WHP Engineering Ltd

Oxford Biomedica Extension, Application 3

Noise Impact Assessment

18584411/03 – August 2023

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BUREAU VERITAS

Document Control Sheet

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Contact Details		
Company Name	Bureau Veritas UK Limited	WHP Engineering Ltd
Contact Name	Craig Scott	Mike Walsh
Position	Business Unit Manager	Project Manager
Address	Atlantic House Atlas Business Park Wythenshawe M22 5PR	Riverside House Delta Bank Road Metro Riverside Park Gateshead NE11 9DJ
Telephone	[redacted]	[redacted]
e-mail		
Websites	www.bureauveritas.com	whp-engineering.com

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	Name	Job Title	Signature
Prepared By	Y Hao MIOA	Principal Consultant	[redacted]
Approved By	R Cope MIOA	Technical Director	[redacted]

Contents

Executive Summary

Bureau Veritas was instructed by WHP Engineering Ltd to undertake an environmental noise impact assessment for proposed extension to the Oxford Biomedica site in Oxford.

The noise impact assessment is in accordance with the methodology set out in BS4142:2014 'Methods for rating and assessing industrial and commercial sound'.

To establish the current levels of ambient and background sound level at the nearest residential receptors, a measurement survey was undertaken in April 2023.

Existing ambient noise levels at the nearest residential receptors are dominated by road traffic, along with birdsong at daytime and occasional light aircraft flyover.

A computational noise model of the site was assembled and populated with noise emission data of the new sound sources associated with the proposed extension. Standard noise propagation calculations were used to predict the noise levels of the new sound sources at the nearest noise sensitive receptors.

The assessment concludes that the noise impact of the plant operation would be Low at the nearest sensitive receptors. No additional noise mitigation measures would be required.

1 Introduction

1.1 Bureau Veritas was instructed by WHP Engineering Ltd to undertake an environmental noise impact assessment for proposed extension to the Oxford Biomedica site in Oxford.

1.2 The purpose of this assessment is to provide an indication of its potential impacts on sensitive receptors off site in terms of noise, based on current guidance and best practice.

1.3 The report also details the baseline noise surveys, assessment methods used, and mitigation measures if required.

1.4 A glossary of acoustic terminology is included in **Appendix One**.

2 Site Location

2.1 The proposed extension and associated plants are within the Oxford Biomedica site in Oxford. The site is located within Oxford Business Park. The unit is surrounded by existing residential properties to the north, west and south, with properties to the west and south separated from the unit by Hollow Way and Garsington Road. To the east are the remaining units which form Oxford Business Park.

2.2 It is anticipated, based on a previous Bureau Veritas assessment of an Oxford BioMedica manufacturing facility at Yarnton, that it will operate 24 hours a day.

2.3 The nearest residential dwellings are identified as those situated approximately 75 m to the southwest of the building, off St Luke's Road, those situated approximately 25 m to the west of the building, off Hollow Way and those approximately 50 m to the north of the building, off Fern Hill Road.

2.4 The locations of the nearest sensitive receptors (NSRs) are shown in **Appendix Two**.

3 Details of Development

3.1 Key elements of the proposed scheme include the following:

- Two-storey extension to accommodate further Class E(g) floorspace
- Relocation of existing fire escape
- Relocated external plant
- Additional car parking including identification of EV Charging spaces
- Cycle shelter
- Security fencing / boundary treatments
- Smokers hut and breakout area (retrospective); and
- 2no. new CRF chillers

3.2 The site layouts, showing the locations of the plant items are shown in **Appendix Three**.

4 Criteria for Assessment

Guidance and Planning Policy

National Planning Policy Framework, 2021

4.1 The Revised NPPF (July 2021) sets out the Government's planning policies for England. It states:

> *"174. Planning policies and decisions should contribute to and enhance the natural and local environment by: …*
>
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and …"*

4.2 It goes on to state:

> *"185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *a) 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 [NPSE – see below];*
>
> *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and…"*

4.3 The terms 'significant adverse impact' and other adverse impacts are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE), which states:

> *There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:*
>
> *NOEL – No Observed Effect Level*
>
> *This is 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*
>
> *LOAEL – Lowest Observed Adverse Effect Level*
>
> *This is the level above which adverse effects on health and quality of life can be detected.*
>
> *Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.*
>
> *SOAEL – Significant Observed Adverse Effect Level*
>
> *This is the level above which significant adverse effects on health and quality of life occur*

4.4 It should be noted that specific noise limits for LOAEL and SOAEL have not yet been specifically defined, and would be specific to different sectors. However, guidance from other acoustic standards may be employed to determine suitable levels within the overall principle of the NPPF.

4.5 The Planning Practice Guidance for Noise (PPGN) provides further detail about how the effects of noise can be categorised. Table 4.1 summarises the noise exposure hierarchy.

Table 4.1: National Planning Practice Guidance Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. 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
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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			
Present and disruptive	The noise causes a material change in the behaviour, attitude or other physiological response, 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
Present and very disruptive	Extensive and regular changes in the behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Oxford Local Plan 2036 (Adopted 8th June 2020)

4.6 The Oxford Local Plan 2036 looks ahead 20 years and beyond, giving consideration to how it can best address the pressures and challenges Oxford faces. In specific relation to noise pollution, the following policies are relevant to this with assessment:

Policy RE8: Noise and vibration

"Planning permission will only be granted for development proposals which manage noise to safeguard or improve amenity, health, and quality of life.

Planning permission will not be granted for development that will generate unacceptable noise and vibration impacts.

Planning permission will not be granted for development sensitive to noise in locations which experience high levels of noise, unless it can be demonstrated, through a noise assessment, that appropriate attenuation measures will be provided to ensure an acceptable level of amenity for end users and to prevent harm to the continued operation of existing uses.

Conditions will be used to secure such mitigation measures and operational commitments.

…"

Technical Guidance

4.7 The newly installed plant items associated with the proposed extension are the noise sources considered in the assessment, therefore British Standard 4142 is the main guidance for the assessment, along with the other relevant references, to assess the potential noise impact on the nearby sensitive receptors.

4.8 The relevant guidance documents are listed below:

- British Standard 4142: 2014+A1:2019*, "Methods for rating and assessing industrial and commercial sound"* (BS4142);
- British Standard 8233: 2014, *"Guidance on sound insulation and noise reduction for buildings"*; and

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

4.9 The Standard provides a method for assessing whether a sound from industrial or commercial premises (e.g., fixed mechanical and electrical (M&E) plant, loading activities etc.) is likely to cause a disturbance to persons living in the vicinity of the site.

4.10 BS 4142 assesses potential significance of effect by comparing the 'specific sound level' of an industrial source to the typically representative background sound level (L_{A90}). Certain acoustic features can increase the potential for a sound to attract attention, and therefore increase its relative significance than that expected from a simple comparison between the specific sound level and the background sound level. In particular, BS 4142 identifies noise that contains discrete impulses and/or audible tonal qualities and in these cases recommends that a correction be added to the specific sound level. The specific sound level along with any applicable correction is referred to as the 'rating level'.

4.11 The greater the difference between the rating level and the background sound level; the greater the likelihood of complaints. The assessment criteria given by BS 4142 are as follows:

- A difference of +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of +5 dB could be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an 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.

- Also to take into account the absolute level, risk that it will cause annoyance/interference with everyday activities, context of the sound, frequency and temporal variations to the sound.

4.12 During the daytime and evening, BS 4142 requires that sound levels are assessed over 1-hour periods. During the night-time, because sleep disturbance is the important issue and individual sound events are, therefore, more important, sound levels are assessed over 15-minute periods.

British Standard 8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings

4.13 BS 8233:2014 provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.

4.14 With regards to external sound sources affecting habitable residential spaces, Table 4 of BS 8233:2014 provides guideline values that it is desirable to not exceed during daytime and night-time periods. These guideline values are reproduced in Table 4.1.

Table 4.1: Indoor ambient sound levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

4.15 For traditional external areas that are used for amenity space, such as gardens and patios, BS8233 states that it is desirable that the external sound level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

5 Baseline Sound Levels

Nearest Sensitive Receptors

5.1 To establish the ambient and background sound levels at the nearest residential receptors, attended and unattended baseline monitoring was carried out during 5th to 6th April 2023.

5.2 The measurement locations were adjacent to the noise sensitive receptors off Fern Hill Road (LT) and a representative location (ST) for NSR1 and NSR2. The measurement locations are shown in **Appendix Two**.

5.1 All measurements were undertaken in free-field conditions at a height of approximately 1.5 m above ground. The noise monitoring equipment was calibrated at the beginning and end of the assessment period using an acoustic calibrator, which had itself been calibrated against a reference set traceable to National and International Standards. No shift in calibration level was observed.

5.2 During the daytime measurement survey, the meteorological conditions comprised a slight (1-2 m/s) breeze from SSW. The temperature was 9 °C, cloudy, with 71% humidity and an atmospheric pressure of 1021 mb.

5.3 Local road traffic noise was predominant and constant at the NSRs, along with birdsong and occasional light aircraft flyover. Plant noise from the cooler units was just audible in absence of road traffic at LT. No plant noise from the data centre was audible at ST.

5.4 At night, there was a slight (3-4 m/s) breeze from south. The temperature was 9-10 °C, light rain and cloudy, with 94% humidity and an atmospheric pressure of 1012 mb.

5.5 Local road traffic noise was predominant and constant at the NSRs.

5.6 Table 5.1 presents a summary of the sound level survey results.

Table 5.1: Summary of Derived Sound Levels at the short-term monitoring location (ST)

Monitoring Location	Date	Period	Start time	Sound Pressure Level, dB re: 20µPa (Fast, Free-field)			
				$L_{Aeq,1h}$	$L_{Amax,1h}$	$L_{A10,1h}$	$L_{A90,1h}$
ST	05/04/2023	Daytime	11:00	66.9	95.6	68.8	52.5

5.7 As shown in Table 5.1, at quiet daytime periods, the measured sound levels are 53 dB $L_{A90,T}$ and 67 dB $L_{Aeq,T}$ at ST.

5.8 Table 5.2 presents a summary of the sound level survey results during the long-term monitoring. The full long-term measurement data is shown in **Appendix Four**.

Table 5.2: Summary of Derived Sound Levels at the long-term monitoring location

Date	Period	Sound Pressure Level, dB re: 20µPa (Fast, Free-field)			
		$L_{Aeq,1h}$	$L_{Amax,1h}$	$L_{A10,1h}$	$L_{A90,1h}$
05-06/04/23	Day	47 – 54 Average 49	62 - 81 Average 68	50 – 53 Average 51	44 – 47 Mode 45
	Night	44 – 53 Average 47	59 – 79 Average 68	45– 58 Average 49	42 – 45 Mode 42

5.9 To undertake a robust assessment, the representative background sound levels were determined to be **53** dB L_{A90} for NSR1 and **45** dB L_{A90} for NSR2 and NSR3 during the daytime period. **42** dB L_{A90} is the representative background sound level for the NSRs during night-time.

Sound Source Measurements

5.10 Source sound emission measurements were also conducted by Bureau Veritas on 5th April 2023 on site to obtain emission data for the significant sound sources for noise prediction of the proposed development.

5.11 The weather conditions during this survey were dry and calm, with wind speeds of 1-2 m/s, typically of SSW direction. The temperature was 9 ºC.

5.12 In general, the significant sound sources on site comprised of:

- Chiller units near fire escape stairs;
- Chiller units near bins;
- Liquid nitrogen storage area and pressurisation;
- CRF chillers; and
- Daikin units

5.13 Table 5.3 shows the sound levels of the plant units on site.

5.14 The locations and the photos of the plant units are shown in **Appendix Five**.

Table 5.3: Sound Spectra of the plant units

	Sound sources	Sound Pressure Level SPL (dBA)	Octave Band Sound Power Level SWL (dB)							
			63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
1	Chiller units near fire escape stairs	57@1m	33	41	45	51	53	47	43	37
2	J&E Hall refrigeration units	58@1m	35	45	49	50	52	53	47	40
3	Liquid nitrogen storage area and pressurisation	58@1m	30	39	44	46	51	51	52	54
4	CRF chillers	65@1m	42	50	58	57	59	58	55	47
5	Daikin units	67@1.5m	41	47	58	58	62	62	59	50

6 Noise and Vibration Assessment

6.1 The impact assessment with respect to the plant noise and vibration on the existing environment covers the following issues:

- Potential operational vibration associated with the plant items; and
- Potential operational noise associated with the plant items

6.2 Due to the typically low vibration levels that are likely to be generated, it is expected that operational plants would not result in perceptible vibration impacts on any of the sensitive receptors. Therefore, no further assessment of operational vibration was undertaken.

6.3 The assessment of the noise impact of site operation is based on the ambient sound levels ($L_{Aeq,T}$) and the background sound levels ($L_{A90,T}$) measured/derived in April 2023. The sound levels of the plant operation at the nearest sensitive receptors are calculated by noise modelling, using CadnaA.

6.4 Noise propagation was predicted using algorithms described in ISO 9613-2, as incorporated within the noise modelling software. The 4 m acoustic fence to the north of the Daikin units is included in the model.

6.5 Based on the site layout provided, the significant operational sound sources are mainly:

- 2no. new CRF chillers;
- Existing Daikin units;
- Existing CRF chillers;
- Emergency generator (i.e., in the event of a major power outage or grid failure); and
- Relocated external chiller plants; and
- Car parking

6.6 It is noted that there are changes to the layout of the car park associated with the Oxbox to the south. According to the Transport Statement by HVJ Transport Ltd, the changes to the car parking spaces include:

- 32 no. general staff parking spaces added to the existing 128 car parking spaces;
- 2no. disabled parking spaces added to the existing 4 car parking spaces;
- 12no. new EV parking spaces (no existing EV parking currently); and
- 13no. new motorcycle parking spaces (no existing motorcyle parking currently)

6.7 There was no generator maintenance or test arranged during the project periods, therefore the generator noise emission data is based on BV measurement data obtained at similar sites. The existing generators are placed in enclosures, and the typical sound level of generator in an enclosure is 81 dB L_{Aeq} at 1 m. The measured spectrum of generator noise is shown in **Appendix Six**.

6.8 The maintenance is assumed to occur at daytime only (0700-2300), and emergency generator operation may occur both daytime and night-time (2300-0700). The operation of the emergency generator operation is temporary, short-term and infrequent.

6.9 The assessment therefore is undertaken with two scenarios:

- Emergency generator not in operation; and
- Emergency generator in operation.

6.10 Worst-cases are used to allow the greatest level of flexibility in the development. It is assumed all the plant items run continuously 24/7, except for emergency generator. The modelled sound emission rates comprise:

- New CRF chiller unit = 71 dB L_{WA}, operating 24 hrs/day;
- Existing Daikin unit = 80 dB L_{WA}, operating 24 hrs/day;
- Existing CRF chiller unit = 71 dB L_{WA}, operating 24 hrs/day;
- Emergency generator = 101 dB L_{WA}, operating in need;
- Relocated external chiller plant = 66 dB L_{WA}, operating 24 hrs/day; and
- Sound power levels modelled using octave spectral distribution.

6.11 The heights of the point noise sources are assumed as the centre of each noise source.

6.12 It is noted that the visits of large vehicles are expected to remain consistent with the level of operation under the current consent. Based on the site survey, the HGV movements were not considered as a significant sound source in the site operation and therefore scoped out of detailed assessment.

Plant Noise – BS4142 Assessment

6.13 The calculated specific sound levels at the nearest receptors during the two operation conditions are shown in **Table 6.1** below.

Table 6.1: Predicted Sound Levels on the nearest facades at ground floor (day)

Receptor(s)	Sound Pressure Level, dB $L_{Aeq,T}$ (Emergency generator NOT in operation)	Sound Pressure Level, dB $L_{Aeq,T}$ (Emergency generator in operation)
NSR1	31	34
NSR2	27	31
NSR3	27	43

6.14 The predicted specific sound levels at the nearest receptors during the night-time operation are shown in **Table 6.2** below.

Table 6.2: Predicted Sound Levels on the nearest facades at first floor (night)

Receptor(s)	Sound Pressure Level, dB $L_{Aeq,T}$ (Emergency generator NOT in operation)	Sound Pressure Level, dB $L_{Aeq,T}$ (Emergency generator in operation)
NSR1	31	35
NSR2	26	32
NSR3	29	45

6.15 **Figures A7.1** to **Figure A7.4** in **Appendix Seven** show the predicted sound propagation grids at 1.5 m (ground floor) at daytime and 4 m (first floor) at night.

6.16 The indicative assessments to BS 4142:2014 are provided in **Table 6.3** to **Table 6.6**, below:

6.17 The results in **Table 6.3** to **Table 6.5** indicate that, during the daytime period, the predicted sound levels generated by the plant units would result in no impact at the nearest residential receptors, with emergency generator operational or not operational.

6.18 The results in **Table 6.6** indicate that, at night, the predicted sound levels generated by the operation of the plant units would result in no impact at NSR1 and NSR2. The rating level of generator noise is 4 dB above the background sound level at NSR3, however given the very low chance of emergency operation during night, it is believed the emergency operation of the generators has low impact at NSR3. It is noted that the results with emergency operation in the tables are based on the worst-case $L_{Aeq,\ 1h}$ for daytime and $L_{Aeq,15min}$ for night-time, as required by BS4142 assessment.

6.19 A sound reduction of 15 dB is expected through a partially open window for ventilation, therefore internal plant noise levels would meet the limit in BS8233 guidelines for bedrooms (30 dB $L_{Aeq,8h}$).

6.20 As such, no additional noise mitigation measures are required.

Table 6.3: Indicative BS 4142:2014 Assessment - Emergency generator NOT in operation - Day

Description	Result	Relevant Clauses of BS 4142:2014	Commentary
Specific Sound Level (free-field)	$L_{Aeq,T}$ = 31 dB (NSR1) $L_{Aeq,T}$ = 27 dB (NSR2) $L_{Aeq,T}$ = 27 dB (NSR3)	7.3.6	Predicted level (free-field) at ground floor level at the nearest receptor. Determined by calculation using CadnaA.
Background sound level	53 dB (NSR1) 45 dB (NSR2) 45 dB (NSR3)	8.1 and 8.2	The background noise levels (free-field) were measured at the monitoring locations close to the noise-sensitive receptors.
Acoustic features correction	+0 dB	9.2	No perceptible tone or other distinctive acoustic features are predicted to be audible at the receptors due to the high background level.
Rating Level	31 dB (NSR1) 27 dB (NSR2) 27 dB (NSR3)		
Excess of Rating Level over Background Sound Level	-22 dB (NSR1) -18 dB (NSR2) -18 dB (NSR3)		
Assessment of impact: indication of no impact due to the plant noise at the receptors		11	
Context		11 8.2	Plant noise levels predicted to be well below existing ambient and background sound levels at all receptor locations.
Uncertainty of the assessment		10	The specific noise level has been predicted by CadnaA, which utilises ISO9613 calculations, which have a claimed uncertainty of +/- 3 dB. The background

Description	Result	Relevant Clauses of BS 4142:2014	Commentary
			sound levels at the receptors are decided based on the short-term noise monitoring at NSR3.

Table 6.4: Indicative BS 4142:2014 Assessment - Emergency generator NOT in operation - Night

Description	Result	Relevant Clauses of BS 4142:2014	Commentary
Specific Sound Level (free-field)	$L_{Aeq,T}$ = 31 dB (NSR1) $L_{Aeq,T}$ = 26 dB (NSR2) $L_{Aeq,T}$ = 29 dB (NSR3)	7.3.6	Predicted level (free-field) at 1st floor window at the nearest receptors. Determined by calculation using CadnaA.
Background sound level	42	8.1 and 8.2	The background noise levels (free-field) were measured at the monitoring locations close to the noise-sensitive receptors.
Acoustic features correction	+0 dB	9.2	No perceptible tone or other distinctive acoustic features are predicted to be audible at the receptors.
Rating Level	31 dB (NSR1) 26 dB (NSR2) 29 dB (NSR3)		
Excess of Rating Level over Background Sound Level	-11 dB (NSR1) -16 dB (NSR2) -13 dB (NSR2)		
Assessment of impact: indication of no impact due to the plant noise at NSRs.		11	
Context		11 8.2	A sound reduction of 15 dB is expected through a partially open window for ventilation, therefore internal plant noise levels would be well below BS8233 guidelines for bedrooms (30 dB $L_{Aeq,8h}$).
Uncertainty of the assessment		10	The specific noise level has been predicted by CadnaA, which utilises ISO9613 calculations, which have a claimed uncertainty of +/- 3 dB.

Table 6.5: Indicative BS 4142:2014 Assessment - Emergency generator in operation - Day

Description	Result	Relevant Clauses of BS 4142:2014	Commentary
Specific Sound Level (free-field)	$L_{Aeq,T}$ = 34 dB (NSR1) $L_{Aeq,T}$ = 31 dB (NSR2) $L_{Aeq,T}$ = 43 dB (NSR3)	7.3.6	Predicted level (free-field) at ground floor level at the nearest receptor. Determined by calculation using CadnaA.
Background sound level	53 dB (NSR1) 45 dB (NSR2) 45 dB (NSR3)	8.1 and 8.2	The background noise levels (free-field) were measured at the monitoring locations close to the noise-sensitive receptors.
Acoustic features correction	+0 dB (NSR1) +0 dB (NSR2) +2 dB (NSR3)	9.2	No perceptible tone or other distinctive acoustic features are predicted to be audible at the receptors due to the high background level at NSR1 and NSR2, but perceptible tonality might be audible at NSR3.
Rating Level	34 dB (NSR1) 31 dB (NSR2) 45 dB (NSR3)		
Excess of Rating Level over Background Sound Level	-19 dB (NSR1) -14 dB (NSR2) +0 dB (NSR3)		
Assessment of impact: indication of no impact due to the plant noise at the receptors		11	
Context		11 8.2	Plant noise levels predicted to be well below existing ambient and background sound levels at all receptor locations.
Uncertainty of the assessment		10	The specific noise level has been predicted by CadnaA, which utilises ISO9613 calculations, which have a claimed uncertainty of +/- 3 dB. The background sound levels at the receptors are decided based on the short-term noise monitoring at NSR3.

Table 6.6: Indicative BS 4142:2014 Assessment - Emergency generator in operation - Night

Description	Result	Relevant Clauses of BS 4142:2014	Commentary
Specific Sound Level (free-field)	$L_{Aeq,T}$ = 35 dB (NSR1) $L_{Aeq,T}$ = 32 dB (NSR2) $L_{Aeq,T}$ = 45 dB (NSR3)	7.3.6	Predicted level (free-field) at 1st floor window at the nearest receptors. Determined by calculation using CadnaA.
Background sound level	42	8.1 and 8.2	The background noise levels (free-field) were measured at the monitoring locations close to the noise-sensitive receptors.
Acoustic features correction	+0 dB (NSR1) +0 dB (NSR2) +2 dB (NSR3)	9.2	No perceptible tone or other distinctive acoustic features are predicted to be audible at the receptors due to the high background level at NSR1 and NSR2, but perceptible tonality might be audible at NSR3.
Rating Level	35 dB (NSR1) 32 dB (NSR2) 47 dB (NSR3)		
Excess of Rating Level over Background Sound Level	-7 dB (NSR1) -10 dB (NSR2) +5 dB (NSR2)		
Assessment of impact: indication of no impact due to the plant noise at NSR1 and NSR2, and low impact at NSR3.		11	
Context		11 8.2	A sound reduction of 15 dB is expected through a partially open window for ventilation, therefore internal plant noise levels would meet BS8233 guidelines for bedrooms (30 dB $L_{Aeq,8h}$). The emergency generator is in operation infrequently and short-term.
Uncertainty of the assessment		10	The specific noise level has been predicted by CadnaA, which utilises ISO9613 calculations, which have a claimed uncertainty of +/- 3 dB.

Car Park Noise

6.21 The results of the CadnaA noise model have been used to generate colour contour noise maps (see Figure A7.5 in Appendix Seven) which are able to help assess the noise impact caused by the changes to the car parking. The use of the car parking mainly occurs during daytime when the office is open.

6.22 The results of the noise modelling have shown that the impact of the car park will be highest for dwellings at NSR1 which be exposed to a noise level of $L_{Aeq,16h}$ 40 dB during the daytime.

6.23 Table 6.1 below shows the noise impact arising from the proposed changes of car park at the most exposed dwelling.

Table 6.7: Car Park Assessment

Receptor	Baseline without Development $L_{Aeq,16h}$ dB	Predicted Car Park $L_{Aeq,16h}$ dB	Future with New Car Park $L_{Aeq,16h}$ dB	Change in dB	Magnitude of Impact
NSR1	67	40	67	0	Negligible

6.24 The table above shows that the closest receptors are to experience an insignificant impact in terms of noise increases for the new proposed car park. It is likely that existing residents will not perceive any change in noise levels due to the operation of the proposed car park.

7 Conclusions

7.1 Bureau Veritas was instructed by WHP Engineering Ltd to undertake an environmental noise impact assessment for proposed extension to the Oxford Biomedica site in Oxford.

7.2 According to BS4142 assessment, the predicted daytime sound levels generated by the plant items would not result in a significant noise impact at the nearest noise sensitive receptors. At night, taking account of the context, the assessment also determined that the noise impacts at night will be not significant.

7.3 The proposed new car park will not result in the noise level increase at the nearest noise sensitive receptors and therefore, has no adverse noise impact.

7.4 The noise impact of the plants is therefore assessed as being Low at the nearest sensitive receptors. No additional noise mitigation measures are needed.

Appendix One – Glossary of Acoustic Terminology

Sound power level	A logarithmic measure of the power of a sound relative to a reference value.
"A" Weighting (dB(A))	The human ear does not respond uniformly to different frequencies. "A" weighting is commonly used to simulate the frequency response of the ear. It is used in the assessment of the risk of damage to hearing due to noise.
Decibel (dB)	The range of audible sound pressures is approximately 2 x 10^{-5} Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0 dB to 140 dB.
Ambient sound level, $L_{Aeq,T}$	equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T. NOTE The ambient sound level is a measure of the residual sound and the specific sound when present.
Background sound level, $L_{90,T}$	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.
Maximum sound level, $L_{Amax,T}$	The maximum RMS A-weighted sound pressure level occurring within a specified time period.
Noise	Unwanted sound.
Ambient sound	Totally encompassing sound in a given situation at any given time composed of noise from many sources, near and far.
Residual sound	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.
Rating level	Specific sound level plus any adjustment for the characteristic features of the sound.

Appendix Two – NSRs and Baseline Monitoring Locations

Appendix Three – Site Layout

Appendix Four – Long-term Monitoring Data

Start Date and Time	$L_{Aeq,1h}$	$L_{Amax,1h}$	$L_{A10,1h}$	$L_{A90,1h}$
05/04/2023 12:05	49.4	81.1	50.8	45.5
05/04/2023 13:05	48.6	68.0	50.5	45.2
05/04/2023 14:05	50.6	70.5	52.7	45.5
05/04/2023 15:05	49.4	71.5	50.3	45.6
05/04/2023 16:05	47.8	64.8	49.5	45.2
05/04/2023 17:05	48.4	61.5	50.6	45.6
05/04/2023 18:05	49.7	67.5	51.3	46.7
05/04/2023 19:05	49.0	65.7	51.3	45.1
05/04/2023 20:05	48.8	66.3	51.3	45.1
05/04/2023 21:05	48.3	65.8	50.9	45.1
05/04/2023 22:05	47.3	63.5	50.0	44.2
05/04/2023 23:05	46.8	65.7	49.4	43.8
06/04/2023 00:05	45.6	58.8	47.7	43.3
06/04/2023 01:05	44.9	58.5	46.6	42.5
06/04/2023 02:05	44.3	65.9	45.4	42.1
06/04/2023 03:05	44.0	64.5	45.3	41.6
06/04/2023 04:05	46.1	72.7	48.9	42.2
06/04/2023 05:05	52.2	78.9	49.4	43.0
06/04/2023 06:05	53.3	76.2	58.2	44.8
06/04/2023 07:05	54.3	79.1	52.3	45.7
06/04/2023 08:05	49.6	66.1	52.0	46.0
06/04/2023 09:05	48.7	64.3	51.7	44.8

Appendix Five – Locations and photos of plant units

	Sound sources	Photos
1	Chiller units near fire escape stairs	

2	J&E Hall refrigeration units	
3	Liquid nitrogen storage area and pressurisation	
4	CRF Chillers	

5	Daikin units	

Appendix Six – Sound Spectrum of Generator Noise

25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
88.4	84.2	86.2	80.3	82.7	84.8	76.2	75.5	76.5	85.9	88	85.3	84.2	82.5	77.3	74.6	74.6	69.8	70.7	70.5	65.3	63.9	64.2	62.8	58.3	55.7	51.4

Appendix Seven – Noise Contours

Figure A7.1: Indicative Specific Sound Level (Day) - Emergency generator NOT in operation – 1.5 m above ground

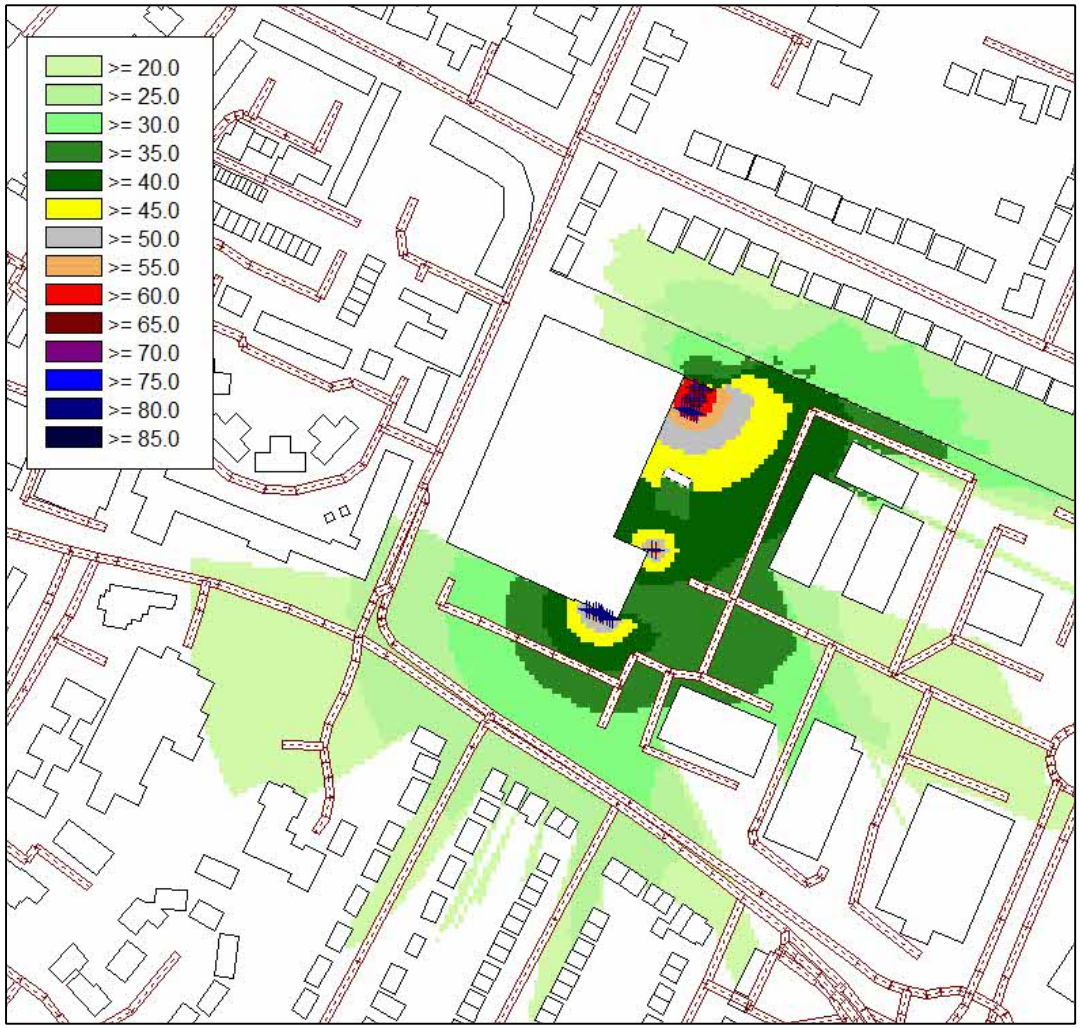

Figure A7.2: Indicative Specific Sound Level (Day) - Emergency generator in operation – 1.5 m above ground

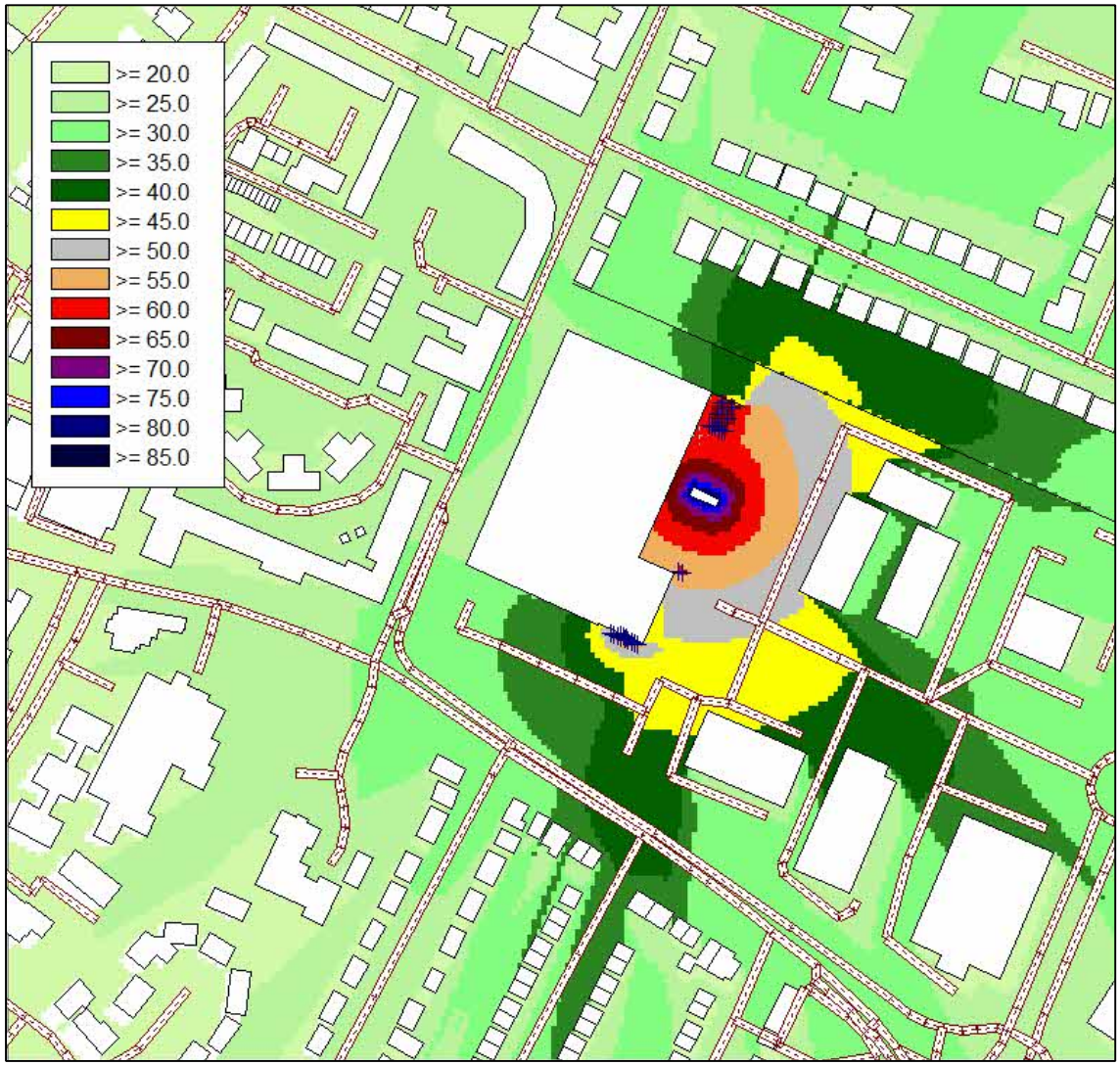

Figure A7.3: Indicative Specific Sound Level (Night) Emergency generator NOT in operation – 4 m above ground

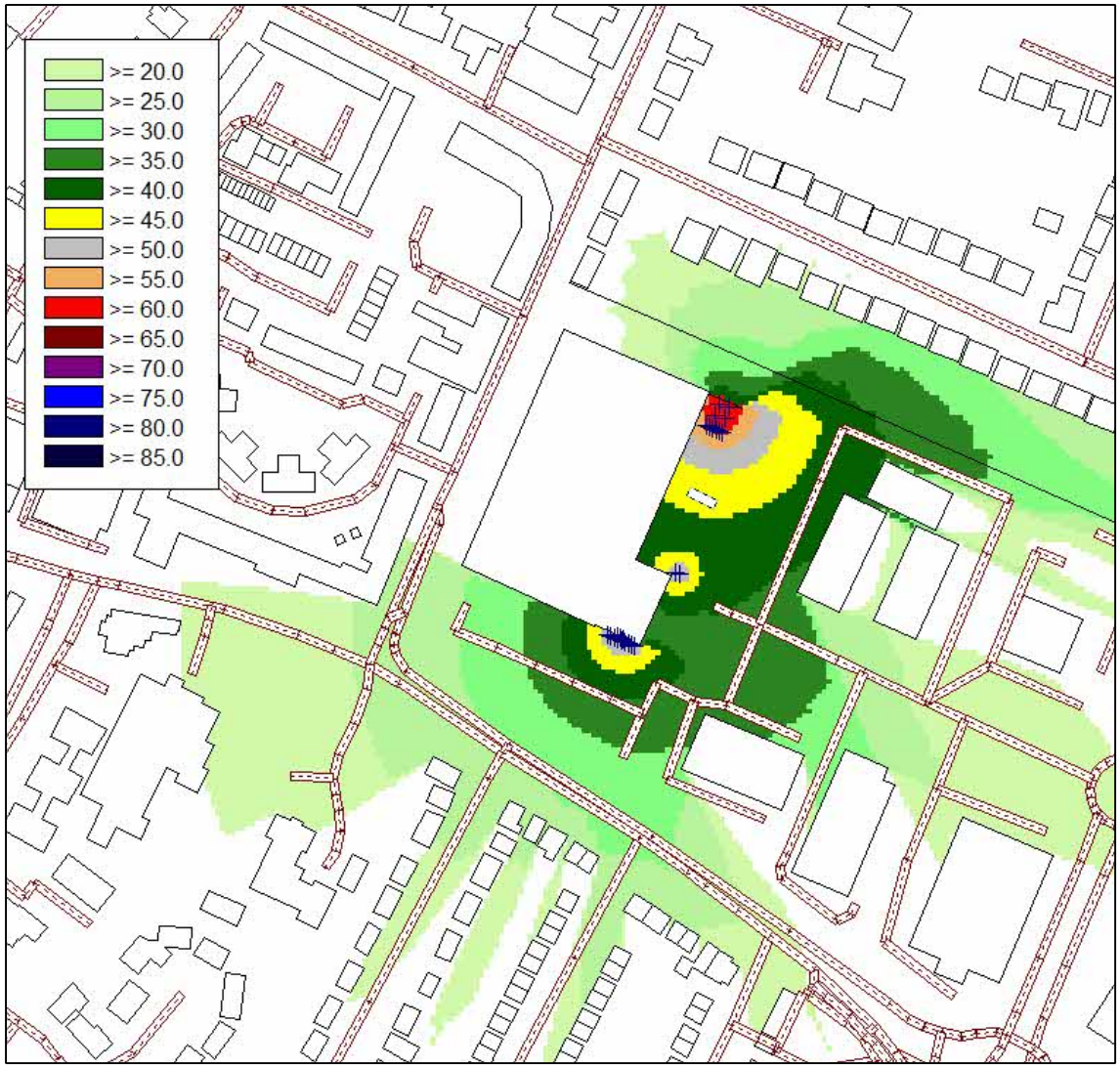

Figure A7.4: Indicative Specific Sound Level (Night) Emergency generator in operation – 4 m above ground

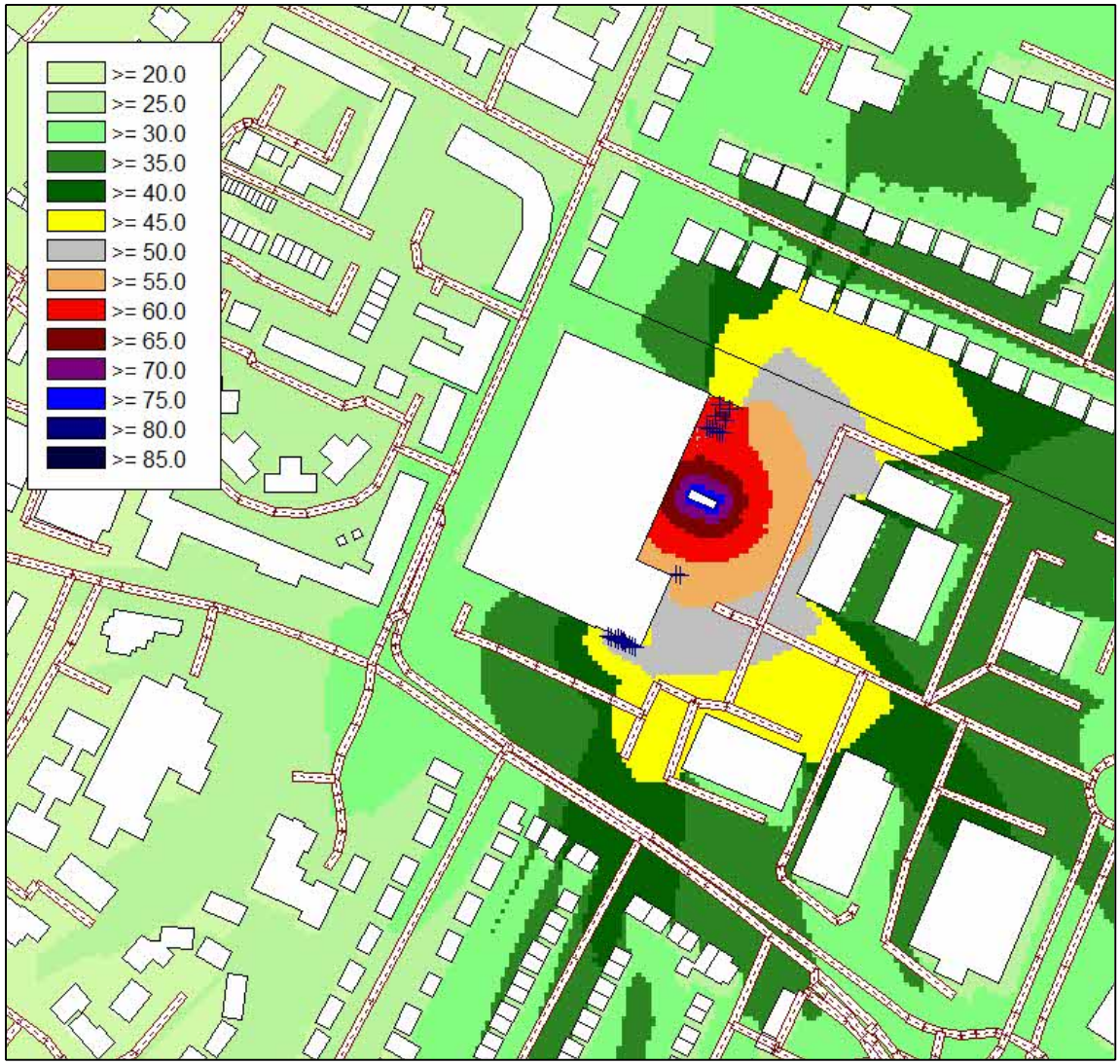

Figure A7.5: Indicative Car Parking Noise Levels (Day) – 1.5 m above ground