Francis Crick Institute – Freezer Farm Noise Assessment

prepared for The Francis Crick Institute, 1 Midland Road, London

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Document Details

Title	Noise Assessment
Project	Francis Crick Institute – Freezer Farm
Reference	2716.RP.1

Revision	Date	Author(s)	Reviewer
0	17 January 2025	TS	RM

Executive Summary

The Francis Crick Institute (FCI) carries out work of national and international importance in carrying out scientific research and translating the results of that research into treatments and technologies to improve the lives of people in the UK and internationally.

To expand their work new cooling plant is required and 2no. chillers are proposed to be installed on the south-west Level 6 roof.

This plant shall need to comply with the noise emission criteria of the London Borough of Camden. This report sets out details of the proposed plant, a survey of background noise levels, and noise mitigation requirements.

It is concluded that, with the inclusion of an acoustic attenuation package for each plant item, noise emission will not exceed relevant noise emission limits at nearby noise sensitive property.

Appendix A sets out a summary of acoustic parameters referred to in this report.

Contents

1.0 Proposals

1.1 Two chillers are proposed to be located on the Level 6 south-west roof. The units may operate throughout the day and night, but both units would not operate at the same time.

1.2 Noise data for the specific units is detailed in **Table 1**. It is expected the unit may periodically switch on and off during any given operational period. It is noted that there is nothing specific in the manufacturers data that would suggest noise emission from the unit is tonal in character.

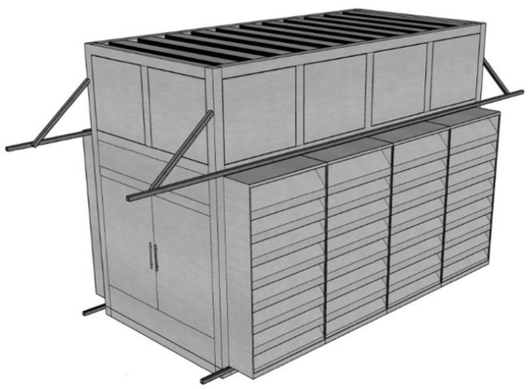
1.3 In anticipation of the requirement for noise control, it is proposed to place each unit inside a noise attenuation package as presented in **Image 1**. The insertion loss from the proposed attenuation package is also presented in **Table 1.**

1.4 With the package, and based on our experience, we would expect sound power to be evenly distributed to the surfaces of the inlet (sides) and discharge (top) louvres, with the residual noise emission from the non-ventilated parts of the package being relatively quiet.

Table 1 Manufacturer supplied plant noise data

Detail	Octave band centred frequency, Hz						
	63	125	250	500	1k	2k	4k
Sound Power, dB, of *Mitsubishi* 'MECH-iS-G07 0092'	88	81	80	78	76	73	68
Acoustic insertion loss of *Allaway* 'AA301S'	-2	-5	-8	-13	-16	-16	-14

Image 1.
Proposed chiller including acoustic attenuation package.



2.0 Noise Limits

Noise Sensitive Locations

2.1 **Image 2** presents the nearest noise sensitive properties to the development site. It is noted that the site is surrounded by a number of residential dwellings of 4-6 stories in height. The British Library may also be noise sensitive, but not standard office hours outside of.

Noise Criteria

2.2 Appendix 3 of the Camden Local Plan sets out noise thresholds in keeping with the National Planning Policy Framework and Planning Practice Guidance, and with reference to BS 4142:2014. Regarding noise from new industrial and commercial sources, Table C of the Appendix suggests a Lowest Observable Adverse Effect Level (LOAEL) corresponds to a rating level of noise 10dB below the background, or 15dB below where the plant is tonal.

2.3 Section 6.27 of the Camden Planning Guidance (CPG) on Amenity (January 2021) states:

> *"Developments proposing plant, ventilation, air extraction or conditioning equipment and flues will need to provide the system's technical specifications to the Council accompanying any acoustic report. 'BS4142 Method for rating Industrial and Commercial Sound' contains guidance and standards which should also be considered within the acoustic report."*

2.4 The approach of BS 4142:2014 + A1:2019 is to compare the rating noise level (the noise level of the equipment plus any relevant corrections) and the background noise at the noise sensitive locations and during the relevant period, and in the context in which the sound occurs. Section 11 of the standard then states:

> *"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."*

2.5 BS 4142:2014 + A1:2019 also suggests a 0 to + 6dB rating correction for tonality, and a potential further 0 to + 3dB rating correction for intermittency.

2.6 On the basis that a level 5dB below background would be significantly beneath a level where noise may be considered to have a "low impact", that the existing noise climate is already affected by plant noise, and that a 0 to 3dB rating correction might apply due to plant intermittency, the BS 4142 approach may suggest a noise limit of 5 to 8dB beneath the background.

2.7 In summary, and assuming the character of the chiller noise is not tonal, the Local Plan and CPG would suggest noise limit at up to 10dB below background.

Noise Survey

2.8 An unattended noise survey was undertaken on 21-24 March 2023 and at two locations, indicated in **Image 2**, taken to be representative of nearby dwellings. Details of the survey are presented in **Appendix B**. and summary results are presented in **Table 2**.

2.9 At the beginning and end of the survey, the noise climate at both locations was noted to be controlled by distance and local road traffic, and anonymous plant noise.

Image 2
Site plan showing location of the FCI, proposed chillers, nearby noise sensitive properties, and noise measurement locations.

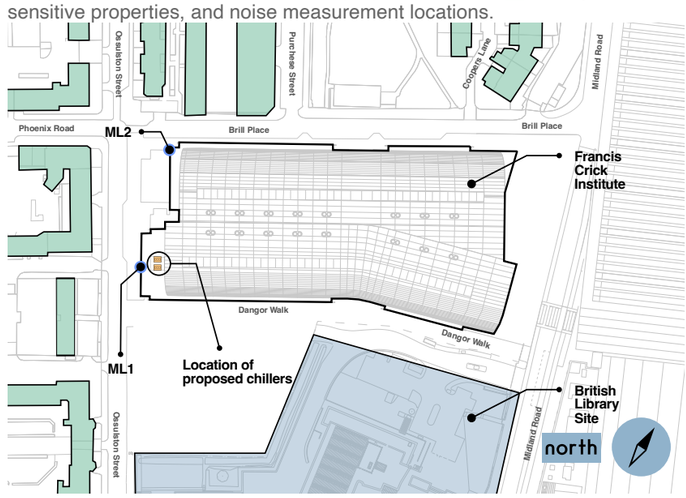


Table 2 Summary background noise levels

Location	Office, 0800-1800 Min. $L_{A90,1h}$	Day, 0700-2300 Min $L_{A90,1h}$	Night 2300-0700 Min $L_{A90,15min}$
ML1	51	49	45
ML2	51	48	45

3.0 Noise Assessment

3.1 To consider propagation from the various construction activity to nearby noise sensitive property, and especially given the complex intervening geometry, we have developed a 3D acoustic model of the surrounding area.

3.2 The model is assessed using acoustic analysis software *Wölful* IMMI 2024, that enables the sound pressure level to be evaluated across a grid of locations and a corresponding noise map to be presented. This model necessarily applies the following assumptions:

- Height of receptors: noting that the highest receptors are approximately 16m above local ground level, whereas the Level 6 roof is approximately 28m above local ground level.
- Noise propagation in accordance with ISO 9613-2:2024
- Downwind noise propagation
- Buildings with façade reflections active where appropriate.

3.3 Using the model **Image 3** presents the dB(A) L_{eq} plant noise at 16m above local ground level. **Table 3** presents the colour scale for noise levels used in the images.

3.4 At the most exposed noise sensitive window, we evaluate noise levels to be 33 and 34 dB(A) from the southern and northern chiller, respectively. Noise emission is therefore estimated to be 11 to 12dB beneath the lowest night-time background noise levels, or 1 to 2dB beneath the derived noise emission limits.

Image 3. Plant noise emission at 16m above local ground

South chiller operating | Northern chiller operating

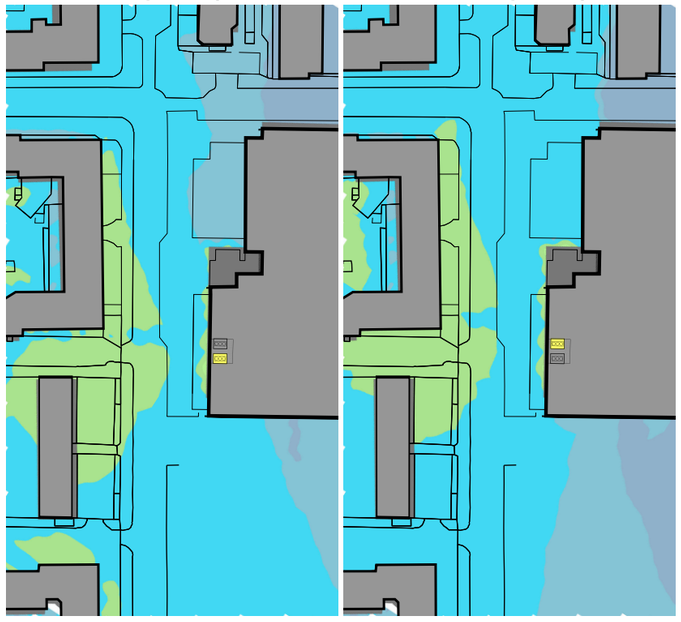


Table 3 Noise map colour key

Noise Level, L_{eq} dB(A)	Noise Map Colour
≤ 20	
20-25	
25-30	
30-35	Plant noise limit ≤ 35dB(A)
35-40	
40-45	
45-50	
≥ 50	

4.0 Conclusions

4.1 A noise survey has been undertaken to establish the typical minimum ambient noise levels at residential properties surrounding the Francis Crick Institute.

4.2 Based on the results of the survey, and with reference to Camden planning policy, plant noise limits have been derived.

4.3 The propagation of noise from proposed plant has been modelled, and plant noise maps presented.

4.4 Assessed noise emission is estimated to be 1 to 2dB beneath the derived noise emission limit and therefore compliant with local authority requirements.

Appendix A: Acoustic Parameters

Explanation of Acoustic Quantities

There are a number of relevant acoustic parameters and quantities that need to be introduced to provide the language and context of design discussions. Here we explain the subjective quality of each quantitative parameter.

Noise Level

Firstly, we note the letters dB (short for decibel) purely mean we are talking about a logarithmic quantity, which means differences in noise level can be deceptive. For reference, a change of 10dB is broadly equivalent to a doubling or halving of perceived noise level, whereas for a time varying noise source 3dB is regarded as a just noticeable difference. The following table of vocal effort (taken from BS EN ISO 9921) might provide a helpful subjective understanding of any given noise level.

Table 4 Subjective correlation of vocal effort and noise level

Vocal Effort	Sound level at 1m from mouth
Very loud	78 dB(A)
Loud	72 dB(A)
Raised	66 dB(A)
Normal	60 dB(A)
Relaxed	54 dB(A)

Time variance

Noise varies with time and statistical parameters have been derived to describe this. In this context we are interested in three such parameters:

L_{eq}

This is the time-average noise level. It is the constant sound level that corresponds to same acoustic energy as a time varying signal. The average over 5-minute would be the $L_{eq,5min}$, and the average over an hour would be the $L_{eq,1hr}$; and this approach to varying time periods similarly applies to the L_{max} and L_{90} below. This quantity is relevant for consideration of overall noise exposure over time.

$L_{max,fast}$

If the whole time period were divided into very short intervals, the interval with the highest L_{eq} is described as the L_{max}. The ‘fast’ element means that the short interval is only 1/8th second, as opposed to ‘slow’ where the interval would be 1 second. For the purposes of this report we will drop the word ‘fast’, and refer to L_{max} as the same. This quantity is relevant for audibility of transient events.

$L_{90, fast}$

As for L_{max}, the L_{90} describes the level above which 90% of the short intervals exceed. Due to the percentile nature of the L_{90}, the time weighting rarely has any effect. This quantity is relevant for considering relatively constant noise from a source in and against an otherwise time varying existing noise level.

Frequency Variance

Noise also varies in terms of frequency. When looking at detailed noise data we often group the broadband noise into whole-octave or one-third-octave centre bands. However, to simplify some specifications and assessments the following single-figure indices are commonly used.

A-weighting

This is a correction curve across all frequencies which matches the typical response of the human ear. Having applied the correction, a summation of all frequencies yields the dB(A) sound level. The ‘A’ can also be incorporated into the above time parameters, so L_{eq} 45dB(A) can also be written as L_{Aeq} 45dB.

Noise Rating

The ‘NR’ curves are similarly intended to be lines of equal noise level, originally relevant to the noise from mechanical services equipment. The NR value of a particular noise level is the highest curve which is not exceeded by the noise level in any whole-octave-band. Of course, the time weighting can still apply so, for example, NR45 L_{max}.

Appendix B: Noise Survey

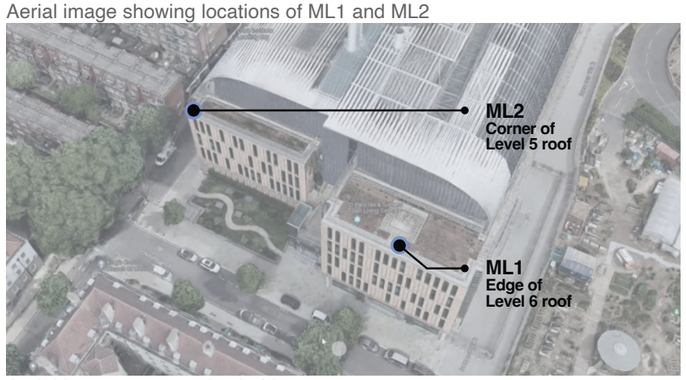
Noise survey methodology and results

Noise monitoring was undertaken on 21-24 March 2023. Measurements were made at two locations, ML1 and ML 2 as indicated in **Images B1-B4**.

Image B1
Measurement location ML1

Image B2
Measurement location ML2

Image B3
Aerial image showing locations of ML1 and ML2



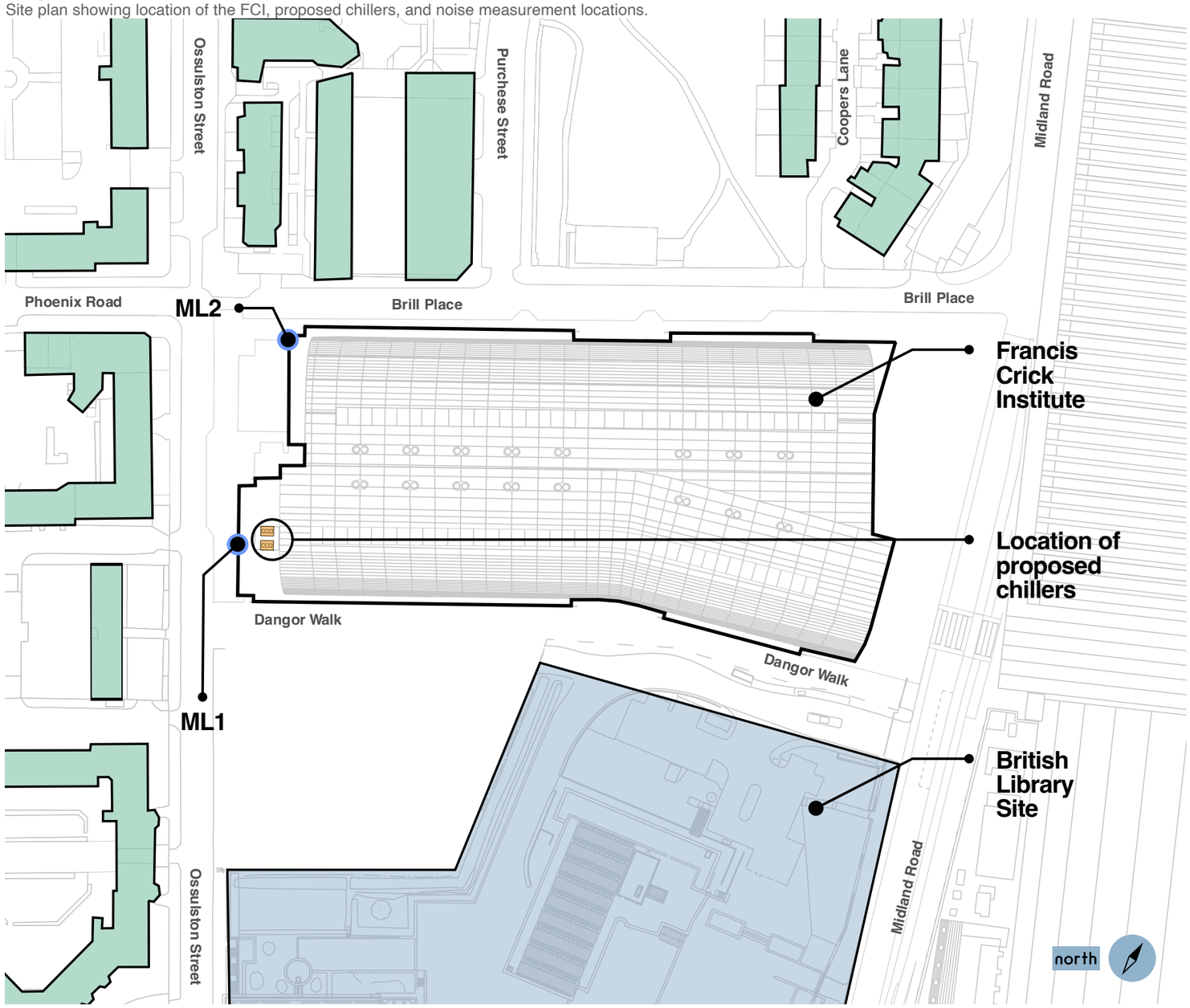
Aerial image courtesy Apple Maps

Measurements were made using equipment set out in **Table 5**. The sound level analysers were calibrated before and after the survey, and no significant drift was noted.

Table 5 Noise survey equipment

Item	Detail
Sound level analyser	2no. Norsonic 140
Outdoor microphone kit	2no. Norsonic 1217
Acoustic Calibrator	2no. Norsonic 1255

Image B4
Site plan showing location of the FCI, proposed chillers, and noise measurement locations.



During the first half of the survey we note weather conditions were occasionally not favourable. For this reason the survey period was extended from 24-hours to the final measurement duration.

At the beginning and end of the survey, the noise climate at both locations was noted to be controlled by distance and local road traffic, and anonymous plant noise.

Measurements were made in terms of L_{Aeq}, $L_{Amax,fast}$ and L_{A90} every 15-minutes throughout the survey period. An overview of these results at locations ML1 and ML2 are presented in **Images B5 and B6**, respectively.

Summary 1-hr average and 1-hr minimum L_{A90} levels, for consideration as background noise in the plant noise assessment, are presented in **Table 6**.

Table 6 Summary noise levels

Time	Minimum $L_{A90,1h}$		Minimum $L_{A90,15min}$	
	ML1	ML2	ML1	ML2
0000-0100	47.9	47.4	47.1	46.6
0100-0200	46.8	46.4	46.4	46.4
0200-0300	45.9	45.8	45.7	45.5
0300-0400	45.5	45.2	45.3	45.0
0400-0500	46.1	45.6	45.7	45.3
0500-0600	47.7	47.2	47.3	46.6
0600-0700	49.7	49.3	49.3	49.1
0700-0800	50.2	49.5	49.7	49.1
0800-0900	52.6	53.0	51.8	51.4
0900-1000	52.6	52.8	52.4	52.4
1000-1100	52.5	52.8	51.6	51.7
1100-1200	52.4	53.0	52.4	52.3
1200-1300	52.8	52.9	52.7	52.7
1300-1400	52.7	53.5	52.3	52.6
1400-1500	51.9	52.6	51.6	52.1
1500-1600	52.5	52.7	51.5	51.8
1600-1700	52.6	51.8	52.0	51.1
1700-1800	51.4	51.2	51.2	50.8
1800-1900	50.6	50.6	50.4	50.3
1900-2000	50.3	50.5	49.8	50.1
2000-2100	49.7	49.6	49.0	48.6
2100-2200	49.5	48.8	49.0	48.4
2200-2300	48.8	48.0	48.4	47.6
2300-2400	48.9	48.3	48.4	48.0

Image B5

Noise level time history at location ML1, of 15-minute L_{Aeq}, $L_{Amax,f}$ and L_{A90}, in terms of sound pressure level (dB, y-axis) against time (hhmm, x-axis)

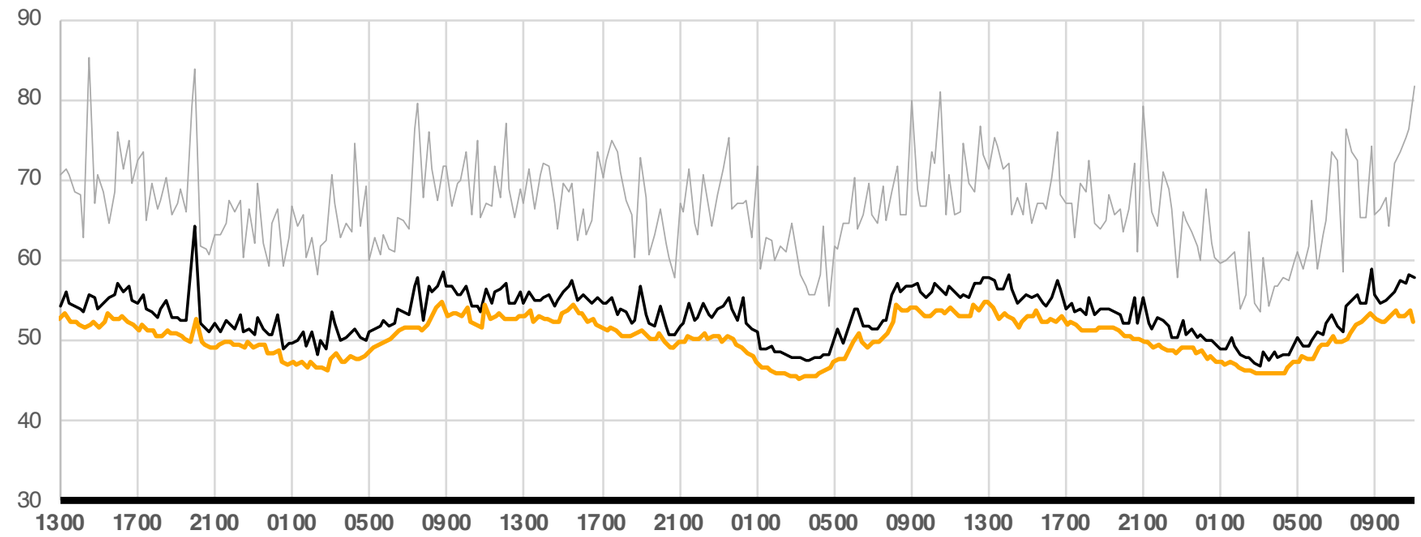


Image B6

Noise level time history at location ML2, of 15-minute L_{Aeq}, $L_{Amax,f}$ and L_{A90}, in terms of sound pressure level (dB, y-axis) against time (hhmm, x-axis)