5-1** shows the maximum modelled hourly mean NH_3 concentrations for the routine testing and emergency use scenarios. The maximum is taken from the 100th percentile of model outputs over each of the 5 years of meteorological data tested, with data presented for the testing and emergency scenarios individually.

5.2.2. The maximum impact on hourly mean NH_3 concentrations at a sensitive receptor is less than 0.25% of the EAL during routine testing and less than 0.5% during an emergency outage. Furthermore, the maximum PEC is less than 1% of the EAL. Using the EA's criteria, these impacts can be screened as insignificant, irrespective of the number or duration of such events during the year.

5.2.3. The maximum impact at a sensitive receptor occurs at Receptor H1 - Busy Bees nursery, adjacent to the data centre. This receptor is to the east of the Site and is the closest receptor to the generators fitted with SCR.

5.2.4. As a maximum anywhere within the study area, the maximum impact is less than 1% of the EAL during testing and less than 2.5% of the EAL during an emergency outage. These maximum impacts occur on the data centre site in the immediate vicinity of the SCR-enabled generators.

Annual Means

5.2.5. **Table 5-2** shows the maximum modelled annual mean NH_3 concentrations for the routine testing and emergency use scenarios, calculated by scaling the continuous operation model results by the hours of operation for each scenario. Data are presented for the testing and emergency scenarios individually and summed over both scenarios, with the maximum taken from the 5 years of meteorological data modelled.

5.2.6. The total impact on annual mean NH_3 concentrations is less than 0.005% of the EAL at any sensitive receptor and less than 0.03% of the EAL anywhere within the study area, including onsite areas. Using the EA's criteria, these impacts can be screened as insignificant. Furthermore, the PEC is less than 1.1% of the EAL and dominated by the effects of background ammonia concentrations.

5.2.7. The maximum impact occurs, as for hourly mean impacts at Receptor H1 – Busy Bees nursery, reflecting the receptors proximity to the generators.

5.2.8. The 72hr Emergency Scenario accounts for over 94% of impacts.

5.3 ODOURS

5.3.1. Ammonia is an odorous compound, with a detection threshold variously reported as between 0.04ppm and 57ppm (28 – 40,000µg/m^3), and an annoyance threshold of 103ppm (approximately 72,000µg/m^3). Whilst odours can be detected within a few seconds of exposure, with the maximum offsite hourly concentrations being less than 15µg/m^3 or 0.015mg/m^3, it is highly unlikely that odours will be detected offsite and there is a negligible risk of annoyance.

Table 5-1 – Maximum modelled impacts on hourly mean NH_3 concentrations (µg/m^3)

Receptor	Back-ground	Virtus Test 2 Scenario NH_3 PC	% of EAL	Virtus Emer-gency 2 Scenario NH_3 PC	% of EAL	PEC Worst Case	Insigni-ficant?
H1	3.8	5.48	0.22%	11.09	0.44%	14.89	Yes
H2	3.8	1.47	0.06%	8.39	0.34%	12.19	Yes
H3	3.8	1.03	0.04%	5.54	0.22%	9.34	Yes
H4	3.8	0.55	0.02%	3.00	0.12%	6.80	Yes
H5	3.8	0.54	0.02%	2.61	0.10%	6.41	Yes
H6	3.8	0.45	0.02%	2.27	0.09%	6.07	Yes
H7	3.8	0.32	0.01%	1.66	0.07%	5.46	Yes
H8	3.8	0.31	0.01%	1.54	0.06%	5.34	Yes
H9	3.8	0.25	0.01%	1.34	0.05%	5.14	Yes
H10	3.8	0.25	0.01%	1.35	0.05%	5.15	Yes
H11	3.8	0.30	0.01%	1.61	0.06%	5.41	Yes
H12	3.8	1.99	0.08%	10.41	0.42%	14.21	Yes
H13	3.8	1.36	0.05%	7.39	0.30%	11.19	Yes
H14	3.8	0.86	0.03%	4.89	0.20%	8.69	Yes
H15	3.8	1.29	0.05%	7.04	0.28%	10.84	Yes
H16	3.8	0.67	0.03%	3.57	0.14%	7.37	Yes
H17	3.8	0.42	0.02%	2.12	0.08%	5.92	Yes
H18	3.8	1.64	0.07%	9.06	0.36%	12.86	Yes
H19	3.8	0.87	0.03%	4.72	0.19%	8.52	Yes
Max on Grid	3.8	20.09	0.80%	52.72	2.11%	56.52	Yes

Table 5-2 – Maximum modelled impacts on annual mean NH_3 concentrations (µg/m^3)

Receptor	Back-ground	Virtus Test 2 Scenario	Virtus Emer-gency 2 Scenario	Total Annual Mean PC	% of EAL	PEC Worst Case	Insigni-ficant?
H1	1.9	0.0002	0.0038	0.0040	0.0022%	1.9040	Yes
H2	1.9	0.0001	0.0016	0.0017	0.0009%	1.9017	Yes
H3	1.9	0.0001	0.0012	0.0012	0.0007%	1.9012	Yes
H4	1.9	0.0000	0.0006	0.0007	0.0004%	1.9007	Yes
H5	1.9	0.0000	0.0006	0.0006	0.0004%	1.9006	Yes
H6	1.9	0.0000	0.0006	0.0006	0.0004%	1.9006	Yes
H7	1.9	0.0000	0.0006	0.0006	0.0003%	1.9006	Yes
H8	1.9	0.0000	0.0011	0.0011	0.0006%	1.9011	Yes
H9	1.9	0.0000	0.0006	0.0006	0.0004%	1.9006	Yes
H10	1.9	0.0000	0.0007	0.0007	0.0004%	1.9007	Yes
H11	1.9	0.0000	0.0005	0.0005	0.0003%	1.9005	Yes
H12	1.9	0.0002	0.0035	0.0037	0.0020%	1.9037	Yes
H13	1.9	0.0001	0.0015	0.0016	0.0009%	1.9016	Yes
H14	1.9	0.0001	0.0013	0.0014	0.0008%	1.9014	Yes
H15	1.9	0.0001	0.0026	0.0027	0.0015%	1.9027	Yes
H16	1.9	0.0000	0.0010	0.0011	0.0006%	1.9011	Yes
H17	1.9	0.0000	0.0006	0.0006	0.0003%	1.9006	Yes
H18	1.9	0.0001	0.0019	0.0020	0.0011%	1.9020	Yes
H19	1.9	0.0001	0.0015	0.0016	0.0009%	1.9016	Yes
Max on Grid	1.9	0.0023	0.0452	0.0475	0.0264%	1.9475	Yes

6 ECOLOGICAL ASSESSMENT RESULTS

6.1 OVERVIEW

6.1.1. For this addendum report, the key metrics for the ecological receptors relate to:

- Hourly mean NH_3 concentrations, assessed against an EAL of 2500µg/m^3,
- Annual mean NH_3 concentrations, assessed against a critical level of 3µg/m^3, and
- Annual mean nitrogen deposition, assessed against a critical load of 10kgN/ha/yr

6.2 NH_3 CONCENTRATIONS

Hourly Means

6.2.1. **Table 6-1** shows the maximum modelled hourly mean NH_3 concentrations for the routine testing and emergency use scenarios. The maximum is taken from the 100th percentile of model outputs over each of the 5 years of meteorological data tested and data are presented for the testing and emergency scenarios individually.

6.2.2. The maximum impact on hourly mean NH_3 concentrations over any designated site is less than 0.1% of the EAL during routine testing and less than 0.5% during an emergency outage. Furthermore, the maximum PEC is less than 1% of the EAL. Using the EA's criteria, these impacts can be screened as insignificant, irrespective of the number or duration of such events during the year.

6.2.3. The maximum impact over an ecological site occurs for Iron Bridge Road Railsides LWS, to the south of the Site, reflecting the proximity of the LWS to the generators fitted with SCR.

Annual Means

6.2.4. **Table 6-2** shows the maximum modelled annual mean NH_3 concentrations for the routine testing and emergency use scenarios, calculated by scaling the continuous operation model results by the hours of operation for each scenario. Data are presented for the testing and emergency scenarios individually and summed over both scenarios, with the maximum taken from the 5 years of meteorological data modelled.

6.2.5. The total impact on annual mean NH_3 concentrations is less than 0.01% of the critical level over the Southwest London Waterbodies SPA / Ramsar (and constituent SSSI), and less than 0.1% of the critical level over all LWS. Using the EA's criteria, these impacts can be screened as insignificant. Furthermore, the PEC is less than 65% of the critical level and dominated by the effects of background ammonia concentrations.

6.2.6. The maximum impact over an ecological site occurs for Iron Bridge Road Railsides LWS, to the south of the Site, reflecting the proximity of the LWS to the generators fitted with SCR.

6.2.7. The 72hr Emergency Scenario accounts for over 95% of impacts over all ecological sites.

Table 6-1 – Hourly mean NH_3 impacts over designated ecological sites

ID	Site	Hourly Mean NH_3 (µg/m^3) [*EAL = 2500µg/m^3*]						Insignif-icant?
		Back-ground	Virtus Test 2 Scenario	% of EAL	Virtus Emergency 2 Scenario	% of EAL	PEC (Worst Case)	
E1	Southwest London Waterbodies SPA	3.6	0.04	0.00%	0.23	0.01%	3.83	Yes
E2	Southwest London Waterbodies Ramsar	3.6	0.04	0.00%	0.22	0.01%	3.82	Yes
E3	Lower Colne LWS	3.8	0.15	0.01%	0.89	0.04%	4.69	Yes
E4	St. George's Meadow LWS	3.8	0.20	0.01%	1.15	0.05%	4.95	Yes
E5	Wall Garden Farm LWS	3.8	0.17	0.01%	1.02	0.04%	4.82	Yes
E6	Stockley Rough Road LWS	3.8	0.43	0.02%	2.37	0.09%	6.17	Yes
E7	Iron Bridge Road Railsides LWS	3.8	1.67	0.07%	10.93	0.44%	14.73	Yes
E8	Stockley Business Park LWS	3.8	0.61	0.02%	3.55	0.14%	7.35	Yes
E9	Bolingbroke Way LWS	3.8	0.23	0.01%	1.30	0.05%	5.10	Yes
E10	Lake Farm Country Park LWS	3.8	0.21	0.01%	1.22	0.05%	5.02	Yes
E11	Stockley Park Country Park LWS	3.8	0.90	0.04%	4.42	0.18%	8.22	Yes
E12	River Pinn & Manor Farm Pastures LWS	3.8	0.22	0.01%	1.19	0.05%	4.99	Yes
E13	Little Britain LWS	3.8	0.21	0.01%	1.22	0.05%	5.02	Yes
E14	The Grove LWS	3.8	0.15	0.01%	0.81	0.03%	4.61	Yes

Table 6-2 – Annual mean NH_3 impacts over designated ecological sites

ID	Site	Annual Mean NH_3 ($\mu g/m^3$) [*Critical Level = 3$\mu g/m^3$*]						Insignif-icant?
		Back-ground	Virtus Test 2 Scenario	Virtus Emergency 2 Scenario	Total Annual Mean PC	% of Critical Level	PEC	
E1	Southwest London Waterbodies SPA	1.8	0.000002	0.0001	0.00006	0.002%	1.8001	Yes
E2	Southwest London Waterbodies Ramsar	1.8	0.000002	0.0000	0.00005	0.002%	1.8001	Yes
E3	Lower Colne LWS	1.9	0.000009	0.0002	0.00023	0.008%	1.9002	Yes
E4	St. George's Meadow LWS	1.9	0.000009	0.0002	0.00024	0.008%	1.9002	Yes
E5	Wall Garden Farm LWS	1.9	0.000005	0.0001	0.00013	0.004%	1.9001	Yes
E6	Stockley Rough Road LWS	1.9	0.000018	0.0005	0.00048	0.016%	1.9005	Yes
E7	Iron Bridge Road Railsides LWS	1.9	0.000070	0.0020	0.00206	0.069%	1.9021	Yes
E8	Stockley Business Park LWS	1.9	0.000059	0.0015	0.00154	0.051%	1.9015	Yes
E9	Bolingbroke Way LWS	1.9	0.000028	0.0007	0.00077	0.026%	1.9008	Yes
E10	Lake Farm Country Park LWS	1.9	0.000026	0.0007	0.00070	0.023%	1.9007	Yes
E11	Stockley Park Country Park LWS	1.9	0.000090	0.0018	0.00193	0.064%	1.9019	Yes
E12	River Pinn & Manor Farm Pastures LWS	1.9	0.000006	0.0001	0.00016	0.005%	1.9002	Yes
E13	Little Britain LWS	1.9	0.000009	0.0002	0.00023	0.008%	1.9002	Yes
E14	The Grove LWS	1.9	0.000006	0.0002	0.00018	0.006%	1.9002	Yes

6.3 NITROGEN DEPOSITION

6.3.1. **Table 6-3** and **Table 6-4** show the modelled annual mean nitrogen deposition, calculated as for annual mean pollutant concentrations on the basis of scaling the continuous operation model results by the hours of operation for each scenario. Data are presented as the sum over all scenarios and provided as:

- the contribution from the deposition of oxidised nitrogen (as presented in the May 2022 Report, from nitrogen dioxide),
- the contribution from reduced nitrogen (ammonia) and
- total deposition.

6.3.2. The value presented is the maximum modelled impact over any of the 5 years of meteorological data tested. As for NO_X and NH_3 concentrations, most of the impact (>95%) relates to the emergency outage scenario.

6.3.3. The impacts over all sites are insignificant. For the Southwest London Waterbodies SPA/Ramsar, the maximum modelled deposition is 0.05% of the critical load, which is considerably less than the EA 1% screening criterion. For the LWS, the impacts are <1.5% of the critical load for grassland/shrub habitats and <3% of the critical load for woodland habitats. These are well within the EA 100% screening criterion. Moreover, with >95% of the impacts arising from the theoretical emergency scenario, impacts over the LWS in a typical year will be <0.2% of the critical load.

Table 6-3 – Annual mean nitrogen deposition over designated grassland habitats within ecological sites

ID	Site	Grassland Habitats (kgN/ha/yr)					Insignif-icant?
		Critical Load	Deposition From NO_2	Deposition From NH_3	Total Deposition	% of Critical Load	
E1	Southwest London Waterbodies SPA	10	0.0051	0.0003	0.0054	0.05%	Yes
E2	Southwest London Waterbodies Ramsar	10	0.0046	0.0003	0.0049	0.05%	Yes
E3	Lower Colne LWS	10	0.0150	0.0012	0.0162	0.16%	Yes
E4	St. George's Meadow LWS	10	0.0148	0.0012	0.0160	0.16%	Yes
E5	Wall Garden Farm LWS	10	0.0089	0.0007	0.0095	0.10%	Yes
E6	Stockley Rough Road LWS	10	0.0235	0.0025	0.0260	0.26%	Yes
E7	Iron Bridge Road Railsides LWS	10	0.0793	0.0107	0.0900	0.90%	Yes
E8	Stockley Business Park LWS	10	0.0681	0.0080	0.0761	0.76%	Yes
E9	Bolingbroke Way LWS	10	0.0448	0.0040	0.0487	0.49%	Yes
E10	Lake Farm Country Park LWS	10	0.0419	0.0037	0.0455	0.46%	Yes
E11	Stockley Park Country Park LWS	10	0.1228	0.0100	0.1328	1.33%	Yes
E12	River Pinn & Manor Farm Pastures LWS	10	0.0090	0.0008	0.0098	0.10%	Yes
E13	Little Britain LWS	10	0.0139	0.0012	0.0151	0.15%	Yes
E14	The Grove LWS	10	0.0111	0.0009	0.0120	0.12%	Yes

Table 6-4 – Annual mean nitrogen deposition over designated woodland habitats within ecological sites

ID	Site	Woodland Habitats (kgN/ha/yr)					Insignif-icant?
		Critical Load	Deposition From NO_2	Deposition From NH_3	Total Deposition	% of Critical Load	
E1	Southwest London Waterbodies SPA	10	N/A	N/A	N/A	N/A	Yes
E2	Southwest London Waterbodies Ramsar	10	N/A	N/A	N/A	N/A	Yes
E3	Lower Colne LWS	10	0.0290	0.0018	0.0308	0.31%	Yes
E4	St. George's Meadow LWS	10	0.0286	0.0018	0.0304	0.30%	Yes
E5	Wall Garden Farm LWS	10	0.0172	0.0010	0.0182	0.18%	Yes
E6	Stockley Rough Road LWS	10	0.0455	0.0037	0.0492	0.49%	Yes
E7	Iron Bridge Road Railsides LWS	10	0.1532	0.0161	0.1693	1.69%	Yes
E8	Stockley Business Park LWS	10	0.1317	0.0120	0.1437	1.44%	Yes
E9	Bolingbroke Way LWS	10	0.0865	0.0060	0.0925	0.93%	Yes
E10	Lake Farm Country Park LWS	10	0.0809	0.0055	0.0864	0.86%	Yes
E11	Stockley Park Country Park LWS	10	0.2374	0.0151	0.2524	2.52%	Yes
E12	River Pinn & Manor Farm Pastures LWS	10	0.0173	0.0012	0.0186	0.19%	Yes
E13	Little Britain LWS	10	0.0269	0.0018	0.0287	0.29%	Yes
E14	The Grove LWS	10	0.0214	0.0014	0.0228	0.23%	Yes

7 ASSESSMENT SUMMARY

7.1 HUMAN HEALTH

7.1.1. ***No significant health effects due to ammonia emissions are likely with the operation of the generators on the Stockley Park Campus***.

7.1.2. With the proposed routine generator testing regime for the Site and the use of the generators for backup power generation during a site-wide outage, there is an insignificant risk of exceedance of the hourly and annual mean EALs. The EALs are intended to protect health.

7.1.3. Impacts are greatest under the theoretical Emergency scenario.

7.1.4. The generator operation is also unlikely to result in odours.

7.2 ECOLOGY

7.2.1. ***No significant effects on ecological sites are likely***.

7.2.2. Hourly and annual average impacts on NH_3 concentrations are negligible for all scenarios (routine testing and emergency outage). The cumulative impacts on nitrogen deposition from the deposition of nitrogen dioxide and the deposition of ammonia are imperceptible and insignificant.

7.2.3. The presented impacts are dominated by the modelled impacts during the theoretical Emergency scenario. In any given year, impacts are likely to be much lower.

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