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ACOUSTICS
NOISE IMPACT ASSESSMENT

REVISION 01 – 28 NOVEMBER 2024

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	08/07/2024	Draft issue.	BHJ	RI	RI
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Contents.

Executive summary.

This report has been prepared on behalf of University College London for the refurbishment of the BSU in the Great Ormond Street Institute of Child Health located on Guilford Street, London. Proposals include replacement of air handling units and installation of new condensers at roof level.

It is recognised that external noise emissions from new plant will need to be controlled to protect the amenity of existing noise-sensitive uses nearby. This report serves to present an acoustic assessment of the plant proposals and demonstrate that the planning requirements of the London Borough of Camden can be achieved.

Baseline sound survey.
An environmental sound survey has been undertaken at the proposed development site to establish the baseline acoustic environment. Unattended measurements were captured over a representative period inclusive of a weekend, to establish long-term trends in the local sound climate. Further attended measurements were captured on Guilford Street.

Prevailing sound levels across the site are predominantly influenced by road and pedestrian traffic on the local road network. Ambient plant noise (typical for cities) is also present around the development site.

The measurement data from the survey have been used to inform the assessment of external noise emission from building services plant.

Assessment of noise emissions.
External plant associated with the development is understood to comprise replacement of multiple air handling units and installation of associated condensers on the ICH roof. External noise limits for new equipment have been established at the nearest noise-sensitive receivers in accordance with the London Borough of Camden's planning guidance and good practice.

The assessment of the proposals indicates that plant noise levels are expected to be 4 dB above the prevailing background sound levels when assessed at the nearest noise-sensitive receivers. This aligns with the "Amber" noise threshold as set out within Camden Local Plan and would be considered indicative of adverse impact in the context of BS 4142. Because of this, acoustic mitigation methods are outlined in this report to reduce the impact and for noise emissions to satisfy local authority requirements.

The following mitigation measures are recommended to reduce noise emissions:

- Installation of attenuators on all AHU terminations
- Installation of enhanced casework around all AHUs (already included within the manufacturer's design)
- Selection of condensers that meet the sound power level limits stated in this report.

With this mitigation strategy implemented, the assessment demonstrates that the "Green" noise threshold is achievable. The proposals are therefore considered compliant with the strategic objectives of Camden's Policy A4 which seeks to prevent "*development likely to generate unacceptable noise and vibration impacts".*

1. Introduction.

Hoare Lea have been appointed by the University College London to provide a noise impact assessment for the proposed plant replacement associated with the refurbishment of the BSU in the Great Ormond Street Institute of Child Health (GOSICH) on Guilford Street, London.

The proposals include the replacement of and installation of new fixed plant equipment at roof level on the ICH roof. The new plant equipment has been identified as potential new source of noise.

Acoustic surveys have been undertaken at various locations at and around the development site, including locations representative of the nearest identified noise sensitive receptors. Noise emission limits are proposed based on the results of the survey following current British Standard guidance, in line with local and national planning policy. The proposals are subject to agreement with the Local Planning Authority, Camden London Borough Council.

Operational noise associated with the proposed new fixed plant noise sources has been assessed and mitigation is discussed.

This report is suitable for submission alongside the planning application for the development.

2. Site context.

The Great Ormond Street Institute of Children's Health (GOSICH) is located on Guilford Street, directly adjacent to the Great Ormond Street Hospital for Children.

The prevailing noise climate is typical of a busy city centre location. Dominant noise is from traffic on Gilford Street. Existing building services plant associated with GOSICH and other nearby buildings is also present and contributes to the prevailing noise climate.

The surrounding uses are mixed including residential, commercial, and healthcare uses. The nearest noise sensitive receptor has been identified as Great Ormond Street Hospital for Children and residential dwellings on Guilford Street and Lansdowne Terrace.

The image below highlights the lower roof plant area where the new plant equipment is proposed, and identified nearest identified noise sensitive receptors:

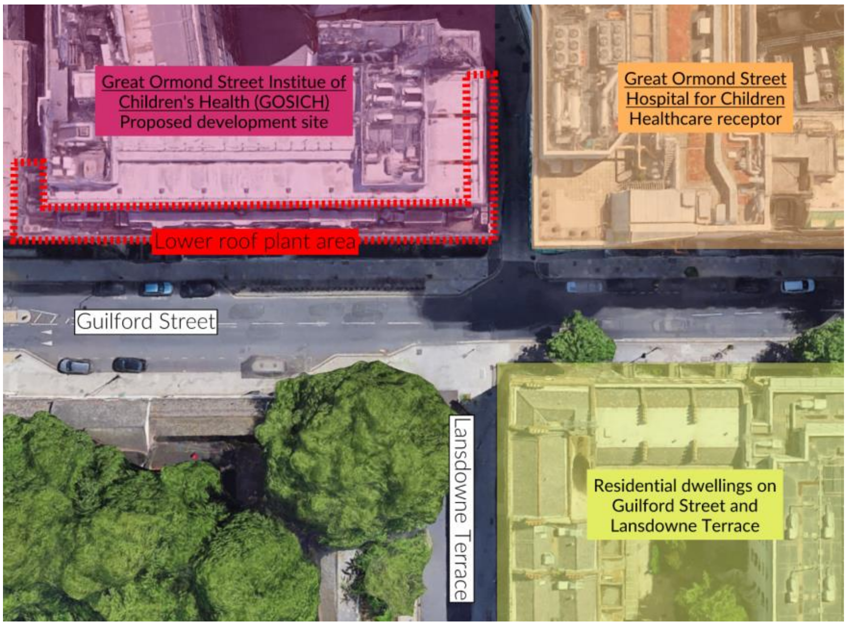

Figure 1: Site context and location of nearest noise sensitive receptors.

3. National and Local Planning Policy.

3.1 National policy

Noise Policy Statement for England

Noise Policy Statement for England (NPSE) advises that noise impacts should be assessed on the basis of adverse and significant adverse effect but does not provide any specific guidance on assessment methods or numerical noise limits.

Paragraphs 2.20 and 2.22 of NPSE introduce the concepts summarised in Table 1, which can be applied when considering the significance of noise impacts, as defined by the World Health Organization.

Paragraph 2.15 of the document advises that it is not possible to have *'a single objective noise-based measure that is… applicable to all sources of noise in all situations*'. NPSE further advises in paragraph 2.22 that the sound level at which an adverse effect occurs is likely to be '*different for different noise sources, for different receptors at different times*'.

Effect Level	Description
No Observed Effect Level (NOEL)	This is the noise 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.
Lowest Observed Adverse Effect Level (LOAEL)	This is the level above which adverse effects on health and quality of life can be detected.
Significant Observed Adverse Effect Level (SOAEL)	This is the level above which significant adverse effects on health and quality of life occur.

Table 1: NPSE observed effect levels.

National Planning Policy Framework

National Planning Policy Framework (NPPF, Dec 2023) sets out the Government's planning policies and how these are expected to be applied. In relation to noise and vibration, NPPF section 15 paragraphs 180, 191 and 193 are presented below:

'180. 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…'.

'191. 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[69];
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 …'

'193. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of

development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.'

Planning Practice Guidance

Online Planning Practice Guidance (PPG) has been published to provide greater details in relation to the relevance of noise to the planning process following the introduction of NPPF and NPSE.

This guidance states, under the heading *'How can noise impacts be determined'*, that the following should be considered by local authorities:

- *'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.'*

In line with NPSE, this includes identifying where noise exposure is above or below the significant observed adverse effect level and the lowest observed adverse effect level for a given situation during the operation of the Proposed Development.

Further guidance on each of the various observed effect levels set out in NPSE is provided in the table contained within the section headed *'How can it be established whether noise is likely to be a concern?'* which is reproduced below in Table 2.

It is important to note that no specific noise parameters or target noise levels are defined in the text.

Under the heading *'What factors influence whether noise could be a concern?'*, the subjective nature of noise is discussed. It is stated that the relationship between noise levels and the impact on those affected is not simple, as this depends on how various factors combine in particular situations.

Perception	Example of outcomes	Increasing effect level	Action
Not present	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
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 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 small actual or 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 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 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 Level	Avoid
Present and very disruptive	Extensive and regular changes in 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

Table 2: PPG Observed Effects.

3.2 Local policy.

3.2.1 Camden Local Plan.

Planning policies for development in the Borough of Camden are included in the Camden London Borough Council *Camden Local Plan 2017*. The Local Plan includes a section on noise and vibration within chapter 6 *Protecting amenity*. The section includes the following relevant policy, Policy A4, which is reproduced below:

Policy A4 Noise and vibration

The Council will seek to ensure that noise and vibration is controlled and managed.

Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:

a. development likely to generate unacceptable noise and vibration impacts; or

b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development.

Appendix 3 of the *Local Plan* introduces a Red-Amber-Green system for assessing the significance of noise impact using the NPSE and PPG observed effect levels. For plant and machinery noise, the following guidance is given for assessment external to noise sensitive dwellings:

Assessment period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Daytime (07:00 – 23:00)	Rating level 10 dB* below background	Rating level between 9 dB below and 5 dB above background	Rating level greater than 5 dB above background
Night-time (23:00 – 07:00)	Rating level 10 dB* below background and no events exceeding 57 dB L_{Amax}	Rating level between 9 dB below and 5 dB above background, or events between 57 dB and 88 dB L_{Amax}	Rating level greater than 5 dB above background, and/or events exceeding 88 dB L_{Amax}
*10 dB should be increased to 15 dB if the noise contains audible tonal elements (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.			

Table 3: Camden Local Plan Appendix 3 Noise levels applicable to proposed industrial and commercial developments (including plant and machinery).

3.2.2 The London Plan.

The importance of managing noise is made clear throughout the London Plan.

Policy D14 specifically relates to noise:

"Policy D14 Noise

A In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:

1) avoiding significant adverse noise impacts on health and quality of life

2) reflecting the Agent of Change principle as set out in Policy D13 Agent of Change

3) mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses

4) improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity

5) separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation

6) where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles

7) promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.

B Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations."

3.3 National Guidance and Standards

British Standard 4142:2014

British Standard 4142:2014 (BS 4142) (British Standards Institute, 2014) provides guidance for assessing commercial operations and fixed building services plant noise. The British Standard provides an objective method for rating the significance of impact from industrial and commercial operations. It describes a means of determining sound levels from fixed plant installations and determining the background sound levels that prevail on a site.

The assessment of the impacts is based on the subtraction of the pre-existing background sound level ($L_{A90,T}$) from the rating level ($L_{Ar,Tr}$).

The standard does not give a definitive method for determining the background sound level but instead, as a commentary, states that:

> *"the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods".*

Clause 8.1.4, which discusses the monitoring duration, states *"there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed."* As a note to this clause the following commentary is given on obtaining a representative backgrounds sound level:

> *"To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."*

The rating level is defined objectively as the specific source noise level in question (either measured or predicted) with graduated corrections for tonality (up to +6 dB(A)), impulsivity (up to +9 dB(A)), intermittency (+3 dB(A)) and other sound characteristics (+3 dB(A)) which may be determined either subjectively or objectively, if necessary.

The background sound level is subtracted from the rating level. The following is considered when evaluating the potential impact:

– A difference of around +10 dB 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; and
– A difference of +0 dB or less is an indication of the specific sound source having a low impact, depending on the context, and the lower the rating is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact.

The importance of context is highlighted in BS 4142, which states that the following factors should be taken into consideration when the initial estimate of the impact needs to be modified due to the context:

"1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

NOTE 3 Consideration should be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the "Effects on humans of industrial and commercial sound" portion of the "Further reading" list in the Bibliography.

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

i) facade insulation treatment;

ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and

iii) acoustic screening."

4. Acoustic survey.

An acoustic survey of prevailing external noise levels was undertaken at the development site during April 2024. Measurements were undertaken at three discrete points local to the development site. The measurement positions are shown in the figures below.

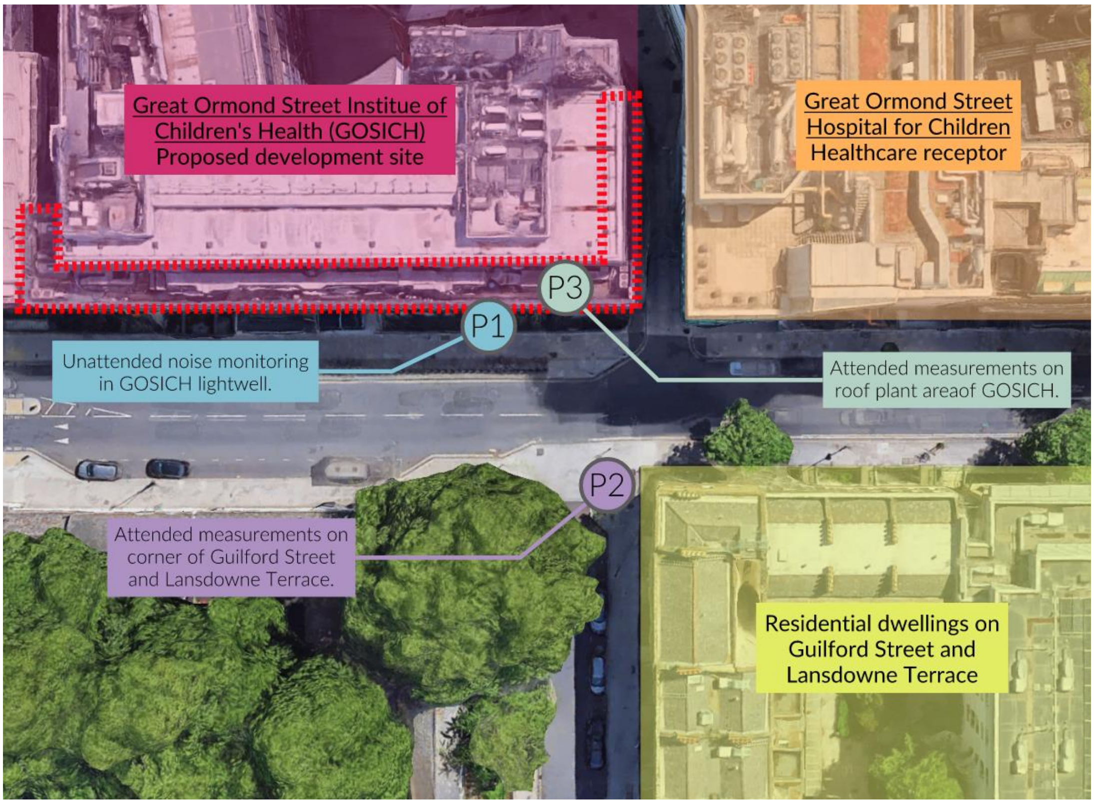

Figure 2: Aerial photograph showing the positions of acoustic survey locations.

Figure 3: Position P1 – GOSICH lightwell.

Figure 4: Position P2 – Corner of Guilford Street and Lansdowne Terrace

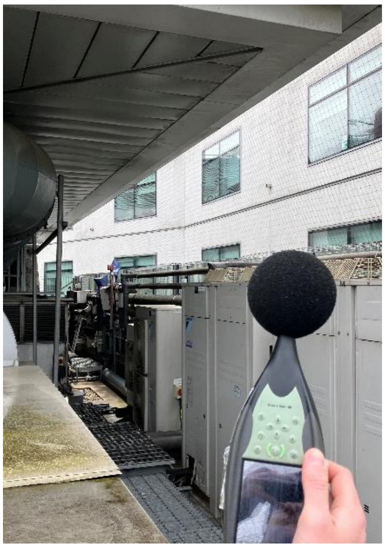

Figure 5: Position P3 - GOSICH lower roof plant area.

The microphone at P1 unattended survey location was under façade conditions. A correction of -3 dB has been applied to all measurements recorded at this position to account for any additional reflections picked up by the microphone from nearby surfaces reflecting surfaces.

Measurements at all other positions were taken under free field conditions so no corrections have been applied.

Measurements at P1 and P2 are considered representative of the receptors on Guilford Street and Lansdowne Terrace.

Measurements at P3 were to benchmark the existing roof level plant noise levels, including equipment to be retained and equipment to be replaced.

All equipment was field calibrated immediately before and after the survey. No significant drift in level was noted to occur during the survey. Details of measurement equipment can be found in Appendix A.

The time history chart below shows the ambient band background sound levels at P1.

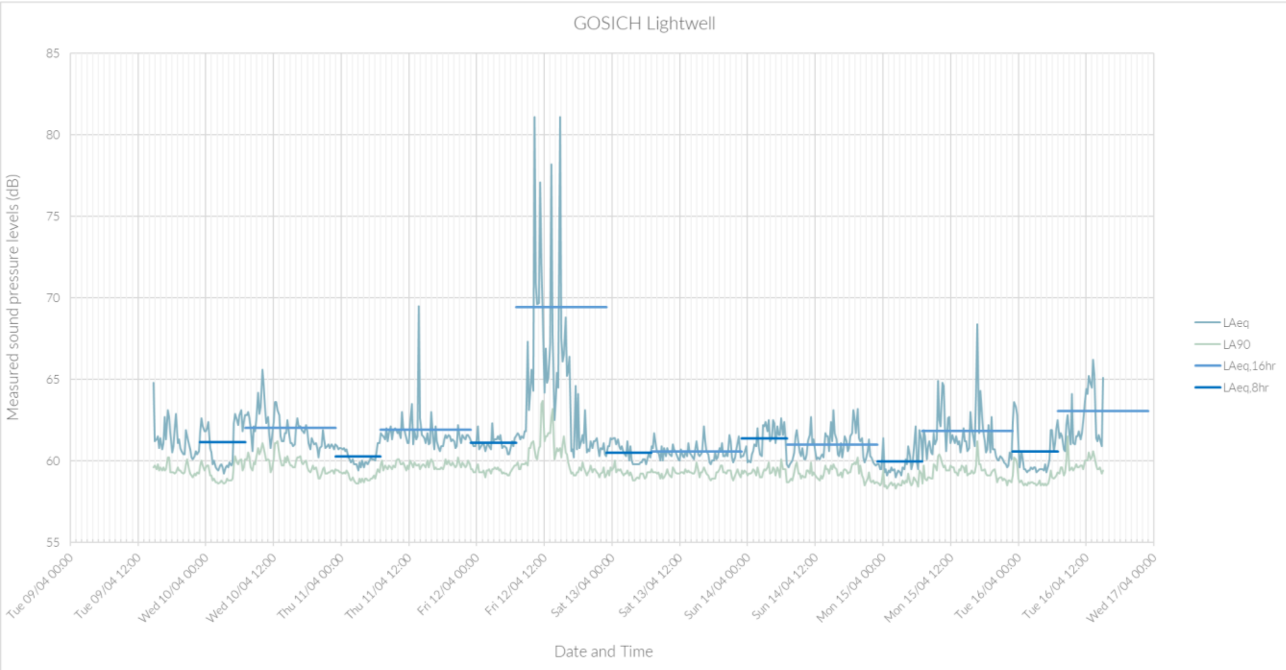

Figure 6: Time history chart of the measured noise levels at P1 (in GOSICH lightwell on Guilford Street) – corrected to free field.

The table below summarises the ambient noise level acoustic survey results at each measurement position.

Survey position	Description.	Ambient noise level, $L_{Aeq,T}$	
		Daytime	Night-time
P1	GOSICH lightwell on Guilford Street.	63	61
P2	Ground level on corner of Guilford Street and Lansdowne Terrace.	67	-
P3	GOSICH lower roof plant level (development area).	69	-

Table 4: Summary of measured external ambient noise levels – corrected to free field.

The Camden London Borough Council Local Plan requires plant noise to be assessed following BS 4142, which includes determining the typical background sound level.

In line with the guidance given in BS 4142, in order to *"quantify what is typical during particular time periods"*, a statistical analysis of the measured background sound levels has been undertaken.

The periods of interest for this development are daytime and night-time. Daytime is taken as between the hours of 07:00 and 23:00. Night-time is taken as between the hours of 23:00 and 07:00.

The 15 minute duration background sound values measured during the day will never be higher than the $L_{A90,1\ h}$ for that period so represent a worst-case. The measured 15 minute values will be used in place of the daytime 1 hour reference time interval required by BS 4142.

The following charts provides an analysis of the daytime and night-time period of interest background sound levels.

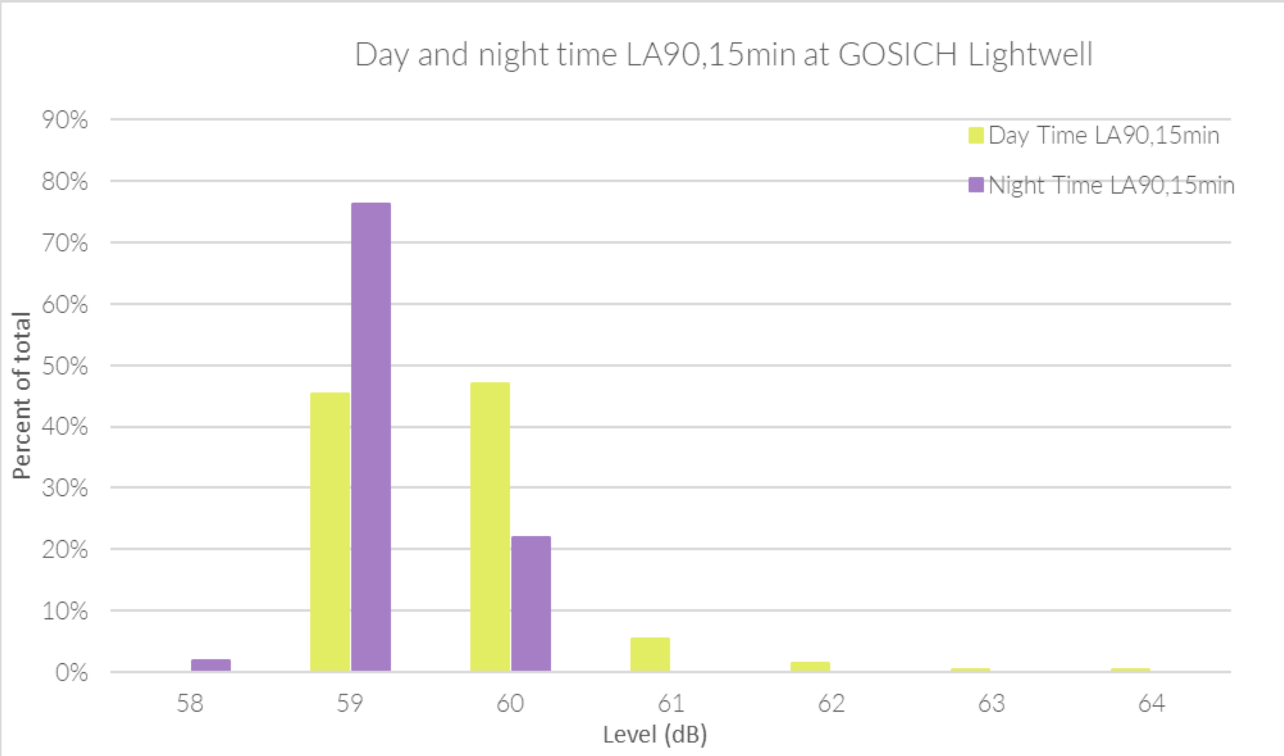

Figure 7: Statistical analysis of the free-field corrected background sound levels at Position 1.

The background sound level measured at P2 was typically 60 dB $L_{A90,15\ min}$. This was measured over an hour period on the morning of Tuesday 23rd April 2024, where local traffic sources were noted to be typical and comparable to those on Tuesday 9th April 2024 when the noise monitor at position P1 was set up. The background level at P2 is equal to the typical daytime background sound level of 60 dB $L_{A90,15\ min}$ at P1. On this basis the measurements at P1 are considered representative of the receptors on Guilford Street.

From the above statistical analysis chart and time history chart, given the context of the site, the following typical lower background sound levels have been determined representative for the periods of interest:

Assessment period	Background sound level
Daytime (07:00 – 23:00)	60 dB $L_{A90,1\ h}$
Night-time (23:00 – 07:00)	59 dB $L_{A90,15\ min}$

Table 5: Background sound levels.

5. Proposed noise emission limits.

Camden London Borough Council have established a series of noise thresholds with which to assess external noise emissions from new building services plant. These are defined within Appendix 3 of the Local Plan and apply to the cumulative rating level, established in accordance with BS 4142: 2014, when assessed at the nearest noise sensitive façade and compared to prevailing background sound levels.

These thresholds are presented in Table 6 alongside project specific design limits derived from the survey data.

Category	Description	Threshold	Project specific threshold
Green	LOAEL	Rating level 10 dB below background.	Day: ≤ 50 dB $L_{A90,1\,h}$ Night: ≤ 49 dB $L_{A90,15\,min}$
Amber	Between LOAEL and SOAEL	Rating level between 9 dB below and 5 dB above background.	Day: 51 - 65 dB $L_{A90,1\,h}$ Night: 50 - 64 dB $L_{A90,15\,min}$
Red	SOAEL	Rating level greater than 5 dB above background.	Day: > 65 dB $L_{A90,1\,h}$ Night: > 64 dB $L_{A90,15\,min}$

Table 6: Camden London Borough Council site specific noise thresholds.

Separate to Camden London Borough Council planning guidance, the assessment methodology of British Standard 4142: 2014 offers the following conclusions when the rating level is compared to background sound levels:

- A difference of around + 10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context;
- A difference of around + 5 dB is likely to be an indication of an adverse impact, depending upon the context; and
- When the rating level does not exceed background sound levels, this is indication of a low impact, depending upon the context.

Ensuring that plant noise does not normally exceed background sound levels would further reduce the risk of noise complaints as this would be a likely indication of a low impact when assessed in accordance with BS 4142.

6. Proposed new fixed plant equipment and assessments.

6.1 Sound sources.

A summary of the proposed MEP strategy is outlined in the figure below:

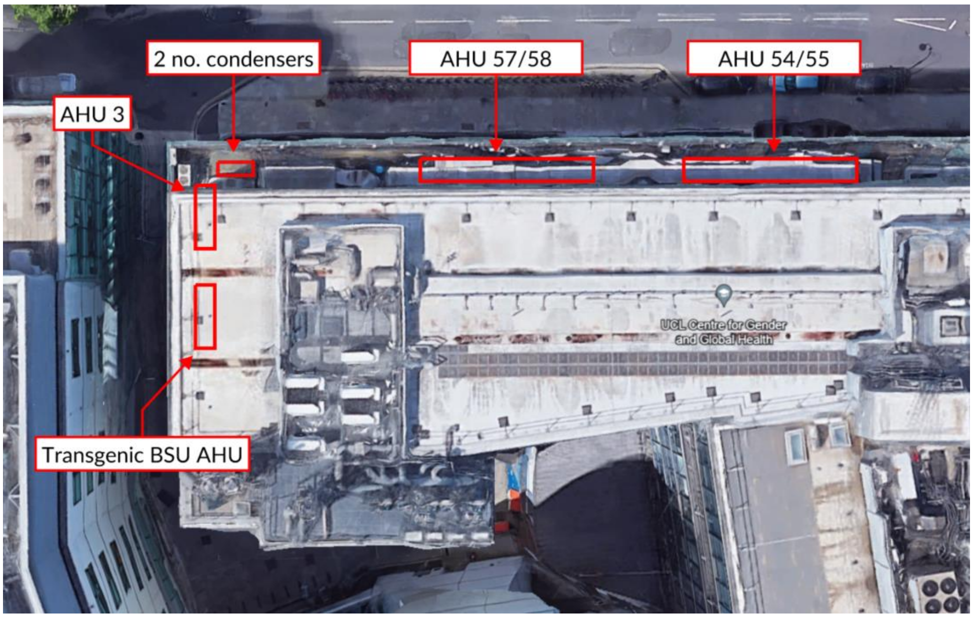

Figure 8: Summary of the proposed MEP strategy, lower roof of ICH.

The project MEP Contractor has provided technical data sheets including noise data for the proposed plant equipment. Source sound levels are summarised below:

Sound source(s)	Sound power level (per item)	Plant information.
AHU 03 Casing Breakout	Lw 70 dB(A)	ATC Millennium Line 2H x 2W
AHU 54 Intake	Lw 67 dB(A)	ATC Millennium Line 4H x 4W
AHU 55 Exhaust	Lw 90 dB(A)	ATC Millennium Line 4H x 4W
AHU 55/54 Casing Breakout	Lw 73 dB(A)	ATC Millennium Line 4H x 4W
AHU 57 Intake	Lw 67 dB(A)	ATC Millennium Line 4H x 4W
AHU 58 Exhaust	Lw 90 dB(A)	ATC Millennium Line 4H x 4W
AHU 58/57 Casing Breakout	Lw 73 dB(A)	ATC Millennium Line 4H x 4W
Transgenic BSU AHU Intake	Lw 69 dB(A)	ATC Millennium Line 2H x 4W
Transgenic BSU AHU Exhaust	Lw 79 dB(A)	ATC Millennium Line 2H x 4W
Transgenic BSU AHU Casing Breakout	Lw 66 dB(A)	ATC Millennium Line 2H x 4W

Table 7: Summary of noise source sound data.

Casing breakout sound power levels are stated without the insertion loss of the manufacturer's enhanced casework applied. This is considered a mitigation measure and is detailed in Section 6.4.

The proposed design also includes two new condenser units. Sound power level for these has not been provided as final selections have not been made. In the absence of detailed information outline sound power levels will be set with outline advice for likely required mitigation. The sound power limits provided should be used to guide selections.

6.2 Calculation methodology.

The principles of ISO 9613-2 have been followed, including barrier screening effect provided by the edges of the ICH Building, to calculate noise emissions to the closest noise sensitive receptors.

The sound sources have potential to operate over 24 h. Night-time noise levels have been assessed as a worst case.

6.3 Preliminary assessment.

Using the received sound data, noise emissions have been calculated and assessed against the Camden London Borough Council site specific noise thresholds. Separate assessments are outlined for the hospital and the residential dwelling. The hospital provides the most onerous assessment due to reduced distance.

Total sound power level.	93 dB L_{WA}	Logarithmic addition of the source sound levels, Table 7.
Attenuation.	30 dB(A)	Geometrical attenuation over 12 metres distance to Great Ormond Street Hospital.
Total specific sound level	63 dB $L_{Aeq,15\ min}$	Resultant specific sound level at the hospital.
Acoustic feature correction	+2 dB	+ 2 dB to account for just perceptible tonality at the receptor.
Daytime Assessment (07:00-23:00)		
Total rated sound level	65 dB $L_{Ar,15\ min}$	Specific sound level with feature corrections applied.
Planning noise limit.	50 dB $L_{Ar,15\ min}$	See Section 5.
Excess over noise limit	15 dB	Rated sound level exceeds the noise limit. 65-50 = 15 dB
CLBC Assessment category	Amber	Between LOAEL and SOAEL
Nighttime Assessment (23:00-07:00)		
Total rated sound level	65 dB $L_{Ar,15\ min}$	Specific sound level with feature corrections applied.
Planning noise limit.	49 dB $L_{Ar,15\ min}$	See Section 5.
Excess over noise limit	16 dB	Rated sound level exceeds the noise limit. 65-49 = 16 dB
CLBC Assessment category	Amber	Between LOAEL and SOAEL

Table 8: Preliminary assessment of proposed plant equipment – to hospital.

Total sound power level.	93 dB L_{WA}	Logarithmic addition of the source sound levels, Table 7.
Attenuation.	42 dB(A)	Geometrical attenuation over 22 metres distance to residential dwelling.
Total specific sound level	51 dB $L_{Aeq,15\ min}$	Resultant specific sound level at the dwelling.
Acoustic feature correction	+2 dB	+ 2 dB to account for just perceptible tonality at the receptor.
Daytime Assessment (07:00-23:00)		
Total rated sound level	53 dB $L_{Ar,15\ min}$	Specific sound level with feature corrections applied.
Planning noise limit	50 dB $L_{A90,15\ min}$	See Table 5
Excess over background sound level	3 dB	Rated sound level exceeds the noise limit. 53-50 = 3 dB
CLBC Assessment category	Amber	Between LOAEL and SOAEL
Nighttime Assessment (23:00-07:00)		
Total rated sound level	53 dB $L_{Ar,15\ min}$	Specific sound level with feature corrections applied.
Planning noise limit	49 dB $L_{A90,15\ min}$	See Table 5
Excess over noise limit	4 dB	Rated sound level exceeds the noise limit. 53-49 = 4 dB
CLBC Assessment category	Amber	Between LOAEL and SOAEL

Table 9: Preliminary assessment of proposed plant equipment – to dwelling.

In both cases, the resultant sound levels at nearby noise sensitive receptors achieve an ‘Amber’ assessment category. Mitigation measures are recommended to reduce noise emissions to achieve a ‘Green’ rating. Details of recommended mitigation are in the following section.

6.4 Recommended mitigation and subsequent assessment.

The mitigation strategy approach follows the flow chart in Figure 9. Mitigation options for the strategy are summarised in Table 10 below.

Operational mitigation	Includes selection (or re-selection) of plant items and operational setbacks.
Mechanical mitigation	Includes acoustic packages and attenuators
Architectural mitigation	Includes solid acoustic barrier around external plant areas and plant room enclosures

Table 10: Mitigation type options.

The mitigation advice is to be reviewed and developed to suit any changes to the mechanical engineering design.

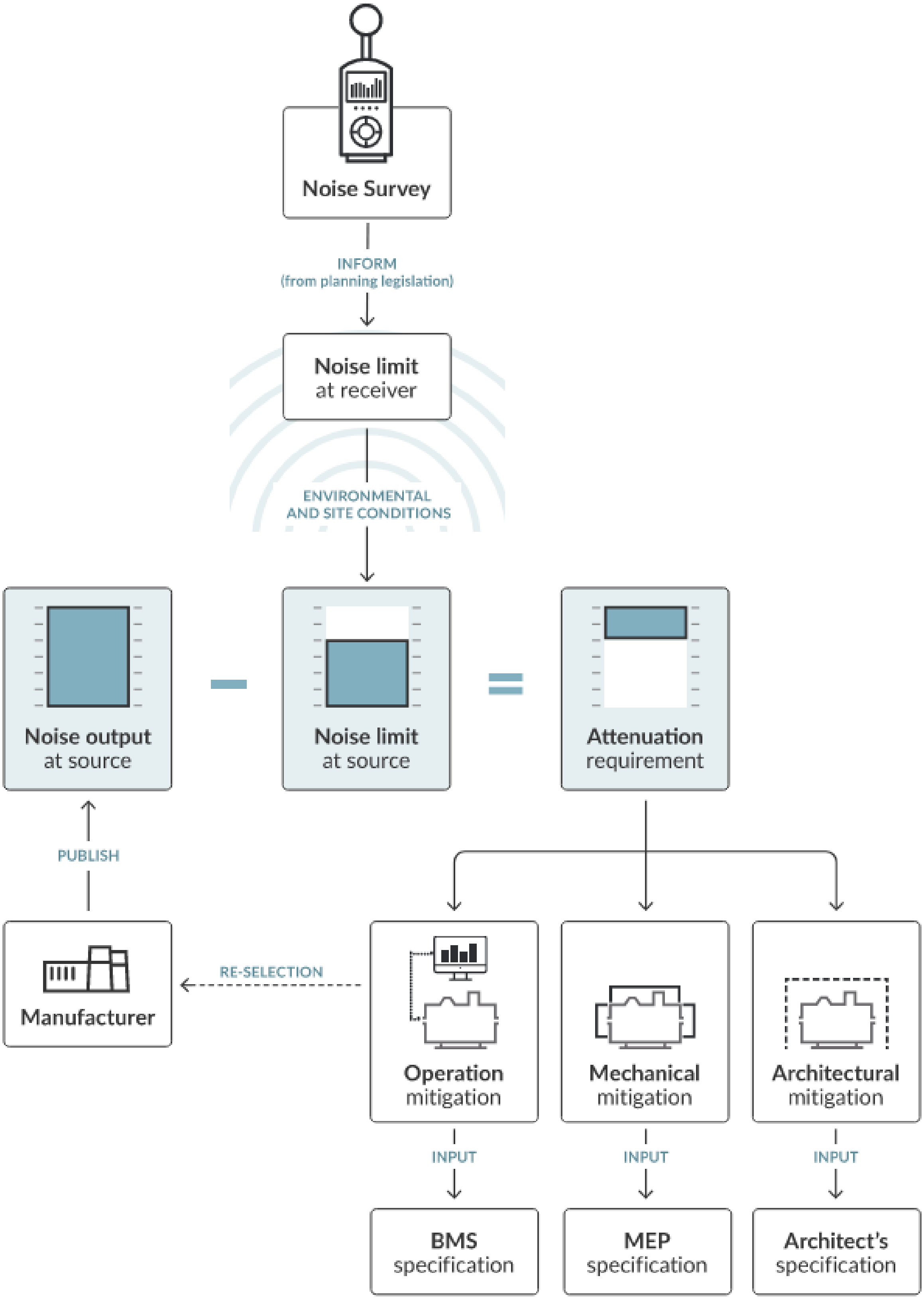

Figure 9: Noise mitigation strategy flow chart.

With noise control mitigation it is possible to reduce the specific sound level with a view to limiting noise levels to the ‘green’ assessment category. Suggested mitigation is summarised below:

Plant item	Suggested sound power level limit	Mitigation type	Details of mitigation.
AHU 03 Casing Breakout	L_W 48 dB(A)	Mechanical	Attenuation provided by manufacturer’s enhanced casework, see table below.
AHU 54 Intake	L_W 51 dB(A)	Mechanical	Attenuator providing 16 dB(A) insertion loss.
AHU 55 Exhaust	L_W 57 dB(A)	Mechanical	Attenuator providing 33 dB(A) insertion loss.
AHU 55/54 Casing Breakout	L_W 49 dB(A)	Mechanical	Attenuation provided by manufacturer’s enhanced casework, see table below.
AHU 57 Intake	L_W 51 dB(A)	Mechanical	Attenuator providing 16 dB(A) insertion loss.
AHU 58 Exhaust	L_W 57 dB(A)	Mechanical	Attenuator providing 33 dB(A) insertion loss.
AHU 58/57 Casing Breakout	L_W 49 dB(A)	Mechanical	Attenuation provided by manufacturer’s enhanced casework, see table below.
Transgenic BSU AHU Intake	L_W 48 dB(A)	Mechanical	Attenuator providing 16 dB(A) insertion loss.
Transgenic BSU AHU Exhaust	L_W 48 dB(A)	Mechanical	Attenuator providing 18 dB(A) insertion loss.
Transgenic BSU AHU Casing Breakout	L_W 43 dB(A)	Mechanical	Attenuation provided by manufacturer’s enhanced casework, see table below.

Table 11: Recommended mitigation.

Sound power level limits for casing breakout have been determined assuming the casing attenuation stated on the manufacturer’s data sheet can be achieved. The insertion loss for these is shown in the table below. With this attenuation applied, noise emissions from the casing of each AHU are predicted to be suitable.

Frequency, Hz	125	250	500	1000	2000	4000	8000
Insertion loss, dB	20	24	24	26	30	38	38

Table 12: Casework insertion loss provided by AHU manufacturer.

Suitable attenuation can be applied to the exhausts of AHU 55 and 58 through installation of an attenuator minimum 1200 mm in length. Suitable attenuation can be applied to all other AHU terminations installation of attenuators minimum 900 mm in length. Actual lengths required are to be coordinated by the MEP engineer to suit the requirements of the system.

The two condensers should be limited to L_{WA} 70 dB each. This value should be used to guide selections. Where a selection exceeds this limit, further mitigation may be required. This limit is deemed reasonable for the selection of the required equipment without the need for further mitigation.

With the above mitigation applied, the Camden London Borough Council site specific noise threshold for the LOAEL is achievable as detailed in the following assessments.

Total sound power level.	74 dB L_{WA}	Logarithmic addition of the source sound levels (Table 7).
Attenuation.	30 dB(A)	Geometrical attenuation over 12 metres distance to Great Ormond Street Hospital.
Total specific sound level	44 dB $L_{Aeq,15\ min}$	Resultant specific sound level at the hospital.
Acoustic feature correction	+2 dB	+ 2 dB to account for just perceptible tonality at the receptor.
Daytime Assessment (07:00-23:00)		
Total rated sound level	46 dB $L_{Ar,15\ min}$	Specific sound level with feature corrections applied.
Planning noise limit.	50 dB $L_{Ar,15\ min}$	See Section 5.
Excess over planning noise limit	-4 dB	Rated sound level is below the noise limit. 46-50 = -4 dB
CLBC Assessment category	Green	LOAEL
Nighttime Assessment (23:00-07:00)		
Total rated sound level	46 dB $L_{Ar,15\ min}$	Specific sound level with feature corrections applied.
Planning noise limit.	49 dB $L_{Ar,15\ min}$	See Section 5.
Excess over noise limit	-3 dB	Rated sound level is below the noise limit. 46-49 = -3 dB
CLBC Assessment category	Green	LOAEL

Table 13: Assessment of mitigated plant equipment – to hospital.

Total sound power level.	74 dB L_{WA}	Logarithmic addition of the source sound levels (Table 7).
Attenuation.	42 dB(A)	Geometrical attenuation over 22 metres distance to residential dwelling.
Total specific sound level	32 dB $L_{Aeq,15\ min}$	Resultant specific sound level at the dwelling.
Acoustic feature correction	+2 dB	+ 2 dB to account for just perceptible tonality at the receptor.
Daytime Assessment (07:00-23:00)		
Total rated sound level	34 dB $L_{Ar,15\ min}$	Specific sound level with feature corrections applied.
Planning noise limit	49 dB $L_{A90,15\ min}$	See Table 5
Excess over noise limit	-15 dB	Rated sound level is below the planning noise limit. 34-49 = -15 dB
CLBC Assessment category	Green	LOAEL
Nighttime Assessment (23:00-07:00)		
Total rated sound level	34 dB $L_{Ar,15\ min}$	Specific sound level with feature corrections applied.
Planning noise limit	50 dB $L_{A90,15\ min}$	See Table 5
Excess over noise limit	-14 dB	Rated sound level is below the planning noise limit. 34-50 = -14 dB
CLBC Assessment category	Green	LOAEL

Table 14: Assessment of mitigated proposed plant equipment – to dwelling.

7. Summary and conclusion.

Hoare Lea have been appointed by the University College London to provide a noise assessment for the proposed plant replacement associated with the refurbishment of the BSU in the Institute of Children's Health.

The proposals replacement of and installation of new fixed plant equipment at lower roof level at the ICH. The new plant equipment has been identified as potential new source of noise.

The closest noise sensitive receptors have been identified as the Great Ormond Street Hospital and nearby residential dwellings. The prevailing noise climate at a locations representative of the closest receptors has been quantified by direct measurement.

This report proposes noise limits for plant installations associated with the development, based on the results of the acoustic survey following the guidance of Camden London Borough Council. The proposed noise emission limits are subject to agreement with Camden London Borough Council.

The assessment of the proposals indicates that plant noise levels are expected to be 4 dB above the prevailing background sound levels when assessed to the nearest noise-sensitive receivers without any mitigation measures during night-time hours. This corresponds to an 'amber' assessment level. Outline noise control advice has been provided for the likely required noise mitigation required to reduce noise emissions to below the LOAEL.

With mechanical mitigation in the form of attenuation on the AHU atmospheric connections, the assessment demonstrates that the Camden London Borough Council site specific noise threshold for the LOAEL is achievable.

The proposals are therefore considered compliant with the strategic objectives of Camden's Policy A4 which seeks to prevent "*development likely to generate unacceptable noise and vibration impacts*".

The report is suitable for submission alongside the planning application for the development and for use by the Local Planning Authority to agree operational noise limits.

Appendix A – Survey equipment.

The table below summarises the survey equipment used at position P1.

Equipment.	Manufacturer.	Model (S/N)	Calibration date.	Calibration cert. no.
Sound level meter.	Rion	NL-52 (00832246)	04/08/2023	UCRT23/2031
Pre-amplifier.	Rion	NH-25 (32274)	04/08/2023	UCRT23/2031
Microphone.	Rion	UC-59 (05473)	04/08/2023	UCRT23/2031
Calibrator.	Brüel & Kjær	4231 (3000377)	23/11/2023	UCRT23/2508

Table 15: Equipment used at survey position P1.

The table below summarises the survey equipment used at position P2 and P3.

Equipment.	Manufacturer.	Model (S/N)	Calibration date.	Calibration cert. no.
Sound level meter.	Brüel & Kjær	2250 (3004428)	28/04/2022	UCRT22/1583
Pre-amplifier.	Brüel & Kjær	ZC 0032 (19784)	28/04/2022	UCRT22/1583
Microphone.	Brüel & Kjær	4189 (2650833)	28/04/2022	UCRT22/1583
Calibrator.	Brüel & Kjær	4231 (3000377)	23/11/2023	UCRT23/2508

Table 16: Equipment used at survey position P2 and P3.

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