Noise Impact Assessment

Client: **Ben Tseng**

Site: **69 Clerkenwell Road, London, EC1R 5BU**

Reference: **2104241NR**

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Executive Summary

A Noise Impact Assessment has been undertaken at 69 Clerkenwell Road, London, EC1R 5BU in relation to the proposed installation of a kitchen extract system.

Measurements of the background noise climate have been undertaken from the 15th – 16th May 2024 at a position deemed representative of the identified Noise Sensitive Receptors (NSRs).

The nearest or most-affected Noise Sensitive Receptor has been identified as the 1st floor window above the site.

A BS4142:2014 Initial Impact Assessment of the predicted daytime noise impact indicated the potential for a 'Low Impact' at the NSR location, with Rating Levels 11 dB below the representative daytime background sound level.

A further Contextual Assessment has been undertaken where noise levels from the site have been assessed to the existing noise climate along with other relevant factors and determined that a Low Impact is indicated with no further mitigation required, corresponding to achievement *'NOEL – No Observed Effect Level'* in the NPSE.

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1. Introduction

Overview

A Noise Impact Assessment has been undertaken at 69 Clerkenwell Road, London in relation to the proposed installation of a kitchen extraction unit.

Details of the proposed plant equipment have been provided by the applicant and are listed below:

- Extract System – VES T-Line 120 with silencer.
- Supply System – Komfovent VERSO-S-1300 with silencer.

Manufacturer technical data sheets with noise level data for the system have been sourced and are given in **Appendix G.**

The system will be installed internally and vented via the ground floor façade.

The plant equipment is associated with the ground floor takeaway use.

An assessment of the proposed plant equipment is to be undertaken to determine whether residents are likely to suffer a loss of amenity as a result of noise from the proposed plant. Mitigation will be given should any potential loss of amenity be indicated.

Scope & Objectives

The scope of the noise assessment can be summarised as follows:

- Baseline sound monitoring survey to evaluate the prevailing background sound levels at the Noise Sensitive Receptor ('NSR') in accordance with BS7445 - *'Description and Measurement of Environmental Noise'*;

- Detailed sound modelling, acoustic calculations and analysis to predict sound levels at the NSR using industry-standard acoustic modelling software 'SoundPLAN'. This software uses ISO-9613-2 - *Attenuation of sound during propagation outdoors;*

- A contextual assessment for the suitability of the site, in accordance with relevant standards in respect of sound from the proposed sources; and

- Recommendation of mitigation measures where necessary, to comply with the requirements of the National Planning Policy Framework (2021), Noise Policy for England (2010) and British Standard BS 4142:2014+A1:2019 – Methods for rating and assessing industrial and commercial sound.

- No local policy guidance or comments have been provided.

- Further information on the legislation can be found in **Appendix I.**

2. Environmental Noise Survey

Measurement Methodology

To establish the existing environmental noise levels on site, a noise survey was conducted from the 15th – 16th May 2024 between 13:35 and 13:00. Measurements of $L_{Aeq,T}$ and $L_{A90,T}$ were logged in 5-minute intervals in accordance with BS7445 - *'Description and Measurement of Environmental Noise'*.

The unattended monitoring location (M1) was positioned out of a ground floor window at a height of approximately 2 metres. A -3dB correction is applied to measured data to account for proximity to the building façade.

The monitoring position is deemed representative of sound levels at 'NSR 1' during the typical operational periods of the proposed development.

Further detail of the measurement along with site pictures is given in **Appendix A.**

Measurements were obtained using Class 1 instrumentation. Full equipment details are given in **Appendix B**.

Equipment was calibrated before and after use and no significant drift occurred during measurements. Up-to-date calibration certification can be provided upon request. Full calibration details are provided in **Appendix C.**

Daytime temperatures during the survey were noted as between 15 - 20°C with wind speeds typically between 1 - 2m/s; deemed suitable for conducting environmental noise monitoring. Detailed meteorological information can be found in **Appendix D.**

The site, proposed noise source and NSR locations are shown in **Figure 1.**

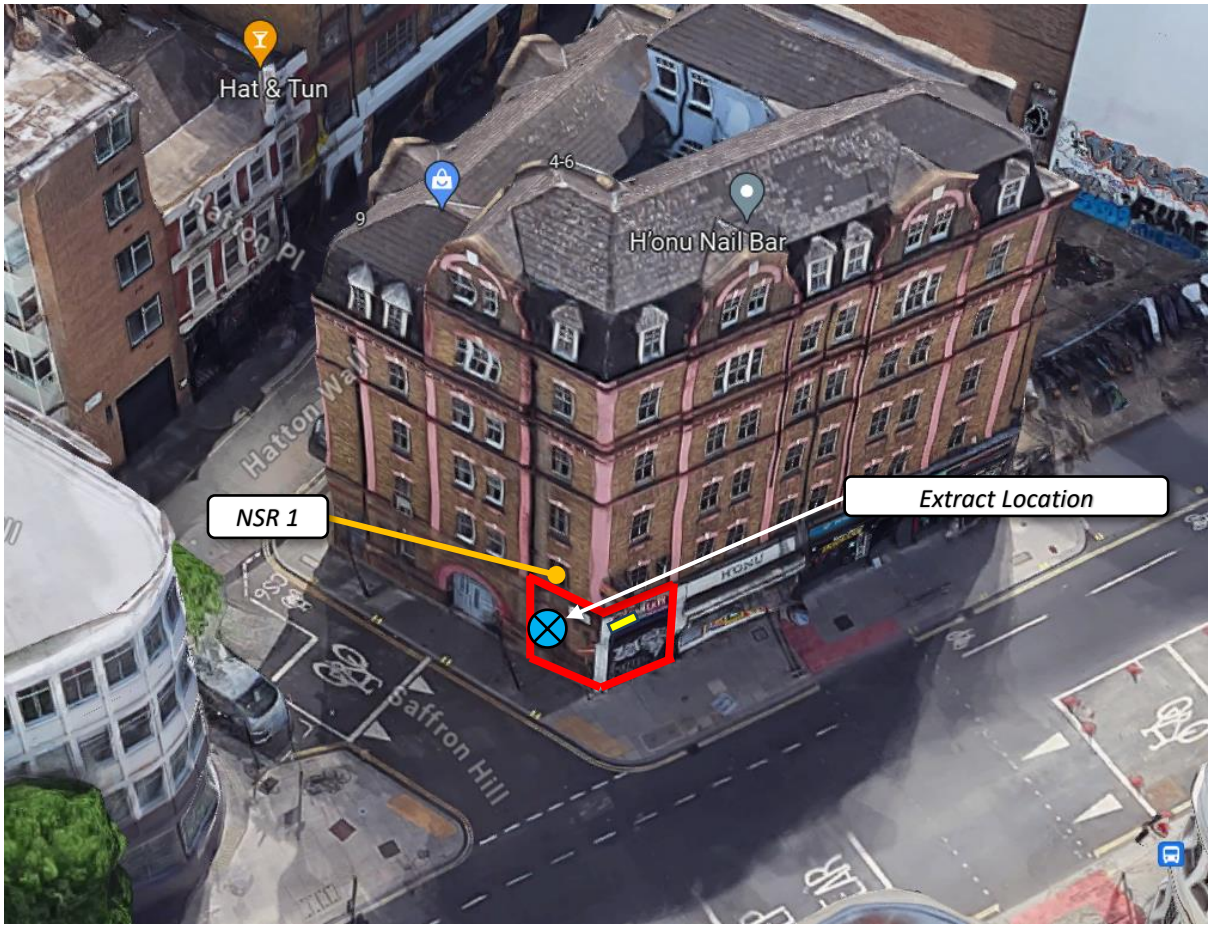

Figure 1: Site, Source & NSR Locations - https://google.co.uk/maps

Site Boundary (Approx.)

Supply Louvre Location

Noise Sensitive Receptor (NSR)

Background Monitoring Location M1 & Extract Louvre Location

Site Description

The site is located on the ground floor of 69 Clerkenwell Road. The site is on the corner of Clerkenwell Road and Saffron Hill in the Clerkenwell area of central London. Clerkenwell Road is a busy main road and bus route with a bus stop and pedestrian crossing opposite the site.

The 1st floor and above are considered as residential areas for the purposes of the assessment.

Context and Subjective Noise Climate

Noise Source	Description	Time of Observation	Photo
Road	Heavy road noise from cars, vans, HGV's, Buses, Motorcycles passing the site	Constant during site visits	
Pub	'Hat & Tun' Pub to the rear of the site with some external seating / patrons talking outside.	Constant during site visits	
Motorcycle Repair Shop	Small repair shop to the rear of the site, engines running and radio playing	Constant during site visits	

Table 1: Subjective Summary of Noise Sources

Non-Representative Noise Sources

During the survey, no noise events occurred which would be deemed as atypical of the site location.

Noise Sensitive Receptors

The nearest or most-affected Noise Sensitive Receptors (NSRs) have been identified as upper floor windows of the site at 1st floor and above which are part of the Griffin House flat complex. The closest habitable room window will be considered as a specific reception point in calculations.

3. Environmental Noise Survey Results

Measurement Results

The kitchen extract system is to serve the proposed takeaway and therefore has the potential to operate during daytime hours of 07:00 – 23:00.

The day and night-time background sound levels from measurement M1 are summarised below.

Measurement	Date(s)	Period	$L_{Aeq,T}$	$L_{A90,T}$
M1	15th & 16th May 2024	Daytime (07:00 – 23:00)	66	53
	15th - 16th May 2024	Night-time (23:00 – 07:00)	60	44

Table 2: M1 Background Noise Survey Results

A full-time history of the survey data is shown in **Appendix E.**

For the derivation of a representative daytime background sound level, data from the whole daytime period (07:00 – 23:00) has been statistically analysed.

A graph of the statistical analysis is given below:

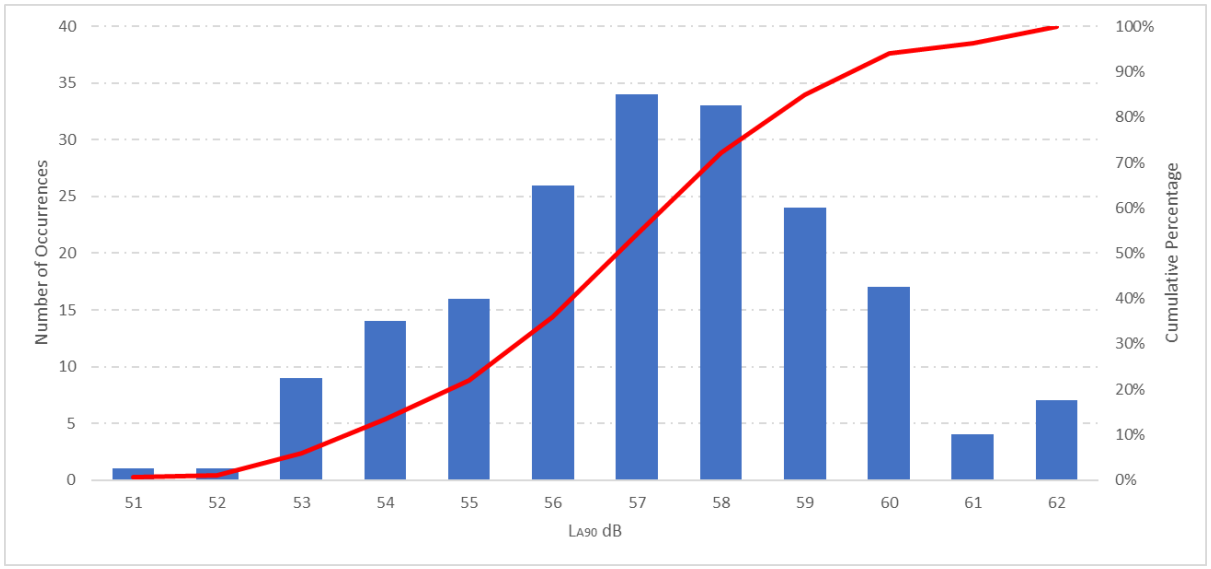

Figure 2: M1 Background Statistical Analysis

From the statistical analysis of M1 measurement and taking into account the -3dB façade correction from section 2, **53dB L_{A90}** has been selected as the representative background sound level for the BS4142:2014 assessment at the NSR locations.

4. BS4142:2014 Initial Impact Assessment

Noise Modelling

External sound propagation from the site has been calculated using industry-standard acoustic modelling software 'SoundPLAN'. This software uses ISO-9613-2 - *Attenuation of sound during propagation outdoors* and the model takes into account the following key factors:

- *Aerial Imagery & Terrain Data sourced from Google Maps/Elevations*
- *Geometric divergence of sound*
- *Atmospheric absorption of sound*
- *Ground absorption*
- *A light downwind correction toward the NSRs*
- *Surrounding structures and objects which may reflect or block sound toward the NSRs*
- *The height of the NSRs (i.e., First/second-floor reception point)*
- *Operational schedule of equipment*

The following input parameters were used in the noise model:

Parameter	Input
Reflection Order	3
Ground Absorption Factors	G = 0.3 (Hard Ground)
Air pressure	1013.3 mbar
Relative Humidity	70.0 %
Temperature	10.0°C

Table 3: Calculation Input Parameters

Source Noise Levels

Details of the proposed extract system have been provided by the applicant, and include

- Extract System – VES T-Line 120 with silencer.
- Supply System – Komfovent VERSO-S-1300 with silencer.

The noise output of the extract and supply louvres has been provided by the system installer:

Unit	Para.	63	125	250	500	1k	2k	4k	8k	dBA
Extract Louvre	LwA	62	64	53	40	42	38	47	40	**53**
Supply Louvre		62	59	53	44	45	41	38	52	**54**

Table 4: Extract and Supply Louvre Noise Levels

Details of the noise sources that have been modelled in 'SoundPLAN' are given below:

Source No.	Source	Parameter	Noise Level, dBA	Height above Ground (m)
1	Extract Louvre	LwA	53	3
2	Supply Louvre		54	3

Table 5: Modelled Source Noise Levels

To account for a worst-case scenario, all sources will be modelled to be running at 100% for the daytime period.

The noise model does not account for minor landscape features such as low walls and fences.

Specific Sound Levels

The Specific Sound Level is denoted L_{As} and is the A-weighted, equivalent noise level at the NSR locations. Specific Sound Levels have been calculated from the noise model and the levels at the worst affected floors of receptors are given below.

Location	Specific Sound Level, dB L_{As}
NSR 1 (1F)	40

Table 6: Specific Sound Levels

Rating Levels

In accordance with BS4142, the Specific Sound Levels may be corrected for characteristics that make the sound more noticeable at the NSR location such as tonality, impulsivity and intermittency. Section 9.2 of BS4142:2014 gives commentary on these characteristics and appropriate penalties:

> ***"Tonality***
> *For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.*
>
> ***Impulsivity***
> *A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.*
>
> ***Other sound characteristics***
> *Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.*

NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Intermittency
When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

Noise output from air handling systems such as the kitchen extract and supply system may have slight tonality and so a +2dB rating penalty will be applied to account for this.

The system is not expected to run intermittently or have impulsive characteristics and so no corrections will be applied in relation to these factors.

The resultant Rating Levels are summarised below:

Location	Specific Sound Level, dB L_{As}	Total BS4142 Character Corrections	Rating Level, dB L_{Ar}
NSR 1	40	+ 2	42

Table 7: Rating Levels

Rating Levels Vs Background

The Rating Levels are to be compared to the representative background sound level to determine the noise impact in accordance with BS4142.

A Sound Rating Level at or below the background noise level is indicative of Low Impact;

A Sound Rating Level that exceeds the background noise level by around +5dB is likely an indication of Adverse Impact, depending on the context;

A Sound Rating Level that exceeds the background noise level by around +10dB is likely an indication of Significant Adverse Impact, depending on the context;

The indicated noise impact at the identified Noise Sensitive Receptors is summarised below:

Location	Rating Level, dB L_{ar}	Background Sound Level, dB L_{A90}	Difference, dB	Noise Impact
NSR 1	42	53	-11	Low

Table 8: Noise Impact

The noise impact at all receptor positions is indicative of a 'Low Impact' in accordance with BS4142:2014.

5. BS4142:2014 Contextual Assessment

Aspects of absolute level

Absolute levels on site with the system operational have been calculated in 'SoundPLAN' to be 41 dBA (this is exclusive of any rating penalties), at position M1. In comparison to the range of daytime background sound levels measured on site (48 – 59 dB L_{A90}) the absolute level is below the range of existing noise levels on site.

With context, it is possible that the system will run continuously throughout the daytime period although at times of low demand the system may run at a low setting or be switched off.

In considering the points above, the absolute sound level is deemed to be appropriate whilst considering a worst-case scenario but with context, the sound levels on site are potentially lower than modelled.

Aspects of character

Noise output by the system is assumed to be broadband in nature, with a slight tonal element and no impulsive or intermittent characteristics. The system provides removal/replacement of hot air and odours from the ground floor unit and so may operate in response to demand.

A +2 dB penalty for tonality has been applied in the Initial Impact Assessment.

Aspects of the receptor

The NSR location is a residential property which is assumed to be accustomed to the current noise climate from the surrounding roads.

Taking guidance from BS8233:2014 for external amenity spaces, a desirable guideline of 50 dB $L_{Aeq,16hr}$ and an acceptable guideline of 55 dB $L_{Aeq,16hr}$ for noisier environments is deemed appropriate. Calculations from the Initial Impact Assessment give specific noise levels at the NSRs well within the desirable guideline while it is noted that the existing noise climate is several decibels above the guidelines.

Guidance is also taken from 'Appendix C' of the '*Acoustics Ventilation And Overheating: Residential Design Guide–January 2020*' to specify an outside-to-inside level difference of approximately 13 dB through an open window. When this is applied to the predicted night-time levels at the NSR location, internal levels within the dwellings would be within the guidelines of BS8233:2014.

Contextual recommendations

After analysis of the existing site use in conjunction with this proposal, no additional mitigation of the proposed system is deemed necessary as a 'Low Impact' is calculated in accordance with BS4142:2014.

6. Conclusion

A Noise Impact Assessment has been undertaken at 69 Clerkenwell Road, London, EC1R 5BU in relation to the proposed installation of a kitchen extract system.

Measurements of the background noise climate have been undertaken from the 15th – 16th May 2024 at a position deemed representative of the identified Noise Sensitive Receptors (NSRs).

The nearest or most-affected Noise Sensitive Receptor has been identified as the 1st floor window above the site.

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A further Contextual Assessment has been undertaken where noise levels from the site have been assessed to the existing noise climate along with other relevant factors and determined that a Low Impact is indicated with no further mitigation required, corresponding to achievement *'NOEL – No Observed Effect Level'* in the NPSE.

7. Uncertainty

The background monitoring equipment is subject to a 1dB error margin, however, calibration before and after measurements allows the drift within the margin to be monitored and thus demonstrates that minimal drift occurred throughout the measurements.

Uncertainty can arise in the prediction of noise propagation from and around flat reflective surfaces, such as the surrounding structures present on site. This has been reduced to a minimum by utilising an acoustic modelling software that uses the validated method, ISO-9613-2, as described in BS4142.

Uncertainty in the calculated specific sound levels is further reduced by utilising manufacturer-given sound power levels.

APPENDIX A - Measurement Details

Measurement	Kit	Start Date	Start Time	End Date	End Time
M1	A3	15/05/2024	13:35	16/05/2024	13:00

Table 9: Measurement Dates

Figure 3: Site Location Measurement Pictures

APPENDIX B - Equipment Details

Kit	Equipment	Make	Model	Class	Serial Number
A3	Sound Meter	Svantek	971	1	41980
A3	Pre-Amp	Svantek	SV18	1	44331
A3	Microphone	ACO	7052E	1	60249
4	Calibrator	Svantek	SV33	1	90107

Table 10: Measurement Equipment Details

APPENDIX C - Calibration Details

Measurement	Calibrator Ref Level (dB)	Deviation Before (dB)	Deviation After (dB)
M1	113.80	0.38	0.43

Table 11: Calibration Details

APPENDIX D - Meteorology Details

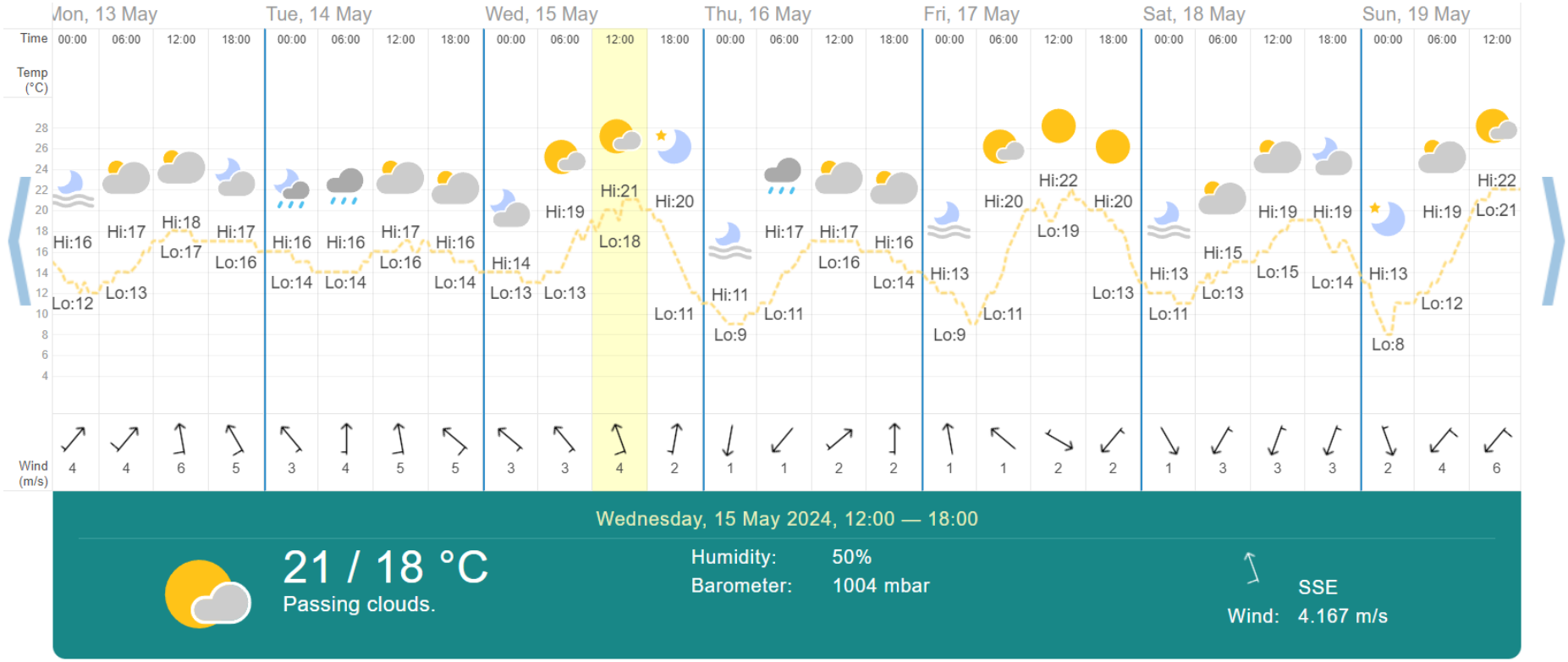

Figure 4: Meteorology Data - https://www.timeanddate.com/weather

APPENDIX E - Noise Survey Results

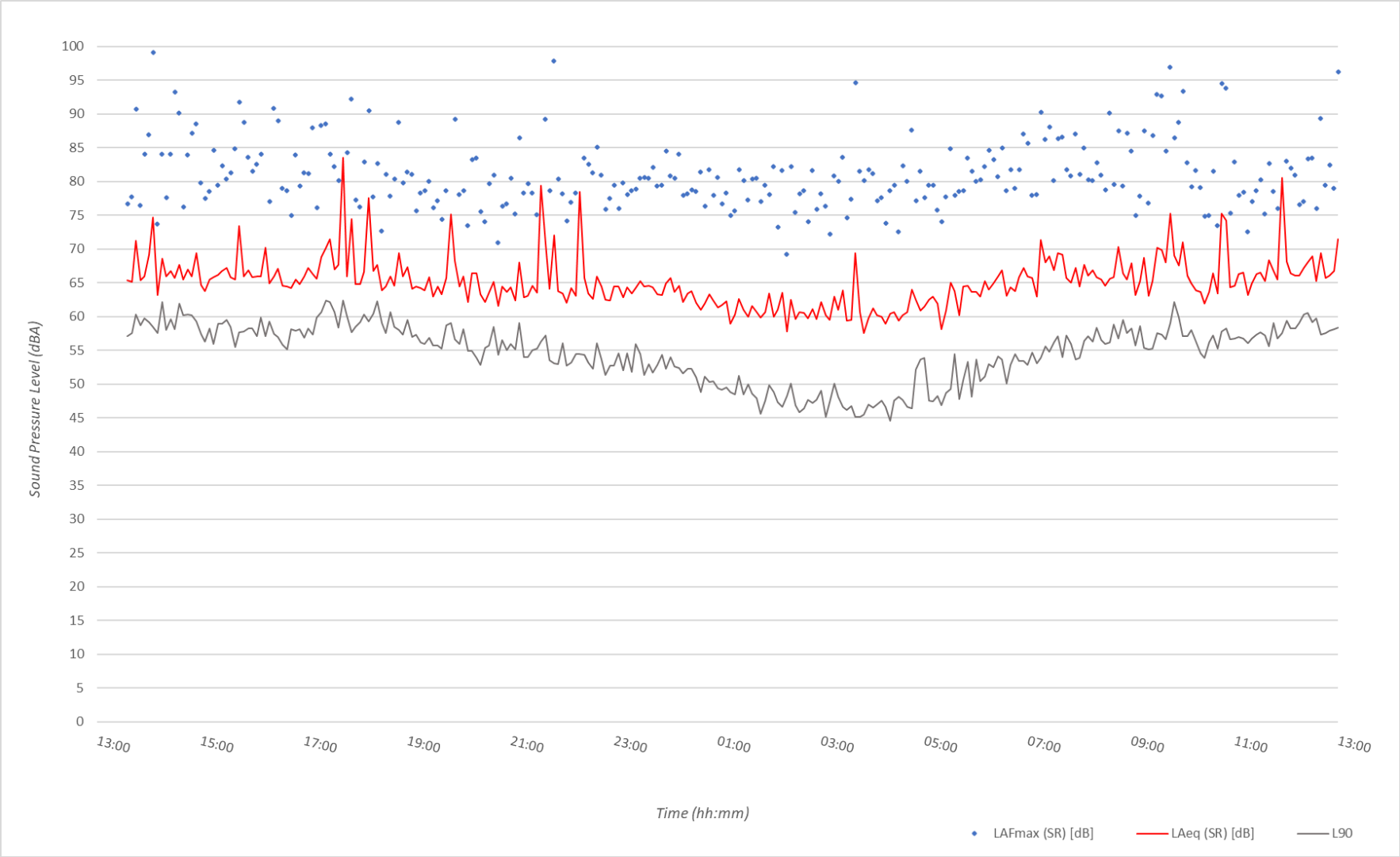

Figure 5: Measured Background Sound Levels Time History (M1), 15th – 16th May 2024

APPENDIX F - Grid Noise Maps

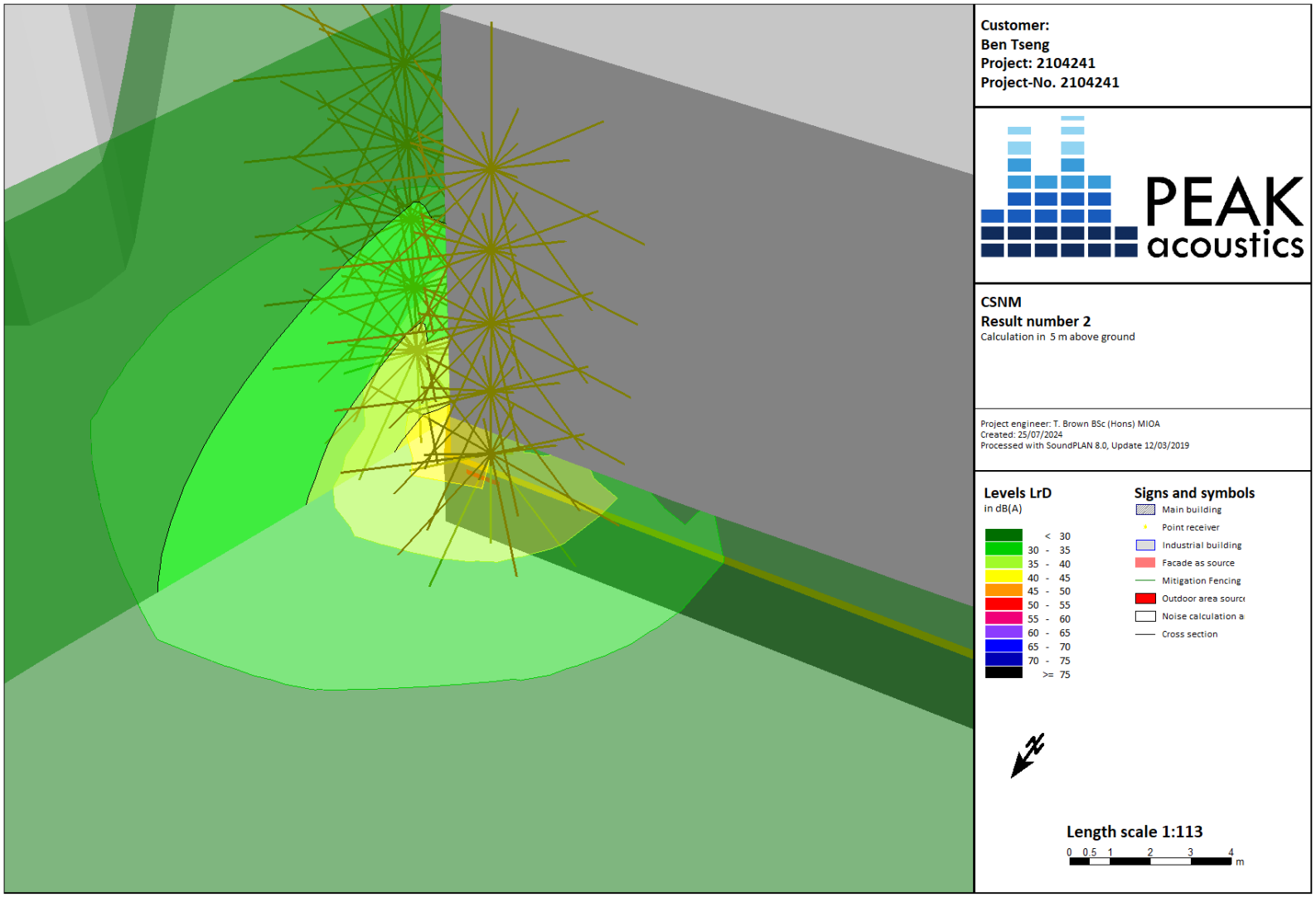

Figure 6: 2D Grid Noise Map of daytime Initial Impact Assessment

APPENDIX G – System Installation Technical Data Sheets

air on

- Carbon filters (MFU) – the Carbon filter unit is fitted with three carbon filters (AES Cadsorb). The carbon units remove the malodourous gasses.

3.2. NOISE CONTROL

A series of measures are designed to reduce the noise power level transferred through the ducts to exterior. The supply system and the exhaust systems are equipped with silencers and lined duct elements. The following table shows an estimation of noise reduction.

Exhaust system:

Bandwidth	63	125	250	500	1000	2000	4000	8000
Fan, noise power level	66	71	76	76	73	69	64	60
Silencer insertion loss	4	7	13	24	28	28	17	24
Duct attenuation (bend, linned)	0	0	8	4	3	3	0	0
Duct attenuation (plenum with lining)	0	0	2	8	10	0	0	0
Resulting noise power level SWL at louvre	62	64	53	40	42*	38*	47	40

- - Limited by silencer regenerated noise

Supply system:

Bandwidth	63	125	250	500	1000	2000	4000	8000
Fan, noise power level	65	65	64	65	66	63	59	59
Silencer insertion loss	3	6	11	19	21	18	21	7
Resulting noise power level SWL at louvre	62	59	53	44	45	41	38	52

Ref	Type	Manufacturer / Model	Noise data , dB	Mechanical capacity	Dimensions , mm	Weight, kg	Electrical
AHU-1	Air handling unit	Komfovent VERSO-S-1300-F-E/15-X-F7/X-C5-X	Sound power level: Supply inlet- 70 dB(A) Supply outlet- 76 dB(A) Casing - 52dB(A)	Airflow 1100 m3/h Pressure drop - 100 Pa	700x350x893	46	Supply voltage- 3-400 V Air heater - 15 kw Max operating current – 24.4 A
MFU	Carbon filter	AES Environmental MFU 600 UNIT	-	AES Cadsorb filters use activated carbon to remove the malodourous gases within the commercial kitchen extract	640x630x925	55.5	-
TLL	Extract fan	T - Line 120 TLL250/21-3	Sound spectrum : 63: - 66 125: -71 250: -76 500: -76 1k: - 73 2k: - 69 4k: - 64 8k: - 60	Airflow 1100 m3/h 400 Pa	380x480x380	30	Phase – 3 Voltage – 400 Vac Motor full load Current – 1.0 A
ESP	Electrostatic filter	Filter Purified Air - ESP1500	-	The ionisation voltage runs at a negative potential which enhances both the ionisation of particles and their consequent precipitation and the production of ozone which helps eliminate odours in a kitchen environment.	450x630x640	55	220/240 V 50/60Hz, 1ph Power consumption – 20 Watts
ATT 01	Silencer	TLLVA250/1250	Induct Loss 63: - 4 125: -7 250: -13 500: -24 1k: -28 2k: -28 4k: -17 8k: -24	-	380x380x 1250	40	-

Figure 7: Data provided by 'Aironteam Ltd'

APPENDIX H - Site Plans

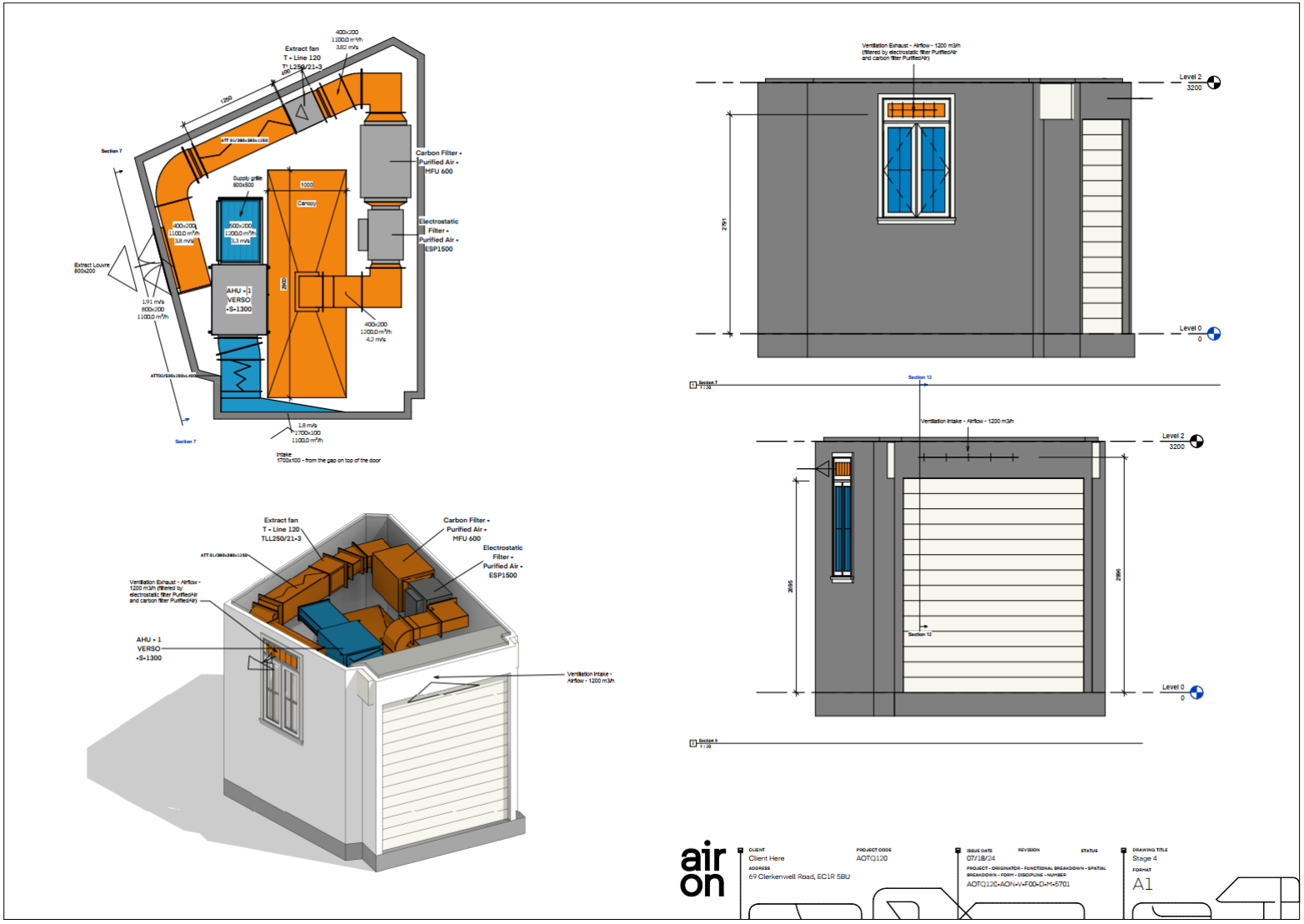

Figure 8: System Plans Provided by 'Aironteam Ltd'

APPENDIX I - Legislation, Policy & Guidance

Guidance for the assessment of noise affecting new residential development is given in the National Planning Policy Framework (NPPF). Section 15 of the NPPF states:

> *"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:*
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of…noise pollution."*

Section 185 further states:

> *"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 impact 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."*

Section 187 states:

> *"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."*

To avoid and mitigate adverse noise effects on health arising from and impacting new development, the NPPF makes reference to NPSE. The Noise Policy Statement for England (NPSE) was published in March 2010 and covers all forms of noise other than occupational noise.

The Noise Policy Statement for England (NPSE) states the following aims in paragraph 2.2.

> **NOEL – No Observed Effect Level.**
> *This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.*
>
> **LOAEL – Lowest Observed 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.*

The NPSE does not define the SOAEL numerically, stating in paragraph 2.22:

> *"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the "NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

There is no local or national guidance on how the three terms should be defined numerically, it is for the assessor to collate and interpret appropriate guidance on noise, such as may be found in British Standards, and correlate the guidance with the concepts of NOEL, LOAEL and SOAEL.

BS4142:2014+A1:2019

The common standard for the assessment of industrial and commercial sound is ***'BS4142 – Methods for rating and assessing industrial and commercial sound'.*** The industrial noise assessment method in BS4142 is based on the difference between the measured 'background sound level' (L_{A90}), and the 'Rating Level' of the industrial source, at a noise-sensitive location (NSR). BS4142:2014 states:

> *"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 sound can be obtained by the difference between the rating sound level and the background sound level whilst considering the following:

> *"A Sound Rating Level at or below the background noise level is indicative of Low Impact;*
>
> *A Sound Rating Level that exceeds the background noise level by around +5dB is likely an indication of Adverse Impact, depending on the context;*
>
> *A Sound Rating Level that exceeds the background noise level by around +10dB is likely an indication of Significant Adverse Impact, depending on the context;"*

BS4142 further 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 negligible impact, depending on the context."*

Achievement of a *Low Impact* in accordance with BS4142 along with a contextual assessment can be deemed to correspond to '*NOEL – No Observed Effect Level'* in the NPSE.

BS8233:2014

BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings* suggests indoor ambient noise levels for dwellings in Table 4, Section 7.7.2. These are summarised below.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

BS8233 states that the guideline values given above are for 'noise without character', further stating:

> *"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."*

Table 4 of BS8233 also has accompanying notes that were subject to additions in ProPG. The relevant notes with the additions of ProPG are given below.

> *"NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax,F, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB LAmax,F more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events."*

"NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal LAeq target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

APPENDIX J - Acoustic Terminology

To aid the understanding of acoustic terminology and the relative difference between noise levels the following background information is provided.

We perceive sound when the ear detects fluctuations in air pressure (sound waves), which are then processed by the brain and perceived as sound. Humans can hear an incredibly wide range of sound intensities ranging from jet engines to fingertips lightly brushing against each other. This range is quantified using a logarithmic scale called the decibel scale (dB). The comfortable range of the decibel scale typically ranges from 0dB (the threshold of hearing) to around 140dB. Here are some examples of common environments and their typical noise levels.

Noise Level	Environment
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a moving car
60 to 70 dB(A)	Typical high street
100 to 110 dB(A)	Fire alarm at 1 metre away
140 dB(A)	Threshold of pain

Terminology

dB (decibel) – A unit used to quantify the pressure level of sound. Defined as 20 times the logarithm of the ratio between the root-mean-square pressure of a given sound field and a reference pressure level ($2x10^{-5}$ Pa – threshold of hearing).

$L_{Aeq,\,T}$ – The equivalent continuous sound pressure level over a stated period. It quantifies a fluctuating sound level over a given period as the equivalent continuous sound level over which the same amount of acoustic energy is contained over. This is A-weighted in order to assess human perception.

L_{A90} – The sound level exceeded 90% of the time. Typically used to describe background noise the L_{90} is regarded as the 'average minimum level' and quantifies the common sound level of a fluctuating sound field i.e. the sound level that occurs 90% of the time. Alternatively, L_{10} describes the sound level exceeded 10% of the time and therefore quantifies the 'average maximum level' of sound which is often used during the calculation of road traffic noise.

A-Weighting – A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

R_w – The Weighted Sound Reduction Index (R_w) is a number used to rate the effectiveness of a soundproofing system or material.