Holker Library Building
London

Environmental Noise Survey and Plant Noise Assessment Report Roof Plantroom Location

27562/PNA2Rev1

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For:
The Honourable Society of Gray's Inn
Treasury Office
8 South Square
London
WC1R 5ET

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Environmental Noise Survey and Plant Noise Assessment Report 27562/PNA2Rev1

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1.0 Introduction

It is proposed to undertake a refurbishment of Holker Library Building, Grays Inn Road, South Square, London WC1R 5ET. To serve the development this refurbishment includes the installation of 4No. condenser units and 1No. MVHR unit within two adjacent attics located to the southern building of this development.

Hann Tucker Associates have therefore been commissioned to undertake a detailed environmental noise survey to determine the currently prevailing noise climate at the site, the results of which will be used in design assessments in order to assess compliance with the Local authority's requirements.

2.0 Objectives

To establish by means of an unmanned 24 hour survey the existing environmental noise levels at up to two secure and accessible on-site positions, using fully computerised noise monitoring equipment.

Measurement procedures shall be in general accordance with British Standard BS 7445 "Description and measurement of environmental noise".

Measurement procedures shall be in general accordance with those described in BS 4142: 2014, Method for rating industrial noise affecting mixed residential areas, published by the British Standards Institution.

The survey will enable noise emission limits from the development to be identified with reference to the requirements of the Local Authority and/or the application of BS 4142: 2014 and to minimise the possibility of noise nuisance to neighbours.

To assess the noise emissions from the proposed plant, based upon data with which we are provided, and comment upon the acceptability.

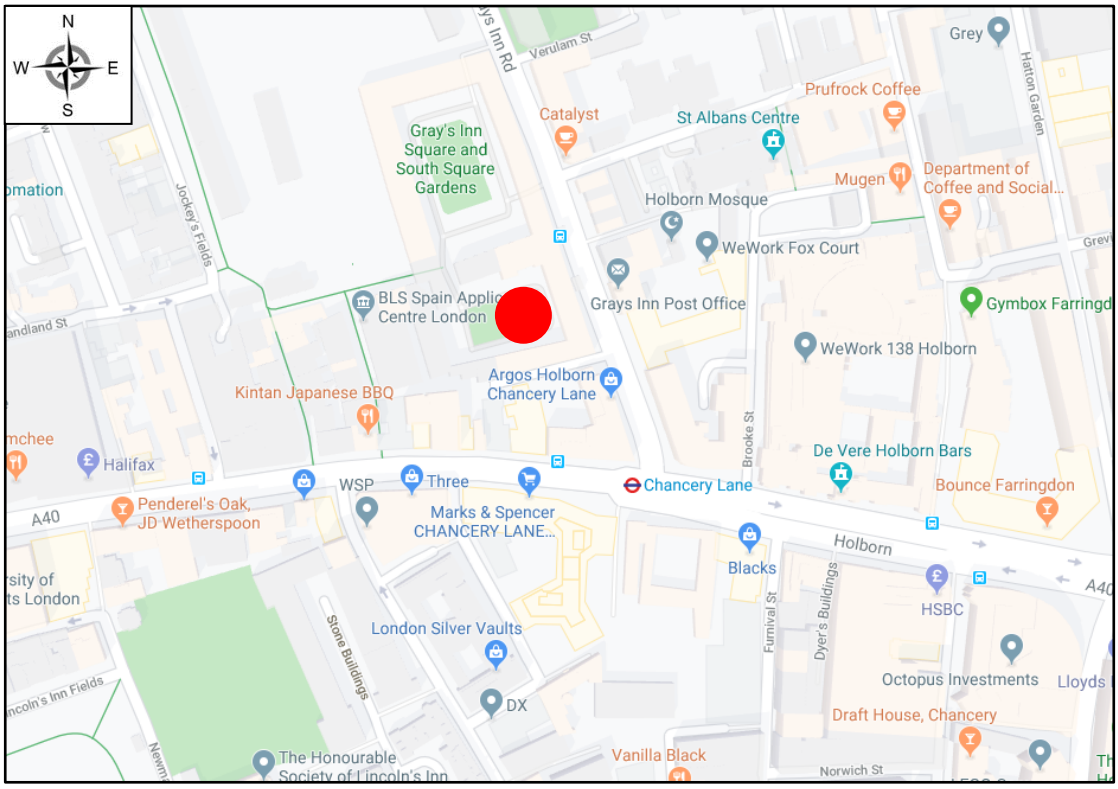
To advise on noise control measures if required with reference to the requirements of the Local Authority.

To present our methodology and findings in a detailed Environmental Noise Survey and Plant Noise Impact Assessment Report to accompany the planning application.

3.0 Site Description

3.1 Location

The site is located between Grays Inn Road and Fulwood Place, in London, and falls within the London Borough of Camden's jurisdiction. The location is shown in the Location Map below (red dot):



Location Map (maps.google.co.uk)

3.2 Description

The existing development site currently comprises three to five storey office buildings. We were informed on site that this development comprises a few residential units located at the top storey (below the attics) of the building located at the southern building of this development. To the north is Gray's Inn Square and South Square Gardens. To the south there is an alleyway and to the other side of this there are residential buildings which we understand to be the nearest neighbouring residential receptor. To the east is Grays Inn Road and to the west there is a building of similar height and nature to this development.

See Site Plan overleaf.

Site Plan (maps.google.co.uk)

4.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 Acoustic Standards and Guidelines

5.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010 (i.e. before the NPPF). The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which is to:

"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level
This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an SOAEL for noise is acknowledged in the NPSE and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three NPSE noise policy aims listed above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."* The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

5.2 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) was first published in March 2012. This document replaced the existing Planning Policy Guidance Note 24 (PPG24) "Planning and

Noise". A new edition of NPPF was published in July 2018 and comes into effect immediately. This new edition however, contains no new directions with respect to noise, and hence, all previous references remain extant. The paragraph references quoted below relate to the July 2018 edition.

Paragraph 170 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by (amongst others) *"preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability."*

The following paragraphs are from the NPPF (revised February 2019):

"180. 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;

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.

182. 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."

Paragraph 180 also references the Noise Policy Statement for England. This document does not refer to specific noise levels but instead sets out three aims:

"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

The NPPF document does not refer to any other documents or British Standards regarding nose other than the NPSE.

Paragraph 2 of the NPPF states that *"planning law required that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise."*

Paragraph 12 of the NPPF states that *"The presumption in favour of sustainable development does not change the statutory status of the development plan as the starting point for decision making. Where a planning application conflicts with an up-to-date development plan (including any neighbourhood plans that form part of the development plan), permission should not usually be granted. Local planning authorities may take decisions that depart from an up-to-date development plan, but only if material considerations in a particular case indicate that the plan should not be followed."*

5.3 Planning Practice Guidance on Noise

Planning Practice Guidance (PPG) under the NPPF has been published by the Government as a web based resource at http://planningguidance.planningportal.gov.uk/blog/guidance/. This includes specific guidance on Noise although, like the NPPF and NPSE the PPG does not provide any quantitative advice. It seeks to illustrate a range of effect levels in terms of examples of outcomes as set out in the following table:

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

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

5.4 Local Authority Requirements

5.4.1 Noise Sensitive Developments

The LB of Camden determines in Policy A4 of their Camden Local Plan (2017) that a noise sensitive development is that which, *"…includes housing, schools and hospitals as well as offices, workshops and open spaces…"*

5.4.2 Building Services Plant Noise Criteria

The site lies within the jurisdiction of the London Borough of Camden. Their policy stated within the *Camden Local Plan (2017)* regarding criteria for atmospheric noise emissions from building service plant is as follows:

"Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise Sensitive Receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings	Garden used for main amenity (free-field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings	Outside bedroom window (façade)	Night	Rating level' 10dB* below background and no events exceeding 57dBLAmax	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB LAmax	Rating 'Rating level' greater than 5dB above background and/or events exceeding 88dBLAmax

5.5 BS 4142:2014

When setting plant noise emission criteria reference is commonly made to BS 4142: 2014 "*Methods for rating and assessing industrial and commercial sound".*

The procedure contained in BS 4142:2014 provides an assessment of the likely effects of sound on people when comparing the specific noise levels from the source with representative background noise levels. Where the noise contains "a tone, impulse or other characteristic" then various corrections can be added to the specific (source) noise level to obtain the "rating level".

BS 4142 states 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". An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:*

• *"Typically, the greater this difference, the greater the magnitude of the impact."*

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

• *"A difference of around +5dB is likely to 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 the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

The determination of the "rating level" and the "background level" are both open to interpretation, depending on the context.

In summary it is not possible to set plant noise emission criteria purely on the basis of BS 4142:2014. It is reasonable to infer from the above, however, that a difference of around -5dB corresponds to "No Observed Effect Level" as defined in the Noise Policy Statement for England. It is also reasonable to infer from the above that if the plant noise rating level does not exceed the existing background noise level outside any noise sensitive residential window then the plant noise is of "low impact".

5.6 World Health Organisation Guidelines on Community Noise

BS8233:2014 is based upon the current World Health Organisation (WHO) guidance "*Guidelines on Community Noise".* A summary of the noise guidelines relevant to the proposed scheme is presented in the table below.

Residential Environment	Critical Health Effect(s)	L_{Aeq}	L_{AFmax}	Time Base
Outdoor living area	Serious annoyance, daytime and evening	55	-	07:00-23:00
	Moderate annoyance, daytime and evening	50	-	07:00-23:00
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	-	07:00-23:00
Inside bedrooms	Sleep disturbance, night-time	30	45	23:00-07:00
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00

These WHO guidelines are based, in almost all cases, on the lower threshold below which the occurrence rates of any particular effect can be assumed to be negligible.

5.7 British Standard BS8233: 2014

British Standard 8233: 2014 "Guidance on sound insulation and noise reduction for buildings" provides guidance for the control of noise in and around buildings.

BS8233:2014 Section 7.7.2 titled "Internal ambient noise levels for dwellings" states:

"In general for steady external noise sources, it is desirable that internal ambient noise levels do not exceed the following guideline values:

Activity	*Location*	*Desirable Internal Ambient Criteria*	
		07:00 - 23:00	*23:00 - 07:00*
Resting	*Living Rooms*	*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 $L_{Aeq,8hour}$*

5.8 Statutory Noise Nuisance

There is no quantitative definition of statutory noise nuisance. It is generally accepted however, that if the plant noise level is at least 5dB (or 10dB if tonal) below the minimum background $L_{90(15minutes)}$ at 1m from the nearest noise sensitive residential window, then the risk of a statutory noise nuisance is avoided. By adopting this as a design criterion the guidance contained in BS 4142:2014 should also be complied with.

6.0 Survey Methodology

The survey was undertaken by Rodrigo Espinosa-Garcia MSc, BEng(Hons), MIOA.

6.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 10:45 hours on Monday 13 January 2020 to approximately 10:45 hours on Thursday 16 January 2020.

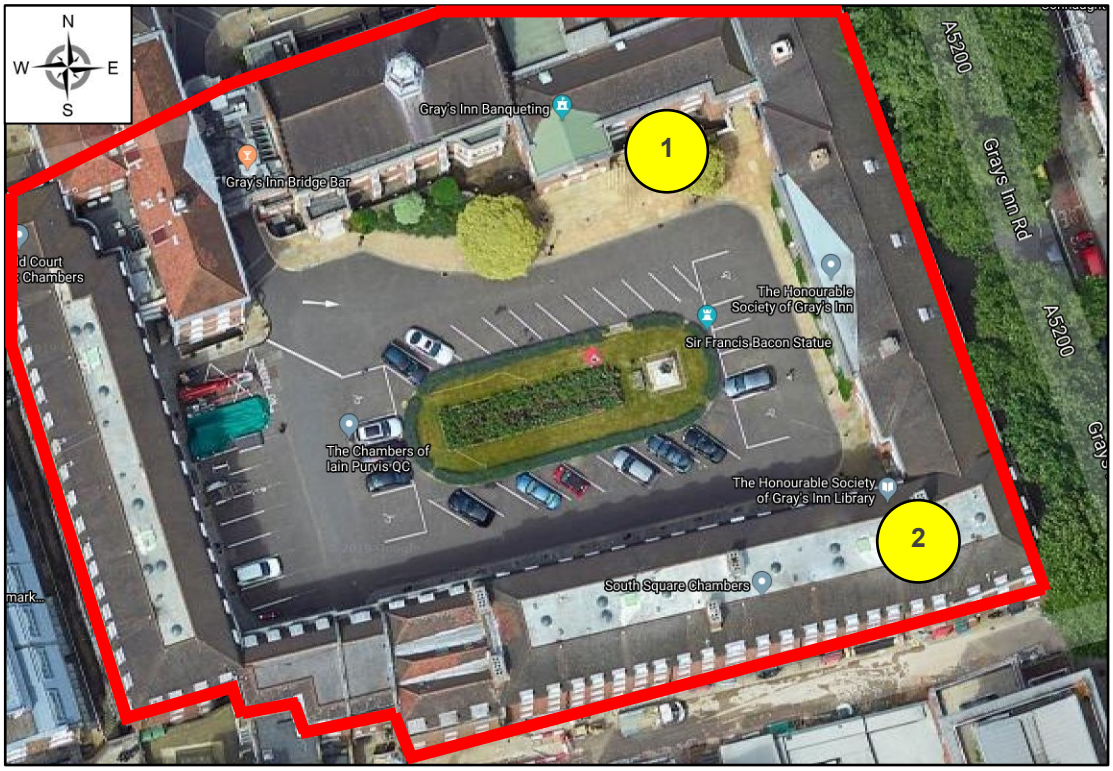
Owing to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However at the beginning and end of the survey period the wind conditions were moderate. The sky was generally patchy cloud. We understand that generally throughout the survey period the weather conditions were similar to this. Measurements were taken continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15 minute periods.

6.2 Measurement Positions

The noise level measurements were undertaken at two positions at the development site:

Position No	Description
1	The sound level meter was installed at ground level to the north of South Square. The microphone was mounted to a handrail located directly above the existing lower ground floor vaults, approximately one metre from the façade and the ground floor.
2	The sound level meter was installed at roof level to the south of South Square. The microphone was mounted to a metal structure approximately one metre from the roof level and sixteen metres above street level.

The approximate measurement position is shown on the plan overleaf:



Plan Showing Unmanned Measurement Position (maps.google.co.uk)

6.3 Instrumentation

The instrumentation used during the survey is presented in the following table:

Description	Manufacturer	Type	Serial Number
Position 1 Type 1 ½" Condenser Microphone	ACO Pacific	7052E	71839
Position 1 Preamp	Svantek	SV18	75733
Position 1 Type 1 Data Logging Sound Level Meter	Svantek	971	74368
Position 2 Type 1 ½" Condenser Microphone	ACO Pacific	7052E	68293
Position 2 Preamp	Svantek	SV18	72276
Position 2 Type 1 Data Logging Sound Level Meter	Svantek	971	72538
Type 1 Calibrator	Bruel & Kjaer	4231	2610161

The sound level meters, including the extension cable, were calibrated prior to and on completion of the surveys. No significant change was found to have occurred (no more than 0.1 dB).

The sound level meters were located in an environmental case with the microphone connected to the sound level meter via an extension cable. The microphone was fitted with a manufacturer windshield.

7.0 Results

The results have been plotted on Time History Graph 27562/TH1 and 27562/TH2 enclosed presenting the 15 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at each measurement position throughout the duration of the survey.

7.1 Measured L_{eq} Noise Levels

The measured daytime $L_{Aeq(16\text{-}hour)}$ and night-time $L_{Aeq(8\text{-}hour)}$ noise levels are presented in the table below.

Position	Date	Daytime and Night-time Measured L_{Aeq} Noise Levels (dBA re 2.0 x 10^{-5} Pa)	
		Daytime (07:00 – 23:00) Hours	Night-Time (23:00 – 07:00) Hours
1	13/01/2020	53*	47
	14/01/2020	54	50
	15/01/2020	52	47
	16/01/2020	53*	N/A
2	13/01/2020	59*	53
	14/01/2020	60	55
	15/01/2020	58	53
	16/01/2020	60*	N/A

*Incomplete period.

7.2 Lowest Measured L_{90} Noise Levels

The following table presents the lowest measured L_{A90} background noise levels during the survey:

Position	Date	Daytime and Night-time Lowest Measured L_{A90} Background Noise Level (dB re 2 x 10^{-5} Pa)	
		Daytime (07:00 – 23:00) Hours	Night-time (23:00 – 07:00 hours)
1	13/01/2020	45*	42
	14/01/2020	45	43
	15/01/2020	44	42
	16/01/2020	45*	N/A
2	13/01/2020	52*	48
	14/01/2020	52	49
	15/01/2020	51	48
	16/01/2020	52*	N/A

*Incomplete period.

8.0 Discussion Of Noise Climate

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately describe the dominant noise sources, or specific noise events throughout the entire survey period. However at the beginning and end of the survey period the dominant noise source was noted to be road traffic from the adjacent road network.

9.0 Plant Noise Emission Criteria

On the basis of the aforementioned Local Authority criteria and the results of the environmental noise survey, we propose that the following plant noise emission criteria be achieved at 1 metre from the nearest noise sensitive receptor.

Plant Noise Emission Criteria (dB re $2x10^{-5}$ Pa)			
Position	**Daytime (07:00 – 23:00 hours)**	**Night-time (23:00 – 07:00 hours)**	**Time of operation (07:00 – 18:00 hours)**
1 (ground level)	34dBA	22dBA	34dBA
2 (roof level)	41dBA	38dBA	41dBA

The above criteria are to be achieved with all of the proposed plant operating simultaneously.

It should be noted that the above are subject to the final approval of the Local Authority.

10.0 Project Proposals

10.1 Proposed Plant

We understand that the proposed new plant comprises 4No. condenser units to be installed in one attic with open roof, and 1No. mechanical ventilation heat recovery unit (MVHR) within the adjacent attic, with the atmospheric ductwork discharging/exhausting into the attic where the condensers will be installed, as illustrated in the drawing presented in Section 10.3.

Plant Description	Location	Qty	Plant Make	Model Number
Condenser unit	Attic	4	Mitsubishi	PURY-EP500 YNW-A
MVHR unit	Attic	1	Airflow	DUPLEXVENT 6500 Multi ECO

10.2 Operating Hours

We understand that the above proposed plant could operate during the daytime (07:00 to 18:00 hours).

10.3 Drawings

Our acoustic analyses is based on the drawings provided by Ralph T. King & Associates. The proposed plantroom arrangement is shown in the site plan below (drawing ref.: MSK11 dated December 2019).

10.4 Plant Noise Data

We understand the manufacturer's noise data for the aforementioned plant to be as follows:

Condenser unit

Plant Description	Sound Pressure Level (dB re $2x10^{-5}$ Pa) measured at 1m at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Standard operation (cooling mode)	77	68	66	61	56	54	51	44	64
Standard Operation (heating mode)	66	64	66	63	57	57	53	49	65

MVHR unit

Plant Description	A-weighted Induct Sound Power Level (dB re 10^{-12} Watts) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Inlet outdoor air	48	56	64	65	60	48	39	31	68
Outlet supply air	68	74	81	87	86	80	72	61	91

Inlet extract air	47	56	63	66	58	45	30	25	68
Outlet exhaust air	59	65	75	81	80	74	67	61	85
Casing to surround	51	57	69	68	66	66	62	50	74

Sound power level at connection ports is measured in accordance with ISO 5136.

10.5 Location of plant and worst affected neighbouring residential window

We understand the worst affected neighbouring residential window is located to the south of the site, within the line of sight of the proposed attic plantroom at approximately 17 metres from this. The approximate location of plant relative to the worst affected neighbouring residential window is shown in the site plan overleaf.

Site Plan (maps.google.co.uk)

11.0 Plant Noise Impact Assessment

The following table summarises our predictions of atmospheric noise emissions from the attic plantroom to the nearest worst affect neighbouring residential window without taking into account the effect of any noise mitigation measures. The effect of the plantroom without the roof installed has been calculated using our in-house software:

Item	Sound Power Level (dB re 10^{-12} Watts) or Sound Pressure Level (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
PURY-EP500 YNW-A Manufacturer's sound pressure level measured at 1m	66	64	66	63	57	57	53	49	65
Cumulative effect for 4No. units	+6	+6	+6	+6	+6	+6	+6	+6	-
16m distance loss	-18	-18	-18	-18	-18	-18	-18	-18	-
Façade effect	+3	+3	+3	+3	+3	+3	+3	+3	-
Calculated Noise Level at Window	57	55	57	54	48	48	44	40	56
MVHR inlet Manufacturer's sound power level	85	81	84	84	80	75	68	60	85
End reflection loss effect	-7	-4	-1	-	-	-	-	-	-
16m distance loss (L_w to L_p)	-32	-32	-32	-32	-32	-32	-32	-32	-
Façade Effect	+3	+3	+3	+3	+3	+3	+3	+3	-
Calculated Noise Level at Window	49	49	54	56	51	46	39	31	56
MVHR outlet Manufacturer's sound power level	74	72	73	68	60	49	40	30	69
End reflection loss effect	-7	-4	-1	-	-	-	-	-	-
16m distance loss (L_w to L_p)	-32	-32	-32	-32	-32	-32	-32	-32	-
Façade Effect	+3	+3	+3	+3	+3	+3	+3	+3	-
Calculated Noise Level at Window	38	40	43	40	31	20	11	1	40
Cumulative Sound Pressure Level at Window	58	56	59	58	53	50	45	41	59

Our calculations indicate that, without the implementation of noise mitigation measures, cumulative noise levels from the vaults plantroom would exceed the requirements of the Local Authority outlined in Section 5.4 by 18dBA during daytime hours. Mitigation measures will need to be considered as per Section 12.0.

12.0 Plant Noise Attenuation

In order to suitably control the atmospheric plant noise emissions in line with the Local Authority requirements, we propose the following noise mitigation measures:

12.1 MVHR unit

The MVHR unit proposed should be provided with suitable atmospheric attenuators. The following table presents the minimum insertion loss values required:

Description	Minimum Insertion Loss Values at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Inlet attenuator (atmospheric)	5	11	19	29	36	37	29	18
Discharge attenuator (atmospheric)	3	7	14	21	27	26	17	12

12.2 Condenser units

The condenser units proposed should be attenuated by at least 15dBA. This level of attenuation could be achieved by installing an acoustic splitter as a lid on the plantroom roof (in which case the atmospheric attenuators of the MVHR unit specified in Section 12.1 could be omitted) providing the following insertion loss values:

Description	Minimum Insertion Loss Values at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Acoustic splitter on roof	5	11	19	29	36	37	29	18

Alternatively the condenser units could be installed within a single/combined acoustic enclosure providing 15dBA attenuation or be reselected to be 15dBA quieter. Please find attached our Acoustic Specification for Acoustic Enclosures and a List of Suitable Suppliers.

13.0 Conclusions

A detailed daytime and night-time fully automated environmental noise survey has been undertaken in order to establish the currently prevailing environmental noise climate around the development site. The results are presented herein.

Plant noise emission criteria have been recommended based on the results of the noise survey and with reference to the Local Authority's policy.

An assessment has been carried out to determine the proposed plant noise emissions at the worst affected neighbouring residential window.

The assessment indicates that the proposed plant should be capable of achieving the proposed environmental noise criteria at the worst affected neighbouring residential window, providing that the noise mitigation measures stated in this report (Section 12.0) are implemented.

Appendix A

The acoustic terms used in this report are defined as follows:

dB — Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

L_{max} — L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

L_p — Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

L_w — Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

SPECIFICATION FOR

SMALL ACOUSTIC ENCLOSURES

Each condenser unit shall be supplied complete with acoustic treatment which shall achieve adequate levels of attenuation to ensure that the following limiting sound pressure levels are not exceeded when measured at a distance of 1m (free field over a reflecting plane) and in any horizontal or vertical direction under any load conditions.

Duty/Time	A-weighted Limiting Sound Pressure Level @ 1m (dB re 2 x 10^{-5} Pa)
Day 07:00 – 23:00 hours	50
Night – 23:00 – 07:00 hours	No operation

Furthermore they shall not exhibit any significant tonal content.

Exceedances in excess of the measurement tolerance for a Type 1 sound level meter shall constitute a failure.

The enclosed outer panels shall be constructed from galvanized sheet steel having a minimum thickness of 1.6mm and fixed at 300mm (max) centres. The enclosure inner panels shall be constructed from punch-perforated (round-hole) galvanised sheet steel facing, having a minimum thickness of 0.7mm fixed at 300mm (max) centres. Flattened-expanded ("Expamet") sheet shall not be used, unless all edges of the sheet are mechanically fixed to the panel casing and galvanised steel cover strips are used to prevent rivet heads pulling through the perforated sheet (trapping the Expamet between two solid steel layers).

The inert, rot and vermin proof, non-hygroscopic and non-combustible mineral wool or glass fibre acoustic medium shall be packed to a density of not less than 48kg/$m^{3.}$ This shall be faced with a glass fibre cloth, or other approved infill protection membrane. Panels shall be constructed and assembled so that no egress of the acoustic medium will occur under the operating conditions.

Doors, access panels, windows and ventilation ducts or electrical cable penetrations hall be treated so as to maintain the specified acoustic insulation of the assembled enclosure.

Demountable sections shall be designed to allow easy disassembly and reassembly by unskilled personnel without affecting the acoustic performance.

The supplier shall ensure that the assembled enclosure is designed and constructed to withstand site operating conditions such as wind and snow loads, roof mounted plant, etc., as appropriate, and if outside, to be suitably weatherproofed.

The acoustic media shall not comprise materials which are generally composed of mineral fibres, either man made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure that fibre migration is prevented.

Any deviations from the above specification must be agreed by, and confirmed in writing to, Hann Tucker Associates.

SUITABLE SUPPLIERS

of

ACOUSTIC ENCLOSURES FOR SMALL AIR CONDITIONING UNITS

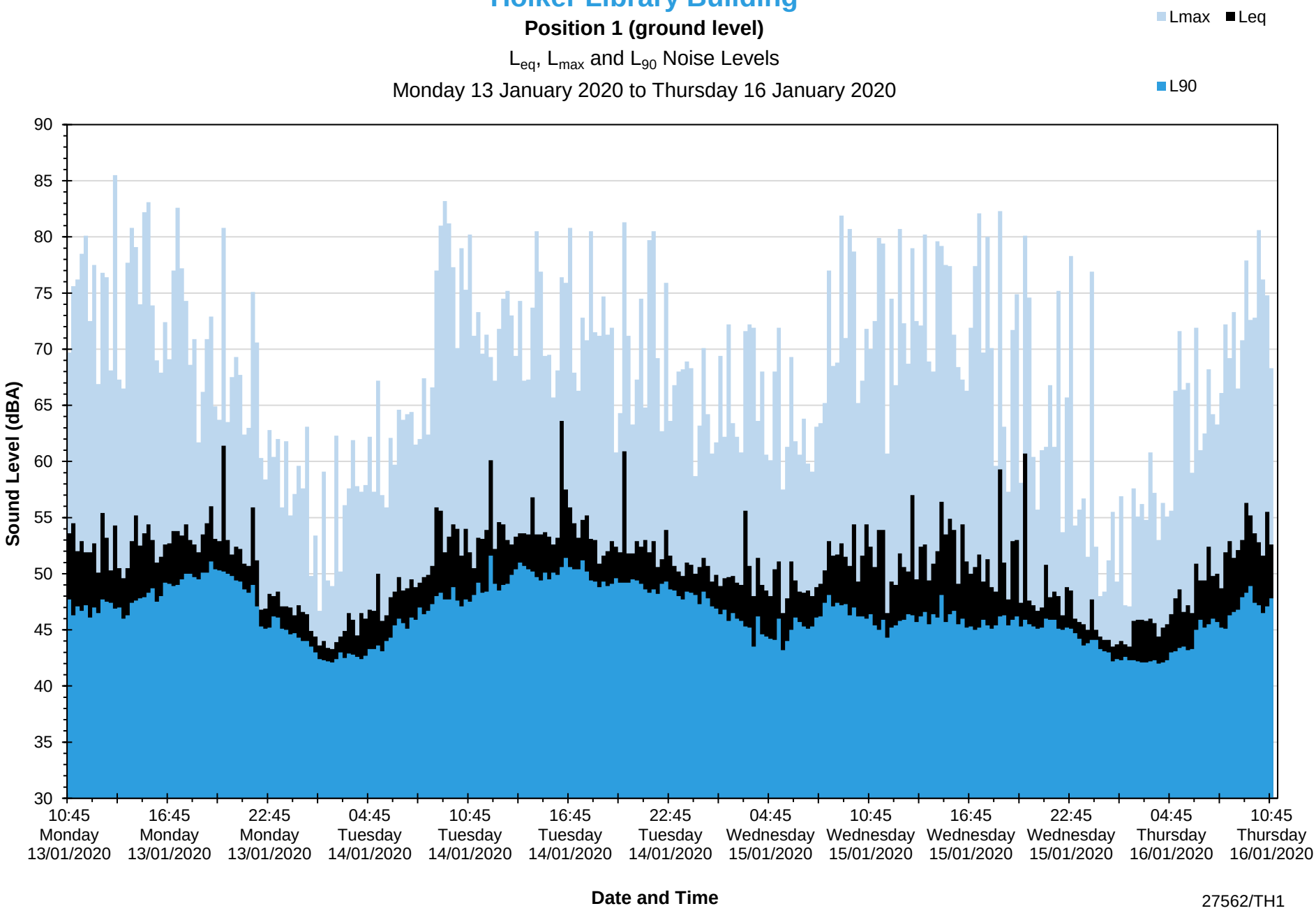
Name & Address	Telephone Number	Contact
Environ Technologies Ltd Regus House 1010 Cambourne Business Park Cambourne CB3 6DP	0870 383 3344	Steve Cox
Acoustic Engineering Services (UK) Ltd The Redwood Suite Guardian House Borough Road Godalming Surrey GU7 2AE	01483 495963	Barry Austin Mark Stagg

Holker Library Building

Position 1 (ground level)

L_{eq}, L_{max} and L_{90} Noise Levels

Monday 13 January 2020 to Thursday 16 January 2020



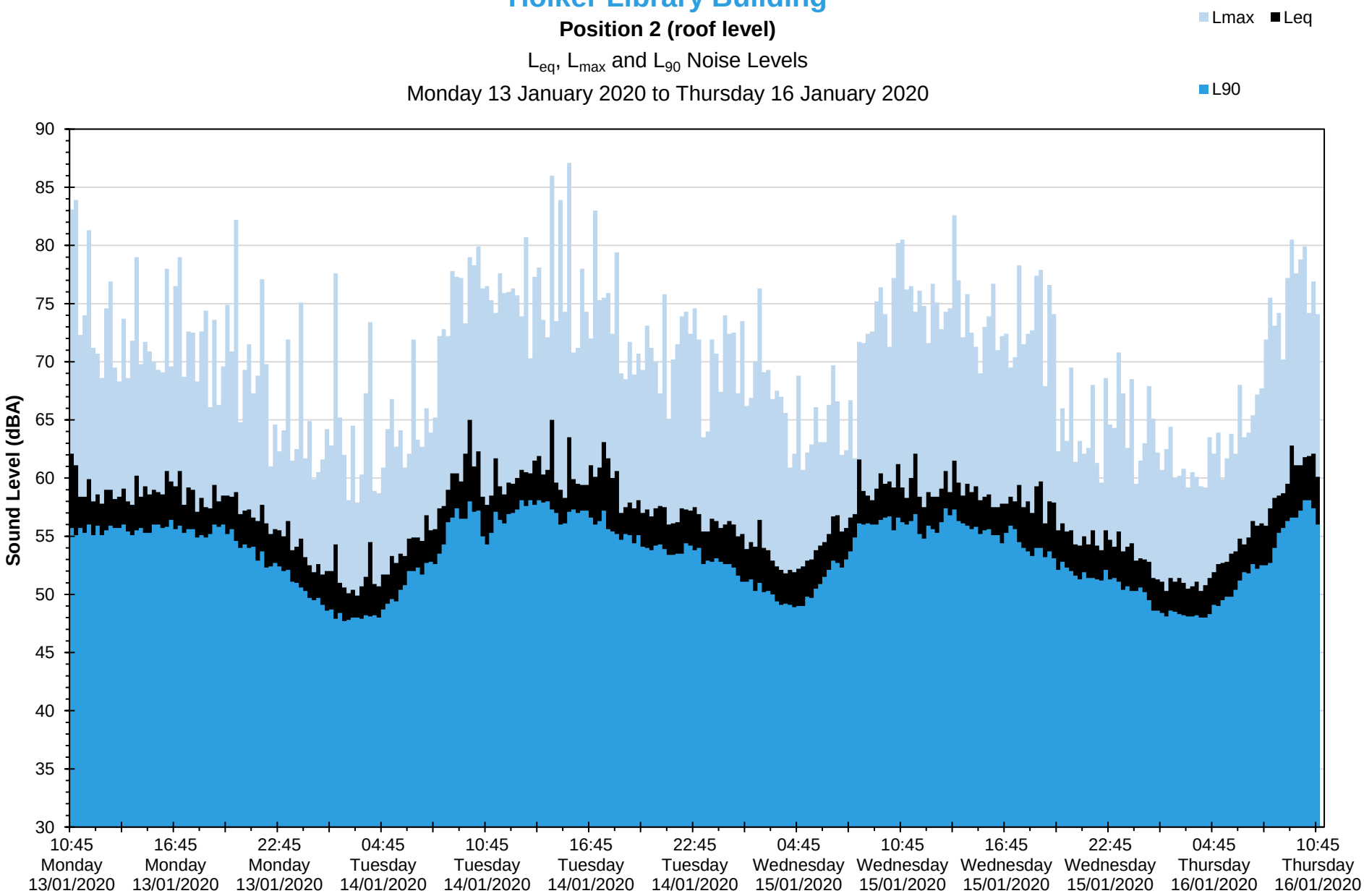
27562/TH1

Holker Library Building

Position 2 (roof level)

L_{eq}, L_{max} and L_{90} Noise Levels

Monday 13 January 2020 to Thursday 16 January 2020



27562/TH2