DIDCOT DATA CENTRE

Noise Impact Assessment for Environmental Permit Application

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Noise Impact Assessment
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Appendices

1 INTRODUCTION

1.1 Purpose of the Report

1.1.1 This Noise Impact Assessment (NIA) has been prepared to support the application for the Environmental Permit (EP) for the development of a data centre at the former Didcot A Power Station in Didcot, Oxfordshire. The NIA forms one of a suite of technical reports forming part of the permit application for the operation of the emergency back-up generators designed to power the adjacent data centre, and associated infrastructure, in the event of a loss of power to the facility from the National Grid.

1.2 Scope

1.2.1 This NIA considers the noise impact from the operation of the of the emergency back-up generators on residential noise sensitive receptors (NSRs) located in the area.

1.3 Authors and Credentials

1.3.1 The assessment is based upon appropriate information regarding the proposed development provided by the Applicant. RPS is a member of the Association of Noise Consultants (ANC), the representative body for acoustics consultancies, having demonstrated the necessary professional and technical competence. The assessment has been undertaken with integrity, objectivity and honesty in accordance with the Code of Conduct of the Institute of Acoustics (IOA) and ethically, professionally and lawfully in accordance with the Code of Ethics of the ANC.

1.3.2 The technical content of this assessment has been provided by RPS personnel, all of whom are members of the IOA (the UK's professional body for those working in acoustics, noise and vibration). This report has been peer reviewed within the RPS team to ensure that it is technically robust and meets the requirements of our Integrated Management System.

2 REGULATIONS, STANDARDS AND GUIDANCE

2.1 Environmental Permitting Regulations

Control and Monitor Emissions for your Environmental Permit

2.1.1 The guidance on “Control and monitor emissions for your environmental permit” was introduced in February 2016. This covers a range of topic areas with noise being mentioned in the section on “Noise and vibration management plan”. This guide provides advice on what is needed to apply for a permit or if you already have a permit.

2.1.2 The section on the noise and vibration management plan states that the plan should explain how you will prevent or minimise noise and vibration emissions and the Environment Agency (EA) may ask for a plan if:

- they think there is a risk of noise and vibration pollution beyond the site boundary; and/or
- after getting a permit, you cause noise or vibration pollution but do not already have a noise and vibration management plan.

2.1.3 When applying for a bespoke permit, a noise and vibration management plan may need to be provided if the following apply:

- your activity uses noisy plant or machinery, for example cooling equipment or fans;
- there will be crushing, grinding or combustion, using trommels and conveyors or moving bulk materials;
- your activities are not contained within buildings;
- some of your activities take place at night;
- the area where you are planning to carry out your activity is sensitive to noise, for example rural areas may have quieter background noise levels than urban areas; and/or
- there are sensitive receptors close to the site, for example houses or habitats.

2.1.4 It then goes on to state that the noise assessment and management plan must be completed using an appropriate noise standard such as BS 4142:2014 (now BS 4142:2014+A1:2019) “Methods for rating and assessing industrial and commercial sound”.

Horizontal Guidance - H3 Part 2 Noise Assessment and Control

2.1.5 The purpose of horizontal guidance is to provide information relevant to all sectors regulated under EPR on specific environmental aspects. For example, noise, odour, energy efficiency, or protection of land.

2.1.6 Horizontal guidance has been produced by collaboration between the EA, Environment Agency Wales (EAW), the Scottish Environment Protection Agency (SEPA) and the Northern Ireland Environment and Heritage Service (EHS). The purpose of Horizontal Guidance Note H3 for Noise Assessment and Control is to provide supplementary information; describe the principles of noise measurement and prediction; and the control of noise by design, by operational and management techniques and abatement technologies. It assists in determining Best Available Techniques (BAT) for a given installation and also covers the basic physics associated with noise and vibration.

2.1.7 H3 suggests that an initial assessment of the risk to sensitive receptors be undertaken and, if shown to be necessary by the level of risk, a more detailed assessment of the impact should be undertaken. It states that the amount of detail and the effort expended should be proportionate to the degree of risk involved.

2.1.8 H3 provides a list and brief descriptions of British and International Standards and guidance that it considers relevant to measurement, prediction and assessment of noise. With regards to prediction, it states:

'For industrial noise it is preferable to use those following the principles of ISO 9613-2 1996.'

(N.B. ISO 9613-2 contains a method for the prediction of acoustic propagation outdoors.)

2.1.9 H3 acknowledges that community reaction to noise is complex to assess and affected by multiple factors both noise and non-noise related. It suggests that people are generally less tolerant of industrial and neighbour noise than transportation noise and that some of factors affecting community response are:

- hours of operation (day, night, 24 hr, 7 day);
- continuous or intermittent sources;
- nature of the noise (tones, clatters, hums and the like);
- whether or not the noise is "avoidable" as perceived by the community;
- community standing of the operator (good/bad neighbour);
- response to complaints and other problems;
- odour/litter/traffic or other adverse environmental effects;
- good/bad employer; and
- nature of the area.

2.1.10 H3 does not contain recommendations for noise limits or criteria. H3 refers to process- or sector-specific guidance for determination of BAT in a general sense or at sector level.

2.1.11 There is no legislation applicable to the assessment of operational noise that needs to be considered in this assessment.

2.2 Standards

British Standard 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

2.2.1 BS 4142:2014+A1:2019 (BSi, 2019) primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound'[1] from the proposed development) at residential noise sensitive receptors. The specific sound level may then be

[1] equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr.

corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the ‘rating level’, whether or not a rating penalty is applied. The ‘residual sound’ is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

2.2.2 The specific sound levels should be determined separately in terms of the $L_{Aeq, T}$ index over a period of 1-hour during the daytime and 15-minutes during the night-time. For the purposes of the Standard, daytime is typically between 07:00 and 23:00 hours and night-time is typically between 23:00 and 07:00 hours.

2.2.3 With regards to the character correction, paragraph 9.2 of BS 4142:2014+A1:2019 (BSi, 2019) states:

“Tonality

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a rating penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. … If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.”

2.2.4 BS 4142:2014+A1:2019 (BSi, 2019) requires that the background sound levels[2] adopted for the assessment be representative for the period being assessed. The Standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated. However, the Standard states that there is no ‘single’ background sound levels that can be derived from such measurements.

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[2] A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

2.2.5 It is particularly difficult to determine what is ‘representative’ of the night-time period is because it can be subject to a wide variation in background sound level between the shoulder night periods. The accompanying note to paragraph 8.1.4 of BS 4142:2014+A1:2019 (BSi, 2019) states that:

“A representative level should account for the range of background sounds levels and should not automatically be assumed to be either the minimum or modal value.”

2.2.6 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level of the specific sound. In the context of the Standard, adverse impacts include, but are not limited to, annoyance and sleep disturbance. Typically, the greater this difference, the greater is the magnitude of the impact:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

2.2.7 The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.2.8 The significance of the effect of the noise in should be determined on the basis of the initial estimate of impact significance from the BS 4142:2014+A1:2019 assessment with reference to the context of the sound.

2.2.9 Whilst there is a relationship between the significance of impacts determined by the method contained within BS 4142:2014+A1:2019 (BSi, 2014) and the significance of effects described in the PPGN (Ministry of Housing, Communities and Local Government, 2019b), there is not a direct link. It is not appropriate to ascribe numerical rating / background level differences to LOAEL and SOAEL because this fails to consider the context of the sound, which is a key requirement of the Standard.

2.2.10 The significance of the effect of the noise in question (i.e. whether above or below SOAEL and LOAEL) should be determined on the basis of the initial estimate of impact significance from the BS 4142:2014+A1:2019 assessment with reference to the examples of outcomes described within the PPGN, and after having considered the context of the sound. It is necessary to consider all pertinent factors, including:

- the absolute level of sound;
- the character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:
  - facade insulation treatment;
  - ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
  - acoustic screening.

2.3 Guidance

Guidelines for Community Noise

2.3.1 The World Health Organisation (WHO) published guidance on the desirable levels of environmental noise in 2000. In this document, Guidelines for Community Noise (GCN) (WHO, 2000), the authors consider that sleep disturbance criteria should be taken as an internal noise level of 30 dB $L_{Aeq,8hr}$ or an external level of 45 dB $L_{Aeq,8hr}$, measured at 1 m from the façade. It is also suggested that internal L_{Amax} levels of 45 dB and external L_{Amax} levels of 60 dB, should not be exceeded.

2.3.2 The criteria for speech intelligibility and moderate annoyance during the daytime and evening should be taken as an internal noise level of 35 dB $L_{Aeq,16hr}$. For external daytime levels, it is considered that:

"To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB LAeq on balconies, terraces, and outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB LAeq. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development."

2.3.3 The WHO published more recent guidance in the Environmental Noise Guidelines for the European Region in 2018 (WHO, 2018). It provides guidance, primarily for policymakers, on protecting human health from harmful exposure to environmental noise and sets health-based recommendations on the average environmental noise exposure of five relevant sources of environmental noise. Industrial noise was not one of the categories included and, therefore, this guidance is not considered to be directly applicable to this assessment notwithstanding the fact that it is primarily for policymakers and does not apply to general assessments.

3 ASSESSMENT METHODOLOGY

3.1.1 Sound immissions from the development have been predicted at the nearest NSRs identified in Section 4 'Baseline'. Predictions have been carried out using SoundPLAN Version 8.1 sound modelling software utilising the propagation method contained in ISO 9613-2:1996 'Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation'. The model predicts sound levels under light down-wind conditions based on hemispherical sound propagation with corrections for atmospheric absorption, ground effects, screening and directivity.

3.1.2 Sound power data for the generators have been provided by the potential suppliers who are tendering for the project. The final selection of plant is subject to tender, but it will be ensured that the final selection of plant would not be environmentally worse than the current selection in terms of noise emissions. The generators would be located in enhanced acoustic enclosures (specifically engineered for greater sound attenuation). The generators have been modelled as industrial buildings with the sound power for each section of the enclosure included in the model. The stack has been modelled as a point source at the exhaust outlet, the highest level on the stack.

3.1.3 In addition to the generators, the following plant would be included in the proposed development, and have been included in the assessment as associated development as there would be cumulative effects with the generators when they operate:

- 43 Air Handling Units (AHUs), including 42 located inside the building and one located externally on the roof above the office area.
- 42 Exhaust Units (Exhausts) located on the roof of the building.
- 12 Direct Exchange Units (DX Units) located on the roof of the building.
- 11 Generators located adjacent to the southern façade of the building, including 10 emergency back-up generators for the data centre and 1 emergency back-up generator for the office.

3.1.4 Acoustic data have been obtained from information provided by the Applicant and RPS' experience of other similar sites.

3.1.5 The AHUs within the buildings are positioned in two banks on each of the long sides of the buildings. The main propagation is through the louvres within the walls on each of the long sides of the building. It has been assumed that there is a loss in the sound power level of the AHUs of 3 dB for transfer to the outside of the building. This is a relatively conservative assumption.

3.1.6 The roof mounted sound sources have been modelled as area sources, with a sound power per source calculated based on the number of units.

3.1.7 Sound power levels of individual units and modelled sound power of sources are provided in Appendix B.

3.1.8 The generators would only operate during an emergency situation, i.e. in the event of a major power outage or grid failure. However, the generators would be tested periodically at the following frequency:

- each generator tested separately at 25% load for a maximum of 0.5 hour (it will usually be a less than half of this) every two weeks per year (i.e. a total of 13 hours per generator per year - all during the daytime period);
- depending on maintenance-needs, there will also be approximately 1 hour of testing of generators (at approximately 25% load) per quarter after preventative maintenance and replacement of some critical components (all during the daytime period); and
- each generator tested separately at 100% load for 1.5 hours twice a year all during the daytime period (i.e. three hours per generator).

3.1.9 To account for the different operating conditions, the following scenarios have been considered:

- Generator testing: one Generator (worst-case for receptor), all AHUs, Exhausts and DX Units operating.
- Emergency operation: all emergency generators, AHUs, Exhausts and DX Units operating.

3.1.10 The following assumptions have been incorporated into the noise model:

- the topography of the site including the proposed landscaping bund has been obtained from site surveyed topographical data and the topography of the surrounding area has been obtained from Ordnance Survey (OS) open data (Terrain 50);
- the effect of screening from solid structures (buildings) has been incorporated into the modelling process by importing OS Open Data 'Settlement Area' shape file data into the model; and
- the ground type in the model has been set to G=0.8 as it is mainly soft ground with some areas of hard ground.

3.1.11 Noise effects due to the operation of the proposed development have been assessed according to the guidance in BS 4142:2014+A1:2019.

3.1.12 Background and residual sound levels have been determined through baseline sound monitoring at locations representative of the nearest NSRs to the site, as indicated in Section 4 'Baseline'.

3.1.13 The specific sound levels have been determined separately in terms of the $L_{Aeq, T}$ index for operations during the daytime (07:00 hrs to 23:00 hrs) and the night-time (23:00 hrs to 07:00 hrs) periods.

3.1.14 At each NSR, the rating level has been determined from the predicted specific sound level. Where RPS has considered it to be appropriate, a rating penalty has been applied for tonality, impulsivity and/or intermittent specific sounds as described in the commentary to paragraph 9.2 of BS 4142:2014+A1:2019. This has been applied with consideration for the main sound sources from the development that contribute to the level and character of the specific sound at each NSR location.

3.1.15 As per the requirements of the Standard, an initial estimate of the impact of the specific sound has been obtained by subtracting the measured background sound level from the rating level of the specific sound. Following the initial evaluation of impact, the context of the sound has also been considered, which is a key requirement of the Standard. In evaluation of the context, the following factors have been considered:

- the absolute level of the sound;
- the character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

3.1.16 The evaluation of the magnitude of noise impacts at receptors has been amended following consideration of the above contextual factors. The absolute level of the sound has been compared to guideline levels provided by the WHO for annoyance during the daytime and sleep disturbance during night-time.

3.1.17 The significance of the effect of the noise from the development (i.e. whether above or below SOAEL and LOAEL) has been determined from the BS 4142:2014+A1:2019 assessment with consideration of the context and with reference to the examples of outcomes described within the PPGN.

4 BASELINE

4.1 Site Location and Noise Sensitive Receptors

4.1.1 The site is located north west of Didcot, Oxfordshire at National Grid Reference (NGR) SU 508913. The site is bounded by Milton Road to the south beyond which are the Great Western Railway line and the A4130, both of which run parallel to the site. There are other industrial uses to the north, west and east of the site. The nearest NSRs are chalets to the west on Roxborough Drive and Lyndene Road. There are also houses to the south within the Great Western Park development and a consented residential development directly to the south of the A4130. Locations of the NSRs are identified on Figure 1 at the end of this report and listed below:

- chalets within Roxborough Drive and Lyndene Road, located approximately 100 m to the east of the Application Site (in total five chalets with line of sight to the Application Site);
- residential properties in Brendan Close, located approximately 200 m to the south east of the Application Site (in total 14 houses with line of sight to the Application Site);
- residential properties in Ash Way, Dunnock End, Heron Lane and Robin Way, located approximately 350 m to the south of the Application Site (in total approx. 40 to 50 houses with line of sight to the Application Site); and
- consented residential development at Dunnock End; located approximately 100 m to the south of the Application Site (in total approx. 20 houses with line of sight to the Application Site).

4.2 Baseline Methodology

4.2.1 Representative baseline sound levels have been determined through a combination of long term monitoring on the site and short-term monitoring at locations close to the nearest residential properties. The baseline sound monitoring locations have been provided on a plan in Figure 2.

4.2.2 The long term monitor (LT1) was installed on the site at a location a similar distance from the railway line and the A4130 to the nearest residential properties to the site. Measurements were recorded between 15:15 hrs on 21st November 2019 and 07:00 hrs on 3rd December 2019.

4.2.3 Sound level measurements were carried out using a ‘Class 1’ Rion NL-52 sound level meter (SLM) in accordance with BS 7445-2:1991(BS, 1991), with the microphone mounted on a pole at around 1.5 m above local ground level.

4.2.4 Data were logged of the broadband, A weighted sound pressure level in 100 ms samples. The sound level meter was calibrated before use and the calibration checked after use and it was observed that no significant drift had occurred during the survey period.

4.2.5 Weather data were monitored during the survey using a mast mounted meteorological kit to monitor wind speeds and a rain gauge to monitor rainfall. Sound measurements recorded during periods of high wind and heavy rainfall were removed from the data set. Weather conditions were mainly dry with wind speeds below 2.5 m/s. Winds were mainly north-easterly until around midday on 27th November, and mainly south-westerly thereafter.

4.2.6 The main source of sound at the monitoring location was road traffic on the A4130 and the wider road network. Sound from rail traffic on the railway line was occasional, but dominant when present. There was also some sound from other industrial plant in the vicinity and from remedial works being carried out on the site, although these were around 150 m to the north of the measurement location.

4.2.7 Short-term baseline sound monitoring was carried out at two locations (ST1 and ST2). ST1 was located adjacent to the A4031 opposite the residential properties on Roxborough Drive. The microphone was mounted on a tripod at a location of 3 m from the edge of the carriageway and 1.5 m above local ground level. 15-minute data samples were recorded over three periods during the daytime and evening on 21st November and two periods during the night-time on 2nd December. The main sound source during the survey was road traffic on the A4130 which was continuous during the daytime and evening. During the night-time, traffic was more sporadic and a low level of plant noise from plant on Basil Hill Road was audible in between vehicle pass-bys. Train pass-bys were also audible on occasion.

4.2.8 ST2 was located near to the playground adjacent to Heron Lane. The microphone was mounted on a tripod at 1.5 m from local ground level. 15-minute data samples were recorded over three periods during the daytime and evening on 21st November and two periods during the night-time on 2nd December. The main source of sound was road traffic on the A4130. There were some light remedial works being carried out on the site to the north that were audible intermittently during the daytime period and occasional local vehicle movements and pedestrians passing by during the daytime and evening periods.

4.3 Baseline Conditions

Results and Analysis

4.3.1 An analysis has been carried out of the measured baseline sound levels at the long term sound monitoring location (LT1). The data has been extracted and post-processed in 15-minute periods for the daytime (07:00 to 23:00 hrs) and night-time (23:00 to 07:00 hrs) periods. These analyses are provided in Table 4.1. Data are rounded to the nearest whole number. Further survey details and graphical plots of the survey data are provided in Appendix A.

Table 4.1: 15-minute Baseline Sound Level Data (whole period) at LT1

Value	Daytime (07:00 to 23:00 hours)		Night-time (23:00 to 07:00 hours)	
	Residual Sound Level $L_{Aeq,T}$ dB	Background Sound Level $L_{A90,T}$ dB	Residual Sound Level $L_{Aeq,T}$ dB	Background Sound Level $L_{A90,T}$ dB
Range	46 - 61	44 - 59	41 - 58	36 - 57
25th Percentile	51	49	47	44
Median	54	52	49	46
75th Percentile	57	55	51	48
Average	54	52	49	46
Standard deviation	3	3	3	3

4.3.2 A more detailed review of the dataset indicated that average daytime ambient noise levels (L_{Aeq}) were approximately 3 dB lower at the weekend than the average across all days. The same difference was noted in the background sound levels (L_{A90}). Data were analysed of the ambient and background sound levels during the evening period between 19:00 and 23:00 hrs, which indicated that evening levels were on average 2 dB lower at the weekend than on the average across all days. Due to the correlation between the L_{Aeq} and L_{A90}, and the fact that a similar difference occurred when only the evening levels were taken into consideration, it is expected that these differences are mainly due to differences in a continuous source of noise i.e. road traffic on the A4130, rather than construction works occurring in the vicinity of the noise monitor. Night-time sound levels were relatively consistent across weekend and weekday periods, although there was one night (24th November 2019) when sound levels were significantly lower between 00:00 hrs and 05:00 hrs than those for other periods.

4.3.3 BS 4142:2014+A1:2019 requires that the background sound levels adopted for the assessment are representative of the period being assessed. The Standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated.

4.3.4 However, the Standard states that there is no ‘single’ background sound level that can be derived from such measurements. It is particularly difficult to determine what is ‘representative’ of the night-time period because it can be subject to a wide variation in background sound level between the beginning and end of the night period, and the quieter middle part of the night period. The accompanying note states that ‘*a representative level should account for the range of background sounds levels and should not automatically be assumed to be either the minimum or modal value*’.

4.3.5 In this instance, the 25th percentile from the monitoring has been used to characterise the baseline sound environment. This is not the lowest sound level encountered but is lower than that obtained using the average. It therefore, represents somewhere in the range of lower sound levels that are likely to be encountered and provides a conservative assessment. It has been considered appropriate to use this for this case, to account for the uncertainty of using a satellite baseline sound monitoring location to represent the nearest NSRs.

4.3.6 Similarly, representative baseline residual levels have been based on the 25th percentile levels.

4.3.7 The results of the short-term sound monitoring surveys are provided in Appendix A.

Representative Baseline Sound Levels at Receptors

4.3.8 Due to the location of the long term sound monitor, levels measured at this location were not considered to be representative of baseline levels at all of the individual receptors.

4.3.9 The sound levels at individual receptors have been based on professional judgement, based on a comparison between the sound levels at the long term and the closest short-term sound monitoring location. ST2 has been considered to be a representative location for residential properties on Ash Way, Dunnock End, Heron Drive and Robin Way. The measured data at ST2 have been correlated with the data measured at LT1 in the same periods and an appropriate reduction has been applied to derive the ambient and background sound levels.

4.3.10 For residential properties on Roxborough Drive, it has been appropriate to apply a sound reduction to the sound levels measured at ST1 to account for the increased distance to the A4130 from the short-term monitoring location. A reduction of 6 dB has been applied to the daytime L_{Aeq} and L_{A90}, and to the night-time L_{Aeq} to account for this difference. As vehicle movements were sporadic in the night-time, and the main source in between vehicle movements was plant from industrial uses that were a similar distance from the NSRs to the sound monitoring location, no correction has been applied to the L_{A90} during the night-time. The measured data at ST1 with the reductions applied, as stated above, have been correlated with the data measured at LT1 for the same periods and an appropriate reduction has been applied to derive the ambient and background sound levels.

4.3.11 Brendon Close is a similar distance from the main sound sources as the long term sound monitor and, therefore, the sound levels from the long term monitor have been applied to this location.

4.3.12 The report that supported the planning application for the consented development at Dunnock End (MEC Acoustic Air, 2018) included baseline ambient sound levels, which have been used to derive residual sound levels (which, from Section 2, is the ambient sound at the assessment location without the sound from the proposed development) for this assessment. In the absence of baseline background sound levels, the L_{A90} measured at LT1 has been used to evaluate the background sound level in this location. In practice it is anticipated that the background sound levels would be higher in this location due to the closer proximity to the A4130, so this is a worst-case assumption.

4.3.13 A summary of the representative baseline sound levels at each of the sensitive receptor groups identified is provided in Table 4.2 below.

Table 4.2: Representative Baseline Sound Levels for Assessment

NSRs	Representative Baseline Sound Levels			
	Daytime (07:00 to 23:00 hours)		Night-time (23:00 to 07:00 hours)	
	Residual Sound Level $L_{Aeq,\,T}$ dB	Background Sound Level $L_{A90,\,T}$ dB	Residual Sound Level $L_{Aeq,\,T}$ dB	Background Sound Level $L_{A90,\,T}$ dB
Chalets within Roxborough Drive and Lyndene Road	51	60	45	52
Residential properties in Brendan Close	49	51	44	47
Residential properties in Ash Way, Dunnock End, Heron Drive and Robin Way	44	46	39	42
Consented residential at Dunnock End	49	60	44	52

5 MITIGATION

5.1 Generator Design, Operation and Planning Considerations

5.1.1 The main source of noise at the data centre would be the diesel powered emergency generators. As discussed in Section 3 'Assessment Methodology', the generators will be located within enhanced acoustic enclosures. The enclosures have been designed to reduce the noise to the lowest practicable levels. Measures include an enhanced cladding specification above what is normally provided to the roof or the enclosures, and a silencer fitted to the stack of each generator.

5.1.2 It should be noted that, without an enclosure, the typical sound level from a generator is 113 dB L_{Aeq} at 1 m. RPS ran an initial model with a generator in an enclosure, which reduced this level to 85 dB L_{Aeq} at 1 m. However, as the predicted noise levels from the generators were still high, the specification of the enclosures was upgraded, using an enhanced and bespoke design, to reduce sound pressure levels to 73 to 75 dB L_{Aeq} at 1 m (giving an overall sound power level of 100 dB L_{WA} based on dimensions of a typical unit in an enclosure). Therefore, considerable acoustic mitigation measures have been incorporated into the design of the generators, reducing the acoustic emissions by over 33%. Note this has required the generator enclosures to be larger to accommodate the additional attenuation material but this has avoided the need to change the scale and massing of the main building.

5.1.3 Consideration was also given to locate an acoustic barrier around the generators to the south of Building 1. However, the mitigation it afforded was of limited benefit (in comparison to the selected mitigation: further enhancements to the enclosures) and was also not considered to be practical with respect to other design constraints. For example, the acoustic barrier would influence air-flow and movement around the generator units (when operational) and this would likely require changes to the generator exhaust systems, and likely increase the scale of the generator units. In addition, the barrier would require greater circulation-space requiring the relocation of multiple under-ground utility connections which would likely increase the scale of the southern element of Unit 1.

5.1.4 Orientation and placement of buildings and site infrastructure have required careful consideration to limit the environmental impact of the development whilst maximising the operational efficiency and internal configuration. The orientation of both units has been driven by key operational considerations including having the main site entrance off Milton Rd (to facilitate access for both construction and operation) and having the Utility compound location north of Unit 1 (driven by the development's incoming power supply).

5.1.5 Within the site, the various attenuation and detention ponds have been located on the site externalities (close to the boundaries) to facilitate the siting of both units, all supporting infrastructure and necessary utility connections in an efficient manner. These have in-turn driven the internal organisation of the buildings and their internal configuration (such as the Data Hall, Electrical Rooms and mechanical and electrical infrastructure). Internally, the Data Hall layout is primarily driven by the process of maintaining appropriate temperatures for equipment during operation; external air is drawn via louvres before being processed and dispensed into multiple aisles of racked equipment. Supporting and external infrastructure (such as the generators, refuelling points and piping, sprinkler tanks etc.) are planned and located to facilitate the efficient operation of the building.

5.2 Grid Reliability and In-built Redundancy

5.2.1 By way of context, in the event of a loss of power supply, i.e. temporary grid blackout, the diesel powered emergency (back-up) generators will be utilised to maintain power supply. These generators are designed to automatically activate and provide power to the plant pending restoration of mains power. In addition to applying acoustic measures to the emergency generators, every effort will be made to ensure that the emergency generators would not be required in practice, as described below.

5.2.2 Power for the data centre will be supplied from/by the National Grid which operates its transmission system in accordance with the Security and Quality of Supply Standard which is a requirement of its Transmission Licence. In accordance with this standard, a level of redundancy is also built into the transmission system[3].

5.2.3 The overall reliability of supply for the National Grid Electricity Transmission (NGET) System during 2018 - 2019 was 99.999984%[4]. During 2018-19, there were 347 NGET system events where transmission circuits were disconnected either automatically or by urgent manual switching. Most of these events had no impact on electricity users with only three resulting in loss of supplies to customers.

5.2.4 The power distribution system, on-site, starting from the Medium Voltage intake substation down to the Low Voltage distribution, is designed to be safe, reliable, robust, and efficient and have in-built redundancy. The Operator designs and builds systems with in-built redundancy, based on Medium Voltage power supply connections from an electricity grid, being the primary power source to the site. The dual redundant circuit provides security of supply in the event of a fault or loss of supply from one source, the other circuit is capable of supplying full load to the site. To achieve this redundancy, the operator is proposing for the full supply to be split 50%/50% (dual-feeds) from alternative supply sources, each capable of supplying the 100%, if required. Essentially, the data centre will be supplied from the Grid by a substation with 2 separate cables from 2 separate feeders; therefore, in the event of a loss of supply from a single source, 50% of the development is still on the alternative source, while the remaining 50% is on back-up emergency generators temporarily until the site’s own distribution system can be rearranged to resume supply from the available source. This arrangement stays in place until the failed source has restored supply, at which point power returns to the two supply sources. This arrangement is subject to connection agreement and compliance with transmission and distribution regulations (and providers).

5.2.5 The on-site infrastructure is designed on N+1[5] reliability and concurrently maintainable design. This means that there is redundancy built into the system, so that any one component, or any one distribution path can be out of service without affecting operations. Similarly, for the grid connection to the data centre to fail, it would require a number of failures to the upstream distribution network to occur simultaneously. The requirement to run back-up generators is therefore minimised.

5.2.6 The Operator also undertakes a regular and robust infrastructure inspection, preventive maintenance and testing programme and has an integrated Building Management System (BMS) and an Electrical Power Monitoring System (EPMS): these are additional control tools which are used to monitor physical assets and equipment status and performance.

5.2.7 The measures above will minimise the potential for emergency operation of the diesel generators, reducing the overall environmental impact from the installation, in the rare event that they are triggered.

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[3] https://www.nationalgridet.com/document/129991/download

[4] https://www.nationalgrideso.com/document/153121/download

[5] N+1 redundancy is a form of resilience that ensures system availability in the event of component failure. Components (N) have at least one independent backup component (+1). The level of resilience is referred to as active/passive or standby as backup components do not actively participate within the system during normal operation

5.3 Phasing

5.3.1 The data centre is a phased facility which means that commissioning of the phases will likely to be carried out over time. The operator will not fully deploy all the IT and data storage equipment (or support infrastructure such as the emergency generators) across the entire facility; instead the data servers will be deployed on a phased-basis, determined by customer demand. The time-gaps between the phased deployment can be months. As subsequent data rooms are bought online, the approved backup generator sets in relation to that phase are delivered and installed. As such, when the data centre first becomes operational, the emergency backup generators associated with the latter phases (of which there are 4 in total) will not be in use in initial operations.

6 ASSESSMENT OF EFFECTS

6.1 Operation

6.1.1 Receptors have been included at the following representative locations for each of the groups identified in Section 4 of this report:

- 10 Roxborough Drive (representative for the five chalets within both Roxborough Drive and Lyndene Road that have line of sight to the Application Site);
- 15 Brendan Close (representative of the 14 houses within Brendan Close that have line of sight to the Application Site);
- 1 Heron Lane (representative for 40 to 50 residential properties in Ash Way, Dunnock End, Heron Lane and Robin Way, approx. 350 m to the south of the Application Site); and
- two receptors within the consented residential development at Dunnock End, one at the closest house in the east part of the Application Site, and one at the closest house in the west part (representative of the approx. 20 houses with line of sight to the Application Site).

6.1.2 The noise assessment has been carried out for the daytime (07:00 hrs to 23:00 hrs) and night-time (23:00 hrs to 07:00 hrs) periods as identified in BS 4142:2014+A1:2019 (BS, 2019). Daytime levels have been evaluated at ground floor and night-time levels at first floor, with the exception of the chalets at Roxborough Drive, where only ground floor is considered.

Generator Testing

6.1.3 Table 6.1 provides the initial estimate of the noise impact at the nearest NSRs due to the operation of the facility during generator testing, which would occur during the daytime only.

6.1.4 In RPS' experience of similar developments, noise from the facility is likely to be of a broadband nature and would not be impulsive or readily distinctive at the nearest NSRs. Therefore, in this instance, it is not considered appropriate to apply any corrections for the acoustic character of the plant to determine the rating level as referred to in BS 4142:2014+A1:2019.

Table 6.1: Initial Assessment of Impact for Generator Testing – Daytime

Noise Sensitive Receptor	Background Sound Level, $L_{A90, T}$ dB	Specific Sound Level, $L_{Aeq, T}$ dB	Character Correction	Rating Level, $L_{Ar, Tr}$ dB	Rating Level minus Background Sound Level dB[1]
1 Heron Lane	44	35	0	35	-9
10 Roxborough Drive	51	35	0	35	-16
15 Brendon Close	49	38	0	38	-11
Consented Development at Dunnock End - West	49	42	0	42	-7
Consented Development at Dunnock End - East	49	39	0	39	-10

1) Level difference may vary by +/- 1 dB from integer levels due to rounding

6.1.5 From Table 6.1, during the daytime testing of the generators, the rating levels are well below the background sound levels, with the maximum level for rating minus background being -7 dB at the consented development at Dunnock End. On this basis, it is likely that the noise impact would be low or even negligible, depending on the context.

6.1.6 Part of the context is to consider the level of the specific sound ($L_{Aeq,\,T}$ from the development), with respect to the residual sound levels ($L_{Aeq,\,T}$ without the development), and whether the development would cause any increases in the overall ambient sound level. Table 6.2 provides an evaluation of the increase in ambient sound levels by combining the residual sound levels and the specific sound level for the generator testing scenario.

Table 6.2: Change in Ambient Sound Levels for Generator Testing – Daytime

Noise Sensitive Receptor	Residual Sound Level, $L_{Aeq,\,T}$ dB	Specific Sound Level, $L_{Aeq,\,T}$ dB	Total Ambient Sound Level (Specific Plus Residual), $L_{Aeq,\,T}$ dB	Change in Ambient Sound Level dB[1]
1 Heron Lane	46	35	46	0
10 Roxborough Drive	60	35	60	0
15 Brendon Close	51	38	52	0
Consented Development at Dunnock End - West	60	42	60	0
Consented Development at Dunnock End - East	60	39	60	0

1) Level difference may vary by +/- 1 dB from integer levels due to rounding

6.1.7 The specific sound levels range from 35 to 42 dB $L_{Aeq,\,T}$ during the daytime. These levels are well below the criteria for speech intelligibility and moderate annoyance during the daytime provided in the WHO Guidelines for Community Noise. The specific sound levels are sufficiently below residual sound levels that they would not cause an increase to the overall ambient sound levels. There are other industrial activities in the vicinity, some of which were audible at the baseline sound monitoring location. Noise emissions from the proposed development are therefore not dissimilar to other existing sources of sound in the area.

6.1.8 Therefore, with consideration of the context, the noise impact of the proposed development is considered to be negligible during generator testing during the daytime.

Grid Power Failure

6.1.9 Tables 6.3 and 6.4 provide the initial estimate of the noise impact at the nearest NSRs due to the operation of the facility during a grid power failure when all, or most, generators would be required to be operational at the same time.

6.1.10 As sound levels from the generators at the NSRs would be sufficiently high during the grid power failure, there is potential for the sound to contain tones that would be clearly perceptible at the NSRs. Therefore, rating penalties of up to +4 dB have been added to the specific sound levels at some NSRs to account for tonality depending on the likelihood of the tone being just perceptible or clearly perceptible at the receptor location.

Table 6.3: Initial Assessment of Impact for Grid Power Failure – Daytime

Noise Sensitive Receptor	Background Sound Level, $L_{A90,\,T}$ dB	Specific Sound Level, $L_{Aeq,\,T}$ dB	Character Correction	Rating Level, $L_{Ar,\,Tr}$ dB	Rating Level minus Background Sound Level dB[1]
1 Heron Lane	44	43	4	47	3
10 Roxborough Drive	51	43	4	47	-4

15 Brendon Close	49	46	4	50	1
Consented Development at Dunnock End - West	49	51	4	55	6
Consented Development at Dunnock End - East	49	46	4	50	1

1) Level difference may vary by +/- 1 dB from integer levels due to rounding

Table 6.4: Initial Assessment of Impact for Grid Power Failure – Night-time

Noise Sensitive Receptor	Background Sound Level, $L_{A90,\ T}$ dB	Specific Sound Level, $L_{Aeq,\ T}$ dB	Character Correction	Rating Level, $L_{Ar,\ Tr}$ dB	Rating Level minus Background Sound Level dB[1]
1 Heron Lane	39	44	4	48	10
10 Roxborough Drive	45	43	0	43	-2
15 Brendon Close	44	47	2	49	4
Consented Development at Dunnock End - West	44	52	4	56	12
Consented Development at Dunnock End - East	44	47	2	49	4

1) Level difference may vary by +/- 1 dB from integer levels due to rounding

6.2 BS 4142:2014+A1:2019 states the following with regards to the difference between the rating and background sound level:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

6.3 From Tables 6.3 and 6.4, in the event of a power failure, the rating levels would exceed the background sound levels by up to 6 dB during the daytime and 12 dB during the night-time. On this basis, it is likely that a significant adverse impact would occur, depending on the context.

6.1.1 A major power outage is also an exceptional event and, as discussed in Section 5.2 of this report, every effort has been made in the design of the development to prevent this from occurring in practice. Although not explicitly stated in the standard, BS 4142:2014+A1:2019 is generally used to assess regular noise from industrial and commercial plant. Therefore, an important consideration in this context, as well as the other factors described in the Standard, is the infrequency of the noise impact occurring. Part of the context is to consider the level of the specific sound ($L_{Aeq,\ T}$ from the development), with respect to the residual sound levels ($L_{Aeq,\ T}$ without the development), and whether the development would cause any increases in the overall ambient sound level. Tables 6.5 and 6.6 provide an evaluation of the increase in ambient sound levels by combining the residual sound levels and the specific sound level for the normal worst-case operating conditions during the daytime and night-time respectively. An evaluation of internal noise levels with the windows open assuming a partially open window providing a sound attenuation of 15 dB has also been provided.

6.1.2 Another consideration is whether the receptor will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as enhanced façade mitigation. Therefore, a scenario with closed windows has also been considered, taking into account the likely façade attenuation for each of the receptors considered in the assessment. Given the source has a reasonably high low frequency content, it is expected that the façade attenuation would be lower than for more common sources such as road traffic noise. Therefore, fairly conservative assumptions have been made regarding the sound attenuation of the façade with respect to noise from generators. These have been evaluated as follows:

- 1 Heron Lane and Brendon Close – standard façade construction with thermal double glazed windows providing a sound insulation of 25 dB.
- 10 Roxborough Drive – chalets, with a less robust façade construction providing a sound insulation of 20 dB.
- Consented Development at Dunnock End – standard façade construction with thermal double glazed windows providing a sound insulation of 25 dB for living rooms (daytime assessment) and enhanced façade specification providing a sound reduction of 30 dB for bedrooms (night-time assessment), based on information provided within the planning documentation attached to this consent via condition, provided in Appendix C of this report.

Table 6.5: Change in Ambient Sound Levels for Grid Power Failure – Daytime

Noise Sensitive Receptor	Residual Sound Level, $L_{Aeq, T}$ dB	Specific Sound Level, $L_{Aeq, T}$ dB	Total Ambient Sound Level (Specific Plus Residual), $L_{Aeq, T}$ dB	Change in Ambient Sound Level dB[1]	Internal Sound Level with Windows Open $L_{Aeq, T}$ dB	Internal Sound Level with Windows Closed $L_{Aeq, T}$ dB
1 Heron Lane	46	43	48	2	33	23
10 Roxborough Drive	60	43	60	0	45	40
15 Brendon Close	51	46	52	1	37	27
Consented Development at Dunnock End - West	60	51	60	0	45	35
Consented Development at Dunnock End - East	60	46	60	0	45	35

1) Change in sound level may vary by +/- 1 dB from integer levels due to rounding

Table 6.6: Change in Ambient Sound Levels for Grid Power Failure – Night-time

Noise Sensitive Receptor	Residual Sound Level, $L_{Aeq, T}$ dB	Specific Sound Level, $L_{Aeq, T}$ dB	Total Ambient Sound Level (Specific Plus Residual), $L_{Aeq, T}$ dB	Change in Ambient Sound Level dB[1]	Internal Sound Level with Windows Open $L_{Aeq, T}$ dB	Internal Sound Level with Windows Closed $L_{Aeq, T}$ dB
1 Heron Lane	42	44	46	4	31	21
10 Roxborough Drive	52	43	53	0	38	33
15 Brendon Close	47	47	50	3	35	25
Consented Development at Dunnock End - West	52	52	55	3	40	25
Consented Development at Dunnock End - East	52	47	53	1	38	23

1) Change in sound level may vary by +/- 1 dB from integer levels due to rounding

6.4 The specific sound levels range from 43 to 51 dB $L_{Aeq, T}$ during the daytime and 46 to 55 dB $L_{Aeq ,T}$ during the night-time. These levels are above the thresholds for annoyance during the daytime at some NSRs and above the thresholds for sleep disturbance during the night-time at all NSRs. The specific sound levels would increase the ambient sound levels at receptors by up to 2 dB during the daytime and up to 6 dB during the night-time. Although the sound would not be out of character of other industrial noise sources in the area, it would be sufficiently high that there would be the potential for it to be noticeable above existing sources of sound, especially during the night-time.

6.1.1 During the daytime with the windows open, the internal sound level would be above the internal ambient noise level criteria in the WHO GCN for speech intelligibility and moderate annoyance of 35 dB $L_{Aeq,16hr}$ at one NSR, 15 Brendan Close, where the noise level is increased. However, the noise increase is only 1 dB, and with the windows closed, the internal ambient sound level would be below this criterion. Bearing in mind the infrequency of this emergency event, this is therefore considered to be not significant.

6.1.2 During the night-time with the windows open, the internal sound level would be increased at all NSRs assessed and would be above the internal ambient noise level criteria in the WHO GCN for sleep disturbance of 30 dB $L_{Aeq,16hr}$. However, with the windows closed, the internal ambient sound level would be below this criterion at the majority of NSRs; the only exception being 10 Roxborough Drive, where there would be no increase in the ambient sound level. Furthermore, the Consented Development at Dunnock End, which would be subject to the highest sound levels from the proposed development, already has enhanced glazing and ventilation to reduce the incident sound from road traffic. If the Dunnock End development were built out, the receptor 1 Heron Lane, which is subject to the highest increase in ambient sound levels would be screened from noise from the proposed development, so the impact here would be lower. Bearing in mind the infrequency of this event, and that the affected receptors would be able to counter the effects of sleep disturbance by closing windows, this is therefore considered to be not significant.

6.1.3 The noise, when present could cause a change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion and having to keep windows closed because of the noise. There is potential for sleep disturbance, but this reduces significantly if the windows are closed, and at the most affected NSRs there is adequate provision for ventilation with the windows closed. A major power outage is also an infrequent event, and every effort has been made in the design of the development to prevent this from occurring in practice. If a power outage did occur, the effect would be short-term until the cause of the outage was rectified, and full grid supply restored. Therefore, with consideration of the context, although the noise impact from the development during a major power outage, would be above the LOAEL during the daytime, and above the LOAEL, with some locations at the SOAEL during the night-time, due to the infrequency of the of the event the overall impact would not be significant.

6.1.4 The generator noise has been mitigated by choosing low noise generators and positioning the generators in enhanced enclosures. The developer is proposing higher-performing acoustic mitigation for the enclosures; with greater noise reduction than standard enclosures used in their other projects in Europe. However, whilst there is potential for a high noise impact to occur in an emergency scenario at night-time, the Environmental Health Officer at SODC and VWHDC has confirmed that the predicted noise levels from the emergency generators would likely be considered acceptable due to the infrequency of the scenario occurring.

7 SUMMARY

7.1 This report, provided by the Acoustics Team of RPS Environment (RPS), provides a noise impact assessment for emergency back-up generators associated with an adjacent data centre located on land at the former Didcot A Power Station, Didcot, Oxfordshire. The site is located within the administrative area of Vale of White Horse District Council and South Oxfordshire District Council.

7.2 An assessment of the noise from the facility has been carried out in accordance with BS 4142:2014+A1:2019 which is the nationally recognised standard and is referred to in the Environmental Permitting Regulations. A baseline acoustic survey was undertaken, and an acoustic model was built of the proposed facility for testing of back-up generators and for the case of a major grid power failure with all generators running.

7.3 During generator testing, predicted operational noise levels at NSRs would be well below the prevailing background sound levels; would be well below the thresholds at which critical health effects would occur according to guidance published by the World Health Organisation; and would only result in a small increase to existing baseline ambient sound levels. Furthermore, noise from the development would be similar in character to other operational facilities in the vicinity. On this basis, the noise impacts for general operation of the proposed development are anticipated to be negligible.

7.4 Noise from the generators has been mitigated and reduced to a minimum by locating the generators in acoustic enclosures. These enclosures are a higher-performance specification than the applicant typically uses. Notwithstanding this, in the event of a major grid failure, if all emergency generators are required, the noise impact would be considered as significant during the night-time. However, the potential for sleep disturbance is very low in a scenario where bedroom windows are kept closed. Due to the rare likelihood of the emergency scenario occurring, National Grid reliability and the in-built redundancy and infrastructure maintenance systems, this is very unlikely to occur in practice and/or for any length of time and should therefore be considered acceptable. The applicant also has a rigorous internal process for equipment inspection and preventative-maintenance with the objective of avoiding the use of the emergency generators.

7.5 Based on the above, it is considered that the development has acceptable noise immissions given the likely frequency of operation and hence complies with the requirements of the Environmental Permitting Regulations and there is no reason with respect to noise why the application for the Environmental Permit should not be granted.

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FIGURES

APPENDICES

Appendix A

Baseline Sound Survey Information and Data

Appendix B

Calculations and Noise Model Input Data

Appendix C

Proposed Residential Development at Dunnock End, Didcot – Noise Assessment Addendum