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Post Installation Plant Noise Assessment

Discharge of Planning Condition U015763

Jodrell Laboratory, Kew Road, Richmond, TW9 3DS

REPORT REFERENCE NO. J005311-8228-01-CW

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Details of Assessment	
Client	Alternative Heat
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Issue	Date	Author	Remark	Status
01	17/12/2024	Chris Wright	First issue	Issued

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1.0 SUMMARY

At the request of Alternative Heat Ltd, PDA have been commissioned to undertake an assessment of plant noise egress from the Jodrell Laboratory development on Kew Road in Richmond, London.

The development comprises a number of new plant installations to replace the previously existing space heating plant at the site. A noise impact assessment was previously undertaken by PDA to support the planning application (*J003991-5742-CW-02 dated 27th September 2022).* It is understood that the following plant items are installed on site:

- 2 no. THAEQU 4370 DP1 Air Source Heat Pumps located within main compound.
- Water source heat pumps and ancillary equipment contained within modular plant room.
- Various water circulation equipment contained within basement plant room.

Planning permission for the development has been approved subject to conditions. Condition U015763 relates to noise and stipulates the following;

> *"The plant hereby permitted shall be installed in strict accordance with the details provided in the Noise Impact Assessment submitted by Philip Dunbavin Acoustics Ltd reference J003991-5742-CW-02 dated 27th September 2022. The plant shall not be operated unless the equipment is in compliance with these details.*
>
> *A commissioning acoustic test report shall be undertaken within two weeks of the mechanical services installation in order to demonstrate the limiting noise levels detailed in the above report have been achieved. The results of the tests shall be submitted to and approved in writing by the Local Planning Authority."*

A noise measurement survey has been undertaken at the site to determine the in-situ plant noise emissions. The results of our measurements show good correlation with the limiting noise criteria specified in our previous report.

With regards to our previous assessment, a worst-case noise of 49 dB was predicted at the facade of the dwellings on Kew Road. Based on the results of our measurement survey as detailed in Section 4.5 above, the noise level at the facade of the nearest dwellings is calculated to be ≤48 dB and is therefore compliant with the limiting noise criteria as referenced in the Planning Condition.

On this basis it is our recommendation that Condition U015763 may be discharged.

2.0 SITE DESCRIPTION

The Jodrell Laboratory is located within the grounds of Kew Gardens off Kew Road in Richmond, London. The nearest noise sensitive residential dwellings are located on the adjacent side of Kew Road approximately 15m from the site boundary.

It is understood that the following plant items are installed on site:

- 2 no. THAEQU 4370 DP1 Air Source Heat Pumps located within main compound.
- Water source heat pumps and ancillary equipment contained within modular plant room.
- Various water circulation equipment contained within basement plant room.

The site layout and location can be seen in the Figure below:

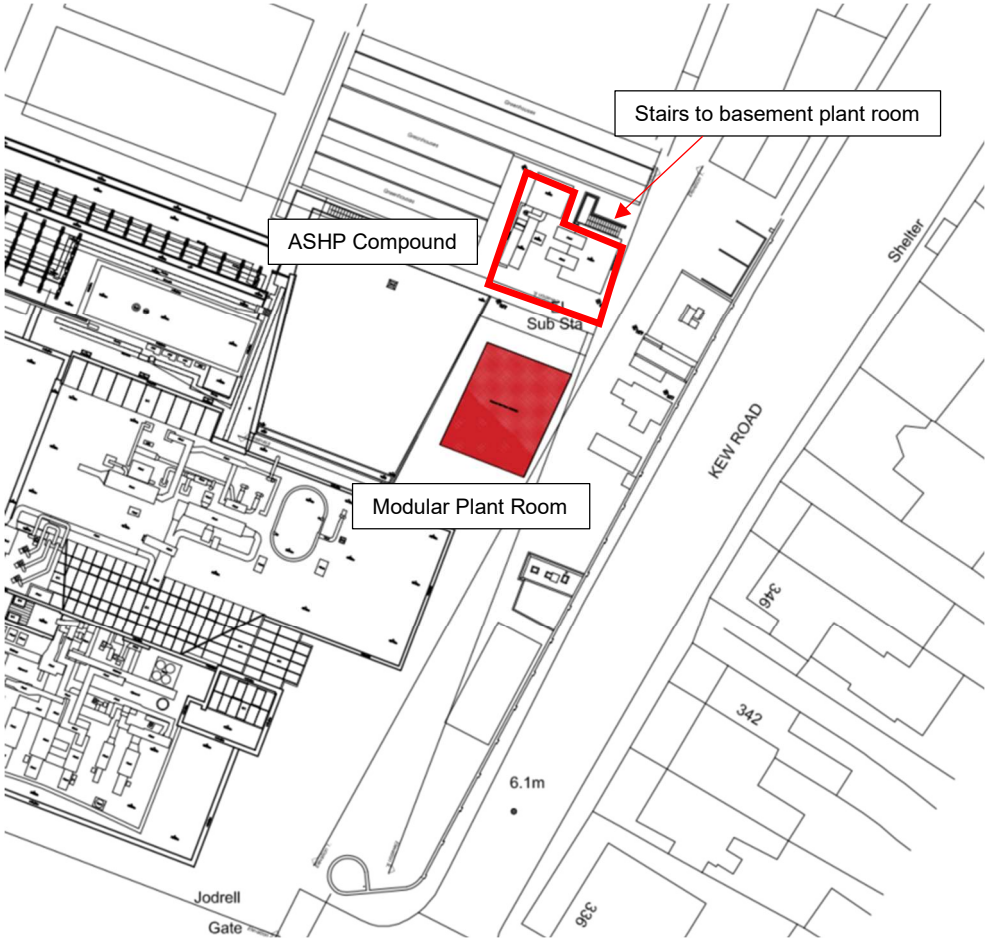

Figure 1 – Site Location

3.0 ASSESSMENT CRITERIA

3.1 Planning Condition U0151763 (application ref: 22/2974/FUL)

We understand that planning permission for the development has been approved subject to conditions. Condition U015763 relates to noise and stipulates the following;

> *"The plant hereby permitted shall be installed in strict accordance with the details provided in the Noise Impact Assessment submitted by Philip Dunbavin Acoustics Ltd reference J003991-5742-CW-02 dated 27th September 2022. The plant shall not be operated unless the equipment is in compliance with these details.*
>
> *A commissioning acoustic test report shall be undertaken within two weeks of the mechanical services installation in order to demonstrate the limiting noise levels detailed in the above report have been achieved. The results of the tests shall be submitted to and approved in writing by the Local Planning Authority."*

3.2 Summary of Previous Acoustic Report

As referenced within the Planning Condition, a noise impact assessment was previously undertaken by PDA Acoustics in September 2022 which was submitted to support the planning application. The assessment was based on the following noise levels:

- Air Source Heat Pump – 91 dB L_{WA}
- Basement Plant Room – 67 dB L_{PA}

It was noted that the proposal also includes a new build modular plant room and a number of back up generators / transformers. However, it was calculated that there would be no significant noise emissions associated with the modular plant room. In addition, the backup generators are for emergency use only as such, no further assessment was undertaken.

Based on the above, the noise level at the facade of the nearby residential dwellings was calculated to be ≤49 dB.

Subsequently our assessment was undertaken in accordance with the requirements of *BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'* and it was concluded that;

> *"…sound levels arising from the proposed development will not result in an adverse impact and will therefore comply with the requirements of the Local and National Planning Policy".*

4.0 ASSESSMENT

4.1 Noise Survey Details

In order to determine the plant noise emissions associated with the scheme a noise measurement survey was undertaken for the installed plant items in situ. All measurements were made using an NTi XL2 sound level meter.

In accordance with IEC 61672-1:2002 the NTi has a class 1 frequency response and can operate as an integrating sound level meter with frequency analysis and statistical functions. The meters were set to measure 'A' weighted, broadband and octave band sound pressure levels and various statistical parameters. The meters were field calibrated to 1kHz at 94dB both before and after the measurement during which time no significant deviation was observed. In addition, a valid calibration certificate is held for both the meters and the calibrator.

All measurements were made Mr C Wright BSc (Hons) MIOA of PDA Ltd.

4.2 Weather Conditions

Weather conditions during the survey period were deemed to be conducive to noise measurements with no significant wind or precipitation observed. A summary of the weather conditions is provided in the Table below:

Table 1: Summary of weather conditions

Measurement Date	Temperature	Windspeed	Events
9th December 2024	7 – 9 °c	0 – 3 m/s	Dry
10th December 2024	6 – 7 °c	0 – 2 m/s	Dry

4.3 Noise Survey Results

It is understood that the following plant items are installed on site:

- 2 no. THAEQU 4370 DP1 Air Source Heat Pumps located within main compound.
- Water source heat pumps and ancillary equipment contained within modular plant room.
- Various water circulation equipment contained within basement plant room.

During our survey it was understood that all the plant items assessed were operating at typical capacity.

Short term measurements were undertaken to determine the noise emissions of the individual plant items. In addition, long term measurements were undertaken at the boundary of the site to determine the overall plant noise emissions from the site and subsequently calculate the noise level at the facade of the nearby residential receivers. A summary of the measurement results is provided in the following sections.

4.3.1 Air Source Heat Pump

Sound pressure measurements were made at a distance (r) from the ASHP. Based on these measurements we have calculated the sound power level as follows:

$$L_w = L_p + 10 \times \log\left(2 \times \pi \times r^2\right)$$

Where;

L_p = Sound pressure level measured at a distance (r) from the source
L_w = Sound power level

The resultant sound power level was calculated to be 85 dB L_{WA} unit.

We note that our previous assessment assumed the ASHP to have a sound power level of 91 dB L_{WA} and therefore, the installed unit complies with the limiting criteria specified in our report.

4.3.2 Modular Plant Room

No significant sources of noise associated with the modular plant room were observed. The only noise sources audible at this location were due to the adjacent ASHP and road traffic on Kew Road. This correlates with the conclusions of our previous assessment in which it was determined that the modular plant room would be non-contributory.

4.3.3 Basement Plant Room

For the purposes of our previous assessment it was assumed that the reverberant sound pressure level within the basement plant room would be ≤67 dB. Whilst on site, internal measurements were undertaken within the basement plant room. The reverberant sound pressure level was found to be 59 dB L_{PA} and is therefore complies with the levels assumed for our initial assessment.

In any case based on our observations on site there were no significant sources of noise associated with the basement plant room. As above the only noise sources audible at this location were due to the adjacent ASHP and road traffic on Kew Road.

4.4 Boundary Noise Measurements

In order to determine the overall noise emissions from the development, measurements were undertaken at the boundary of the site. The microphone was mounted on a mast approximately 3.5m above ground level with a clear line of sight to the plant installations on the site.

The ASHP was considered to be the dominant plant noise source at the site as such, to assist with our analysis of the measurement data and determine periods during which the ASHP was operational measurements were also made in close proximity to the ASHP.

Measurements were undertaken continuously over a period of approximately 21 hours between 12:40 on Monday 9th until 09:10 on Tuesday 10th December.

The measurement location is illustrated in the Figure below:

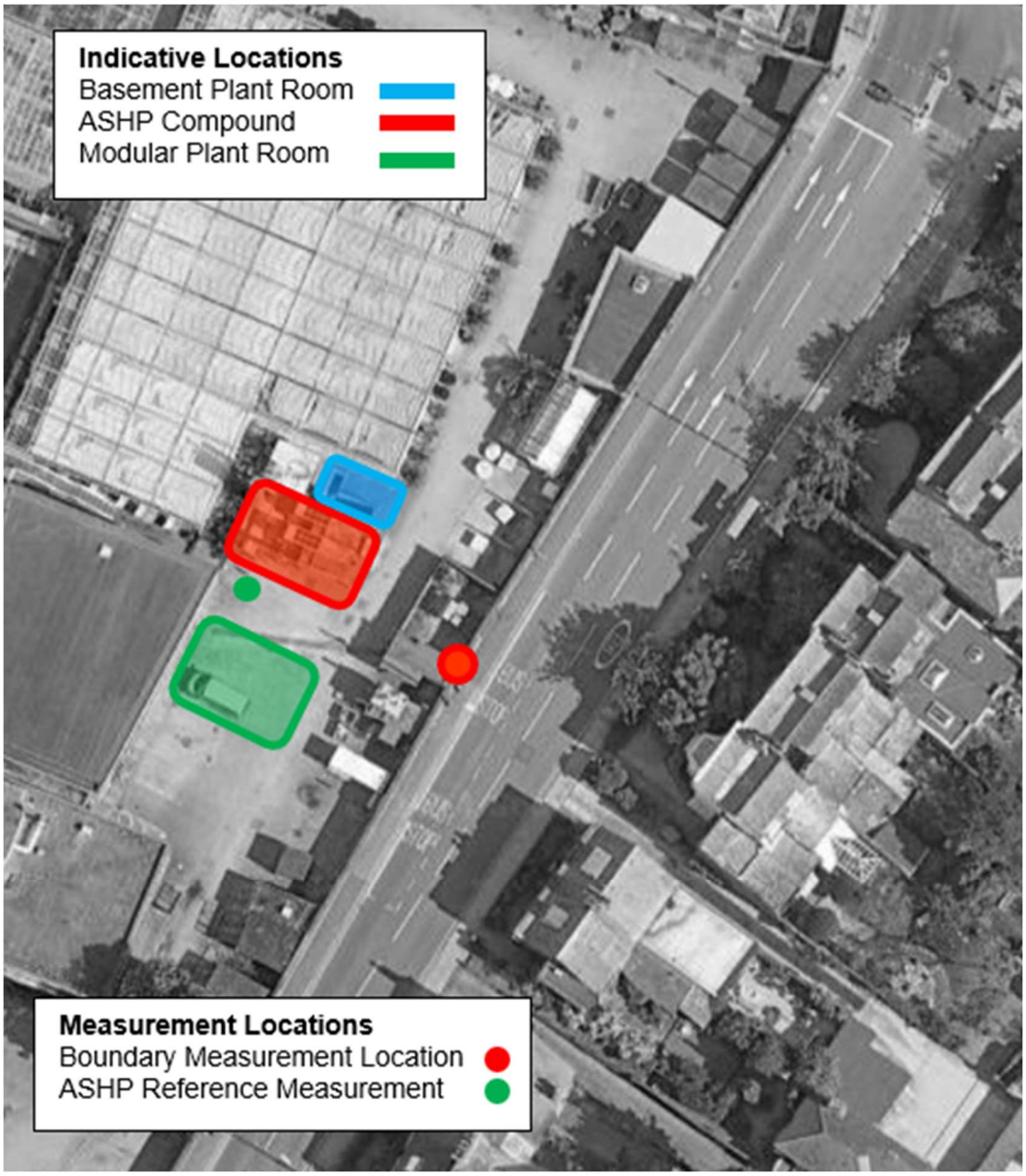

Figure 2 – Long term boundary measurement location

4.5 Boundary Noise Measurement Results

A time history of the noise levels measured at the boundary have been plotted against the source reference measurements taken at the ASHP in the graph below:

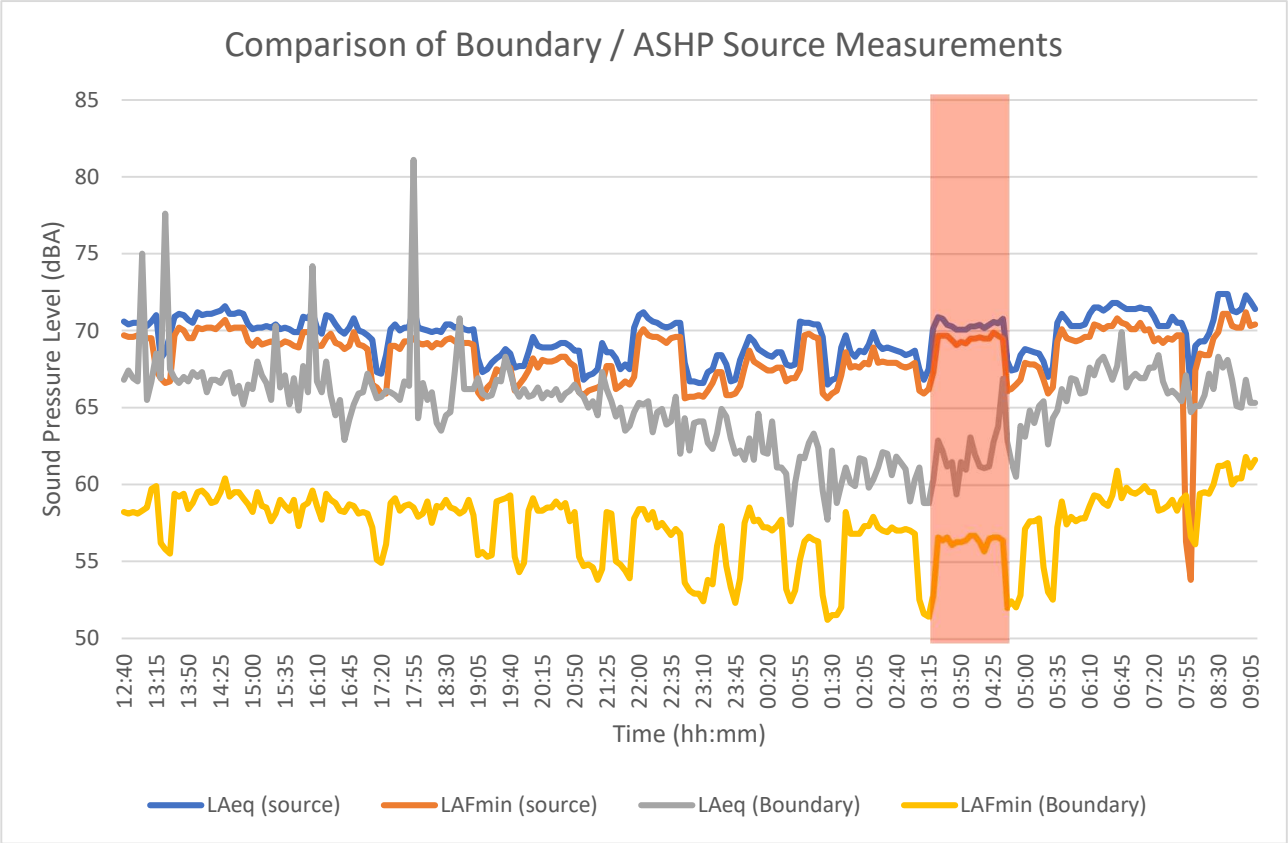

Figure 3 – Comparison of Boundary and ASHP Source Measurements

It can be seen that during periods when the ASHP was operational the measured noise levels at source are reasonably consistent ~70dBA in terms of both L_{Aeq} and $L_{AFmin.}$ However, extraneous noise sources such as road traffic and activity on the site had a relatively significant contribution to the ambient noise climate as reflected in the measured L_{Aeq} noise levels above. This is most notable during the daytime period and therefore, the daytime period has been excluded from our assessment.

Note that the L_{Aeq} parameter refers to the energy averaged noise level across a given time period whereas the L_{AFmin} refers to the lowest measured level within that period. Thus for steady and continuous plant noise sources such as this, it is expected that the L_{Aeq} and L_{Amin} will be comparable whilst minimizing the contribution from extraneous sources which fluctuate during the measurement period.

As such, our assessment is based on the measured noise levels between 03:25 – 04:25 hours as highlighted in Figure 3 above. For ease of reference a summary of the measured noise levels during this period is provided in the Table below:

Table 2: Summary of measured noise levels during assessment period

Description	dB L_{Aeq}	dB L_{AFmin}
ASHP Source Reference Measurement	70	70
Boundary Measurement	62	56

The results of our measurements indicate that plant noise level at the boundary of the site is 56 dB however, in order to determine the noise level at the facade of the dwellings on the adjacent side of Kew Road it is necessary to apply a correction to account for the additional distance between the source and receivers.

The boundary measurements were undertaken at a distance of ~10m from the ASHP however, the nearest dwellings relative to the ASHP are located ~27m from the ASHP. Therefore, we have calculated the distance attenuation as follows:

$$L_2 = L_1 - 20 \times log(r2/r1)$$

Where;

L_1 = Sound pressure level measured at a distance (r_1) from the source
L_2 = Sound pressure level at a distance (r_2) from the source

The resultant sound pressure level at the facade of the nearest dwellings is calculated to be 48 dB.

5.0 DISCUSSION OF RESULTS

The results of our measurements show good correlation with the results of our previous noise impact assessment which was submitted to support the planning application.

It was found that there were no significant sources of noise associated with the modular or basement plant rooms which did not contribute to the noise climate. The ASHP's installed at the site were considered to be the dominant plant noise source.

It should be noted that our previous assessment assumed a single *TWA/WP 682S/G/P/A SL ECH PD NS* Air Source Heat Pump was proposed with a sound power level of 91 dB $L_{WA.}$ However, it is understood as an alternative 2 no. THAEQU 4370 DP1 Air Source Heat Pumps have been installed within the ASHP compound. The results of our measurements indicate that these units have a sound power level of 85 dB L_{WA} per unit. Effectively this equates to a combined output of 88 dB L_{WA} and is therefore compliant with the 91 dB L_{WA} limiting criteria specified in our previous report.

Planning Condition U015763 stipulates that;

> *"The plant hereby permitted shall be installed in strict accordance with the details provided in the Noise Impact Assessment submitted by Philip Dunbavin Acoustics Ltd reference J003991-5742-CW-02 dated 27th September 2022. The plant shall not be operated unless the equipment is in compliance with these details.*
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> *A commissioning acoustic test report shall be undertaken within two weeks of the mechanical services installation in order to demonstrate the limiting noise levels detailed in the above report have been achieved. The results of the tests shall be submitted to and approved in writing by the Local Planning Authority."*

With regards to our previous assessment, a worst-case noise of 49 dB was predicted at the facade of the dwellings on Kew Road. Based on the results of our measurement survey as detailed in Section 4.5 above, the noise level at the facade of the nearest dwellings is calculated to be ≤48 dB and is therefore compliant with the limiting noise criteria as referenced in the Planning Condition.

On this basis it is our recommendation that Condition U015763 may be discharged.

APPENDIX A – DEFINITION OF ACOUSTIC TERMS

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB $L_{Aeq.}$ Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq}. It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB $L_{An.}$ It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) $L_{max,}$ dB $L_{Amax,}$ etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq}, L_{90}, L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the source.