Red & Yellow
Specialist Extra Care
Melliss Avenue - Kew

Noise Survey and Assessment
October 2018

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Quality information

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1. Introduction

The Melliss Avenue site in Kew, London is undergoing redevelopment works. The development will result in the demolition of the former Thames Water Biothane treatment plant associated with Stag Brewery and the erection of a new Specialist Extra Care facility (C2 Use Class) for the elderly with existing health conditions. Comprising, 89 units, with extensive private and communal healthcare, therapy, leisure and social facilities set within a building of ground plus 3 to 5 storeys including set backs. Provision of car and cycle parking, associated landscaping and publicly accessible amenity spaces including a children's play area.

The new residential building is understood to be provided with both centralised plant on the ground floor and on the roof and in addition MVHRs units in each apartment. Noise emission from these items need to be considered, to make sure that noise at neighbouring properties are suitable.

In addition, the internal noise levels within the new dwellings in the development need to be limited to a suitable level, over the façade, so external noise sources such as road traffic etc. are controlled in line with recommended practice for daytime and night-time and will be conclusive to good sleeping conditions.

This document details the measures that have been proposed such that the acoustic requirements are in line with Local Authority planning strategies which are outlined below.

The following sections of this report detail the methodology and findings of an external noise survey that was undertaken at the proposed site. The results of the survey have been used to determine typical background noise levels, which have been used to set plant noise emission requirements and typical noise levels expected to influence the building envelope to assess noise ingress over the proposed building envelope elements.

A glossary of acoustic terminology used in this report is presented in Appendix A and the full noise measurement results graphs are included in Appendix B.

All noise levels are, unless stated otherwise, sound pressure levels in dB re 20 µPa.

2. Planning Guidance

The following guidance is provided for planning by the Local Authority, the London Borough of Richmond, in their Local Validation Checklist document dated October 2017:

> *Where noise is likely to be a material consideration / cause an impact for either Noise Sensitive Development or Noise Generating Development, an Acoustic Assessment and/or an Acoustic Design Statement is needed. Reference should be given to planning Local Development Framework policy DM DC05 in the Local Development plan.*

It further states that new residential properties and institutions are deemed by the Local Authority to be classed as Noise Sensitive Developments.

DM DC05 has the following comments with regards to noise:

> *In considering proposals for development the Council will seek to protect adjoining properties from unreasonable loss of privacy, pollution, visual intrusion, noise and disturbance.*

Apart from the above no specific noise/acoustic reference is give under that guidance document. However, more detailed guidance from the Local Authority is given their Unitary Development Plan dated Feb 2012, within section BLT 30 Protection from Pollution in New Development. This document has been referenced, where applicable.

3. Site Description

The site is located off the private housing area on Melliss Avenue, Kew, London. The site is bounded by residential dwellings to the west on Melliss Avenue and to the south on Woodman Mews. The north of the site is bounded by a Thames Water industrial premise, and to the east is the River Thames. The site is also under the incoming flight path for Heathrow with a large number of frequent aircraft fly overs.

The noise climate across the site is a result of distant traffic from the surrounding roads and noise from aircraft flyovers. The aircraft are very frequent, with just less than one occurrence a minute for the busiest times of the day, each lasting around 30-45 seconds. The noise levels across the site are very consistent owing to the flight path being over the centre of the site from the East to West.

The Nearest Noise Sensitive Locations (NNSRs) in the vicinity of the site are the residential properties on Melliss Avenue to the west and the properties on Woodman Mews to the south. The NNSRs are shown in relation to the site in Figure 3.1, along with the measurement locations.

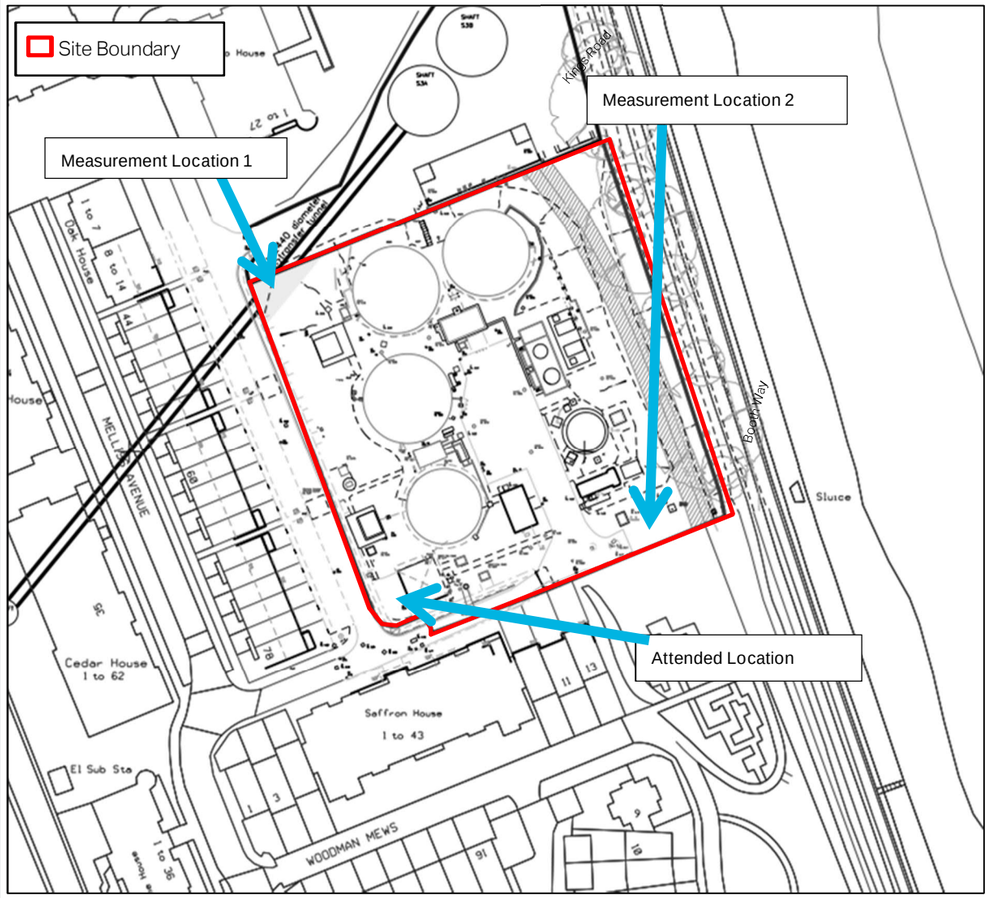


Figure 3.1. Melliss Avenue Site and Surrounding Area Showing Measurement Locations

4. Measurement Methodology

To understand the full variation in the noise climate across the site unattended noise measurements were undertaken for a week between 12:00hrs on Wednesday 22nd and 12:00hrs Wednesday 29th November 2017.

In addition to the long term unattended measurements, attended measurements were also conducted at a third location to understand any variation between the long term noise monitoring and the east of the site.

At location 1 the microphone was positioned on a tripod and extended approximately 2.5m above the relative ground, at the north western corner of the site. The noise levels measured at location 1 are considered to be representative of the likely façade noise levels incident on the northern and western facades of the new development and of the background noise levels at the residential premises on Melliss Avenue.

At location 2 the microphone was positioned on a tripod and extended approximately 2.5m above the prevailing ground near the south eastern site boundary. The noise levels measured at location 2 are considered to be representative of the likely façade noise levels at the south and east facades of the new development and of the background noise levels at the residential properties on Woodman Mews.

At the attended location the sound level meter was attached to a tripod, and positioned on the south east site boundary approximately 1.5m above relative floor height.

Figure 4.1. Measurement Microphone Location 1

Figure 4.2. Measurement Microphone Location 2

Figure 4.3. Measurement Microphone Attended Location

All noise logging equipment was set to continuously monitor noise levels in 15-minute sample periods. For each measurement period the overall dB L_{A90} was measured (typically used to assess the background noise) and octave band dB L_{eq} and L_{max} values were recorded (used to assess noise ingress).

The following equipment was used to undertake the noise level measurements:

Table 4.1: Measurement Equipment

Location	Equipment	Type	Serial No.
1	Integrating average sound level meter	Norsonic 140	140 4740
	Weatherproof microphone enclosure	Norsonic 1212	N/A
2	Integrating average sound level meter	Norsonic 140	140 2919
	Weatherproof microphone enclosure	Norsonic 1212	N/A
A1	Integrating average sound level meter	Norsonic 118	28136
All	Calibrator	Norsonic 1251	30896

The noise analysers and their associated microphones were checked against the calibrator at the beginning and end of the measurement period, in accordance with recommended practice. No significant drift in calibration was observed. The accuracy of the calibrator and meter calibration can be traced to the National Physical Laboratory Standards.

Weather conditions during the attended measurement period on site are presented in Table 3.2. The weather conditions were considered suitable for external noise level measurements.

Table 4.2. Weather Conditions during Measurements

Date	Wind m/s	Temperature (□C)	Typical Cloud Cover
22/11/17	2.5 North Easterly	8	50%
29/11/17	1.4 North Easterly	8	40%

From weather forecasts it is understood that the wind conditions over the first 2 days of measurements at some times, may have been above what is suitable for noise monitoring at the site. It is noted however, that as a full week of measurements was conducted and a statistical assessments of the noise levels undertaken, this is a suitable approach to limit the influence of wind noise.

At 23:45 on 27th November the measurement equipment at location 2 developed a fault with the connection between the measurement microphone and the sound level meter, and stopped measuring. As all the noise levels measured at location 2 before this point are still valid and represent a full 6 days of monitoring these have been used in the following assessment.

5. Measurement Results and Commentary

The noise level measurement results are presented in Graphs in, Appendix B. The full spectra data is available on request.

The daytime noise levels measured at the attended location show very comparable levels of noise when compared with the long term noise loggers. As a result it is considered that the noise at this location can be considered to be the same as location L1.

The following table presents the typical background noise levels at the closest residential properties. The values selected have been based on a statistical assessment of the typical lowest levels for the daytime (07:00-23:00), and night-time (23:00-07:00) periods.

Table 5.1. Typical Lowest Measured Background Noise Level

Measurement Location	Index	Daytime (07:00 – 23:00)	Night-Time (23:00 – 07:00)
1	dB $L_{A90(15\ min)}$	42	36
2	dB $L_{A90(15\ min)}$	43	39

Typically the levels of both the ambient and maximum noise levels measured across the site have been dominated by the frequent aircraft fly overs which appear to operate both for the full length of the day and notably into the night-time period. The noise levels from these needs to be considered in assessing the level of noise ingress into the new dwellings during the daytime and night-time in terms of sleep disturbance.

The typical daytime ambient and night-time ambient and maximum noise levels that are considered to be indicative of those that will be incident on the facades of the development are also summarised below. They are based on a statistical assessment of the typical upper levels of noise.

Table 5.2. Typical Ambient and Maximum Façade Incident Noise Level

Location	Time Period	Index	Octave Band Centre Frequency (Hz)								dBA
			63	125	250	500	1K	2K	4K	8K	
1 North & West Facade	Daytime (07:00 – 19:00)	dB L_{eq}	65	65	64	63	60	53	39	27	64
	Night-Time (23:00 – 07:00)	dB L_{eq}	65	65	64	63	60	53	39	27	64
	Night-Time (23:00 – 07:00)	dB L_{max}	81	81	80	79	75	72	68	52	81
2 South & East Facade	Daytime (07:00 – 19:00)	dB L_{eq}	64	66	65	63	59	52	39	24	64
	Night-Time (23:00 – 07:00)	dB L_{eq}	64	65	64	63	58	52	38	29	64
	Night-Time (23:00 – 07:00)	dB L_{max}	83	80	81	80	75	72	69	44	81

Owing to the regular aircraft pass overs directly above the site, the ambient (L_{Aeq}) noise levels as shown the table above are the same across the site; they are also the same for the daytime and night-time periods as the aircraft are operational during both. The night time maximum (L_{Amax}) noise levels are also the same across the site.

The prevailing background noise levels are lowest at location 1, properties on Melliss Avenue will be the most stringent in terms of the control of noise emission from the site.

6. Plant Noise Assessment

This section of the report presents the relevant guidance for plant noise and discusses the plant noise requirements which have been set based on the criteria put forward and survey results.

6.1 Criteria

6.1.1 BS 4142: 2014

British Standard *BS 4142: 2014 'Methods for rating and assessing industrial and commercial sound'* provides a methodology for assessing whether noise from industrial and commercial activities is likely to give rise to complaints from nearby noise-sensitive premises. This method compares the noise level from the source in question (called the 'specific noise level') with the background noise level in the absence of the noise source, taking into account the character and type of noise. Unusual acoustic features associated with tonality, impulsivity, intermittency, and other sound characteristics, where present, are accounted for under BS 4142 by the addition of a rating penalty to the specific sound level. The corrected specific sound level is the 'rating level'.

The Standard notes that the lower the rating noise level is relative to the measured background 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. A difference of around +5 dB is likely to be an indication of an adverse impact whilst a difference of around +10 dB is likely to be an indication of a significant adverse impact

Many guidance documents that address noise emission criteria, including some of those mentioned below still refer to the previous 1997 version of BS 4142. Whilst there is little practical difference between the two versions when it comes to determination of the background sound level, there are significant differences in the way in which the rating level is determined. As such we recommend any specific requirements will be reviewed as appropriate as the detailed design is finalised.

6.1.2 Environmental Protection Act 1990

Under the provisions of the Environmental Protection Act, occupants of neighbouring properties could take direct action if they believe they have been subjected to a noise nuisance. Achievement of a BS 4142 Rating Level of between 5 and 10 dB below the lowest background noise level at the façade of the nearest neighbouring noise sensitive development is considered a robust approach to minimising the risk of such action being upheld.

6.1.3 Local Authority Guidance: Richmond Borough Council

The Local Authorities UDP Feb 2012 section BLT 30 Protection from Pollution in a New Development states the following:

> *6.104 The Council recognises the need to control noise (including vibration) and pollution by making sure that new development does not generate unacceptable levels of noise and pollution, by ensuring that new development is not adversely affected by existing sources and by controlling noise and pollution within the development itself. The policy seeks to ensure that potential pollution problems are minimised by keeping incompatible uses apart and requiring that developments are designed to eliminate or reduce pollution to acceptable levels.*

Noise control is mentioned in a number of sections of the UDP, however, no specific guidance on the precise levels of noise or standards to use has been provided.

It is very common for Local Authorities to require noise emission to be controlled to below the background noise level in line with BS:4142. As a result we recommend targeting a level of at least 5 dB below the background noise (from non-tonal sources) as a noise emission limit for new plant associated with the new development.

6.2 Noise Emission Limits

Based on the typical lowest background noise levels and the guidance above, it is recommended that the following noise emission limits of 5 dB below the existing background levels be adopted.

Table 6.1. Plant Noise Emission Limit at 1m from the Façade of the Nearest Noise Sensitive Receivers

Measurement Location & NNSR	Index	Daytime (07:00 – 19:00)	Night-Time (23:00 – 07:00)
1 Melliss Avenue	dB L_{Ar}	37	31
2 Woodman Mews	dB L_{Ar}	38	34

The above limits set should be met with all plant operating simultaneously.

In line with guidance within BS 4142, 2014 all sources should be controlled such that they do not produce any "distinguishable, discrete or continuous note (whine, hiss, screech, hum, etc.) or distinct impulses (bangs, clicks, clatters or thumps)" at any noise sensitive façade, where they do contain such features reduced rating level limits as defined in BS 4142 will apply.

By meeting the plant noise emission limits set above it is anticipated that noise emission from building services plant will be in-line with the Local Authorities expectations and will suitably reduce the likelihood of noise complaints.

It is understood that there will also be life safety equipment that will only operate in an emergency or under scheduled testing. The noise levels under these conditions do not need to be as stringent as the one in Table 5.1. It is recommended that a relaxation of 15 dB so that these provide a limit of no more than 10 dB above the background noise is suitable for the life safety equipment.

Table 6.2. Life Safety Plant Noise Emission Limit at 1m from the Façade of the Nearest Noise Sensitive Receivers

Measurement Location & NNSR	Index	Daytime (07:00 – 19:00)	Night-Time (23:00 – 07:00)
1 Melliss Avenue	dB L_{Ar}	52	46
2 Woodman Mews	dB L_{Ar}	53	49

6.3 Noise Emission Assessment

It is understood, the building will be serviced mechanically by individual mechanical units in each dwelling. Along with the following items:

- Ground Floor Generator (life safety)
- Ground Floor Heating Plant
- Ground Floor Ventilation Plant
- Roof Chiller

All plant has the potential to operate over a 24-hour period so the more stringent night time noise limits needs to be attained.

It is understood that the MVHRs will be located in each apartment and will have ducts that run out to the façade for air in and out.

Noise emission from the centralised plant and the facade outlets for the MVHRs will need to be controlled so that the noise limits are met in combination.

The ground floor generator is a life safety item and will only operate in an emergency or under scheduled testing. The noise levels under these conditions do not need to meet the less stringent as the in Table 5.2.

Once proposals have been developed we recommend that a plant noise assessment is undertaken to set upper limits for each external termination of the individual mechanical systems (and any other external plant) to ensure that the noise emission limits at neighbouring properties are attained.

7. Façade Noise Ingress

This section of the report presents the initial recommendations for the control of external noise intrusion into the new dwellings that are provided as part of the Red & Yellow Specialist Extra Care accommodation.

7.1 Criteria

7.1.1 Local Authorities Guidance

The following is also noted in BLT 30 of the UDP Feb 2012 Protection from Pollution in a New Development:

> *6.103 New development including changes of use should not cause an unacceptable increase in noise or pollution levels. Noisy or other development likely to cause pollution should generally be located in areas where this would not be a major consideration or where its impact can be minimised. Noise levels within the development should be within acceptable levels compatible with the use. As far as practicable, noise or in other ways sensitive development should be located away from existing sources of noise or other pollution. It should be designed so that existing sources of noise and pollution do not adversely affect it. The Council will provide supplementary planning guidance as to appropriate on or off site noise levels and design to reduce problems, and this will be regarded as a material consideration when processing planning applications.*
>
> *6.105 Housing, schools and hospitals are particularly sensitive to noise, while noise sources could include roads, aircraft, railways, certain commercial uses, waste disposal sites and sport/entertainment uses. As far as is practicable, sensitive development should be located away from existing sources of noise or other pollution. Where new developments would be subject to noise levels in excess of the supplementary guidance the Council will require remedial measures to be taken at the design stage.*
>
> *6.106 Noise can be reduced by a suitable site layout and the provision of walls and landscaping which can act as an acoustic barrier. Appropriate juxtaposition of uses between and within buildings, both horizontally and vertically, can help prevent the problem of noise transmission, and soundproofing can also significantly reduce the level of noise within new buildings; this is covered by the Building Regulations which set out required levels. Planning conditions may also be imposed with the aim of reducing the impact of noise and pollution, e.g. restriction the type of use or the hours of opening. Whilst the Council prefers appropriate uses, remedial action or the use of suitable conditions rather than the under-utilisation of land, where these are not practical and the problem cannot be overcome, development may be refused.*

7.1.2 National Planning Policy Framework (NPPF)

This document was published in March 2012 and supersedes a number of other planning documents. In terms of noise requirements for planning the following is noted:

> *-Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
>
> *-mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
>
> *-recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established ; and*
>
> *-identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

7.1.3 Recommended Upper Levels of External Noise

It is considered that a suitable way of demonstrating that the recommendations from the Local Authority and the NPPF has been taken into account is to make sure that the internal noise levels in bedrooms are suitable for sleeping and in-line with recommended practice, in BS:8233 2014 as detailed in the following section.

7.1.4 BS 8233: 2014

British Standard *BS 8233, 2014: Guidance on sound insulation and noise reduction in buildings* contains the following recommendations on suitable internal noise levels within residential dwellings.

Table 7.1. Indoor Ambient Noise Levels for Dwellings (BS 8233: 2014)

Activity	Location	Daytime (07:00 – 23:00)	Night-Time (23:00 – 07:00)
Resting	Living Room	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 $L_{Aeq,\ 8hour}$

The above is based on studies undertaken by the World Health Organisation (WHO). The WHO guidance also notes the following with regard to maximum intermittent noise levels:

> *-For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10–15 times per night;*

We recommend that the BS 8233 internal noise level are adopted in all bedrooms, dining rooms and living rooms. In addition the WHO maximum limit at night also needs to be met in bedrooms.

7.2 Initial Noise Ingress Assessment

7.2.1 Ventilation and Façade Proposals

Detailed design of the facade and ventilation systems is still to be undertaken, however, at this stage the following is understood to be provided.

The façade is understood to consist of a glazed double glazed window unit in combination with a masonry facade and concrete roof. As MVHRs are being used no openings for ventilation have been considered acoustically in the façade.

7.2.2 Initial Recommendations

Based on the above and the typical façade incident noise levels reported in Table 5.2, the following guidance is provided on control of external noise ingress.

The most stringent bedrooms on the 5th floor with the roof directly above been used to predict the noise levels into, however as the noise levels are consent across the site then the below comments are applicable in all bedrooms.

> *- Acoustic natural ventilation methods are not recommended.*
>
> *- A heavy weight façade build up, such as the proposed combination of heavy weight brickwork and reconstituted stone cladding, will be necessary.*
>
> *- A concrete roof is needed to control the aircraft noise (minimum surface mass 234 kg/m^2, lightweight roofs are not recommended.*
>
> *- High performance acoustic glazing will be necessary. This is likely to require laminated double glazing with acoustic interlayers and large air gap between panes.*

Appendix A Glossary of Acoustic Terms

Sound

This is a description of the physical phenomena of the transmission of energy through gaseous or liquid media via rapid fluctuations in pressure.

Sound Pressure Level

This is the basic measure of howmuch sound there is at a given location. It is a measure of the size of the pressure fluctuations in the air, that we perceive as sound.

Sound Pressure Level is expressed in decibels with a reference level of 20 mPa (Lp in dB re 20 mPa).

Sound Power Level

This is the total amount of sound produced by a source. It cannot be measured directly but it can be calculated from Sound Pressure Level measurements in known conditions. It can be used to predict the Sound Pressure Level at any point.

Sound Power Level is expressed in decibels with a reference level of 1 pW (L_W in dB re 1 pW). In the US a reference of 100 fW is sometimes used.

L_p L_{pA} (or L_A)

The instantaneous sound pressure level (L_p).

The A-weighted instantaneous sound pressure level (L_{pA} or L_A).

This is the root mean square size of the pressure fluctuations in the air. This level can fluctuate wildly even for seemingly steady sounds. To make sound level meters easier to read the values on the display are smoothed or damped out. This is effectively done by taking a rolling average of the previous 0.125 s (FAST time constant) or the previous 1 s (SLOW time constant).

L_{max} L_{Amax}

The (A-weighted) maximum instantaneous sound pressure level *(*L_{Amax}).

$L_{Aeq,T}$

The A-weighted equivalent continuous sound pressure level over period, T.

This is effectively the average sound pressure level over a given period. As the decibel is a logarithmic quantity the L_{eq} is not a simple arithmetic mean value.

The L_{eq} is calculated from the raw sound pressure data. It is not appropriate to include a reference to the FAST and SLOW time constants in the notation.

L_{Ar}

Plant rating level as defined under British Standard BS4142:2014.

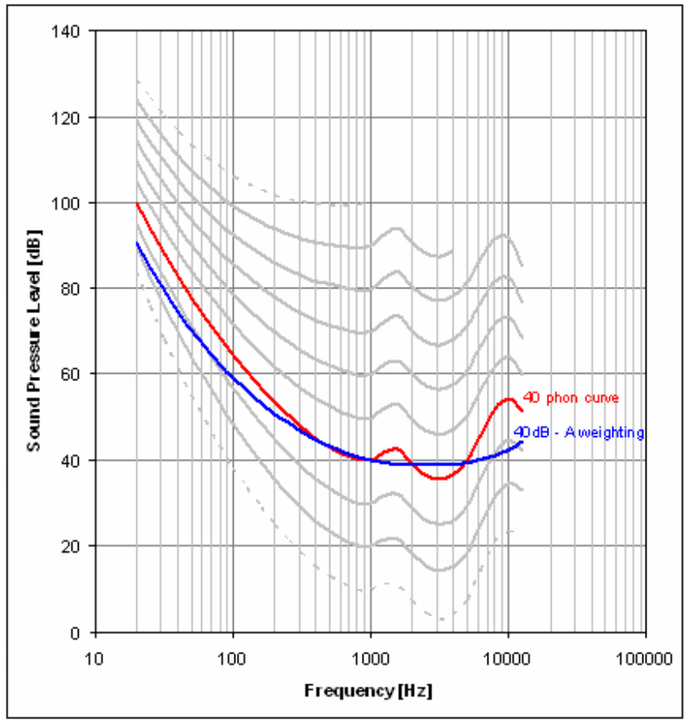
This is the specific sound level generated by the plant items inclusive of any adjustment for the characteristic features of the source.

A-Weighting

The human ear does not sense all frequencies of sound equally. Our sensitivity is at a maximum at around 2 kHz and steadily decreases above and below. Below 20 Hz and above about 20 kHz we can't hear at all.

Within its operating limits a precision measurement microphone measures all frequencies the same so the output it produces does not reflect what we would actually hear. The A-weighting is an electronic filter that matches the response of a sound level meter to that of the human ear. When A-weighted the Sound Pressure Level L_p becomes L_{pA} (or L_A) and the Sound Power Level L_W becomes L_{WA}.

It used to be common to identify that a level was A-weighted by writing dB(A) or dBA instead of dB. These terms are now obsolete and should not be used as they conflict with other, non-acoustic, uses of decibels.



Percentiles

To describe the time-varying character of environmental noise, statistical noise descriptors were developed:

L_{A10} is the A-weighted sound level equalled or exceeded during only 10% of the measurement time. The L_{A10} provides a good measure of the maximum sound levels caused by intermittent or intrusive noise.

L_{A50} is the A-weighted sound level that is equalled or exceeded 50% of the measurement time period; it represents the median sound level.

L_{A90} is the A-weighted sound level equalled or exceeded 90% of the time. Since this represents 'most' of the time, L_{A90} generally has been adopted as a good measure of the ambient baseline noise of the measurement site. Therefore, the baseline noise is defined as L_{A90} of the overall background noise.

Appendix B Measurement Results

The time history results are presented in the following Graphs. All the data are sound pressure levels in dB re 20 µPa and are of 10-minute duration

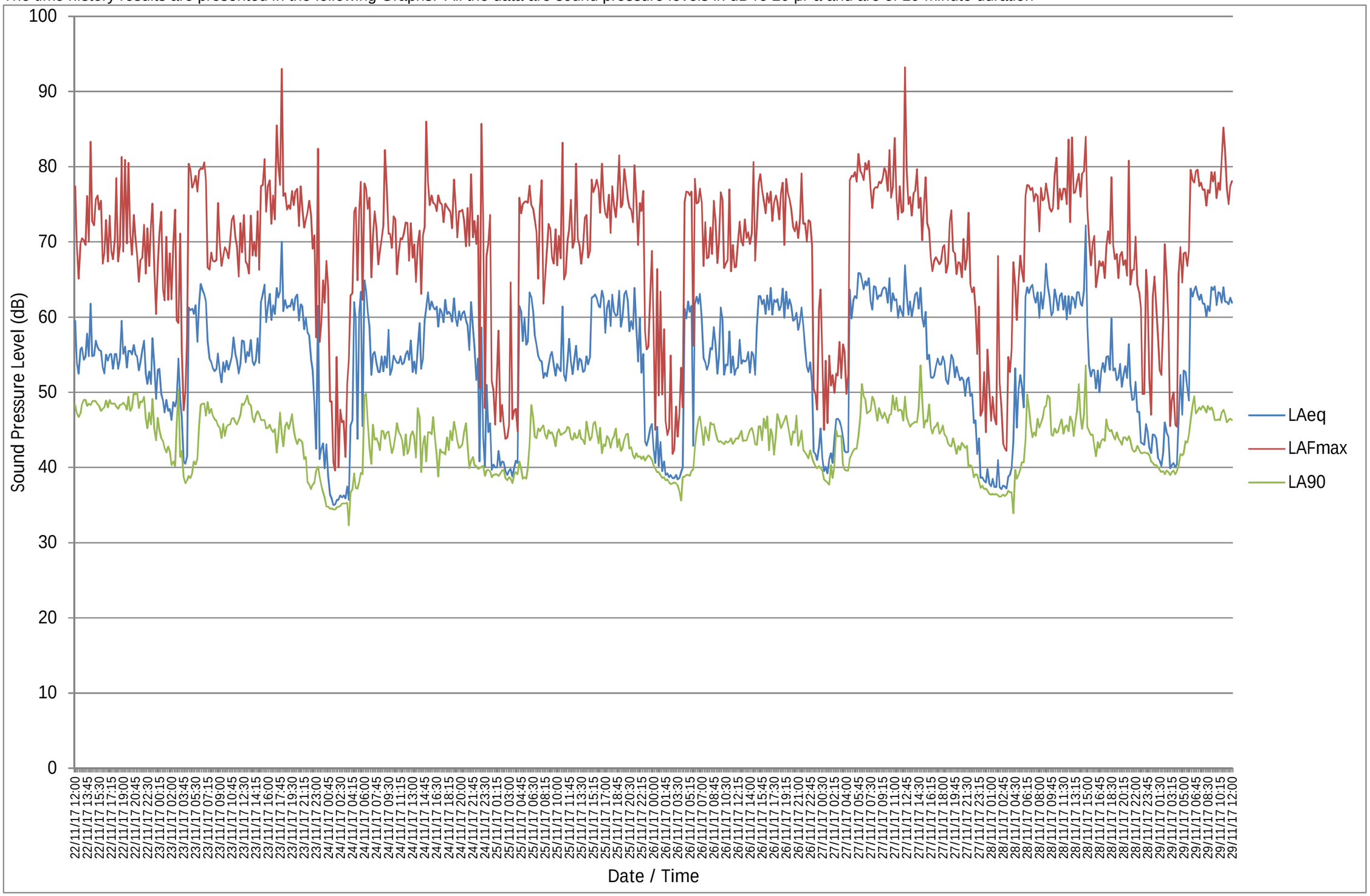


Figure B.1 Noise Time History Graph Location 1

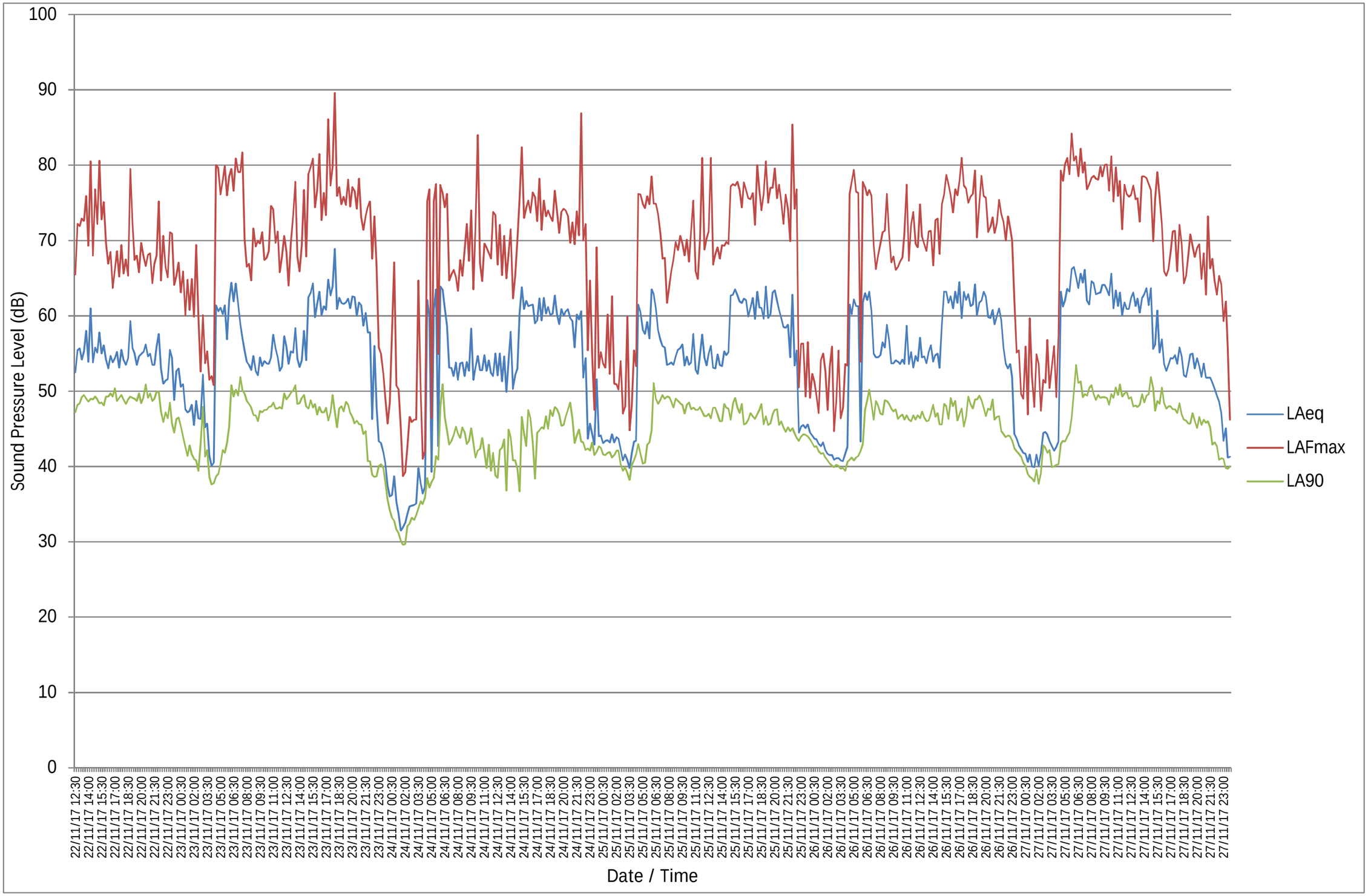


Figure B.2 Noise Time History Graph Location 2

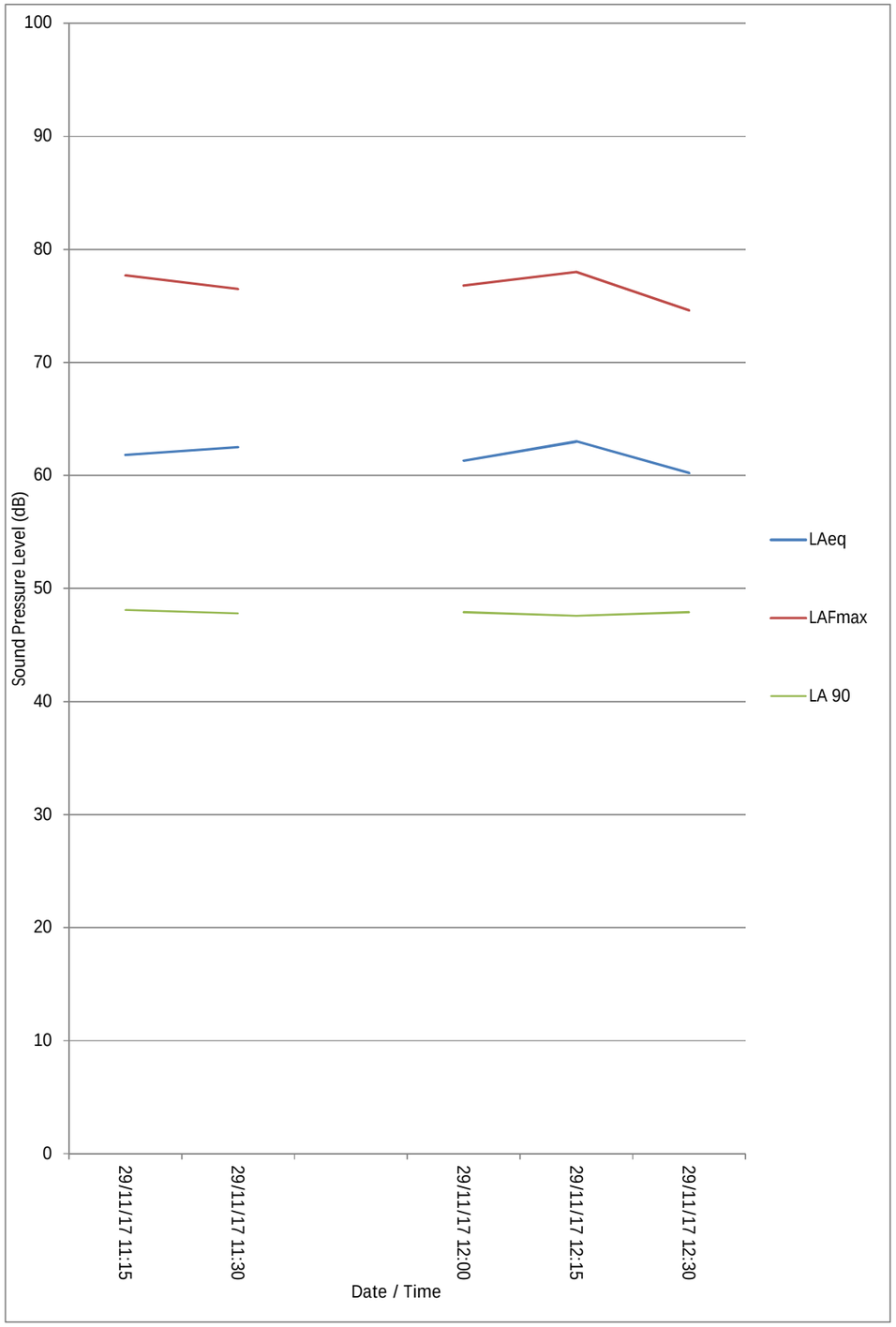


Figure B.3 Noise Time History Graph Attended Location

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