Kodak House
Kingsway
London

Environmental Noise Survey and Plant Noise Impact Assessment Report

27008/PNA1 Rev1

13 September 2019

For:
Kings Keeley Ltd
c/o Clearbell Capital LLP
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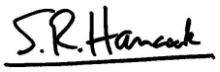
Document Control

Rev	Date	Comment	Prepared by	Authorised by
0	14/08/2019	-	Jacob Tyler Assistant Consultant BSc(Hons), AMIOA	Simon Hancock Director BEng(Hons), CEng, MIMechE MCIBSE, FIOA
1	13/09/2019	Included full assessment to nearest noise sensitive receptor.		
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1.0 Introduction

An office refurbishment has been proposed at Kodak House, 65 Kingsway.

Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey and plant noise assessment to assist with the planning application and to demonstrate compliance with BREEAM 2014: *Pol 05 Reduction of Noise Pollution.*

This report presents the methodology and findings of our noise survey and assessment in the context of national planning policies and the Local Authority.

2.0 Objectives

To inspect the site to familiarise ourselves with its layout and surroundings in order to identify suitable accessible locations for environmental noise measurements.

To establish by means of an unmanned 24 hour survey the existing L_{Amax}, L_{Aeq} and L_{A90} environmental noise levels at selected 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.

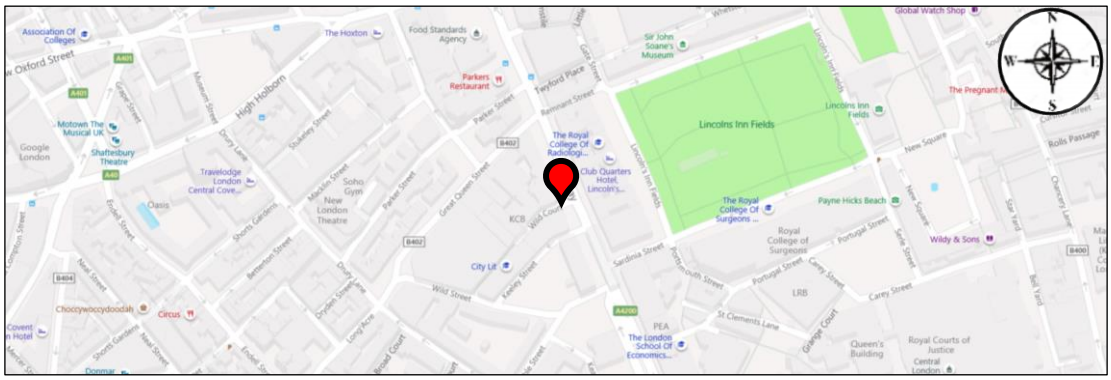
To advise on noise control measures if required with reference to the requirements of the Local Authority.

3.0 Site Description

3.1 Location

The site is located within a mixed commercial and residential area at 65 Kingsway, London.

The location is shown in the Location Map below.



Location Map (©2019 Microsoft)

The site falls within the jurisdiction of the London Borough of Camden.

3.2 Description

The site is approximately seven storeys + ground. The site is bordered by Wild Court to the north, Kingsway (A4200) to the east and Keeley Street to the south. A small café is located on the ground floor of Kodak House and several other restaurants are nearby along Kingsway Road.

The site is shown in the Site Plan below.

Site Plan (Imagery ©2019 Google; Map data ©2019 Google)

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 Local Authority Requirements

5.1.1 Noise Sensitive Developments

In policy DP28, the LB of Camden determines a noise sensitive development to be that which, *"…includes housing, schools and hospitals as well as offices, workshops and open spaces…"*

5.1.2 Building Services Plant Noise Criteria

The site lies within the jurisdiction of the London Borough of Camden. Their policy stated within the *"Camden Development Policies 2010-2025: Local Development Framework"* regarding criteria for atmospheric noise emissions from building service plant is as follows:

"Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise Level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatter, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dBL_{Aeq}

"

5.1.3 BREEAM 2014 – Pol 05

To satisfy Planning, the proposed refurbishment must satisfy BREEAM 2014 with the production of a BS7445 Noise Impact Assessment. The BREEAM document states the following:

"2. …where the building does have noise-sensitive areas or buildings with 800m radius of the development, one credit can be awarded as follows:

a) Where a noise impact assessment in compliance with BS7445 has been carried out and the following noise levels measured/determined:

i) Existing background noise levels at the nearest or most exposed noise-sensitive development to the proposed development or at a location where background conditions can be argued to be similar.

ii) The rating noise level resulting from the new noise source…

4. The noise level from the proposed site/building, as measured in the locality of the nearest or most exposed noise-sensitive development, is a difference no greater than +5dB during the day (07:00 to 23:00) and +3dB at night (23:00 to 07:00) compared to the background noise level.

5. Where the noise source(s) from the proposed site/building is greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with criterion 4."

5.2 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".

5.3 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."

That vision is supported by the following NPSE noise policy aims which are reflected in three of the four aims of planning policies and decisions in paragraph 123 of the NPPF (see paragraph 8.2 (b) below):

"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.

5.4 National Planning Policy Framework (NPPF)

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."

5.5 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

5.6 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

Residential Environment	Critical Health Effect(s)	L_{Aeq}	L_{AFmax}	Time Base
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 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 J W Hardacre.

6.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 11:30 hours on 7 August 2019 to 12:30 hours on 8 August 2019.

During the periods we were on site the wind conditions were moderate and the sky was generally patchy cloud. We understand that generally throughout the survey period the weather conditions remained the same. These conditions are considered suitable for obtaining representative measurement results.

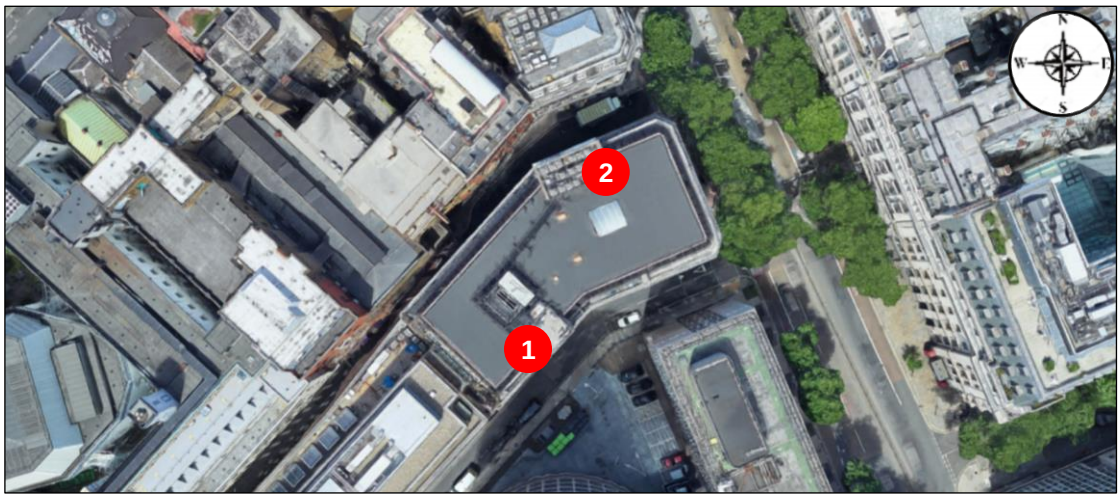
Measurements were taken continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15 minute periods.

6.2 Measurement Positions

The noise level measurements were undertaken at two positions as described in the table below.

Position No	Description
1	The microphone was attached to a pole approximately 4 metres above roof level, and positioned along the south-eastern perimeter of the site overlooking Keeley Street.
2	The microphone was attached to a pole approximately 3 metres above roof level, and positioned along the North North East perimeter of the site overlooking Wild Court.

The approximate measurement locations can be seen in the site plan below.



Plan Showing Measurement Positions (Imagery ©2019 Google; Map data ©2019 Google)

6.3 Instrumentation

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

Description	Manufacturer	Type	Serial Number	Annual Calibration
Position 1 Type 1 ½" Condenser Microphone	PCB	377B02	107427	Calibration on 13/09/2018
Position 1 Preamp	Larson Davis	PRM902	4154	Calibration on 13/09/2018
Position 1 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3155	Calibration on 13/09/2018
Position 2 Type 1 ½" Condenser Microphone	ACO Pacific	7052E	52450	Calibration on 08/03/2019
Position 2 Preamp	Svantek	SV12L	30424	Calibration on 08/03/2019
Position 2 Type 1 Data Logging Sound Level Meter	Svantek	957	28035	Calibration on 08/03/2019

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

Each sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable.

Each microphone was fitted with a windshield.

7.0 Results

The results have been plotted on Time History Graphs 27008/TH1.1 and 27008/TH1.2 enclosed, presenting the 15 minute A-weighted (dBA) L_{90} and L_{eq} noise levels at each measurement position throughout the duration of the survey.

The L_{Aeq} measurements recorded during the survey are presented in the table below:

Period Beginning	Measured $L_{Aeq(15min)}$ Noise Level (dBA re 2 x 10^{-5} Pa)			
	Position 1		Position 2	
	Daytime (07:00 – 23:00) Hours	Night-Time (23:00 – 07:00) Hours	Daytime (07:00 – 23:00) Hours	Night-Time (23:00 – 07:00) Hours
07/08/2019 11:00	60	58	61	57
08/08/2019 07:00	60		60	

The typical (modal) $L_{A90\ (15\ min)}$ measurements recorded during the survey are presented in the table below:

Position	Typical (Modal) Measured $L_{A90(15min)}$ Background Noise Level (dBA re 2 x 10^{-5} Pa)	
	Daytime (07:00 – 23:00) Hours	Night-Time (23:00 – 07:00) Hours
1	58	54

8.0 Discussion Of Noise Climate

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately determine the individual noise sources and specific noise events that occurred throughout the survey period. During the periods we were on site the dominant noise sources were traffic along Keeley Street and Kingsway Road.

9.0 Plant Noise Emission Criteria

Building services plant external noise emission levels will need to comply with Local Authority requirements and statutory noise nuisance legislation.

On the basis of the above 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 window.

Plant Noise Emission Limits (dBA re $2x10^{-5}$ Pa)	
Daytime (07:00 – 23:00 hours)	**Night-time (23:00 – 07:00 hours)**
53	**49**

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

If plant contains tonal or impulsive characteristics the external design criteria should be reduced by 5dBA.

The above criteria should not be applied to emergency plant. Atmospheric noise emissions from smoke extract fans are not normally considered to be an issue.

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

10.0 Plant Noise Impact Assessment

10.1 Operational Periods

We understand that the units will be operational during the following periods.

Description	Operational Period
ARK plant	06:00-19:00 hours
Soho Coffee Shop plant	06:00-20:00 hours
Landlord plant	06:00-19:00 hours

10.2 Drawings

Our acoustic analyses is based upon the following drawings provided by Malcolm Hollis.

Reference	Title	Date
77298-MHL-00-B1-M2-G-10200-A7-01	Basement	06/06/2019
77298-MHL-00-GF-M2-G-10200-A7-01	Ground Floor Plan	07/06/2019
77298-MHL-00-01-M2-G-10200-A7-01	First Floor Plan	07/06/2019
77298-MHL-00-02-M2-G-10200-A7-02	Second Floor Plan	14/06/2019
77298-MHL-00-03-M2-G-10200-A7-01	Third Floor Plan	14/06/2019
77298-MHL-00-04-M2-G-10200-A7-01	Fourth Floor Plan	14/06/2019
77298-MHL-00-05-M2-G-10200-A7-01	Fifth Floor Plan	14/06/2019

Reference	Title	Date
77298-MHL-00-06-M2-G-10200-A7-01	Sixth Floor Plan	14/06/2019
77298-MHL-00-07-M2-G-10200-A7-01	Seventh Floor Plan	14/06/2019
4541 - 65 Kingsway	Roof Plant Sketch – Acoustic Layout	02/09/2019

10.3 Plant Noise Data

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

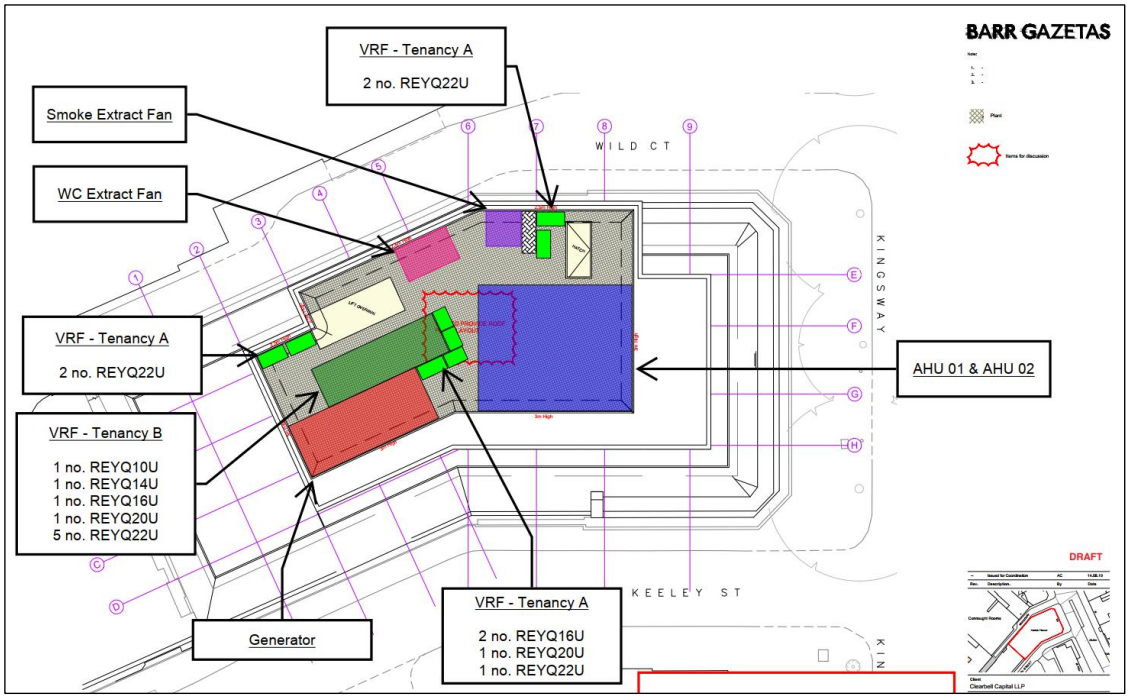
Plant Description			Sound Pressure Level (dB re $2x10^{-5}$ Pa) at 1 metre at Octave Band Centre Frequency (Hz)								dB A	Qty.
			63	125	250	500	1k	2k	4k	8k		
AHU01	Casing Radiated	L_p@ 1m	67	69	60	60	54	49	43	40	61	1
	Supply (Atmospheric)	L_w	75	76	59	44	53	62	61	42	67	
	Supply (Roomside)	L_w	76	78	63	52	49	55	52	51	65	
	Extract (Roomside)	L_w	78	81	67	49	42	47	46	43	66	
	Extract (Atmospheric)	L_w	77	77	59	47	47	50	48	54	63	
AHU02	Casing Radiated	L_p@ 1m	67	69	60	60	54	49	43	40	61	1
	Supply (Atmospheric)	L_w	75	76	59	44	52	60	60	42	66	
	Supply (Roomside)	L_w	76	78	63	52	48	54	52	51	64	
	Extract (Roomside)	L_w	77	80	66	48	40	44	45	42	65	
	Extract (Atmospheric)	L_w	76	76	58	46	45	49	47	53	62	
VRF REYQ10U	L_w		87	82	80	77	72	72	67	62	79	1
VRF REYQ14U	L_w		87	83	80	80	75	70	70	67	81	1
VRF REYQ16U	L_w		94	90	85	85	77	73	73	71	85	3
VRF REYQ20U	L_w		96	87	87	88	81	76	75	70	88	2
VRF REYQ22U	L_w		90	85	83	81	76	75	76	67	84	10
Generator G01	L_p@1m		50	54	73	74	77	74	67	56	80	1
Extract Fan (Smoke & WC)	Inlet	L_w	87	94	105	106	109	105	100	96	112	2
	Fan	L_w	87	94	105	106	109	105	100	96	112	
	Outlet	L_w	87	94	105	106	109	105	100	96	112	
	Breakout	L_p@ 1m	67	71	79	77	77	70	62	55	80	

N.B. AHU01 and AHU02 have had attenuators specified by Dalair Limited. The above table presents resultant noise levels. The Dalair specifications sheet is shown in the Appendix.

N.B. It has been proposed by Stuart Power Ltd. to enclose the generator to achieve a noise level of 80dBA at 1 metre.

10.4 Location of Plant

The proposed plant locations are presented on the site plane below.



Site Plan Showing Proposed Plant Locations (Image courtesy of Barr Gazetas)

The nearest noise sensitive location is shown below.

Nearest Noise Sensitive Receptor (Imagery ©2019 Bluesky, Getmapping plc, Infoterra Ltd. & Bluesky. Maxar Technologies, The GeoInformation Group; Map data ©2019 Google)

10.5 Mitigation Measures

In order to control plant noise emissions in line with the proposed criterion, we recommend installing an acoustic louvre surrounding the plant. The louvre should be capable of achieving the following sound transmission losses:

Sound Transmission Loss for Acoustic Louvre							
63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
6	7	10	12	18	18	14	13

N.B. This could typically be achieved with a 300mm acoustic louvre.

We would also recommend installing attenuators to the WC Extract Fan. The attenuator should be capable of achieving the following insertion losses:

Insertion Loss for Attenuators							
63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
9	18	30	48	50	50	50	40

A list of suitable suppliers for acoustic louvres and attenuators are presented in the appendix.

10.6 Plant Noise Impact Assessment

The following tables summarises our predictions of atmospheric noise emissions from the plantroom louvres to the nearest noise sensitive residential window.

Description			Sound Pressure Level (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency (Hz)								dBA
			63	125	250	500	1k	2k	4k	8k	
AHU01	Supply	L_w	76	79	63	52	49	55	52	57	65
	Extract	L_w	77	77	59	47	47	50	48	53	63
Cumulative Level			80	81	65	53	57	56	54	56	67
Conformal Area Distance Correction (Approx. 17m)			-37	-37	-37	-37	-37	-37	-37	-37	
300mm Acoustic Louvre			-6	-7	-10	-12	-18	-18	-14	-13	
Façade Reflection			+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor		L_p@1m	40	40	21	7	5	4	6	9	25
AHU02	Supply	L_w	75	76	59	44	52	60	60	42	60
	Extract	L_w	76	76	58	46	45	49	47	53	62
Cumulative Level			79	79	62	48	53	60	60	53	67
Conformal Area Distance Correction (Approx. 17m)			-37	-37	-37	-37	-37	-37	-37	-37	
300mm Acoustic Louvre			-6	-7	-10	-12	-18	-18	-14	-13	
Façade Reflection			+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor		L_p@1m	39	38	18	2	1	8	12	6	23
2 No. REYQ16U		L_w	97	93	88	88	80	76	76	74	88
1 No. REYQ20U		L_w	96	87	87	88	81	76	75	70	88
1 No. REYQ22U		L_w	90	85	83	81	76	75	76	67	84
VRF Tenancy A Cumulative Noise Levels		L_w	100	95	91	91	84	81	81	76	92
Conformal Area Distance Correction (Approx. 23m)			-39	-39	-39	-39	-39	-39	-39	-39	
300mm Acoustic Louvre			-6	-7	-10	-12	-18	-18	-14	-13	
Façade Reflection			+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor		L_p@1m	58	52	45	43	30	27	31	29	44
1 No. REYQ10U		L_w	87	82	80	77	72	72	67	62	79
1 No. REYQ14U		L_w	87	83	80	80	75	70	70	67	81
1 No. REYQ16U		L_w	94	90	85	85	77	73	73	71	85
1 No. REYQ20U		L_w	96	87	87	88	81	76	75	70	88
5 No. REYQ22U		L_w	97	92	90	88	83	82	83	74	91
VRF Tenancy B Cumulative Noise Levels		L_w	101	95	93	92	86	84	84	77	94
Conformal Area Distance Correction (Approx. 19m)			-38	-38	-38	-38	-38	-38	-38	-38	
300mm Acoustic Louvre			-6	-7	-10	-12	-18	-18	-14	-13	
Façade Reflection			+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor		L_p@1m	60	53	48	45	33	31	35	27	46
VRF Tenancy A 2 No. REYQ22U		L_w	93	88	86	84	79	78	79	70	87

Distance Correction		-38	-38	-38	-38	-38	-38	-38	-38	
300mm Acoustic Louvre		-6	-7	-10	-12	-18	-18	-14	-13	
Façade Reflection		+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor	L_p@1m	52	46	41	37	26	25	30	22	39
WC Extract Fan	L_w	87	94	105	106	109	105	100	96	112
Attenuator		-9	-18	-30	-48	-50	-50	-50	-40	
Ductwork Correction		-4	-2	0	0	0	0	0	0	
Point Source Distance Correction (Approx. 27m)		-37	-37	-37	-37	-37	-37	-37	-37	
300mm Acoustic Louvre		-6	-7	-10	-12	-18	-18	-14	-13	
Façade Reflection		+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor	L_p@1m	34	33	31	12	7	3	2	9	24
VRF – Tenancy A 2No. REYQ22U	L_w	93	88	86	84	79	78	79	70	87
Point Source Distance Correction (Approx. 28m)		-37	-37	-37	-37	-37	-37	-37	-37	
300mm Acoustic Louvre		-6	-7	-10	-12	-18	-18	-14	-13	
Façade Reflection		+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor	L_p@1m	53	47	42	38	27	26	31	23	40
Total Cumulative Noise Level at 1 metre from Receptor		63	57	51	48	36	34	38	32	49

Our calculations indicate that the proposed plant, in conjunction with the propose mitigation measures, should be capable of achieving the requirements of the Local Authority outlined in Section 8.0.

11.0 Conclusions

An environmental noise survey has been undertaken in order to establish the existing L_{Amax}, L_{Aeq} and L_{A90} environmental noise levels.

Plant noise emission criteria have been recommended based on the results of the noise survey and with reference to the Local Authority's requirements to minimise the possibility of noise nuisance to neighbours.

Our calculations indicate that the proposed plant, in conjunction with the proposed mitigation measures, should be capable of achieving the requirements of the Local Authority.

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.

Sound Pressure Level (L_p) 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).

Sound Power Level (SWL or L_w) 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).

Appendix B

Dalair Limited (Technical Centre)
Quotation Reference: E190412
Project Reference: 65 Kingsway

Dalair Limited
Air Handling Equipment

Air Handling Unit Acoustic Analysis

AHU Reference : AHU 01 Supply & Extract (Supply Air Volume: 4.941m³/s & Extract Air Volume: 4.45m³/s)

CASING RADIATED		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum (Fan Outlet)	SWL	80	85	81	81	81	78	76	73	
Mounting Fan Within AHU Section	dB	4	4	4	4	4	4	4	4	
Supply & Extract Fans Running Together	dB	3	3	3	3	3	3	3	3	
50mm Panel Transmission Loss (Rockwool - 100Kg/m3)	dB	-17	-20	-25	-25	-31	-33	-37	-37	
SPL Panel	dB	70	72	63	63	57	52	46	43	
Distance @ 1 metre (Corrected to Actual Test Values)	dB	-3	-3	-3	-3	-3	-3	-3	-3	
RESULTANT Sound Pressure Level	dB	67	69	60	60	54	49	43	40	61

ATMOSPHERIC - Supply		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Inlet (Supply Fan)	SWL	77	83	80	77	75	73	71	68	
Mounting Fan Within AHU Section	dB	8	8	8	4	4	4	4	4	
AHU Mounted Component Losses	dB	-2	-2	-2	-2	-3	-5	-8	-8	
1200mm Long Silencer Insertion Losses	dB	-8	-13	-27	-39	-45	-45	-35	-24	
Regenerated Noise Correction	dB	0	0	0	4	22	35	29	2	
Sound Power Level To AHU Fresh Air Inlet	SWL	75	76	59	44	53	62	61	42	67

ROOMSIDE - Supply		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Outlet (Supply Fan)	SWL	80	85	81	81	81	78	76	73	
Mounting Fan Within AHU Section	dB	4	4	4	4	4	4	4	4	
AHU Mounted Component Losses	dB	-1	-1	-1	-1	-1	-2	-2	-2	
900mm Long Silencer Insertion Losses	dB	-7	-10	-21	-32	-43	-43	-28	-24	
Regenerated Noise Correction	dB	0	0	0	0	8	18	2	0	
Sound Power Level To AHU Supply Air Outlet	SWL	76	78	63	52	49	55	52	51	65

ROOMSIDE - Extract		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Inlet (Extract Fan)	SWL	78	84	81	78	76	74	72	69	
Mounting Fan Within AHU Section	dB	8	8	8	4	4	4	4	4	
AHU Mounted Component Losses	dB	-1	-1	-1	-1	-1	-2	-2	-2	
900mm Long Silencer Insertion Losses	dB	-7	-10	-21	-32	-43	-43	-28	-28	
Regenerated Noise Correction	dB	0	0	0	0	6	14	0	0	
Sound Power Level To AHU Return Air Inlet	SWL	78	81	67	49	42	47	46	43	66

ATMOSPHERIC - Extract		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Outlet (Extract Fan)	SWL	81	86	82	82	82	79	77	74	
Mounting Fan Within AHU Section	dB	4	4	4	4	4	4	4	4	
AHU Mounted Component Losses	dB	0	0	0	0	0	0	0	0	
1200mm Long Silencer Insertion Losses	dB	-8	-13	-27	-39	-45	-45	-35	-24	
Regenerated Noise Correction	dB	0	0	0	0	6	12	2	0	
Sound Power Level To AHU Exhaust Air Outlet	SWL	77	77	59	47	47	50	48	54	63

Dalair Limited (Technical Centre)
Quotation Reference: E190412
Project Reference: 65 Kingsway

Air Handling Equipment

Air Handling Unit Acoustic Analysis

AHU Reference : AHU 02 Supply & Extract (Supply Air Volume: 4.848m³/s & Extract Air Volume: 4.366m³/s)

CASING RADIATED		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum (Fan Outlet)	SWL	80	85	81	81	81	78	76	73	
Mounting Fan Within AHU Section	dB	4	4	4	4	4	4	4	4	
Supply & Extract Fans Running Together	dB	3	3	3	3	3	3	3	3	
50mm Panel Transmission Loss (Rockwool - 100Kg/m3)	dB	-17	-20	-25	-25	-31	-33	-37	-37	
SPL Panel	dB	70	72	63	63	57	52	46	43	
Distance @ 1 metre (Corrected to Actual Test Values)	dB	-3	-3	-3	-3	-3	-3	-3	-3	
RESULTANT Sound Pressure Level	**dB**	**67**	**69**	**60**	**60**	**54**	**49**	**43**	**40**	**61**

ATMOSPHERIC - Supply		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Inlet (Supply Fan)	SWL	77	83	80	77	75	73	71	68	
Mounting Fan Within AHU Section	dB	8	8	8	4	4	4	4	4	
AHU Mounted Component Losses	dB	-2	-2	-2	-2	-3	-5	-8	-8	
1200mm Long Silencer Insertion Losses	**dB**	**-8**	**-13**	**-27**	**-39**	**-45**	**-45**	**-35**	**-24**	
Regenerated Noise Correction	dB	0	0	0	4	21	33	28	2	
Sound Power Level To AHU Fresh Air Inlet	**SWL**	**75**	**76**	**59**	**44**	**52**	**60**	**60**	**42**	**66**

ROOMSIDE - Supply		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Outlet (Supply Fan)	SWL	80	85	81	81	81	78	76	73	
Mounting Fan Within AHU Section	dB	4	4	4	4	4	4	4	4	
AHU Mounted Component Losses	dB	-1	-1	-1	-1	-1	-2	-2	-2	
900mm Long Silencer Insertion Losses	**dB**	**-7**	**-10**	**-21**	**-32**	**-43**	**-43**	**-28**	**-24**	
Regenerated Noise Correction	dB	0	0	0	0	7	17	2	0	
Sound Power Level To AHU Supply Air Outlet	**SWL**	**76**	**78**	**63**	**52**	**48**	**54**	**52**	**51**	**64**

ROOMSIDE - Extract		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Inlet (Extract Fan)	SWL	77	83	80	77	75	73	71	68	
Mounting Fan Within AHU Section	dB	8	8	8	4	4	4	4	4	
AHU Mounted Component Losses	dB	-1	-1	-1	-1	-1	-2	-2	-2	
900mm Long Silencer Insertion Losses	**dB**	**-7**	**-10**	**-21**	**-32**	**-43**	**-43**	**-28**	**-28**	
Regenerated Noise Correction	dB	0	0	0	0	5	12	0	0	
Sound Power Level To AHU Return Air Inlet	**SWL**	**77**	**80**	**66**	**48**	**40**	**44**	**45**	**42**	**65**

ATMOSPHERIC - Extract		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Outlet (Extract Fan)	SWL	80	85	81	81	81	78	76	73	
Mounting Fan Within AHU Section	dB	4	4	4	4	4	4	4	4	
AHU Mounted Component Losses	dB	0	0	0	0	0	0	0	0	
1200mm Long Silencer Insertion Losses	**dB**	**-8**	**-13**	**-27**	**-39**	**-45**	**-45**	**-35**	**-24**	
Regenerated Noise Correction	dB	0	0	0	0	5	12	2	0	
Sound Power Level To AHU Exhaust Air Outlet	**SWL**	**76**	**76**	**58**	**46**	**45**	**49**	**47**	**53**	**62**

Dalair Limited (Technical Centre)
Quotation Reference: E190412
Project Reference: 65 Kingsway

Air Handling Unit Acoustic Analysis

AHU Reference : EX 01 Extract (Extract Air Volume: 2.595m³/s)

CASING RADIATED		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum (Fan Outlet)	SWL	72	75	79	78	78	79	79	70	
Mounting Fan Within AHU Section	dB	4	4	4	4	4	4	4	4	
50mm Panel Transmission Loss (Rockwool - 100Kg/m3)	dB	-17	-20	-25	-25	-31	-33	-37	-37	
SPL Panel	dB	59	59	58	57	51	50	46	37	
Distance @ 1 metre (Corrected to Actual Test Values)	dB	-3	-3	-3	-3	-3	-3	-3	-3	
RESULTANT Sound Pressure Level	dB	56	56	55	54	48	47	43	34	55

ROOMSIDE - Extract		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Inlet (Extract Fan)	SWL	72	78	80	74	72	73	72	67	
Mounting Fan Within AHU Section	dB	8	8	8	4	4	4	4	4	
AHU Mounted Component Losses	dB	-1	-1	-1	-1	-1	-1	-1	-1	
1200mm Long Silencer Insertion Losses	dB	-8	-13	-27	-39	-45	-45	-35	-35	
Regenerated Noise Correction	dB	0	0	0	0	6	8	0	0	
Sound Power Level To AHU Return Air Inlet	SWL	71	72	60	38	36	39	40	35	58

ATMOSPHERIC - Extract		Octave Band Centre Frequency								O/All dBA
	Hz	63	125	250	500	1000	2000	4000	8000	
Power Spectrum Outlet (Extract Fan)	SWL	72	75	79	78	78	79	79	70	
Mounting Fan Within AHU Section	dB	4	4	4	4	4	4	4	4	
AHU Mounted Component Losses	dB	0	0	0	0	0	0	0	0	
1200mm Long Silencer Insertion Losses	dB	-8	-13	-27	-39	-45	-45	-35	-24	
Regenerated Noise Correction	dB	0	0	0	0	4	4	2	0	
Sound Power Level To AHU Exhaust Air Outlet	SWL	68	66	56	43	41	42	50	50	57

Appendix C

Suitable Suppliers of Acoustic Louvres

Name & Address	Telephone Number	Contact
IAC Acoustics IAC House Moorside Road Winchester SO23 7US	01962 873000	Paul Gilbert
Allaway Acoustics Ltd 1 Queens Road Hertford SG14 1EN	01992 550825	Jim Grieves Andy Smith
Caice Riverside House 3 Winnersh Fields Gazelle Close Winnersh Wokingham RG41 5QS	0118 918 6470	Mike Jackson
QuietStar Limited 1 Glen Road Fleet Hampshire GU51 3QS	01252 674327	Luke Willis

Appendix D

Suitable Suppliers of Attenuators

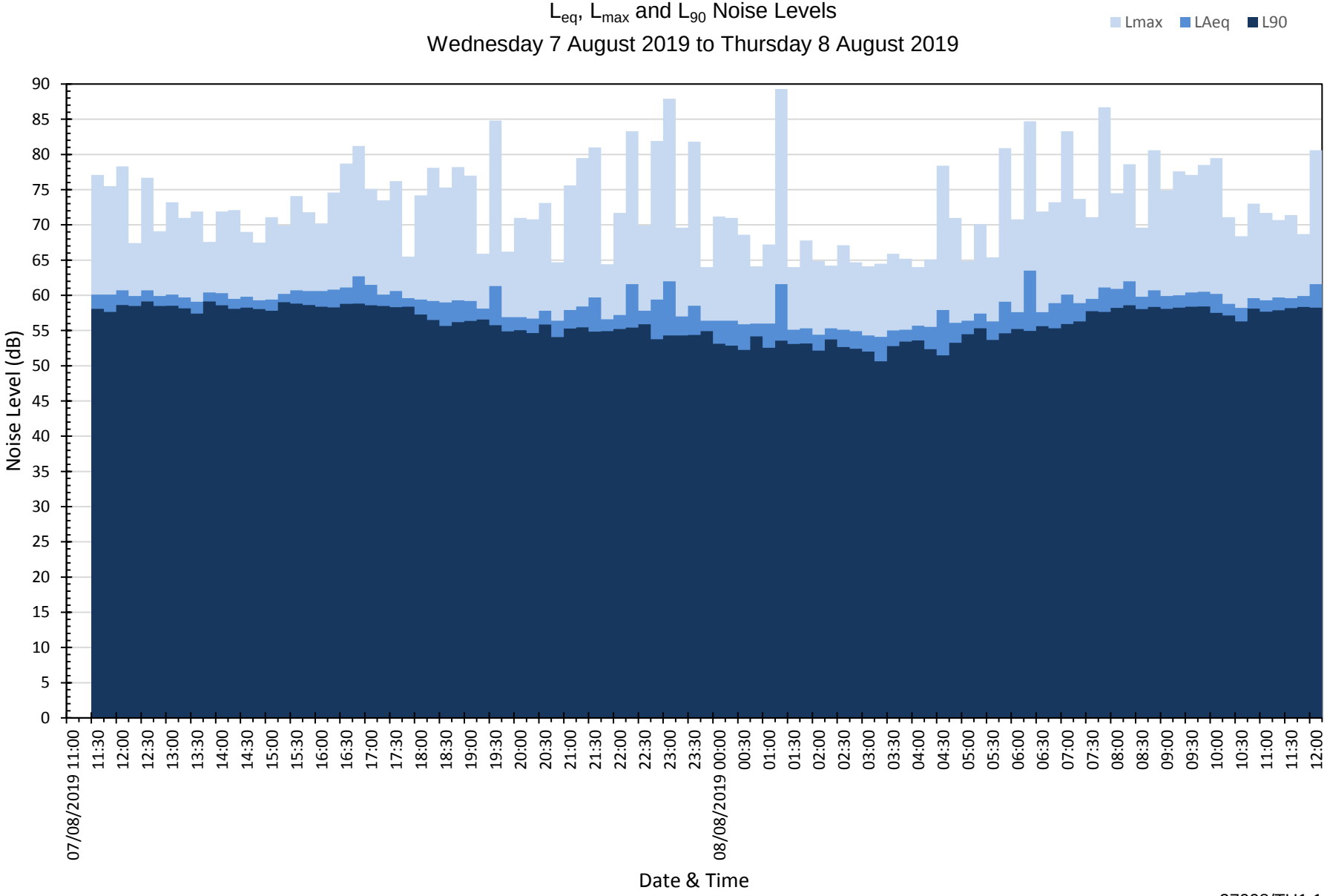
Name & Address	Telephone Number	Contact
IAC Acoustics IAC House Moorside Road Winchester SO23 7US	01962 87300	Kevin Shipway Gill Budd
Allaway Acoustics Ltd 1 Queens Road Hertford SG14 1EN	01992 550825	Jim Grieves Andy Smith
Caice Riverside House 3 Winnersh Fields Gazelle Close Winnersh Wokingham RG41 5QS	0118 918 6470	Mike Jackson

Kodak House

Position 1

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

Wednesday 7 August 2019 to Thursday 8 August 2019



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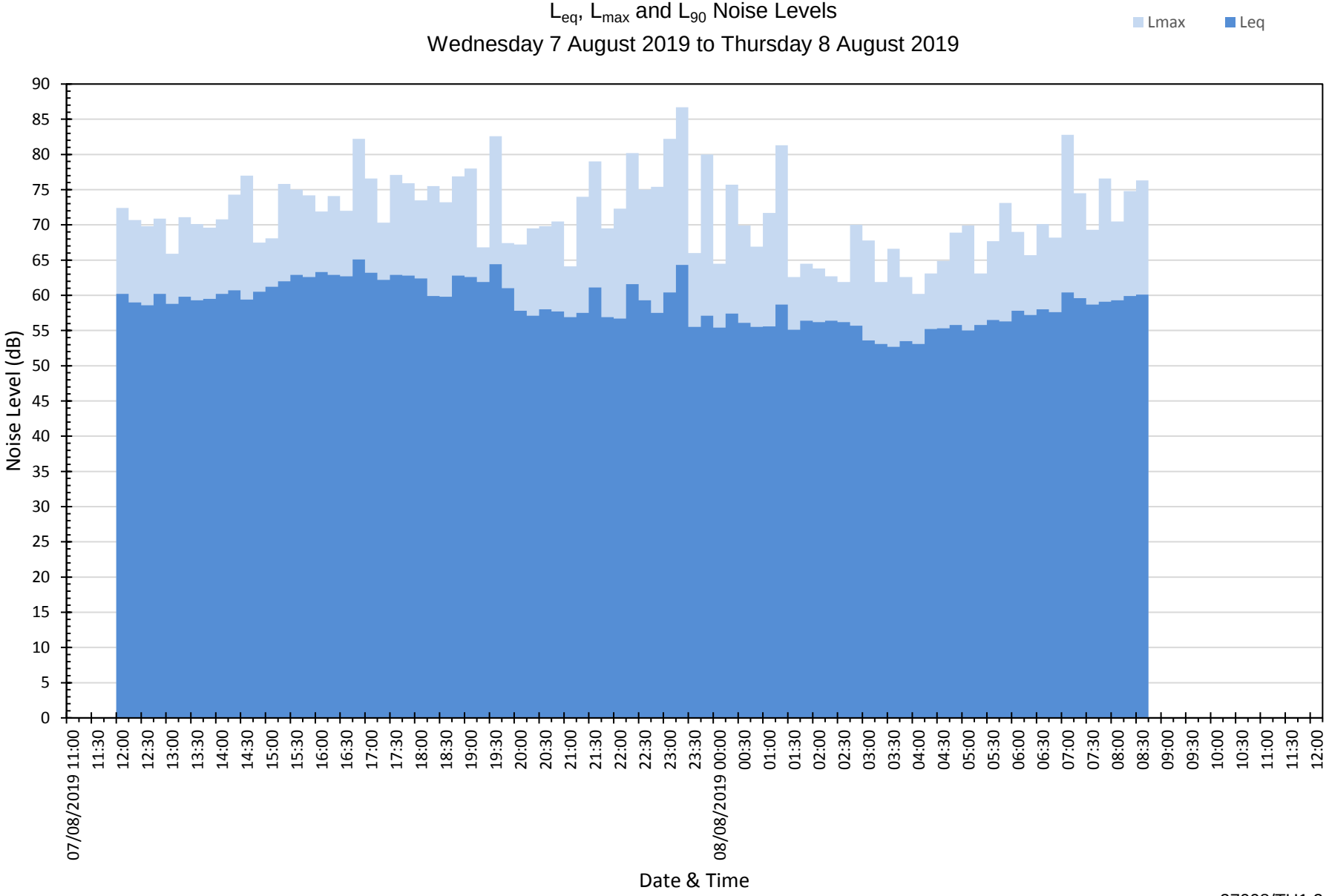
Kodak House

Position 2

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

Wednesday 7 August 2019 to Thursday 8 August 2019



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