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IRON MOUNTAIN LON-3 DATA CENTRE NOISE IMPACT ASSESSMENT

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IRON MOUNTAIN LON-3 DATA CENTRE
NOISE IMPACT ASSESSMENT

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CONTENTS

EXECUTIVE SUMMARY		**iii**
1.	**INTRODUCTION**	**4**
2.	**Site Description and Proposed Development**	**5**
2.1	Site Description and Existing Uses	5
2.2	Nearest Existing Noise-Sensitive Receptors	5
2.3	The Proposed Development	6
3.	**Legislation, Policy and Guidance**	**9**
3.1	Overview	9
3.2	National Planning Policy and Guidance	9
3.3	Local Planning Policy	11
3.4	Iron Mountain Design Standards	12
3.5	Guidance	12
4.	**Assessment Methodology**	**14**
5.	**Environmental Noise Survey**	**15**
5.1	Overview	15
5.2	Procedure	15
5.3	Survey Results	16
5.4	Baseline Noise Conditions at NSR04	17
5.5	Representative Sound Levels at the Nearest Receptor Buildings	18
6.	**Noise Impact Assessment**	**19**
6.1	Overview	19
6.2	Operational Noise Level Predictions	19
6.3	Assessment of Effects at High Sensitivity Receptors: Normal Operation	26
6.4	Assessment of Effects at High Sensitivity Receptors: Emergency Operation	28
6.5	Assessment of Effects at the Medium Sensitivity Receptor	29
6.6	Road traffic noise levels	30
6.7	Assessment Outcome	30
7.	**Noise Control Requirements**	**31**
7.1	Overview	31
7.2	Operational Noise Limits	31
7.3	Expected Mitigation Requirements	31
8.	**Conclusions**	**33**
Appendix 1 – Acoustic Glossary		**34**
Appendix 2 – Noise Survey Details		**36**
Appendix 3 – Noise Source Assumptions		**1**
Appendix 4 – Noise Level Contours		**1**
Appendix 5 – Uncertainty		**1**

TABLE OF TABLES

Table 1: Nearest existing noise-sensitive receptors	6
Table 2: Generator Testing Schedule	8
Table 3: PPG Noise Exposure Hierarchy	10
Table 4: Effect level thresholds at residential receptors: normal operation	13
Table 5: Summary of long-term measurements results from location LT1	16
Table 6: Summary of short-term noise measurements results	17
Table 7: Representative background sound levels at the NSRs	18

Table 8: Level 03 Chiller sound power level spectrum 21
Table 9: Generator sound pressure level spectrum 23
Table 10: Generator radiator sound power level spectrum 23
Table 11: Predicted operational noise levels 26
Table 12: Predicted rating levels and initial assessment: Normal operation: High Sensitivity Receptors 27
Table 13: Predicted rating levels and initial assessment: Normal operation with Generator Testing: High Sensitivity Receptors 27
Table 14: Predicted rating levels and initial assessment: Emergency operation: High Sensitivity Receptors 28
Table 15: Predicted rating levels and initial assessment: Medium Sensitivity Receptors 29
Table 16 - Operational noise limits: normal operation and maintenance testing 31
Table 17 - Operational noise limits: emergency operation 31

TABLE OF FIGURES

Figure 1: Site location and nearby noise-sensitive receptor groups 5
Figure 2: Noise survey measurement locations 15
Figure 3: Sound propagation model: Normal Operation 20
Figure 4: Sound propagation model: Normal Operation with Generator Testing (S) 20
Figure 5: Sound propagation model: Normal Operation with Generator Testing (N) 20
Figure 6: Sound propagation model: Emergency Operation 21
Figure 7: Screen between main building and gantry 24
Figure 8: Main building roof canopy 24

EXECUTIVE SUMMARY

This noise impact assessment has been prepared by Ramboll UK Ltd. ('Ramboll') on behalf of I3 Solutions in support of an Environmental Permit application for the Lon-3 data centre at 111 Buckingham Avenue, Slough, Berkshire, SL1 4PF, UK ('the Site').

This report presents an assessment of the likely effects of operational noise from the proposed development, comprising noise from the proposed mechanical and electrical systems required to serve the proposed facility. This assessment has been carried out following the approach within BS 4142 and has been informed by a detailed baseline noise survey and through communication between Ramboll and the mechanical and electrical designers.

The assessment demonstrates that, based on input data and assumptions, operational noise from the proposed development under all scenarios would result in a low impact. Expected operational noise levels do not exceed the typical noise control requirements of SBC under each scenario. The proposed development therefore is in line with national and local planning policy objectives relating to noise.

Where systems are varied in quantity, location or sound output, the implications will need to be reviewed by an acoustician and the noise impact assessment presented within this report updated, where necessary, to ensure that the operational noise limits in Section 7.2 are not exceeded.

The measures taken to reduce uncertainty in this assessment are described within Appendix 5.

1. INTRODUCTION

This noise impact assessment has been prepared by Ramboll UK Ltd. ('Ramboll') on behalf of I3 Solutions in support of an Environmental Permit application for the proposed Lon-3 data centre (the 'proposed development') at 111 Buckingham Avenue, Slough, Berkshire, SL1 4PF (the 'site'), within the Slough Trading Estate. The proposed development is located within the Slough Borough Council (SBC) planning authority area.

The proposed development comprises a datacentre building with ancillary and office spaces, and the provision of mechanical and electrical plant and machinery associated with datacentre operations. Details of the proposed development are presented in Section 2 of this report.

The proposed development has the potential to result in sound of an industrial or commercial nature, referred to as 'operational noise', at the nearby noise sensitive receptors ('NSRs'). Sound of this nature will originate from the mechanical and electrical systems associated with the operation of the proposed development.

Following consultation with SBC, the assessment of operational noise has been carried out in accordance with British Standard 4142:2014+A1:2019 (BS 4142), informed by an environmental noise survey carried out in the vicinity of the site. The assessment has informed the noise control requirements for the proposed development presented within Section 7 of this report.

This report is prepared in support of the Environmental Permit application for the proposed development. It is not intended to present the acoustic design specifications for the facility. Specifications for plant and other noise sources stated within this report are for the purpose of assessing the operational noise impacts only.

At the time of writing, details of the proposed mechanical and electrical plant and machinery remain under development. Therefore, the noise control requirements presented within this report will need to be accounted for during the detailed design and equipment procurement stages.

This report contains technical terminology relating to acoustics. A glossary of terminology is presented in Appendix 1.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 Site Description and Existing Uses

The site is located within the Slough Trading Estate, an industrial area to the west of Slough town centre within the jurisdiction of Slough Borough Council (SBC).

The site is bounded by Buckingham Avenue to the north, Malton Avenue to the south, and data centres to the east and west. The site is currently vacant.

The site is situated within a Simplified Planning Zone. The SPZ Scheme sets out a range of conditions that must be met in order that some types of development, including data centres, can be built without the need to apply for an individual planning permission.

A map showing the approximate boundary of the site is presented in Figure 1.

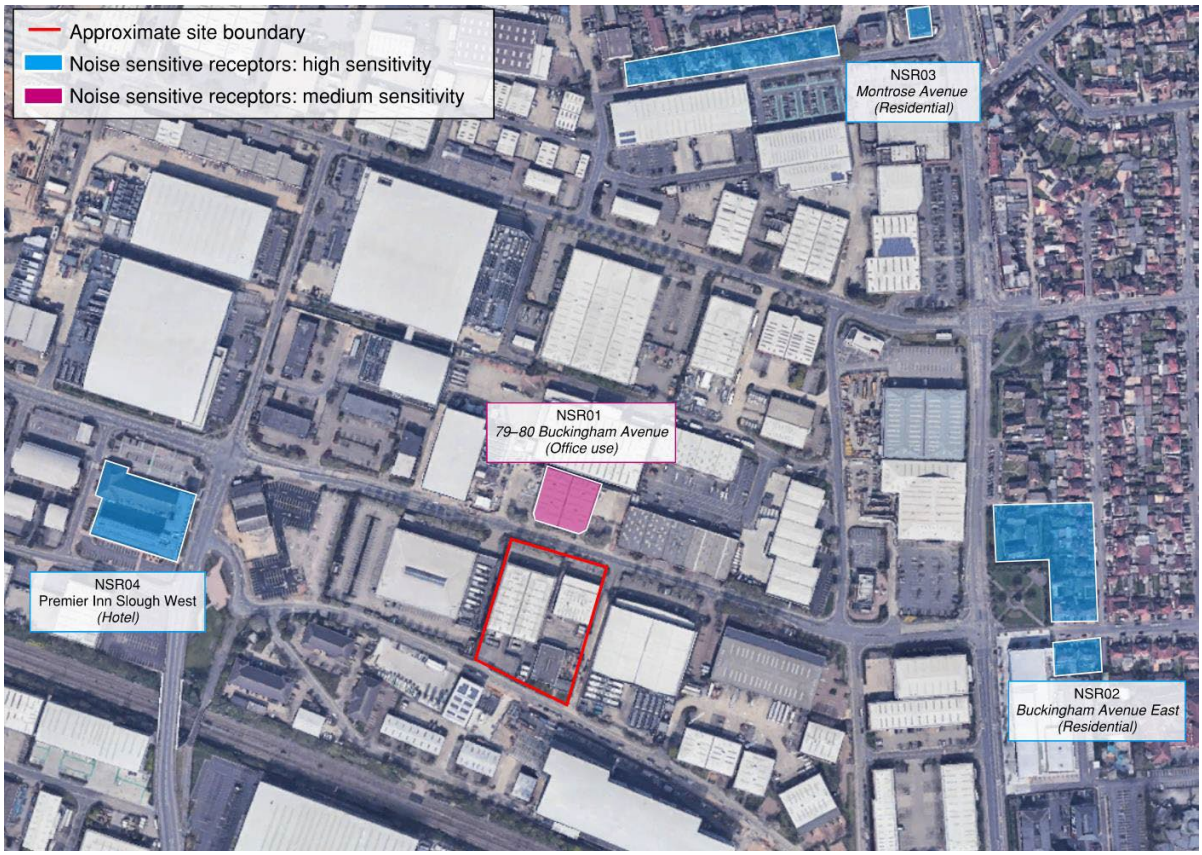


Figure 1: Site location and nearby noise-sensitive receptor groups

2.2 Nearest Existing Noise-Sensitive Receptors

The nearest noise-sensitive receptors to the proposed development have been identified. These have been grouped into NSR groups shown in Table 1.

Table 1: Nearest existing noise-sensitive receptors

Ref.	Receptor (and distance)	Type	Sensitivity
NSR01	79–80 Buckingham Avenue (35m north)	Commercial: office use (assumed daytime use only)	Medium
NSR02	5–11 Buckingham Avenue East (350m east)	Residential use	High
NSR03	5–38 Montrose Avenue (380m north)	Residential use	High
NSR04	Premier Inn Slough West (250m west)	Commercial hotel use	High

These NSR groups are also presented in Figure 1.

2.3 The Proposed Development

2.3.1 Overview

Based on information provided by the design team, the proposed development will comprise:

- A datacentre building (four floors) accommodating:
  - Level 00 to Level 02: two data halls per floor with six data halls in total; and
  - Level 03: two large areas of external plant either side of central plant rooms.
- An external plant gantry of three levels with "Power Stream" rooms on Gantry Level 0 and 1 and external generator enclosures, including radiators on top, on Gantry Level 2;
- An office area (floors) spanning most of the north elevation accommodating:
  - Office L0 to L2: Office and control room spaces including meeting and conference facility, welfare and access;
  - Office L3: plant rooms; and
  - Roof: additional external plant in designated areas.
- Ancillary development such as landscaping and access.

The proposed generators will be used to provide back-up power in the event of a loss of power to the data centre, i.e. an emergency scenario. Regular testing of the generators at the site is also required to ensure that the generators are operational and capable of providing back-up power.

2.3.2 Phasing

The proposed development will be completed in two phases, as follows:

- Phase 1: Data Halls 2, 4 and 6 on Level 00, 01 and 02 South.
- Phase 2: Data Halls 1, 3 and 5 on Level 00, 01 and 02 North.

Phase 1 will include all site infrastructure including associated power streams, Meet-Me Rooms (MMRs), office and external works.

Part of the Phase 1 works (known as "Phase 1 – supply only") will include the chillers, generators and E-pods required to serve Phase 2. These systems, while being delivered as part of Phase 1, would not be installed, tested and commissioned until required for Phase 2. Ten of the main power stream generators and the office building generator will be commissioned as part of Phase 1 and the remaining six power stream generators will be commissioned as part of Phase 2.

The noise impact assessment considers the cumulative noise emissions from both phases of the development, therefore representing the completed, fully occupied proposed development (i.e. after Phase 2 completion).

2.3.3 Summary of Key Plant Items

The proposed development includes the following noise-generating plant systems:

Roof plant

- 28 No. 1200 kW cooling capacity Chillers (each unit nominally 11.5 m by 2.5 m, height 2.5 m);
- 26 No. smaller (12 to 73 kW cooling capacity) condensing units;
- 12 No. roof-mounted air handling units (case-radiated sound); and
- Ventilation grilles associated with the air handling units and supply and extract fans, including the above AHUs.

Generator gantry plant

- 26 No. Power back-up 4000kVA diesel generators within acoustic enclosures in pairs at gantry level 2;
- 26 No. generator radiators (2 No. mounted on top of each enclosed generator pair) at gantry level 2;
- 26 No. "Power Stream Rooms" at gantry level 0 and level 1 with 2 No. smaller (9 kW cooling capacity) condensing units per rooms (total 28 No.) operating in N+1 mode; and
- 38 No. other smaller (4 kW cooling capacity) condensing units at gantry level 0 and level 1, positioned on the east elevation of the main building.

Office plant

- 15 No. smaller (4 to 13 kW cooling capacity) condensing units at office roof level.
- 1 no. back-up generator within acoustic enclosure.

2.3.4 Operational Scenarios

The following operational scenarios were considered as part of the noise impact assessment for the proposed development.

2.3.4.1 Normal Operation Scenario

During normal operation, it is assumed that emergency power back-up systems are not operating (e.g. generators and associated radiators are not active).

All other systems are assumed to be operating at the expected duty for the completed, fully occupied proposed development (i.e. after Phase 2 completion).

2.3.4.2 Normal Operation with Generator Maintenance Testing Scenario

In additional to the above "normal operation" systems, each of the generators at the site will be subject to a regular testing regime.

The anticipated testing regime is shown in Table 2. The generator testing regime will involve periods of operation at different loads on a monthly basis, but as worst-case basis full load operation was used in the modelling. It is assumed that the associated generator radiator is also operating at design duty during this maintenance testing.

For the purposes of the noise impact assessment, noise emissions have been assessed for the following scenarios:

- A normal operation with generator maintenance testing scenario with testing of the northern-most generator pair.
- A normal operation with generator maintenance testing scenario with testing of the southern-most generator pair.

The above scenarios represent the worst-case noise emissions that could occur as a result of regular maintenance testing of the generators closest to the site boundaries.

Table 2: Generator Testing Schedule

Generator	Frequency	Number	Load	Annual hours	Total
Main Power Stream (4000kVA)	0.5 hours every 2 weeks	16	45%	13	208
Admin (500kVA)		1	45%	13	13
Main Power Stream (4000kVA)	1 hour every 3 months	16	45%	2	32
Admin (500kVA)		1	45%	2	2
Main Power Stream (4000kVA)	1.5 hours every 6 months	16	100%	3	48
Admin (500kVA)		1	100%	3	3
Main Power Stream (4000kVA)	4 hours per year simultaneously	12	99%	4	48
Main Power Stream (4000kVA)		2	51%	4	8
Main Power Stream (4000kVA)		2	25%	4	8

2.3.4.3 Emergency Operation Scenario

For the purposes of the modelling the potential noise impact of emergency operation, it is assumed that all of the generators would operate simultaneously at maximum load in an emergency.

For the purposes of the noise impact assessment, noise emissions have been assessed with all generators (and radiators) active, in combination with the "normal operation" systems.

It is noted that the likelihood of all generators operating at maximum load is very low given the grid reliability and redundancy in power supplies to the data centre. In addition, it is not possible to predict when or how often such an emergency scenario could occur.

3. LEGISLATION, POLICY AND GUIDANCE

3.1 Overview

The following section presents national and local policies, standards and guidance that are relevant to the proposed development and the scope of this report.

3.2 National Planning Policy and Guidance

Two national planning policy documents are relevant to the proposed development and the scope of this report:

- The National Planning Policy Framework, 2023 (NPPF)1; and
- The Noise Policy Statement for England, 2010 (NPSE)[2].

In addition, further guidance relating to noise has been produced by the Department for Communities and Local Government (DCLG) (now the Ministry for Housing, Communities and Local Government) and released as a web-based Planning Practice Guidance (PPG) resource[3].

The parts of these documents and guidance that are relevant to the proposed development and the scope of this report are summarised below.

3.2.1 National Planning Policy Framework, 2023

The NPPF adopted in December 2023 in England outlines the Government's planning policies and requirements for the planning system. The NPPF forms a material consideration in planning decisions and hence must be complied with for planning permission to be granted.

Paragraph 191 of the NPPF states that the planning system should seek to:

- "*Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason".*

To achieve these aims the NPPF refers to the Noise Policy Statement for England.

3.2.2 Noise Policy Statement for England, 2010

The NPSE sets out the long-term vision of Government noise policy which is to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

The NPSE outlines the following three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

- "*Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life."*

The first two aims of the NPSE follow established concepts from toxicology that are applied to noise impacts, for example, by the World Health Organisation (WHO). They are:

[1] Department for Communities and Local Government, 2023. National Planning Policy Framework. HMSO. London.

[2] Department for Environment, Food and Rural Affairs (DEFRA), 2010, Noise Policy Statement for England, DEFRA.

[3] https://www.gov.uk/government/collections/planning-practice-guidance.

- NOEL – No Observed Effect Level - the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise;
- LOAEL – Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.

The NPSE extends these to the concept of a significant observed adverse effect level:
- SOAEL – Significant Observed Adverse Effect Level - The level above which significant adverse effects on health and quality of life occur.

3.2.3 Planning Practice Guidance: Noise

In March 2014, the PPG: Noise web-based resource was released to support the NPPF (and was subsequently updated in 2019). In relation to the potential effects of noise from a proposed development, the guidance advises that local planning authorities should consider:
- "*Whether or not a significant adverse effect is occurring or likely to occur;*
- *Whether or not an adverse effect is occurring or likely to occur; and*
- *Whether or not a good standard of amenity can be achieved."*

The PPG qualifies the effect of noise based on whether a source is noticeable and/or intrusive and/or causes a change in behaviour or attitude.

The Lowest Observed Adverse Effect Level (LOAEL) is described as noise that can be heard and can cause small changes to behaviour and/or attitudes, for example turning up the volume on the television. The LOAEL affects the acoustic character of the area such that there is a perceived change in the quality of life.

The Significant Observed Adverse Effect Level (SOAEL) is defined as the level at which noise causes a change in behaviour and/or attitude, such as avoiding certain activities during periods of intrusion or, where there is no alternative to ventilation, having to keep windows closed most of the time because of the noise.

The latest version of PPG introduced the concepts of NOEL (No Observed Effect Level), and UAEL (Unacceptable Adverse Effect Level). For the purposes of this assessment, the magnitude of effect is assigned by reference to the guidance in PPG-Noise, as summarised in Table 3.

Table 3: PPG Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level (NOEL)			
Not noticeable	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level (NOAEL)			
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required

Perception	Examples of Outcomes	Increasing Effect Level	Action
Lowest Observed Adverse Effect Level (LOAEL)			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

3.3 Local Planning Policy

The section below presents the current local planning policies relevant to this report.

3.3.1 Slough Borough Council Requirements and the Simplified Planning Zone

The Slough Trading Estate Simplified Planning Zone Scheme 2014 – 2024[4], adopted 12 November 2014, sets out the terms governing the implementation of the third Simplified Planning Zone (SPZ) for the Slough Trading Estate.

The SPZ recommends consultation with the SBC Environmental Quality Team to determine the noise limits for planning.

The SBC environmental health team confirmed on 16 April 2024 that the following condition is relevant to the scheme:

"Plant noise rating level ($L_{Ar,Tr}$) from the site shall not exceed the "typical" background noise level ($L_{A90,T}$) at nearby noise-sensitive receptors, when assessed in accordance with BS4142:2014"

It was agreed that this condition can be relaxed by 5 dB when assessing the impact on commercial offices and by 10 dB when assessing the impact of noise from emergency plant.

[4] Slough Borough Council, 'Simplified Planning Zone Scheme 2014 – 2024. Slough Trading Estate, Slough. Adopted 12 November 2014'. 2014.

3.4 Iron Mountain Design Standards

The Iron Mountain North America Engineering Design Standards[5] provide guidance for all Iron Mountain North America data centres. While this document does not provide performance requirements for operational noise, it does refer to the potential requirement for attenuation of noise from diesel generators.

3.5 Guidance

3.5.1 British Standard 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound

BS 4142:2014+A1:2019[6] provides a method for rating industrial and commercial sound and method for assessing resulting impacts upon people. The method is applicable to fixed plant installations, sound from industrial and manufacturing process and other associated activities. The basis of BS4142 is a comparison between the background noise level in the vicinity of residential locations and the rating level of the noise source under consideration. The relevant parameters in this instance are as follows:

- Background Sound Level, $L_{A90,T}$: defined in the Standard as the 'A' weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, and quoted to the nearest whole number of decibels;
- Specific Sound Level, $L_{Aeq,T}$: the equivalent continuous 'A' weighted sound pressure level at the assessment location due to the specific sound source under consideration, over a given time interval, T; and
- Rating Level, $L_{Ar,T}$: the specific sound level plus any adjustment made for the characteristic features of the noise.
- Residual Sound Level, $L_{Aeq,T}$: the equivalent continuous 'A' weighted sound pressure level due to residual sound (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 level) at the assessment location over a given time interval, T.

An initial estimate of the impact of the specific sound is determined from the difference between the background sound level and the rating level considering that:

- Typically, the greater the difference, the greater the magnitude of the impact, and the lower the rating level is relative to the background sound level, the less likely it is that the specific sound source will have an adverse impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context.
- 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.

In determining the likelihood of significant effects due to noise, BS 4142 requires a consideration of the context of the assessment. The initial estimate of the impact can be modified due to the context to account for relevant site-specific information, include the absolute level of specific sound, the character and level of the residual sound, the sensitivity of the receptor and whether dwellings will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

[5] Iron Mountain, 'Iron Mountain North America (NA) Engineering Design Standards. December 20, 2019'. 2019.

[6] British Standards Institute, 2014 and 2019. British Standard BS 4142+A1:2019: Methods for rating and assessing industrial and commercial sound. BSI

On this basis, the project-specific effect level thresholds and corresponding actions have been defined for residential receptors as shown in Table 4.

Table 4: Effect level thresholds at residential receptors: normal operation

Effect Level	Project-specific Effect Level Thresholds for Commercial/Industrial Sound	Action
No Observed Adverse Effect Level	Rating level of commercial/industrial sound is around 5 dB or more below the existing background sound level	No specific measures required
LOAEL (Lowest Observed Adverse Effect Level)	Rating level of commercial/industrial sound is around the same level as the existing background sound level.	Above these thresholds, mitigate and reduce industrial noise to a minimum
Between LOAEL and SOAEL	Rating level of commercial/industrial sound is around 5 dB above the existing background sound level.	Mitigate and reduce industrial noise to a minimum
SOAEL (Significant Observed Adverse Effect Level)	Rating level of commercial/industrial sound is around 10 dB above the existing background sound level.	Avoid industrial noise levels exceeding these thresholds
Unacceptable Adverse Effect Level	Rating level of commercial/industrial sound is more than around 10 dB above the existing background sound level.	Prevent

The above thresholds apply to operational noise at high sensitivity receptors during normal operating conditions.

The above thresholds are relaxed by 5 dB when assessing operational noise at commercial offices (medium sensitivity) during normal operating conditions.

The above thresholds are relaxed by 10 dB when assessing the operational noise at medium or high sensitivity receptors during the emergency scenario (when all power back-up systems are assumed to be active).

4. ASSESSMENT METHODOLOGY

Based on the guidance and standards summarised in Section 3, the following approach was adopted for the assessment of operational noise.

- An environmental noise survey was to be undertaken at positions representing the nearest noise-sensitive receptors to the proposed development.
- The survey included observations of the existing sources of sound and a review of the sound context into which new sound sources would be introduced.
- An analysis of the noise survey data was undertaken to determine representative sound levels at the nearest noise-sensitive receptors during relevant time periods.
- A sound propagation model of the proposed development was constructed, to estimate the likely level of operational noise from the proposed development once complete.
- An assessment of operational noise was then carried out, accounting for the mechanical and electrical services systems expected to be associated with the proposed development. This was to be carried out through an initial comparison of the predicted operational noise level with the representative background sound level at each receptor (as per BS 4142:2014+A1:2019). Where necessary, adjustments for context were applied.
- The assessment was to be used to establish the likelihood of significant adverse effects due to operational noise at the nearest receptors, using the thresholds in Table 4.
- Where necessary, suitable forms of mitigation were to be identified with the intention of avoiding significant adverse effects due to operational noise and minimising any remaining residual adverse effects, in line with national planning policy.
- Where necessary, the assessment was repeated to include the additional mitigation, to determine the residual effects expected to occur at the nearest receptors due to operational noise, using the thresholds in Table 4.
- The above assessment was then repeated, to consider operational noise emissions during the emergency scenario and during the "Normal Operation with Generator Testing" scenarios.

5. ENVIRONMENTAL NOISE SURVEY

5.1 Overview

An environmental noise survey was completed by Ramboll to quantify the existing environmental noise conditions in the vicinity of the site and the nearby noise-sensitive receptors.

The section presents details of the survey methodology and a summary of the survey results. Further details regarding the noise survey are presented in Appendix 2.

5.2 Procedure

The environmental noise survey was undertaken between Thursday 14 December 2023 and Wednesday 20 December 2023.

The survey comprised unattended long-term noise monitoring at one fixed position throughout the survey period and attended short-term noise monitoring at additional positions. Noise measurements were taken to quantify the prevailing noise climate at locations representing the nearest noise-sensitive receptors to the site. These locations are shown in Figure 2.

Figure 2: Noise survey measurement locations

The location denoted with suffix 'LT' represents the location where continuous noise measurements were taken throughout the survey period. Measurement location LT1 was deemed representative of the free-field noise climate at the offices at 79-80 Buckingham Avenue (NSR01). The microphone was positioned in free-field conditions at a height of 2.5 m above local ground level, such that the microphone was above the height of an existing site hoarding fence.

The locations denoted with suffix 'ST' represent short-term attended noise measurement undertaken on Wednesday 20 December 2023. These locations were deemed representative of the closest dwellings (5 – 11 Buckingham Avenue East, NSR02, and 5 – 38 Montrose Avenue, NSR03). For each measurement the microphone was positioned in free-field conditions at a height of 1.5 m above local ground level.

Each sound level meter was configured to log sound pressure levels every 125ms over the measurement period, and each short-term noise measurement was 15 minutes in duration. The following noise level parameters were then determined for relevant periods (T):

- dB $L_{Aeq,T}$: Equivalent continuous A-weighted sound pressure level;
- dB $L_{AFmax,T}$: Maximum A-weighted sound pressure level; and
- dB $L_{A90,T}$: 90th percentile A-weighted sound pressure level (commonly described as the background sound level).

Details of the measurement instrumentation and calibration process are presented in Appendix 2.

The audible sources of noise that contributed to the noise climate at each unattended measurement location were noted during setup and collection of the equipment. Weather conditions were also observed during attended periods and reviewed over the entire survey period using publicly available historic weather data from local weather stations.

Details of the observed sound sources and weather conditions during the survey are presented within Appendix 2.

5.3 Survey Results

The unattended measurement data was analysed to determine the following parameters for each day of the survey:

- The equivalent continuous noise level (dB $L_{Aeq,T}$) for the 16-hour daytime period and 8-hour night-time period.
- The typical (most commonly occurring value) background sound level dB $L_{A90,15min}$ for the 16-hour daytime period and the 8-hour night-time period.

Tables 5 and 6 present the results of the unattended noise measurements and the short-term attended noise measurements respectively.

Further detail, including time history graphs of the unattended measurements, are presented in Appendix 2.

Table 5: Summary of long-term measurements results from location LT1

Location ID	Long-term equivalent continuous SPL, dB $L_{Aeq,T}$		Lowest most commonly occurring background sound level, dB $L_{A90,15min}$	
	Office hours, T=8hr [09:00-17:00]	Night-time T=8hr [23:00-07:00]	Office hours [09:00-17:00]	Night-time [23:00-07:00]
LT1	62 to 64	56 to 60	53	49

Table 6: Summary of short-term noise measurements results

Location ID	Time of day	Equivalent continuous SPL, dB $L_{Aeq,15min}$	Maximum SPL, dB $L_{AFmax,15min}$	Background sound level, dB $L_{A90,15min}$
ST1	Daytime (09:00-12:00)	59	71 to 73	55 to 56
	Night-time (02:00-04:00)	51 to 52	62 to 64	47 to 48
ST2	Daytime (09:00-12:00)	63 to 65	78 to 82	53 to 55
	Night-time (02:00-04:00)	52 to 53	72 to 75	47

The observed existing sound sources and acoustic context were, in summary, as follows:

- At residential receptors NS02 and NSR03, the night-time baseline noise climate included sound from intermittent road traffic movements as well as some continuous noise from plant associated with other nearby commercial or industrial buildings.
- At commercial office receptor NSR01, the baseline noise climate during the office hours includes road traffic noise from Buckingham Avenue and continuous noise from fixed plant installations, particularly at 74 to 75 Buckingham Avenue.

Weather conditions were observed to be suitable for environmental noise monitoring during all attended periods (with low wind speeds and no precipitation). Historical weather data from a local weather station is presented in Appendix 2 and demonstrated that weather conditions were generally suitable for environmental noise monitoring. Unattended noise measurement data obtained during periods of heavy rainfall have been excluded from the survey data analysis.

5.4 Baseline Noise Conditions at NSR04

Noise-sensitive receptor NSR04 was considered during the noise impact assessment. However, this receptor (the Premier Inn) was not identified until after the environmental noise survey was complete.

As a guide to likely background sound levels present at this receptor, data from a noise survey carried out by others has been referred to. Details of this third-party environmental noise survey are presented in a Noise Impact Assessment report[7] accompanying a planning application for a development at 183-187 Liverpool Road (SBC planning application reference P/19650/000).

Existing environmental noise levels were measured between Thursday 8 April and Friday 9 April 2021. This included noise monitoring at a position located directly opposite the Premier Inn façade, approximately 5m from the carriageway. The microphone was positioned in free-field conditions at a height of 1.5m above local ground level.

The survey results stated in Table 3.3 of the Stantec Report show the typical background noise level was 57 dB $L_{A90,15min}$ during the daytime (07:00-23:00) and 44 dB $L_{A90,15min}$ during the night-time (23:00-07:00). These values were determined by Stantec through application of the example method within Section 8.1.4 of BS 4142 (i.e. the most commonly occurring value).

[7] Stantec, 'SEGRO V Park, Slough Trading Estate: Noise Impact Assessment, ref. 332110180 NIA_01 rev AA, dated September 2021.

It is noted that the Premier Inn has a sealed façade, without opening windows, to control road traffic noise due to its proximity to the road.

5.5 Representative Sound Levels at the Nearest Receptor Buildings

For noise measurements at position LT1, representing NSR01, representative values of the background sound level were determined following the example method shown in Figure 4 of BS 4142:2014+A1:2019. The representative value of the background sound level was taken as the most commonly occurring value for each period. The representative background sound levels for the typical office hours (09:00 to 17:00) and night (23:00 to 07:00) period were determined as the lowest most-commonly occurring value across the survey.

For noise measurements at positions ST1 and ST2, representing NSR02 and NSR03, representative values of the background sound level for the typical office hours (09:00 to 17:00) and night (23:00 to 07:00) period were determined as the lowest 15-minute background sound level measured during these periods.

Background sound levels were measured in free-field conditions at positions representing each receptor. Background sound levels have been adjusted to façade conditions, to represent the receptor building, through the addition of 2.5 dB. This is to allow a like-for-like comparison with operational noise levels predicted at the receptor building façade.

On this basis, the representative background sound levels are as shown in Table 7.

Table 7: Representative background sound levels at the NSRs

Receptor	Representative measurement location	Representative background sound level, dB $L_{A90,15min}$ (in façade conditions)	
		Office hours [09:00-17:00]	Night-time [23:00-07:00]
NSR01: 79-80 Buckingham Avenue offices	LT1	56	N/A
NSR02: 5 – 11 Buckingham Avenue East dwellings	ST1	58	50
NSR03: 5 – 38 Montrose Avenue dwellings	ST2	56	50
NSR04: Premier Inn Slough West	Data from third party baseline noise survey	60 (See below)	47 (See below)

6. NOISE IMPACT ASSESSMENT

6.1 Overview

This section presents an assessment of operational noise arising from the mechanical and electrical services systems associated with the proposed development.

In order to carry out this assessment, it is necessary to estimate the likely level of operational noise that would be present with the proposed development in operation (the "specific sound level" defined within BS 4142). Details and results of the operational noise level prediction method are described in Section 6.2.

An assessment of operational noise was then carried out in accordance with the approach set out in Section 4.

The assessment within this section includes continuous operation of the normal operating systems throughout the day and night, and considers the following scenarios:

1. Normal Operation Scenario
2. Normal Operation with Generator Testing Scenario (subdivided to consider the testing of different generators near the site boundary); and
3. Emergency Operation Scenario.

6.2 Operational Noise Level Predictions

6.2.1 Method

In order to predict the level of operational noise from the proposed development at each receptor building, a three-dimensional sound propagation model has been constructed using the Datakustik Cadna/A software. The software carries out sound propagation predictions in accordance with ISO 9613-2 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation'* (1996).

Predictions of the operational noise level (dB $L_{Aeq,T}$) were carried out by introducing the proposed development, including the expected sources of operational noise, into the sound propagation model. The model then allows for the operational noise level to be predicted at each assessment location accounting for factors such as geometric spreading and ground absorption over distance, the effect of any intervening buildings, walls or ground features, as well as reflections from the hard surfaces that are part of the proposed development.

The noise impact assessment incorporates the following assumptions:

- In the Normal Operation Scenario no generators are in operation;
- In the Normal Operation with Generator Testing scenarios, the routine testing is assumed to occur during the daytime only and it is assumed that up to two generators could be active;
- During Emergency Operation Scenario, all generators are active; and
- During all scenarios all other items are operating continuously (allowing for N units operating where the proposals are for an N+1 operating mode).

Screenshots of the operational noise model (created in CadnaA software) for each scenario are shown in Figure 3 to 6.

Details of the sound source assumptions and the other assumptions incorporated into this assessment are presented below.

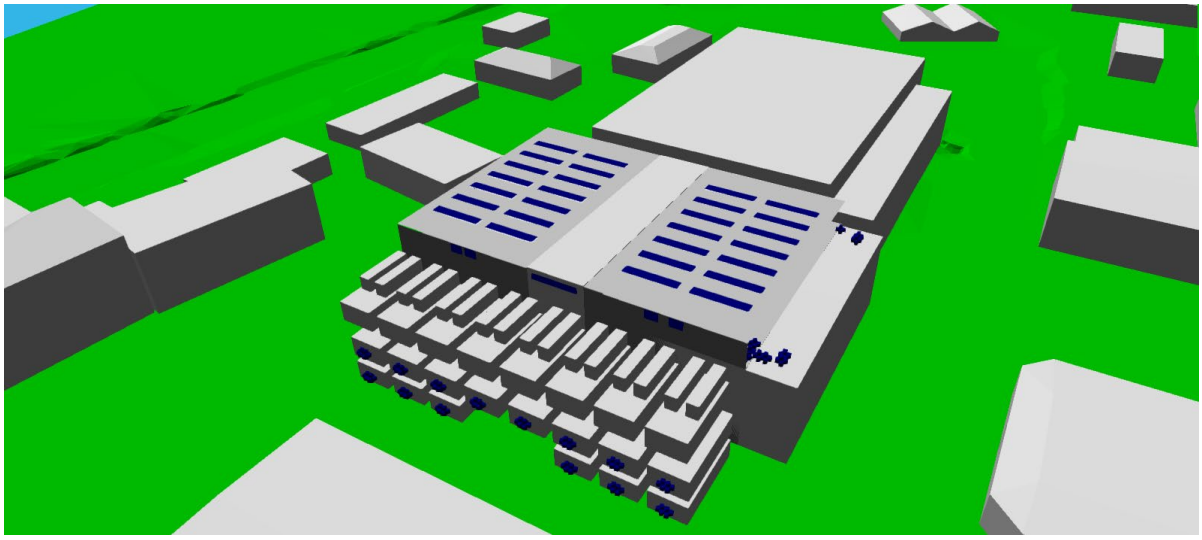


Figure 3: Sound propagation model: Normal Operation

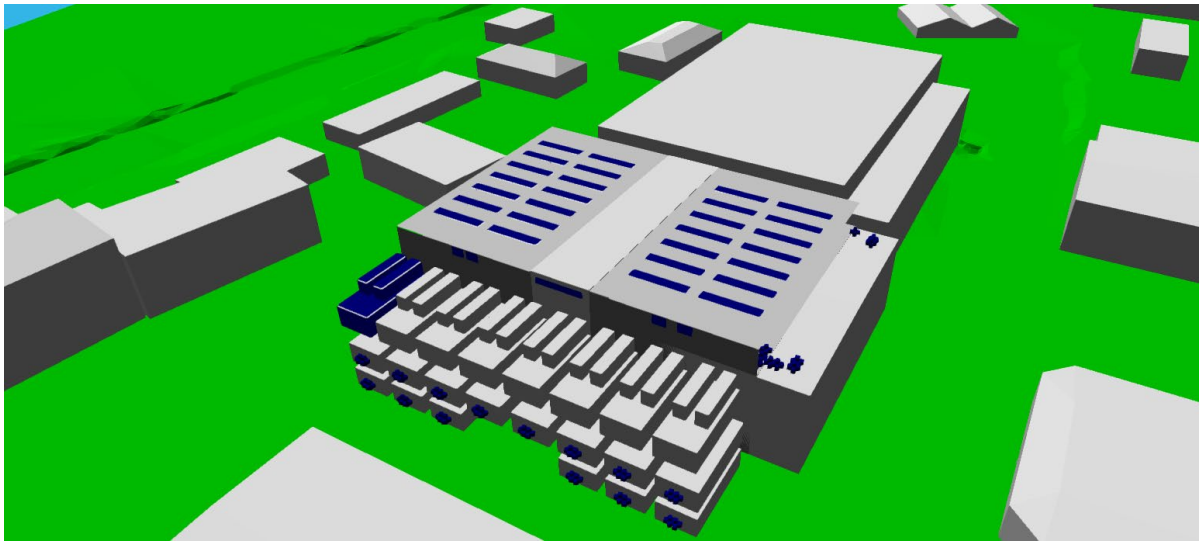


Figure 4: Sound propagation model: Normal Operation with Generator Testing (S)

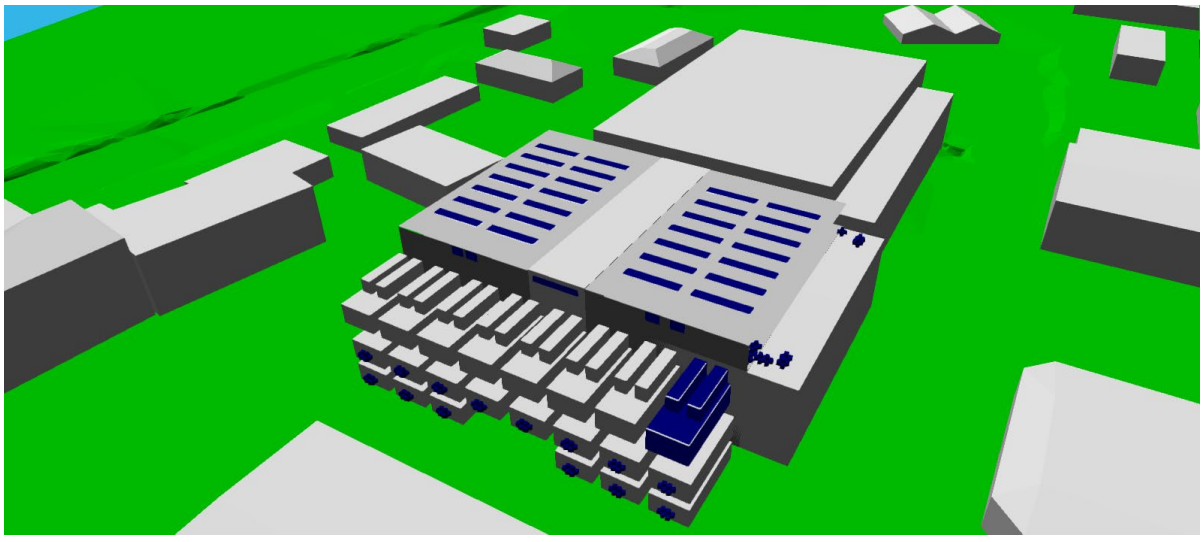


Figure 5: Sound propagation model: Normal Operation with Generator Testing (N)

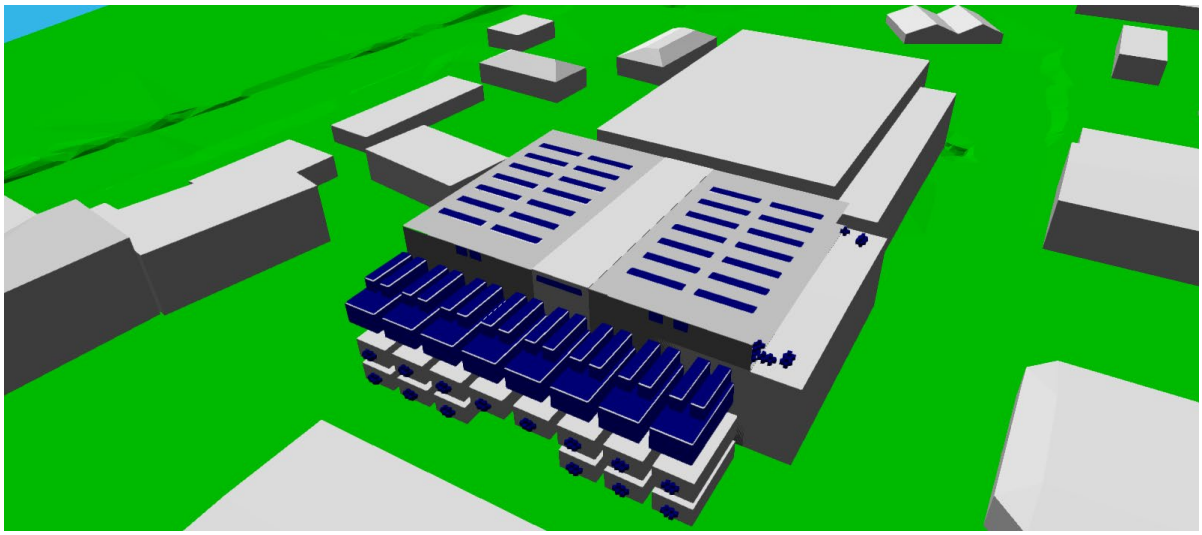


Figure 6: Sound propagation model: Emergency Operation

6.2.2 Noise Source Assumptions

The sound propagation model incorporates the following noise source emission limit information:

Main building: Level 03 chillers

The chillers on Level 03 have a total sound power level of 98 dB L_{wA} per unit. For a unit of nominal dimensions of 11.5 m by 2.5 m with height 2.5 m, this is approximately equal to a sound pressure level limit of 65 dB(A) at 10 m from the unit.

The assumed sound emission spectrum has been provided for the proposed selection and is shown in Table 8. The assumed distribution of sound power level is also shown, determined from a sound power level determination report for a similar representative chiller system.

Table 8: Level 03 Chiller sound power level spectrum

Plant	Sound power level, dB L_w (per octave band, Hz)								Overall sound power level, dB L_{wA}
	63	125	250	500	1k	2k	4k	8k	
Roof-top chiller (total)	94	96	100	95	91	90	84	79	98
Roof-top chiller (top only)	92	93	98	93	89	88	82	77	95
Roof-top chiller (long-side only, per side)	87	88	93	88	84	83	77	72	90
Roof-top chiller (short-side only, per side)	79	81	85	80	76	75	69	64	83

Main building: Level 03 condensing units

Roof-top condensing units with the following sound power levels are included:

- 8 No. units with sound power level of 78 dB L_{wA} per unit.
- 6 No. units with sound power level of 81 dB L_{wA} per unit.
- 12 No. units with sound power level of 89 dB L_{wA} per unit.

The sound level spectrum per octave band was determined from manufacturer's information for the specific unit selections.

Main building: Level 03 air handling units
Roof-top air handling units have the following case-radiated sound power levels:
- 6 No. units with case-radiated sound power level of 53 dB L_{wA} per unit.
- 2 No. units with case-radiated sound power level of 56 dB L_{wA} per unit.
- 4 No. units with case-radiated sound power level of 63 dB L_{wA} per unit.

Atmosphere-side grilles have the following sound power levels:
- 6 No. units with grille sound power level of 60 dB L_{wA} per unit.
- 2 No. units with grille sound power level of 67 dB L_{wA} per unit.
- 4 No. units with grille sound power level of 75 dB L_{wA} per unit.

Duct-borne noise from air handling ductwork grilles located on the main building Level 03 shall not exceed a sound pressure level limit of 70 dB(A) measured at 1m directly in front of the grille.

Office building: Condensing units
Office condensing units have the following sound power levels:
- 7 No. units with sound power level of 65 dB L_{wA} per unit.
- 2 No. units with sound power level of 67 dB L_{wA} per unit.
- 2 No. units with sound power level of 72 dB L_{wA} per unit.
- 4 No. units with sound power level of 52 dB L_{wA} per unit.
- 1 No. units with sound power level of 67 dB L_{wA} per unit.

Office building: Duct-borne noise from air handling grilles

Ductborne noise from external grilles associated with the office shall be limited as follows:
- Ductborne noise from north-facing grilles connected to AHUs and located at roof level shall not exceed a sound pressure level of 60 dB(A) measured at 1m directly in front of the grille.
- Ductborne noise from north-facing grilles connected to HRUs within the office shall not exceed a sound pressure level of 45 dB(A) measured at 1m directly in front of the grille.
- Ductborne noise from east-facing grilles associated with emergency systems (smoke ventilation) shall not exceed a sound pressure level of 75 dB(A) measured at 1m directly in front of the grille.

Generator gantry: Generators

The manufacturer's sound spectrum for the Kohler KD3500 diesel gen set has been used (Table 9) and adjusted such that the overall L_{wA} produces a level of 75dB(A) at 1m from each face of the generator, and the exhaust flue outlet. This has been calibrated at a 1m distance using the modelling software.

Based on the current layouts, noise from the generator will be limited as follows:
- The sound pressure level measured at 10 m from the generator enclosure shall not exceed 64 dB $L_{Aeq,T}$. Based on the current enclosure size, this is approximately the same as a sound pressure level limit of 75 dB $L_{Aeq,T}$ at 1 m from the enclosure.
- The above shall be measured with the generator operating at the expected duty and situated in free-space above a sound-reflecting plane (i.e. hemispherical sound propagation).
- Noise from the flue shall be limited to not exceed a sound pressure level limit of 75 dB(A) at 1 m horizontally from the flue termination.

Table 9: Generator sound pressure level spectrum

Plant	Sound pressure level, dB(Z), per octave band (Hz), at 1m from Generator								Total SPL at 1m	Total SPL at 10 m
	63	125	250	500	1k	2k	4k	8k	dB(A)	dB(A)
Enclosure general break-out	83	87	79	67	61	62	60	60	75	64
Inlet / outlet (≤16m^2 area)	87	90	72	61	59	60	61	71	76	65

Generator gantry: generator radiators

The generator radiators have the following sound power levels:

- Total sound power level of 93 dB L_{wA} per unit.
- Sound power level spectrum as shown in Table 10.
- Based on the current equipment size, this is approximately the same as a sound pressure level limit of 75 dB $L_{Aeq,T}$ at 1 m from the equipment.

Table 10: Generator radiator sound power level spectrum

Plant	Sound power level, dB L_w, per octave band (Hz)								Overall sound power level, dB L_{wA}
	63	125	250	500	1k	2k	4k	8k	
Generator radiator	98*	95	85	82	86	88	84	79	93
** Worst-case estimation/assumption due to lack of available sound power level information*									

Generator gantry: condensing units

Gantry condensing units associated with the Power Stream Rooms have the following sound power levels:

- 26 No. units with sound power level of 69 dB L_{wA} per unit.

Gantry condensing units associated positioned on the main building east elevation have the following sound power levels:

- 36 No. units with sound power level of 68 dB L_{wA} per unit.
- 2 No. units with sound power levels of 70 dB L_{WA} per unit

6.2.3 Assumptions Relating to Architecture

Noise Break-out from Data-halls and Plant Rooms

Noise break-out from high noise rooms and spaces within the building is assumed to be insignificant in comparison to the noise from outdoor plant systems for the following reasons:

- Horizontal noise break-out from the data-halls is limited through the lobbied nature of these spaces (there are no external walls bounding these spaces).
- Vertical noise break-out from the data-halls will be insignificant in comparison to noise from the roof plant.
- Indoor noise levels within the secondary plant rooms are not expected to be more than NR 70.

Acoustic screens and louvres
No purpose-built acoustic barriers or acoustic louvres are expected to be required.

The assessment includes the screening effect of the wall between the main building and the gantry between grid line SK and GA (shown in Figure 7). This wall will be imperforate and have a minimum mass per unit area of 15 kg/m^2.

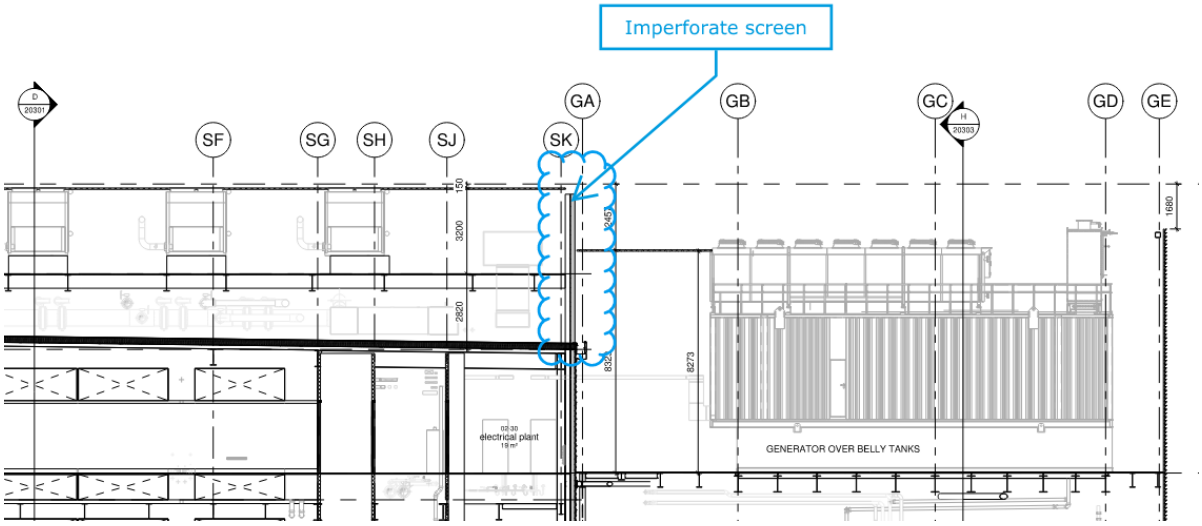


Figure 7: Screen between main building and gantry

Ductborne sound is to be reduced through attenuators within the ductwork. Therefore it is anticipated that no acoustic louvres will be required on any duct terminations.

The assessment includes the effect of the roof canopy situated above the chillers (as shown in Figure 8). The chiller discharge shall be ducted to the canopy. The canopy affects the propagation of sound from the chiller sides (located below the canopy)

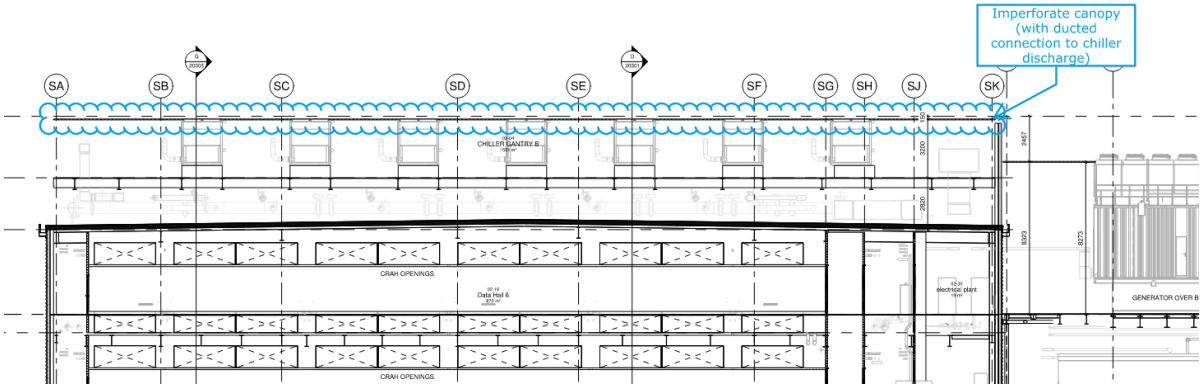


Figure 8: Main building roof canopy

6.2.4 Other Key Assumptions and Limitations

1. Noise source locations are as shown in Appendix 3.

2. The sound power level for the chiller has been provided by the Client as a single figure per octave band from all of the surfaces measured. It has been assumed that the majority of noise is emitted from the top surface of the chiller, with lower contributions from the sides, using detailed sound power level information for a similar and representative chiller unit.

3. In the absence of information on the specific measurement conditions of the sound power level of the generators (an overall figure averaged from measurements all around the generator is provided) it is assumed that the generator radiates equal sound levels from all faces.

4. Generators will be for emergency/maintenance testing use only.

5. Noise from the generators (when passed through the attenuators of the acoustic package) is not expected to be tonal or intermittent. The sound power level spectrum does not indicate any strong tonal properties to the noise.

6. Modelling predictions use the following settings and conditions:
   6.1. Sound propagation calculated according to ISO9613-2:1996
   6.2. 4 orders of reflection to account for canopy.
   6.3. General ground absorption hard ground (0.1).
   6.4. Temp: 20°C, RH: 70%

7. All receivers are in façade conditions, 1m from the receptor building, including sound reflections from the building. Background sound levels are therefore adjusted to façade conditions for a like-for-like comparison through the addition of 2.5 dB.

8. The details used in the modelling presented in this report have been provided by i3 Solutions and the design team and have been implemented by Ramboll based on the assumptions above. This report does not represent an acoustic design for the scheme and is not intended to provide Employer's Requirements or commissioning noise levels for contractors or designers.

6.2.5 Predicted Operational Noise Levels

Based on the above input data and assumptions, the predicted operational noise levels at each assessment location for each scenario are as shown in Table 11.

Contour maps showing predicted operational noise levels for each scenario at first floor height are shown in Appendix 4.

Table 11: Predicted operational noise levels

Location	Predicted specific sound level at receptor [dB $L_{Aeq,T}$]			
	Normal Operation	Normal Operation with Generator Testing (South)	Normal Operation with Generator Testing (North)	Emergency Operation
NSR01: 79-80 Buckingham Avenue offices	60.6	60.6	61.3	61.5
NSR02: 5 – 11 Buckingham Avenue East dwellings	48.1	48.3	48.5	50.1
NSR03: 5 – 38 Montrose Avenue dwellings	44.3	44.4	44.4	44.7
NSR04: Premier Inn Slough West	47.4	47.4	47.4	47.6

In the Normal Operation Scenario, operational noise predominantly originates from the chillers located on Level 03. Rooftop condensers provide a secondary contribution, with other plant items resulting in comparatively lower sound levels.

In the Emergency Operation Scenario, the emergency generators represent a secondary noise contribution at the nearest residential receptors, with the Level 03 chillers remaining the dominant noise source. The generators are the dominant noise source at the commercial office building to the north of the site (79-80 Buckingham Avenue).

6.3 Assessment of Effects at High Sensitivity Receptors: Normal Operation

An assessment in accordance with BS 4142 requires that the level of operational noise at nearest noise-sensitive receptors is quantified in terms of the rating level. The rating level includes a correction to account for acoustic characteristics that could draw more attention to the noise.

Operational noise from the proposed development will include noise from new noise sources that are not yet operating. As the noise sources are not yet operating it is not possible to assess the acoustic characteristics directly. Instead, the following corrections have been applied based on the expected noise source characteristics:

- **Tonality:** The proposed Level 03 chillers are the dominant source of operational noise during normal conditions. Noise from the individual chillers is not expected to contain any significant tonal features. Furthermore, the potential for tonal features from the proposed development being perceptible at the nearest high sensitivity receptors is very low due to the distance to the receptor (250m to NSR04, over 300m to NSR02 & NSR03) and due to presence of a multitude of other sites with sound emissions of an industrial or commercial nature. Therefore, no correction is applied for tonality.
- **Impulsivity:** The nature of the proposed plant and machinery is unlikely to result in any impulsive noises (crashes and bangs, etc.). Therefore, no correction is applied for impulsivity.

- **Intermittency:** It is not expected that the plant would operate continuously. In terms of total operational noise emissions from the site there are not expected to be any distinct on/off periods. Therefore, no correction is applied for intermittency.

Accounting for the above, the resulting rating levels and the initial assessment of impact are presented in Table 12 and Table 13 for the Normal Operation Scenario and the Normal Operation with Generator Testing Scenarios.

Table 12: Predicted rating levels and initial assessment: Normal operation: High Sensitivity Receptors

Receptor	Time of day	BS 4142: Initial assessment of impact: Normal Operation				
		Specific sound level	Feature correction	Rating level	Background sound level	Difference
NSR02: 5 – 11 Buckingham Avenue East dwellings	Day	48 dB $L_{Aeq,T}$	0 dB	48 dB $L_{Ar,Tr}$	58 dB $L_{A90,T}$	-10 dB
	Night				50 dB $L_{A90,T}$	-2 dB
NSR03: 5 – 38 Montrose Avenue dwellings	Day	44 dB $L_{Aeq,T}$	0 dB	44 dB $L_{Ar,Tr}$	56 dB $L_{A90,T}$	-12 dB
	Night				50 dB $L_{A90,T}$	-6 dB
NSR04: Premier Inn Slough West	Day	47 dB $L_{Aeq,T}$	0 dB	47 dB $L_{Ar,Tr}$	60 dB $L_{A90,T}$	-13 dB
	Night				47 dB $L_{A90,T}$	0 dB

Table 13: Predicted rating levels and initial assessment: Normal operation with Generator Testing: High Sensitivity Receptors

Receptor	Time of day	BS 4142: Initial assessment of impact: Normal Operation with Generator Testing (worst-case)				
		Specific sound level	Feature correction	Rating level	Background sound level	Difference
NSR02: 5 – 11 Buckingham Avenue East dwellings	Day	49 dB $L_{Aeq,T}$	0 dB	49 dB $L_{Ar,Tr}$	58 dB $L_{A90,T}$	-9 dB
NSR03: 5 – 38 Montrose Avenue dwellings	Day	44 dB $L_{Aeq,T}$	0 dB	44 dB $L_{Ar,Tr}$	56 dB $L_{A90,T}$	-12 dB
NSR04: Premier Inn Slough West	Day	47 dB $L_{Aeq,T}$	0 dB	47 dB $L_{Ar,Tr}$	60 dB $L_{A90,T}$	-13 dB

Table 12 and Table 13 demonstrate that the operational noise rating level during the normal operation scenarios is not expected to exceed the existing background sound level at any high sensitivity receptor during the night-time, and is expected to be at least 10 dB below the existing

background sound level during the daytime. This is an indication that operational noise from the proposed development during normal operations would have a low impact, and meets the typical noise control requirements of SBC.

The predicted operational noise rating level is closest to the existing background sound level at NSR04 (hotel). It is noted that the façade to the receptor building is sealed due to the proximity to the adjacent road network, with ventilation provided mechanically. This building envelope is likely to provide a sound level difference (from outdoors to indoors) of at least 25 dB. Therefore, operational noise from the proposed development would be no more than 22 dB $L_{Aeq,T}$ indoors. This indoor operational noise level is not expected to result in any adverse effects in terms of sleep disturbance or annoyance.

In summary, operational noise during all normal operation scenarios is not expected to result in any adverse effects and does not exceed the typical requirements of SBC.

6.4 Assessment of Effects at High Sensitivity Receptors: Emergency Operation

The expected level of operational noise during the Emergency Scenario at each receptor is shown in Table 14.

The rating level has been determined assuming the character of operational noise during the Emergency Scenario remains the same as the Normal Operation Scenarios (since the Level 03 Chillers remain the dominant source of industrial sound).

Table 14: Predicted rating levels and initial assessment: Emergency operation: High Sensitivity Receptors

Receptor	Time of day	BS 4142: Initial assessment of impact: Emergency Operation				
		Specific sound level	Feature correction	Rating level	Background sound level	Difference
NSR02: 5 – 11 Buckingham Avenue East dwellings	Day	50 dB $L_{Aeq,T}$	0 dB	50 dB $L_{Ar,Tr}$	58 dB $L_{A90,T}$	-8 dB
	Night				50 dB $L_{A90,T}$	0 dB
NSR03: 5 – 38 Montrose Avenue dwellings	Day	45 dB $L_{Aeq,T}$	0 dB	45 dB $L_{Ar,Tr}$	56 dB $L_{A90,T}$	-11 dB
	Night				50 dB $L_{A90,T}$	-5 dB
NSR04: Premier Inn Slough West	Day	48 dB $L_{Aeq,T}$	0 dB	48 dB $L_{Ar,Tr}$	60 dB $L_{A90,T}$	-12 dB
	Night				47 dB $L_{A90,T}$	+1 dB

Table 14 demonstrates that the operational noise rating levels during the emergency operation scenario (when all generators are active) are not significantly different to the rating levels expected under normal operation. The expected rating level is not expected to exceed the existing background sound level at most high sensitivity receptor during the night-time, and is expected to be at least 8 dB below the existing background sound level during the daytime. The expected rating level marginally exceeds the existing background sound at night at NSR04.

The above is an indication that operational noise from the proposed development during emergency operations would have a low impact at most receptors. This also meets the typical

noise control requirements of SBC (a rating level of no more than 10 dB above the existing background sound level).

The predicted operational noise rating level is marginally above the existing background sound level at NSR04 (hotel). As noted above, the façade to the receptor building is sealed. Under emergency conditions, operational noise from the proposed development would be no more than 23 dB $L_{Aeq,T}$ indoors. This indoor operational noise level is also not expected to result in any adverse effects in terms of sleep disturbance or annoyance.

In summary, operational noise during emergency operations is not expected to result in any adverse effects and does not exceed the typical requirements of SBC.

6.5 Assessment of Effects at the Medium Sensitivity Receptor

The expected level of operational noise during each scenario at the medium sensitivity receptor (NSR01: office use) is shown in Table 14. It is noted that the BS 4142 methodology is intended to be applied to determine the "*likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident*.". Therefore, the BS 4142 initial assessment is provided for information only. The evaluation of the likely effects of operational noise requires consideration of context and receptor sensitivity, and SBC accept a higher level of operational noise at medium sensitivity receptors such as offices.

The proposed Level 03 chillers are the dominant source of operational noise during all scenarios at this receptor. Noise from the individual chillers is not expected to contain any significant tonal features. Furthermore, the potential for tonal features from the proposed development being perceptible at this receptor is low due to the presence of other sites with sound emissions of an industrial or commercial nature, including directly adjacent to the receptor. Therefore, no feature corrections have been applied for tonality, impulsivity, or intermittency.

No assessment is presented for night-time on the assumption that the NSR01 receptor building would not normally be occupied or noise-sensitive at night.

Table 15: Predicted rating levels and initial assessment: Medium Sensitivity Receptors

Receptor	Scenario	Time of day	BS 4142: Initial assessment of impact: Medium sensitivity receptor				
			Specific sound level	Feature correction	Rating level	Background sound level	Difference
NSR01: 79-80 Bucking-ham Avenue offices	Normal	Day	61 dB $L_{Aeq,T}$	0 dB	61 dB $L_{Ar,Tr}$	56 dB $L_{A90,T}$	+5 dB
	Normal with Generator Testing	Day	61 dB $L_{Aeq,T}$	0 dB	61 dB $L_{Ar,Tr}$	56 dB $L_{A90,T}$	+5 dB
	Emergency	Day	62 dB $L_{Aeq,T}$	0 dB	62 dB $L_{Ar,Tr}$	56 dB $L_{A90,T}$	+6 dB

Table 15 demonstrates that the operational noise rating levels during the normal operation scenarios exceeds the background sound level by 5 dB, and during emergency operation (when all generators are active) exceeds the background sound level by 6 dB. Considering the receptor sensitivity, this outcome is an indication that operational noise would have a low impact. This also meets the typical noise control requirements of SBC (a rating level of no more than 5 dB above the existing background sound level during normal operational conditions).

Table 15 demonstrates that, during emergency conditions, operational noise would also meet the typical noise control requirements of SBC (a rating level of no more than 10 dB above the existing background sound level) at this receptor.

Considering context, BS 8233:2014 provides guideline indoor noise levels for office workspaces for the purposes of providing an acoustic environment fit for study and work requiring concentration. Guideline values for staff rooms, meeting rooms and training rooms range from 35 to 45 dB $L_{Aeq,T}$ whereas a greater level of noise is recommended for open plan areas for the purposes of acoustic privacy in shared spaces (45 to 50 $L_{Aeq,T}$). The receptor building NSR01 is a sealed façade, and it is assumed that the office areas are mechanically ventilated. This building envelope is likely to provide a sound level difference (from outdoors to indoors) of at least 25 dB. Therefore, indoor sound levels due to the proposed development would be no more than 36 dB $L_{Aeq,T}$ during any normal operation scenario and no more than 37 dB $L_{Aeq,T}$ during emergency operations. These indoor sound levels are close to the lower end of the indoor noise level guidelines in BS 8233:2014 and are unlikely to result in any adverse effects on study or work requiring concentration.

In summary, operational noise is not expected to result in any adverse effects at medium sensitivity receptors (such as disruption of work required concentration) and does not exceed the typical requirements of SBC.

6.6 Road Traffic Noise Effects

Road traffic flow data is not available for assessment at the time of writing this report. However, road traffic flows would need to change by 25% for the resultant noise level to change by 1 dB. A change in noise level of 1 dB would be considered to be negligible. On this basis, it is expected that a data centre usage on this site would provide negligible changes in road traffic noise levels.

6.7 Assessment Outcome

It is concluded that, based on input data and assumptions presented above, operational noise from the proposed development under all scenarios would result in a low impact. Expected operational noise levels do not exceed the typical noise control requirements of SBC under each scenario. The proposed development therefore is in line with national and local planning policy objectives relating to noise.

7. NOISE CONTROL REQUIREMENTS

7.1 Overview

The noise impact assessment presented above demonstrates that the potential for adverse effects due to operational noise has been minimised, subject to the installation being consistent with the assumptions applied as part of the assessment.

This section presents industrial sound level limits that are to apply at the nearest receptors, and describes the key assumptions incorporated into the assessment.

7.2 Operational Noise Limits

As per the requirements of SBC, operational noise during normal conditions shall not exceed the prevailing background sound level for residential receptors (and not exceed 5 dB above the prevailing background sound level for office receptors). The same limits are applied during routine testing of generators, which will take place in the daytime only.

Noise limits during emergency operation or power back-up have been set at 10 dB above the prevailing background sound level.

The proposed plant noise limits are set out in the tables below, based on the typical background noise levels measured. The Rating Level should include any penalties to the methodology of BS 4142:2014+A1:2019. The sum of all fixed plant installations associated with the scheme has been designed to meet the total plant noise rating levels given below.

Table 16 - Operational noise limits: normal operation and maintenance testing

Location	Plant noise rating level at sensitive receptors (façade conditions), dB $L_{Ar,Tr}$	
	Day [09:00 – 17:00]	Night [23:00 – 07:00]
NSR01: 79-80 Buckingham Avenue (office)	61	N/A
NSR02: 5 – 11 Buckingham Avenue East	58	50
NSR03: 5 – 38 Montrose Avenue	56	50
NSR04: Premier Inn	60	47

Table 17 - Operational noise limits: emergency operation

Location	Plant noise rating level at sensitive receptors (facade conditions), dB $L_{Ar,Tr}$	
	Day [09:00 – 17:00]	Night [23:00 – 07:00]
NSR01: 79-80 Buckingham Avenue (office)	66	N/A
NSR02: 5 – 11 Buckingham Avenue East	68	60
NSR03: 5 – 38 Montrose Avenue	66	60
NSR04: Premier Inn	61	57

7.3 Expected Mitigation Requirements

In order to achieve the operational noise level presented in the assessment, the following measures will need to be accounted for. These measures account for the proposed sound sources and the proposed layout and include architectural measures as well as specifications for the primary plant systems.

7.3.1 Architectural design

Two architectural features are incorporated into the design that affect the propagation of operational noise - the screen shown in Figure 7 and the canopy shown in Figure 8. These features shall be installed to be consistent in dimensions with the proposed layouts.

The canopy and screen shall be specified to have a minimum mass per unit area of 15 kg/m^2 such that both features act as an effective acoustic screen.

7.3.2 Mechanical and electrical design

The proposed mechanical and electrical noise sources shall be designed, specified, and installed, such that the sound emission levels shown in Section 6.2.2 are not exceeded.

In summary, the key requirements are as follows:

- Level 03 chillers shall have a total sound power level per unit of no more than 98 dB(A);
- Generators shall be specified within an acoustic enclosure that achieves a sound pressure level of no more than 64 dB $L_{Aeq,T}$ at 10 m from the generator enclosure. Based on the current enclosure size, this is approximately the same as a sound pressure level limit of 75 dB $L_{Aeq,T}$ at 1 m from the enclosure.
- Noise from individual generator flues shall be limited to not exceed a sound pressure level limit of 75 dB(A) at 1 m horizontally from the flue termination.
- Generator radiators shall have a total sound power level per unit of no more than 93 dB(A);
- Duct-borne noise from air handling ductwork grilles located on the main building Level 03 shall not exceed a sound pressure level limit of 70 dB(A) measured at 1m directly in front of the grille; and
- All other systems to be specified in line with the sound emission levels shown in Section 6.2.2.

In addition, generator maintenance testing shall be carried out during daytime only.

Where systems are varied in quantity, location or sound output, the implications will need to be reviewed by an acoustician. Where operational noise emissions could be greater, the noise impact assessment presented within this report will need to be updated and further noise control measures incorporated, where necessary, to ensure that the operational noise limits in Section 7.2 are not exceeded.

8. CONCLUSIONS

Ramboll Acoustics has been appointed by I3 Solutions to prepare a noise impact assessment in support of an Environmental Permit application for the proposed Lon-3 data centre within the Slough Trading Estate. The proposed development comprises a datacentre building with ancillary and office spaces, and the provision of mechanical and electrical plant and machinery associated with datacentre operations.

The proposed development has the potential to result in sound of an industrial or commercial nature, at the nearby noise sensitive receptors.

Following consultation with Slough Borough Council, the assessment of operational noise has been carried out in accordance with British Standard 4142:2014+A1:2019 informed by an environmental noise survey carried out in the vicinity of the site. This assessment has included operational noise level predictions based on the noise source emission assumptions provided by the Client team and set out within this report.

The assessment demonstrates that, based on input data and assumptions, operational noise from the proposed development under all scenarios would result in a low impact. Expected operational noise levels do not exceed the typical noise control requirements of SBC under each scenario. The proposed development therefore is in line with national and local planning policy objectives relating to noise.

Where systems are varied in quantity, location or sound output, the implications will need to be reviewed by an acoustician. Where operational noise emissions could be greater, the noise impact assessment presented within this report will need to be updated and further noise control measures incorporated, where necessary, to ensure that the operational noise limits in Section 7.2 are not exceeded.

This report is prepared in support of the Environmental Permit application for the proposed development. It is not intended to present the acoustic design specifications for the facility. Specifications for plant and other noise sources stated within this report are for the purpose of assessing the operational noise impacts only.

The measures taken to reduce uncertainty in this assessment are described within Appendix 5.

APPENDIX 1 – ACOUSTIC GLOSSARY

Table A1-1: Glossary of acoustic terminology

Terminology	Definition
Ambient sound level	The total sound pressure level in a given position from all surrounding sources of noise, both near and far. Normally expressed as an equivalent continuous A-weighted sound pressure level, dB $L_{Aeq,T}$.
A-weighting	The process of weighting the observed sound pressure level at each frequency band, to approximate the sensitivity of the human ear to sounds of different frequencies. A-weighted sound pressure levels are expressed as dB(A) or dB L_{Ap}.
Decibel	A logarithmic value quantifying the sound pressure at a specified position or sound power. relative to a reference sound pressure or sound power (20 µPa for sound pressure, 10^{-12} W for sound power).
Façade	A sound monitoring position is a "façade" position when it includes a strong reflection from an adjacent building or structure. This corresponds with a position that is between 1 and 2 metres away from a reflecting building or structure.
Free-field	A sound monitoring position is a "free-field" position when it is not affected by sound reflections from surrounding buildings and structures. This corresponds with a position at least 3.5 metres away from reflecting buildings or structures.
Frequency	The number of oscillations per second of a vibrating particle in a medium, measured in Hertz (Hz) or cycles per second.
$L_{A90,T}$	The A-weighted sound pressure level exceeded during 90% of the time interval, T. Typically used to quantify the background sound level at a specified position.
$L_{Aeq,T}$	The equivalent continuous A-weighted sound pressure level over a time interval, T. This is an energy-average sound pressure level over the specified time period.
$L_{AFmax,T}$	The maximum A-weight sound pressure level during a specified time interval, T. Measured with "fast" time-weighting (which approximates the time-response of the human ear).
Noise	Unwanted or undesirable sounds observed by a listener.
Octave band	A frequency band used in acoustical measurements. An octave is a frequency interval between two sounds where the frequency of the lower sound is half the frequency of the upper sound. The human hearing range is divided into ten logarithmically equal frequency divisions called octave bands, with centre-band frequencies as follows: (16 Hz, 32 Hz,) 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 16000 Hz.
Rating level, $L_{Ar,Tr}$	The specific sound level plus a correction accounting for acoustic features such as impulses, tones, intermittent features, or any other characteristics that draw more attention to the sound source.
Residual sound level	The equivalent continuous A-weighted sound pressure level of the ambient sound remaining at a specified position when the specific sound source (the sound source being assessed) does not contribute to the ambient sound.
Reverberation	The reflection of sound from room surfaces, resulting in the prolongation or persistence of a sound in a room.

Terminology	Definition
Reverberation time	Time, in seconds, required for the sound pressure level in a room to decrease by 60 dB after a sound source has stopped. Long reverberation times are present in large empty rooms with hard surfaces (e.g. a cathedral); short reverberation times are present in smaller rooms with soft furnishing (e.g. typical living room, a recording studio).
Sound	The vibration, or oscillation, of particles in a medium, such as air, which may be detected by the human ear.
Sound absorption	The reduction of sound energy by transmission through an absorbing medium such an "acoustically soft" material or surface which results in a reduced reflection of incident sound.
Sound insulation	The ability of architectural elements or structures to reduce the transmission of sound, predominantly due to the reflection of sound incident on the element or structure. Typically measured as the difference in sound pressure levels between a "source" room containing a loudspeaker and an adjacent "receiving" room.
Sound power level	A logarithmic measurement that quantifies the total sound power of a source emitted in all directions relative to a reference sound power (W_{ref} = 1 pW or 10^{-12} W). Equal to 10 $\log_{10}$ (W / W_{ref}) and expressed in decibels.
Sound pressure level	A logarithmic measurement that quantifies the sound pressure at a specified position relative to a reference sound pressure (p_{ref} = 20 µPa). Equal to 20 $\log_{10}$ (p / p_{ref}) and expressed in decibels.
Specific sound level	The equivalent continuous A-weighted sound pressure level at a specified position due to the specific sound source (the sound source being assessed).

Table A1-2: Range of sound pressure levels in typical environments

Source of sound or environment	Typical SPL, dB(A)
Inside a sealed anechoic chamber (acoustic test chamber)	Around 20
A quiet bedroom at night	Around 30
A busy library	Around 40
A busy office environment	Around 50
Beside an urban high street	Around 60
Beside a busy urban trunk road	Around 70
In a cinema during an action sequence; vacuum cleaner in the home	Around 80
Pneumatic drill breaking concrete at a few metres	Around 90
In the audience at a loud rock concert	Around 100
Dance floor of a modern nightclub	Around 110
Threshold of pain	120

APPENDIX 2 – NOISE SURVEY DETAILS

Equipment
The measurement instrumentation used during the noise survey is shown in Table A2-1.

Table A2-1: Measurement equipment details

Sound Level Meter		Microphone		Calibrator		Measurement Location(s)
Type	Serial #	Type	Serial #	Type	Serial #	
01 dB Fusion	15265	GRAS 40AE	562247	Cirrus CR:515	102107	LT1
Svantek 971A	127629	ACO Pacific 7152	82004	Svantek SV33B	139039	ST1, ST2
NTi Audio XL2-TA	A2A-09209-E0	NTi Audio MC230	8072	Larson Davis CAL20	16089	ST1

The calibration of all sound level meters was checked with a field calibrator before and after the measurements and no significant drifts were observed. All equipment owned or hired by Ramboll is subject to regular calibration checks traceable to national standards.

Calibration certificates are available upon request.

Observations
The sources of noise that contributed to the noise climate at each measurement location were noted during the installation and collection of equipment, and during attended measurements. These are summarised in Table A2-2.

Table A2-2: Noise climate observations

Measurement Location	Observations
LT1	Frequent road traffic movements on Buckingham Avenue were the dominant source of environmental noise at this location. Plant noise from fixed plant installations at the data centre on the opposite side of Buckingham Avenue (74 – 75 Buckingham Avenue) was also a main noise source and dominant in breaks in traffic.
ST1	Frequent road traffic movements on A355 Farnham Road were the dominant source of environmental noise during both daytime and night-time. High-frequency tonal plant noise from a louvre on the northern façade of The Centre, Farnham Road, was audible during the daytime and the dominant noise source during breaks in intermittent road traffic at night. Distant road traffic noise from the east was also audible at night.
ST2	Frequent road traffic movements on Montrose Avenue were the dominant source of environmental noise during daytime measurements. Distant road traffic to the east and industrial noise to the west were also audible in breaks in road traffic. Industrial plant noise to the west was the dominant noise source during night-time measurements. Vehicles travelling on Montrose Avenue were infrequent at night.

Weather Conditions

Weather conditions were observed to be suitable for measurement (low wind speeds and no precipitation) during all attended measurements.

Historical weather data from a local weather station (Weather Underground station reference ISLOUG12) indicates conditions were suitable for measurement throughout the survey period, with the exception of 02:00 to 15:00 on Tuesday 19 December due to rainfall. Data obtained during this period has been excluded from the analysis.

Weather data for the whole survey period is presently graphically as Figure A3-1 to Figure A3-3.

Figure A3-1: Air temperature data from local weather station

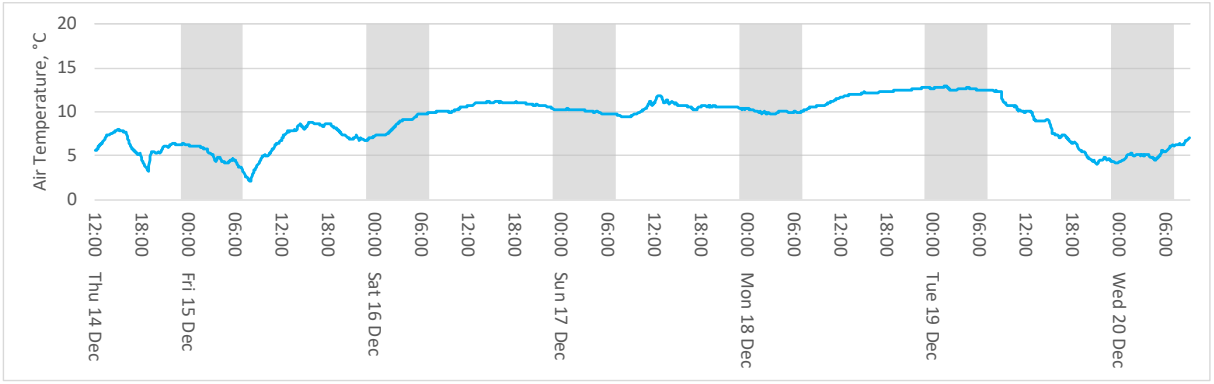


Figure A3-2: Rainfall data from local weather station

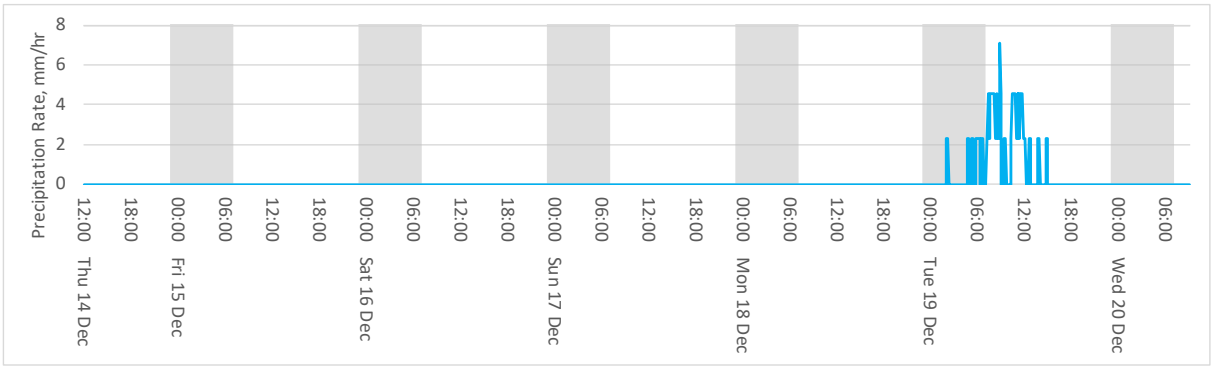
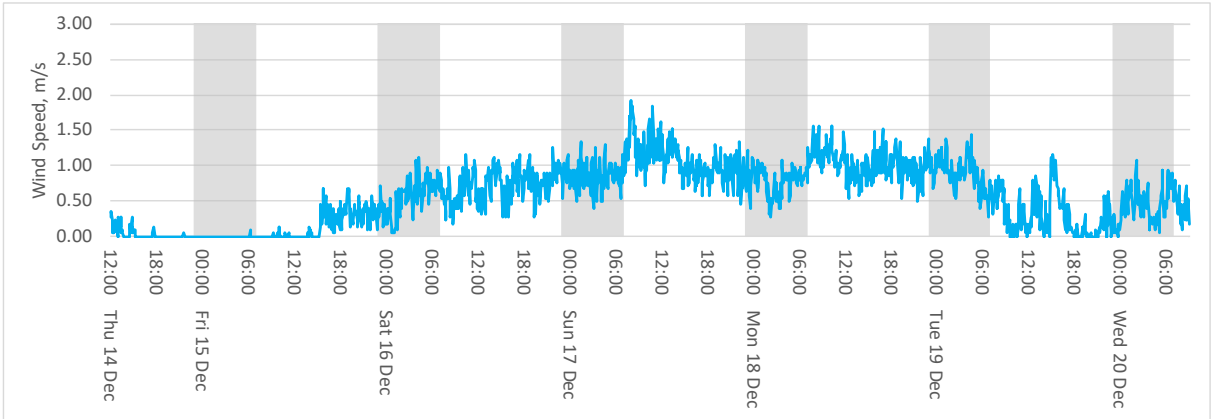


Figure A3-3: Wind speed data from local weather station



Noise Survey Measurement Results

The sound level parameters determined during each 24-hour period at location LT1 are shown in Table A2-3. A time history is presented as Figure A2-1.

Table A2-3: Noise measurement results at location LT1 in free-field conditions

Date	Equivalent continuous SPL, dB $L_{Aeq,T}$		Typical one-percentile SPL, dB $L_{AF01,1hour}$	Most commonly occurring background sound level, dB $L_{A90,15min}$	
	Office hours, T=8 hour [09:00-17:00]	Night-time, T=8 hour [23:00-07:00]	Office hours, T=8 hour [09:00-17:00]	Office hours [09:00-17:00]	Night-time [23:00-07:00]
Thursday 14 December	-	58	74	54	49
Friday 15 December	64	56	73	53	49
Saturday 16 December	63	56	72	53	50
Sunday 17 December	62	57	71	53	49
Monday 18 December	64	60	72	56	54
Tuesday 19 December†	68	58	77	57	50
Representative value	**62 to 64**	**56 to 60**	**72**	**53**	**49**

- denotes an incomplete measurement period.

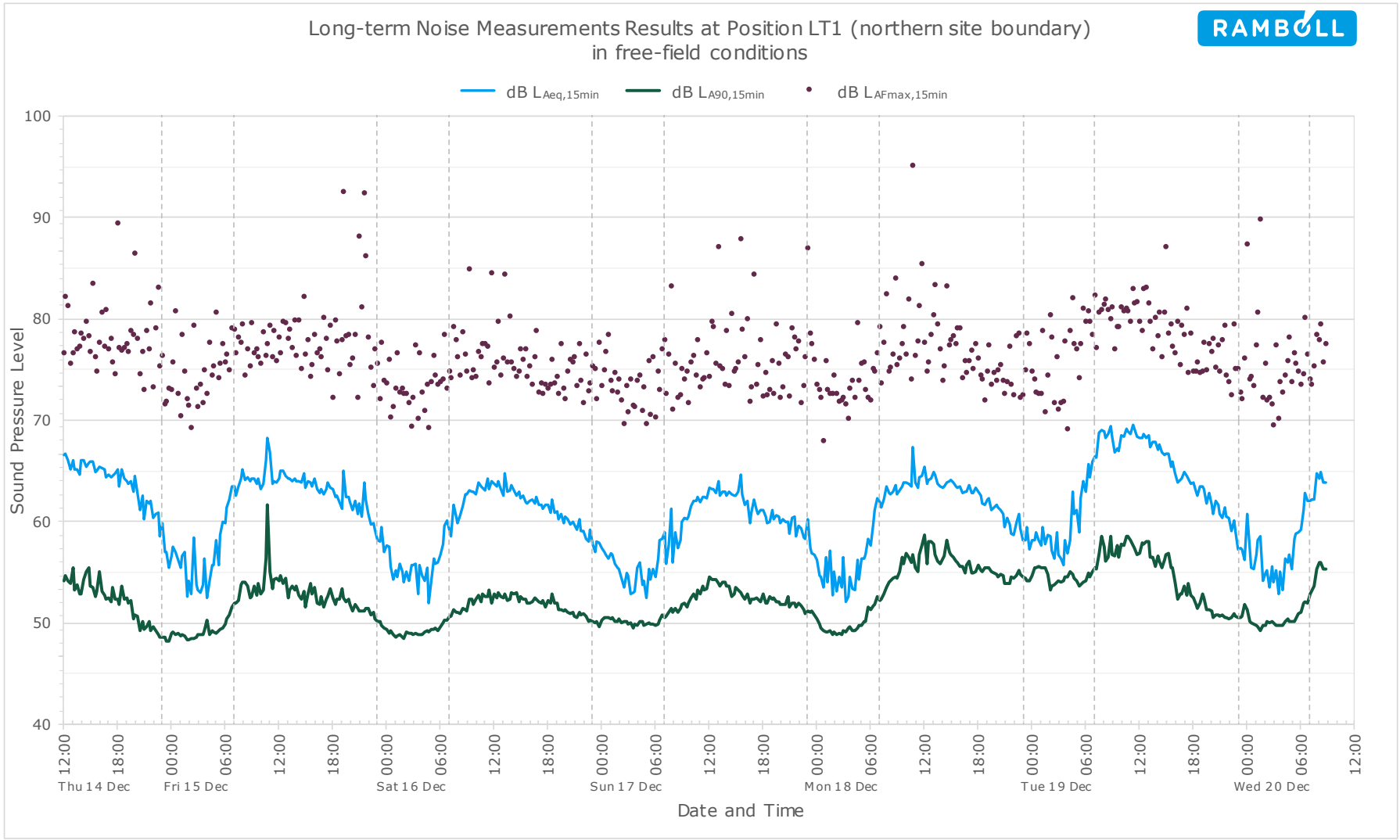
† measurements on this day were affected by periods of sustained rainfall and were excluded from the analysis.

Table A2-4 presents a summary of additional attended noise measurements taken on Wednesday 20 December 2023.

Table A2-4: Attended noise measurement results in free-field conditions

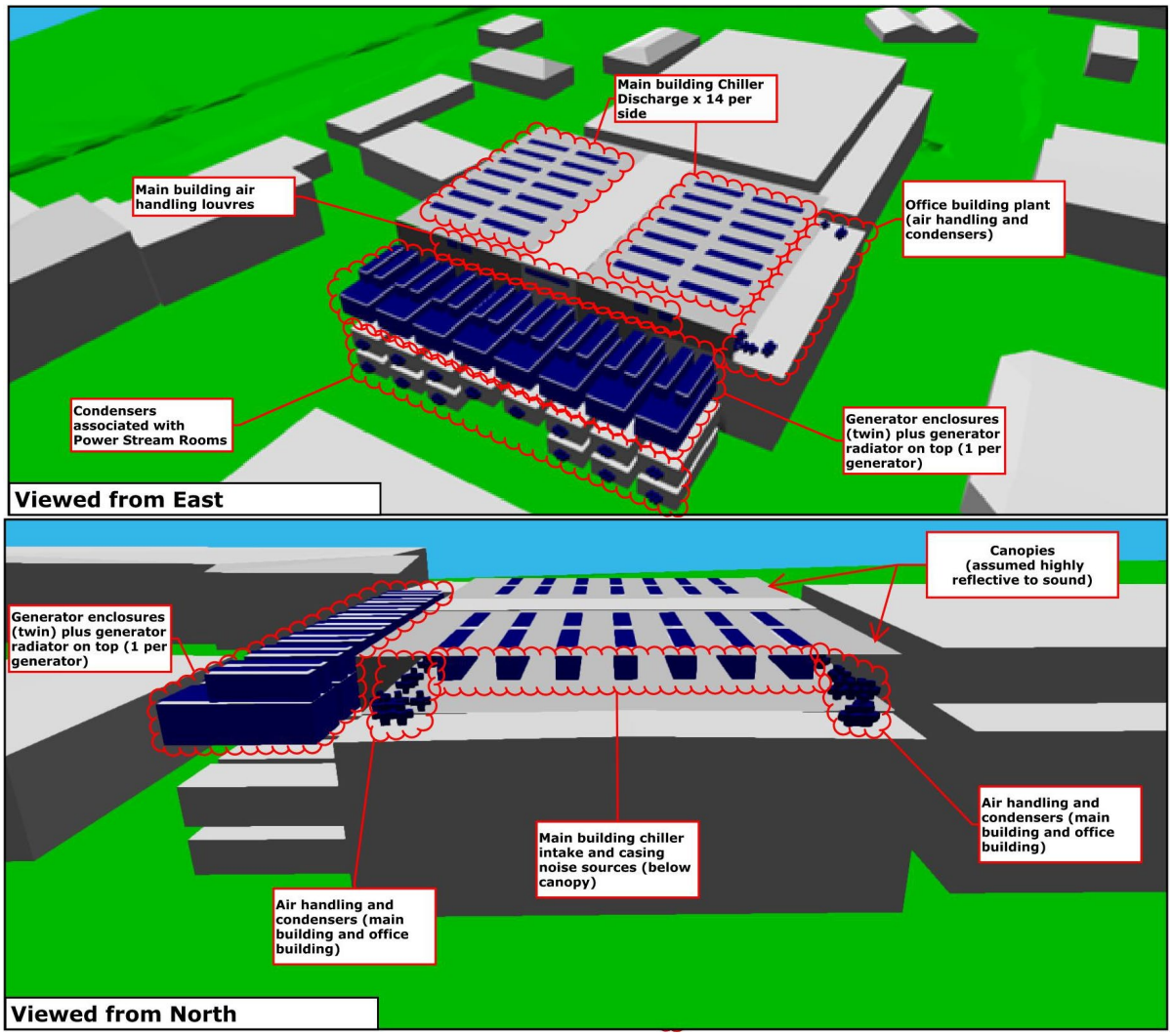
Measurement Location	Measurement period (T)	Equivalent continuous SPL, dB $L_{Aeq,T}$	Maximum SPL, dB $L_{AFmax,T}$	Background sound level, dB $L_{A90,T}$
ST1	02:20 – 02:35 (15min)	51	64	47
	03:07 – 03:22 (15min)	52	62	48
	09:35 – 09:50 (15min)	59	72	56
	10:00 – 10:15 (15min)	59	73	55
	11:00 – 11:15 (15min)	59	71	56
ST2	02:45 – 03:00 (15min)	52	72	47
	03:30 – 03:45 (15min)	53	75	47
	09:35 – 09:50 (15min)	64	82	55
	10:30 – 10:45 (15min)	63	78	53
	11:00 – 11:15 (15min)	65	81	55

Figure A2-1: Long-term noise measurements results at position LT1



APPENDIX 3 – NOISE SOURCE ASSUMPTIONS

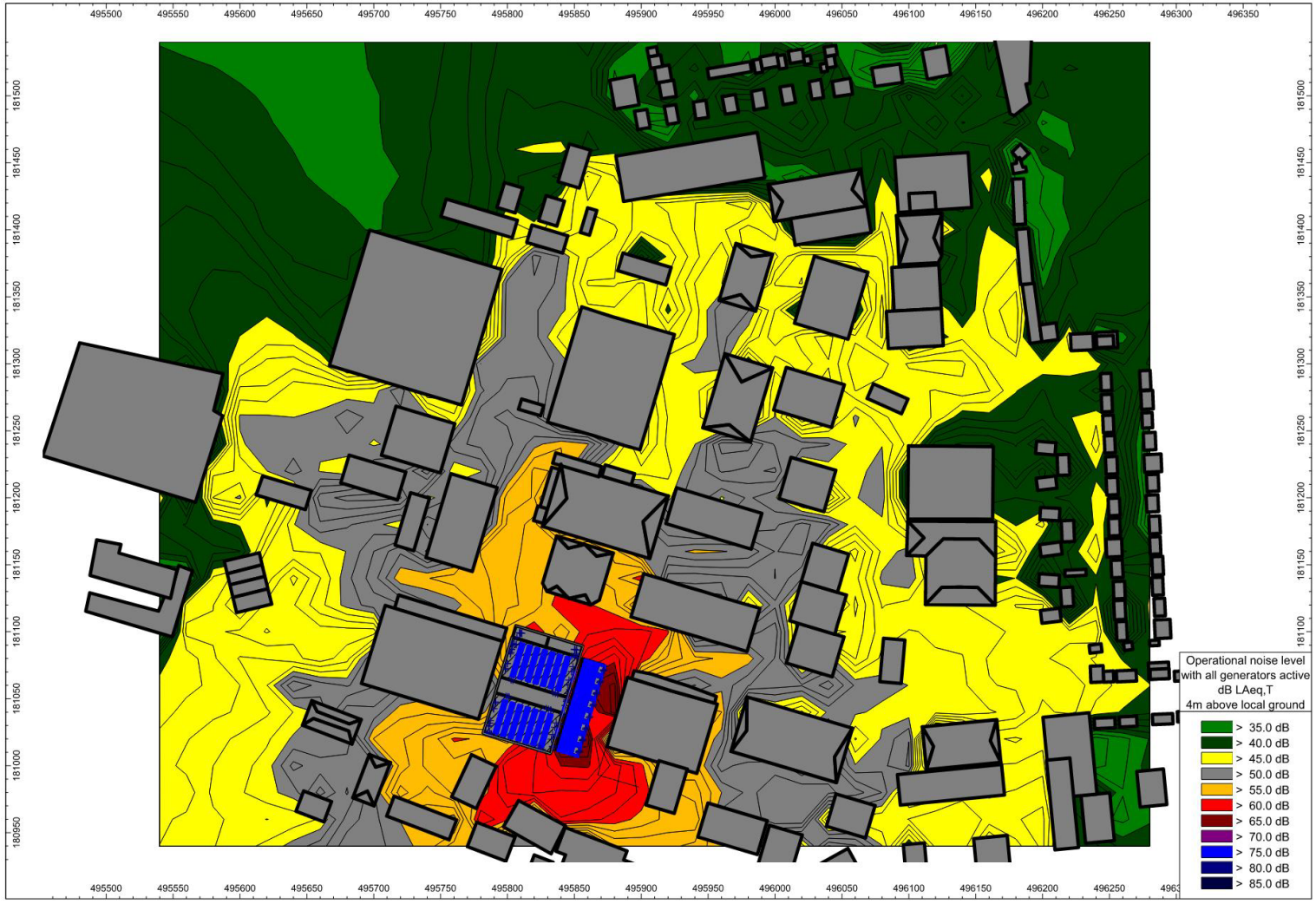
Figure A3-1: Noise source locations



APPENDIX 4 – NOISE LEVEL CONTOURS

Figure A4-1: Operational noise contour map: normal operation, no generators active

Figure A4-2: Operational noise contour map: emergency operation, all generators active



APPENDIX 5 – UNCERTAINTY

An assessment in accordance with BS 4142:2014+A1:2019 requires consideration of the potential effects of uncertainty on the assessment outcome. The effect of some types of uncertainty cannot be easily quantified. For this reason, the approach taken during this assessment has been to ensure control measures are in place to minimise uncertainty as far as practicable. The control measures are listed below. Primarily, the assessment was undertaken by suitably qualified practitioners, using established best practice methods of measuring and predicting sound levels and applying professional judgement throughout the assessment.

After minimising uncertainty through these measures, the resulting assessment is deemed suitable for establishing the potential for long-term effects due to operational noise.

Table A5-1: Control measures taken to reduce uncertainty

Possible source of uncertainty	Control measures to reduce uncertainty
Selection of representative assessment locations	Initial appraisal and desk study carried out beforehand. Assessment and noise monitoring locations agreed with the client. Site walk-over was carried out to select measurement positions in terms of noise climate before measurements were taken.
Background sound level: measurement uncertainty	Measurements carried out with Class 1 (BS EN 61672-1:2013) instrumentation with effective windshield to minimise turbulence at the microphone. Calibration level checked before and after the survey. Background sound level measured over a period of several days to include the day and night. Representative value then determined using the typical average background sound level while excluding periods deemed to be atypical.
Background sound level: effects of weather	Noise survey carried out under suitable weather conditions for environmental noise measurement, and weather conditions reported. Measurement results affected by periods of rain excluded from the analysis. Wind velocity during the survey was not sufficient to affect the measured background sound level. The background sound levels presented are considered representative of typical conditions in the absence of adverse weather conditions.
Specific sound level: source level uncertainty	Source emission levels for new sources were agreed with the client beforehand. The source emission levels will also form source emission limits for each system during the detailed design and procurement stages.
Sound propagation uncertainty	Sound propagation predictions carried out using best industry practice (computational modelling applying ISO 9613-2). Industrial sound level predictions apply under moderate downwind conditions at the assessment location (a moderate wind between source and receptor). This is considered suitable for evaluating the worst-case condition.
Rating level: acoustic feature corrections	Acoustic feature corrections applied based on expected character of sound at the receptor location.
Context	Observations carried out during noise survey to assess the context into which the sound sources will be introduced. Consideration of the existing industrial sound level context forms part of the assessment.