Our ref: NIA/6583/16/6500 v1

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Dear Ms Ham

NOISE IMPACT ASSESSMENT FOR THE INSTALLATION OF 6 NO. EXTERNAL CONDENSER UNITS, 15 ADELINE PLACE, LONDON, WC1B 3AJ

1.00 INTRODUCTION

1.01 Environmental Noise Solutions Limited (ENS) has been commissioned by Cooley Architects, on behalf of its client Mr A Weisz, to undertake a noise impact assessment for the installation of 6 No. roof mounted external condenser units as part of the refurbishment of office accommodation at 15 Adeline Place (hereafter referred to as the application site).

1.02 The objectives of the assessment were to:

- Establish the existing background noise climate in the vicinity of the application site during representative periods when the condenser units will be operational.
- Predict noise emissions for the condenser units at the nearest identified noise sensitive receptors (NSRs) based on manufacturer data.
- In accordance with the requirements of the Local Planning Authority (LPA), assess the impact of the condenser units noise emissions at the NSRs with reference to British Standard BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound' (BS 4142).
- Consider noise attenuation measures as necessary.

1.03 This report details the methodology and results of the assessment and has been prepared to accompany a planning application to be submitted to the LPA.

1.04 This report has been prepared for Cooley Architects and its client Mr A Weisz for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult the parties above and ENS as to the extent to which the findings may be appropriate for their use.

1.05 A glossary of acoustic terms used in the main body of the text is contained in Appendix 1.

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2.00 SITE SETTING AND DESCRIPTION OF THE NOISE SOURCES

2.01 The application site is a five storey office building located at 15 Adeline Place, a mid-terrace property in a mixed-use residential/commercial environment.

2.02 The proposal is to install 6 No. external condenser units towards the rear (eastern) end of the flat roof to the property. The flat roof is bound by:

- Residential accommodation to the north, with a solid wall adjacent to the proposed plant compound and glazed elements fully screened from the plant compound. The nearest windows with a partial line of sight to the plant compound are circa 12 metres to the north east.
- A fire escape stair and courtyard area to the east.
- The rear elevation of the Cheshire Hotel circa 8 metres to the south.
- The flat roof of the application site to the west.

2.03 An annotated aerial image of the site is contained in Appendix 2.

2.04 Based on the above, the nearest NSR has been identified as the glazed façade of the Cheshire Hotel (NSR1) and the assessment has been undertaken at this reference point.

2.05 The proposal is to locate the condenser units towards the eastern end of the flat roof. A layout plan indicating the proposed location of the condenser units is contained in Appendix 2. The proposed condensers are understood to be 6 No. Daikin RZQG 140L9V1 units.

2.06 The condenser units are understood to serve air conditioning cassettes in the office accommodation and it is assumed they will predominantly operate during normal office hours (circa 08:00 to 18:00 hours). The proposed units have a 'quiet' mode for night time operation.

3.00 BASELINE NOISE MONITORING / PLANT NOISE EMISSION DATA

3.01 In order to establish the ambient noise climate in the vicinity of the application site, a noise survey was undertaken between 12:35 hours on Monday 14th March and 09:20 hours on Tuesday 15th March 2016. The noise survey was predominantly unmanned. During the manned periods of the survey, the noise climate was noted to be associated with road traffic noise and general urban noise sources.

3.02 For the purpose of the noise impact assessment, a single noise monitoring position was adopted as follows (the approximate location of the noise monitoring position is contained in Appendix 2):

- MP1 was located in a free field environment, at 1.5 metres above roof level, on the eastern area of the flat roof. This position was taken as representative of the background noise climate in general and, as such, representative of the nearest NSRs.

3.03 Noise measurements were undertaken using a Bruel & Kjaer 2250 Type 1 integrating sound level meter. A windshield was fitted for all measurements. The measurement system calibration was verified immediately before the commencement of the measurement sessions and again at the end, using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration level was noted. Weather conditions throughout the survey were appropriate for monitoring.

3.04 Measurements consisted of A–weighted broadband parameters, together with linear octave band L_{eq} levels, with a logging interval of 1 minute. Table 3.1 contains a summary of the measurement data at MP1 rounded to the nearest decibel.

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Table 3.1 – Summary of Noise Measurement Data at MP1

Position	Date	Time	$L_{Aeq,T}$ (dB)	L_{AFmax} (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)	Comment
MP1	14/3/16 15/3/16	12:25-19:00 07:00-09:20	55	80	56	51	Daytime baseline noise climate, consisting primarily of local and distant road traffic. No significant variation in background noise level ($L_{A90,T}$) over the measurement period.
MP1	14/3/16	19:00-23:00	52	78	53	50	Evening baseline noise climate, consisting primarily of local and distant road traffic. No significant variation in background noise level ($L_{A90,T}$) over the measurement period.
MP1	14/3/16	23:00-07:00	49	70	50	46	Night time baseline noise climate, consisting primarily of local and distant road traffic. No significant variation in background noise level ($L_{A90,T}$) over the measurement period.

3.05 Noise emission data for a Daikin RZQG 140L9V1 unit, as supplied by the manufacturer, is contained in Appendix 2. The data is presented as linear octave band data, together with a broadband sound pressure level (SPL) at 1 metre from source on the discharge side of the unit in a free field environment (hemispherical radiation, i.e. unit mounted on the floor). The broadband level, with the unit operating under normal conditions, is 52 dB(A) at 1 metre from source. The 'night mode' broadband level is 45 dB(A) at 1 metre from source (although not shown on the Appendix 2 data sheet).

3.06 In order to predict the overall SPL associated with the 6 No. units operating, standard acoustic theory has been used, with 3 No. units taken with hemispherical radiation (as per the data sheet) and 3 No. units (adjacent to the masonry wall) taken as 'quarter sphere' radiation (i.e. 3 dB higher level than hemispherical radiation).

3.07 On the basis of the above, the combined SPL of 6 No. units operating is calculated as 62 dB(A) at 1 metre from source under normal operating conditions and 55 dB(A) in 'night mode'. As NSR1 is 8 metres from the edge of the flat roof, the cumulative SPL at NSR1 is calculated as:

- 44 dB $L_{Aeq,T}$ at NSR1 under normal operating conditions.
- 37 dB $L_{Aeq,T}$ at NSR1 under 'night mode' conditions.

4.00 NOISE IMPACT ASSESSMENT CRITERIA

British Standard BS 4142:2014

4.01 British Standard BS 4142:2014 '*Methods for Rating and Assessing Industrial and Commercial Sound*' (BS 4142) describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in BS 4142 use outdoor sound levels to assess the likely effects of sound on people for the purposes of (i) investigating complaints, (ii) assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature, and (iii) assessing sound at proposed new dwellings or premises used for residential purposes.

4.02 BS 4142 considers that the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. It goes on to suggest that:

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

- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and

- 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.

4.03 Where the initial estimate of the impact needs to be modified due to the context, factors to be taken into account include the absolute level of sound and whether dwellings will already incorporate design measures that secure good internal and/or outdoor acoustic conditions. The reference time interval of the specific sound is 1 hour during the day and 15 minutes at night.

4.04 The rating level is described as the specific sound level (the equivalent continuous A-weighted sound pressure level at the assessment position (NSR) produced by the specific sound source over the given reference time interval) plus any adjustment for the characteristic features of the sound. The character correction relates to whether and to what degree the specific sound is assessed to have an element of tonality, impulsivity and/or characteristics that are readily distinctive against the residual acoustic environment. Based on the plant noise data contained in Appendix 2, no tonality correction is considered warranted, however, an intermittency correction of +3 dB has been applied due to the potential cycling times of the condenser units (note: BS 4142 considers that '*if the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied*').

4.05 The background sound level is the A-weighted sound pressure level of the residual sound at the assessment position that is exceeded for 90 percent of a given time interval, T, measured using time weighting 'F' and quoted to the nearest whole number of decibels. The residual sound is described as the ambient sound remaining in a given position in a given situation when the specific sound source is suppressed to a degree such that it does not contribute to the ambient sound.

5.00 ASSESSMENT OF CONDENSER UNITS NOISE EMISSIONS

5.01 BS 4142 assessments for the potential impact of the condenser units at NSR1 are contained in Table 5.1 (daytime/evening) and Table 5.2 (night time).

Table 5.1: BS 4142 assessment for condenser units – daytime/evening

Noise Parameter	Value	Comments
(A) Specific noise level	44 dB $L_{Aeq, T}$	Predicted level at NSR1 all units operating (Para. 3.07).
(B) Acoustic feature correction	+3 dB	Character penalty for intermittency (Para. 4.04).
(C) Screening at receptor	0 dB	
(D = A+B+C) Rating level	47 dB $L_{Ar, T}$	
(E) Background noise level	50 dB $L_{A90, T}$	Measured background noise level during the evening period (Table 3.1)
Excess of rating over background noise level (D – E)	-3 dB	Indication of low impact (Para. 4.02).

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Table 5.2: BS 4142 assessment for condenser units – night time

Noise Parameter	Value	Comments
(A) Specific noise level	37 dB $L_{Aeq, T}$	Predicted level at NSR1 all units operating (Para. 3.07).
(B) Acoustic feature correction	+3 dB	Character penalty for intermittency (Para. 4.04).
(C) Screening at receptor	0 dB	
(D = A+B+C) Rating level	40 dB $L_{Ar, T}$	
(E) Background noise level	46 dB $L_{A90, T}$	Measured background noise level during the night time period (Table 3.1)
Excess of rating over background noise level (D – E)	-6 dB	Indication of low impact (Para. 4.02).

5.04 On the basis of the BS 4142 assessment above, the operation of the condenser units represents an indication of a low impact at NSR1 with no mitigation in place.

I trust the foregoing is sufficient for your needs. Should you have any queries regarding the above, please do not hesitate to contact me.

Yours sincerely

Richard Pennell
For Environmental Noise Solutions Limited

Appendix 1
Glossary of Acoustic Terms

Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20 µPa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$L_p = 20 \log_{10}(p/p_0)$

Where L_p = sound pressure level in dB; p = rms sound pressure in Pa; and p_0 = reference sound pressure (20 µPa).

A-weighting Network

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T, has the same mean-square sound pressure as a sound that varies with time. $L_{Aeq, 16h}$ (07:00 to 23:00 hours) and $L_{Aeq, 8h}$ (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

$L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T. $L_{A10, 18h}$ is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

$L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T. L_{A90} is typically taken as representative of background noise.

$L_{AF\ max}$

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

Sound Exposure Level (SEL or L_{AE})

The energy produced by a discrete noise event averaged over one second, no matter how long the event actually took. This allows for comparison between different noise events which occur over different lengths of time.

Weighted Sound Reduction Index (R_W)

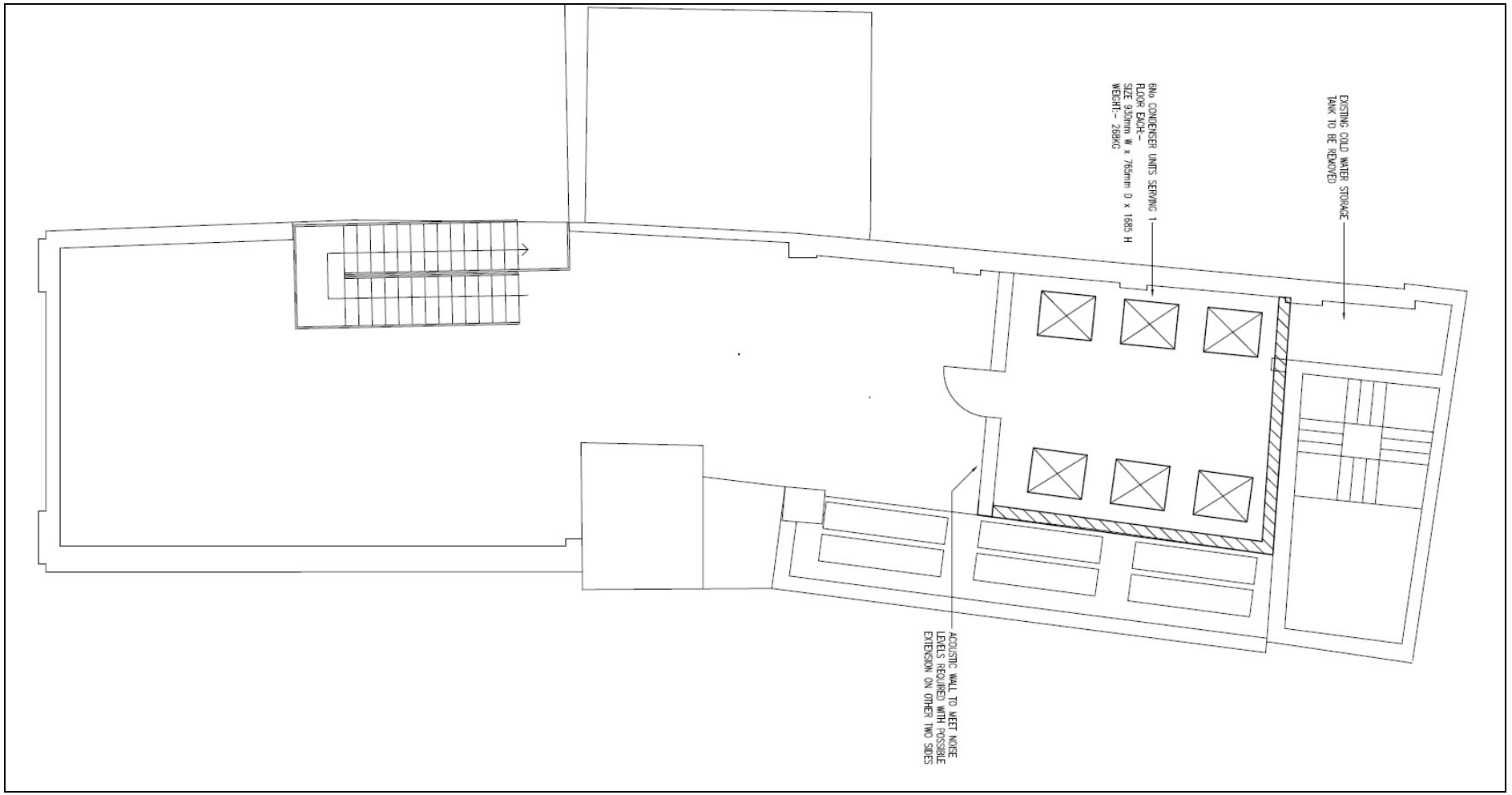
Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies (R_W is used to characterise the insulation of a material or product that has been measured in a laboratory).

Weighted Airborne Sound Insulation ($D_{nT,w}$)

Single number quantity which characterises the airborne sound insulation between rooms.

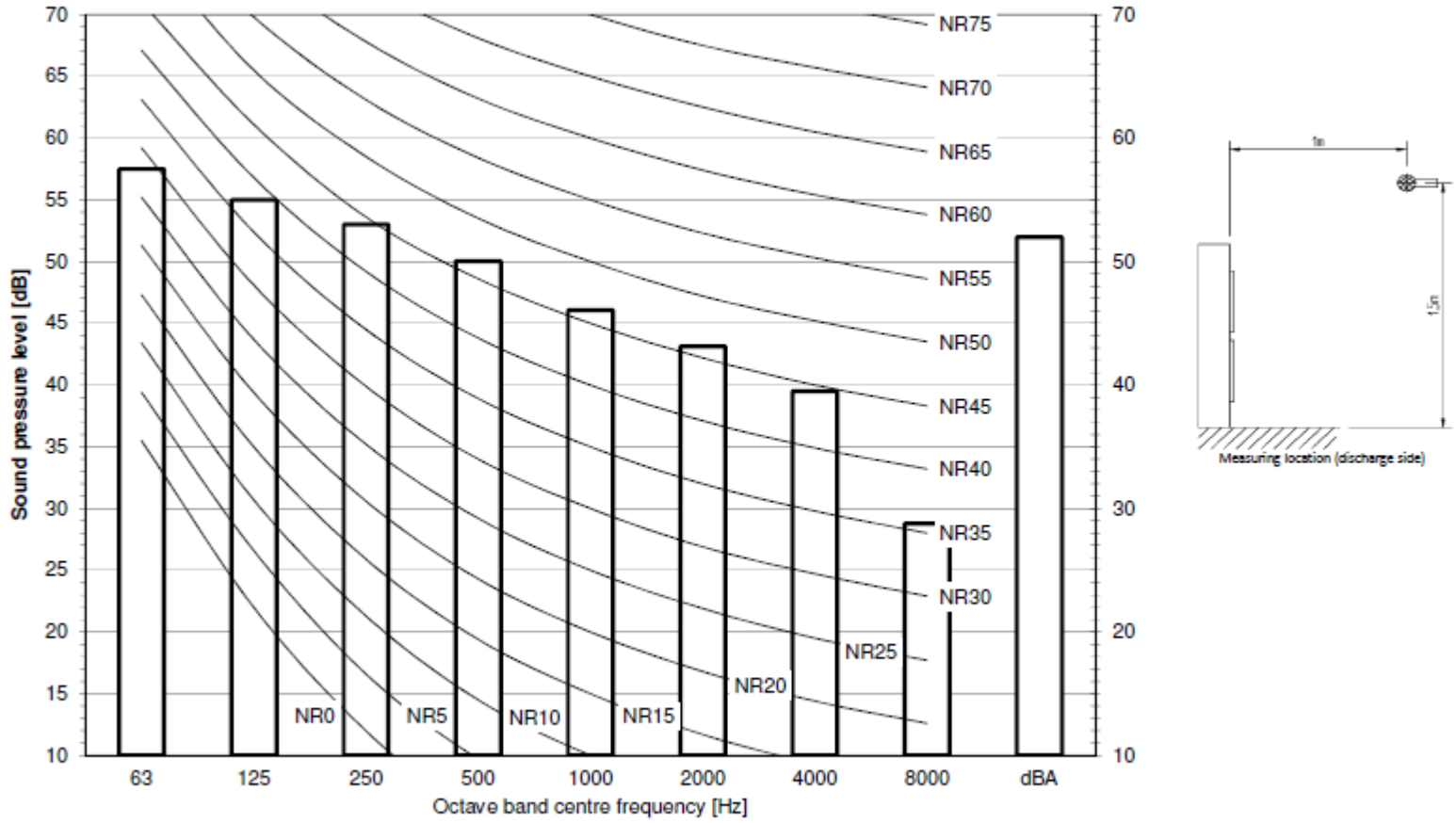
Appendix 2
Annotated aerial image of the site indicating the noise measurement position (MP) and noise sensitive receptor (NSR1)

Appendix 2
Proposed location of roof top condenser units



Appendix 2
Manufacturer supplied condenser unit noise emission data

RZQG140L9V1



Notes
- Data is valid at free field condition.
- Data is valid at nominal operation condition.
- dBA = A-weighted sound pressure level (A scale according to IEC).
- Reference acoustic pressure 0 dB = 20 µPa