Environmental Permit Application - Noise Impact Assessment

Aldbrough Hydrogen Pathfinder

PREPARED FOR

SSE Hornsea Ltd

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Aldbrough Hydrogen Pathfinder

0653313

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ACRONYMS AND ABBREVIATIONS

Acronym	Description
AGS	Aldbrough Gas Storage
AHP	Aldbrough Hydrogen Pathfinder
dB	Decibels
dBA	A-weighted decibel value
DESNZ	Department for Energy Security and Net Zero
EA	Environment Agency

Acronym	Description
EP	Environmental Permit
ERM	Environmental Resources Management Limited
FOAK	First of a Kind
$L_{A90,T}$	90th percentile level, i.e., the sound pressure level in dBA which is exceeded for 90% of the time interval T
$L_{Aeq,T}$	Continuous equivalent sound level
$L_{Ar,Tr}$	Rating sound level
L_s	Specific sound level
LW	Sound power level
LWA	A-weighted sound power level
NIA	Noise Impact Assessment
NSR(s)	Noise Sensitive Receptor(s)
OCGT	Open Cycle Gas Turbine
RBSL	Representative Background Sound Level
SSE	SSE Hornsea Ltd

1. INTRODUCTION

This Noise Impact Assessment (NIA) has been prepared for the proposed Aldbrough Hydrogen Pathfinder (AHP) project to support the Environmental Permit (EP) application described further below being made by SSE Hornsea Ltd (SSE). The facility will be operated at SSE's Aldbrough Gas Storage (AGS) site on Garton Road, East Riding of Yorkshire.

The AHP project is an important building block in the development of a thriving Humber hydrogen economy, underpinning the region's decarbonisation and supporting economic growth locally and nationally. In the context of this application, 'the Site' is the "installation" permitted boundary.

The concept aims to store energy during periods of low carbon abundant generation and release that energy as low carbon power during periods of shortfall such as high barometric pressure (low wind) and low solar radiation (sunlight). Therefore, the AHP project supports energy security in the UK, which is an important consideration for the UK Government and the Department for Energy Security and Net Zero (DESNZ). This concept also aims at reducing reliance on natural gas for power generation when renewable energy is unavailable. The Site therefore enables decarbonisation of the Humber region and should support the region economically as it becomes a hub for low carbon power.

The AHP project is an innovative power-to-power project, integrating electrolytic hydrogen production, salt cavern hydrogen storage and use of the hydrogen for the generation of low carbon power by way of an Open Cycle Gas Turbine (OCGT) (up to 50 MWe (gross) capacity). All three components of the Site will be located on the same site, making it a First of a Kind (FOAK) development.

The main commercial activity of the Site will be the combustion of hydrogen and natural gas in an OCGT to produce electricity. The OCGT commissioning and start up will use natural gas before moving to a hydrogen / natural gas blend (75/25%) for the initial 2 – 3 years during an extended commissioning / testing phase before building up to 100% hydrogen. This activity is listed under Schedule 1, Part 2 of the Environmental Permitting (England and Wales) Regulations 2016 (as amended) (EP Regulations), specifically the combustion of natural gas and hydrogen in an appliance with an aggregated thermal input of more than 50 megawatts (MWth). To support this operation, a new hydrogen plant is also being developed to produce hydrogen from electrolysis, which is also considered a listed activity under Schedule 1, Part of the EP Regulations. As such, SSE are seeking to apply for an Environmental Permit (EP) with the Environment Agency (EA) for these activities.

This NIA has been prepared by Environmental Resources Management Limited (ERM) based on current and anticipated operations provided to ERM by SSE and publicly available data. It makes use of the noise assessment carried out to support the planning application, which was based on the design available at the time.

This NIA follows the Environment Agency's (EA) guidance on NIAs for environmental permits (1), hereafter referred to as the 'EA guidance'. The primary consideration of the NIA is noise emissions from fixed plant, which are the Site's main sources of noise during operation.

For the purpose of this report, 'noise' and 'sound' have the same definition and may be used interchangeably throughout the text. Generally, noise will be used at times to differentiate between wanted and unwanted sound, e.g. sound produced by the Site operations is typically considered unwanted so will therefore be more commonly referred to as 'noise'.

Given that the Site has not yet been built, there is no history of complaints relating to noise or vibration.

2. SITE LOCATION AND DESCRIPTION

2.1 SITE LOCATION

The Site will be constructed within the boundary of SSE's AGS facility and will utilise approximately 3 ha of the AGS land. Location and the EP installation boundary of the AHP Site is shown in Figure 2.1.

The existing AGS facility at Garton Road, Aldbrough (Grid Reference TA 260370) is situated approximately 12 km north-east of Hull and approximately 21 km east of Beverley, in the county of East Riding of Yorkshire. It is located approximately 2.5 km south-east of the village of Aldbrough, with the hamlet of East Newton approximately 1 km away to the north-east and the village of Garton approximately 2 km away to the south.

The Site lies within a rural-urban fringe area with occasional manmade industrial features, including the AGS facility.

2.2 NOISE SENSITIVE RECEPTORS

The scope of this assessment considers the closest noise sensitive receptors (NSRs) likely to be worst affected by noise emissions from the Site. If acceptable levels are achieved at these locations, then acceptable noise emissions would also be expected at receptors that are further away by extension. The key NSRs in this instance are the nearby residential properties. The identified nearby residential properties are listed below and included in Figure 2.1.

R1. Low Farm House Cottage;

R2. Grange Farm Cottage;

R3. Crossmere Hill Bungalow;

R4. Ringborough Farm West;

R5. Springfield Farm;

R6. Bail View Farm;

R7. Millview Stables;

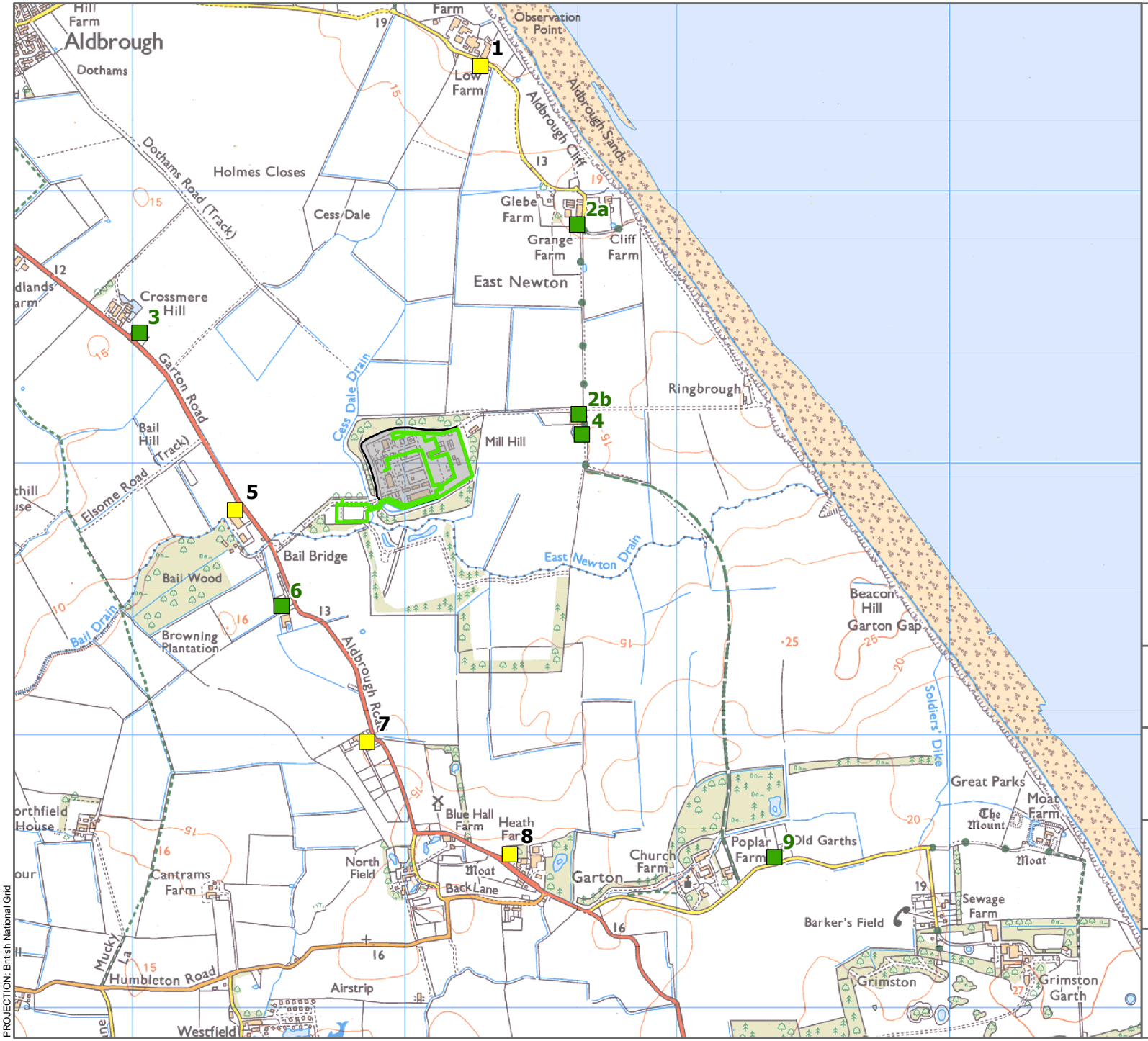
R8. The bungalow; and

R9. Church Farm Cottage.

Other receptors nearby include local footpaths, Bailwood Scout Campsite, and Newton Shores caravan park.

Footpaths by their nature are transitory in use and therefore users are unlikely to be significantly affected by noise from the Site. Noise from the Site affecting nearby footpaths has therefore not been considered further.

Visitors of the Bailwood Scout campsite and Newton Shores caravan park are expected to stay for short durations and will therefore be less sensitive to noise from the Site than the nearby permanent residential properties Grange Farm Cottage and Bail View Farm, which are included in the assessment. Noise effects from the Site affecting the Bailview Scout campsite and Newton Shores caravan park will therefore be lower than at the NSRs listed above.



Proposed Installation Boundary

Existing AGS Site

Noise Sensitive Receptor

Noise Sensitive Receptor and Noise Monitoring Location

0 250 500 750 1,000

Metres

N

SCALE: See Scale Bar	VERSION: A02
SIZE: A4	DRAWN: MC
PROJECT: 0653313	CHECKED: TR
DATE: 17/03/2025	APPROVED: ROO

Figure 2.1
Noise Sensitive Receptors

PROJECTION: British National Grid

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3. ASSESSMENT METHODOLOGY

3.1 NOISE IMPACT ON HUMAN RECEPTORS

BS 4142 sets out a method for the assessment of sound of an industrial and / or commercial nature. The method described in BS 4142 uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling used for residential purposes.

This assessment is limited to the effects on human receptors, with effects on ecological receptors addressed in Section 9.

BS 4142 defines several terms which are referred to in this assessment, as listed below:

- **specific sound level, L_s:** the A-weighted sound level of the sound source being assessed;
- **rating level, $L_{Ar,Tr}$:** the specific sound level plus any adjustment for characteristic features of the sound;
- **residual sound level, L_r:** the A-weighted sound level remaining when the specific sound level is sufficiently suppressed so as not to contribute to the ambient sound level; and
- **background sound level, $L_{A90,T}$:** the L_{90} statistical measure of the residual sound level. The background sound level is an underlying level of sound over a time period, T. It does not reflect the occurrence of transient and / or higher sound level events and is generally governed by continuous or semi-continuous sounds.

Details of how the background, specific, and rating levels have been derived are provided in Section 4 and Section 5.

3.1.1 INITIAL ASSESSMENT

The initial assessment compares the difference between the background sound level and the rating level at the NSR location.

The rating level is equal to the specific sound level plus any adjustment for characteristic features of the sound. BS 4142 states:

> "Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."

The following acoustic features are described in the standard:

- tonality: up to a +6 dB character correction;
- impulsivity: up to a +9 dB character correction (if necessary, this can be summed with the tonality character correction);
- intermittency: up to a +3 dB character correction; and
- other sound characteristics (neither tonal nor impulsive but still readily distinctive): up to a +3 dB character correction.

With reference to the difference between the rating ($L_{Ar,Tr}$) and background ($L_{A90,T}$) sound level, BS 4142 states:

"…

a) Typically the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context

d) The lower the rating level is relative to the measured background sound level, the less likely 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 low impact, depending on the context

Note: Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

3.1.2 CONSIDERATION OF CONTEXT

Following the initial assessment, BS 4142 requires consideration of the context in which the sound occurs when determining the significance of the impact. BS 4142 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 effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs / will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

Various pertinent factors need to be considered when modifying the initial estimate based on context, including:

- the absolute level of sound;
- the character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and / or outdoor acoustic conditions.

Where the initial estimate is amended due to context, clear justification has been provided.

Where mitigation sound measures have been recommended, evidence is provided in line with EA requirements.

3.2 SIGNIFICANCE OF THE NOISE IMPACT

The EA guidance provides definitions for the outcome of the BS 4142 assessment. These definitions are summarised in Table 3.1.

TABLE 3.1 - EA DEFINITIONS FOR THE BS 4142 ASSESSMENT OUTCOMES

BS 4142 Assessment Outcome[a]	EA Definition	EA Advice
Low or No Impact	No noise, or barely audible or detectable noise	…*"no action is needed beyond basic appropriate measures or BAT."* [b]
Adverse Impact	Audible or detectable noise	… *"use appropriate measures to prevent or, where that is not practicable, minimise noise. You are not in breach if you are using appropriate measures. But you will need to rigorously demonstrate that you are using appropriate measures."*
Significant Adverse Impact	Unacceptable level of audible or detectable noise	*"You must take further action or you may have to reduce or stop operations. The environment agencies will not issue a permit if you are likely to be operating at this level."*

Notes:
[a] Following the consideration of context.
[b] The EA guidance states that "*Low impact does not mean there is no pollution. However, if you have correctly assessed it as low impact under BS 4142, the environment agencies may decide that taking action to minimise noise is a low priority*".

3.3 SOUNDSCAPE

Whilst BS 4142 is the primary method for assessing the noise impact of the Site operations, the EA guidance recommends that the soundscape quality is also assessed. Soundscape is the perception and experience of the acoustic environment in context. It is noted that soundscapes are an emerging area of research so guidance on assessment methodology is limited. The EA guidance refers to BS ISO 12913-1:2014 (3), which describes a framework for defining soundscape and provides guidance on aspects such as data collection and data analysis. The method used in this assessment has also drawn on a study which draws parallels with landscape and visual impact assessment (LVIA) (4).

In a LVIA, landscape is assessed in terms of its value (designations, distinctive features or cultural importance) and susceptibility (its ability to accommodate the specific proposed development without undue negative consequences for the baseline situation). Susceptibility will vary depending on the type of development and the scale of the change. The assessment of effects considers the landscape's sensitivity, which combines judgements on value and susceptibility.

Visual impact is concerned with how people will be affected by changes in views and visual amenity. The definitions of value, susceptibility, and sensitivity are largely the same but from the perspective of views and visual amenity.

The soundscape assessment has followed this approach by considering the value and susceptibility of the existing soundscape when assessing potential effects from the introduction of the development.

Table 3.2 sets out examples of assessment criteria for soundscape value. Table 3.3 sets out examples of assessment criteria for soundscape susceptibility. Table 3.4 presents a matrix for the assessment of soundscape effects, based on value and susceptibility.

TABLE 3.2 - SOUNDSCAPE VALUE

Value	Assessment Criteria
High	Sites designated as a Local Green Space[a] prized for their tranquillity, Area of Natural Beauty (AONB), a soundscape valued for its heritage or cultural association. Notable soundmark.
Medium	Soundscape is neither appealing or unappealing. Not valued for its heritage or cultural association.
Low	Sound is uncharacteristic or out of place, unwanted, disturbing, commercial or industrial, out of control. Does not provide people with sense of safety.

Notes:
[a] As defined in the NPPF 2023 (9), Section 105 and 106 with reference to Local Green Space.

TABLE 3.3 - SOUNDSCAPE SUSCEPTIBILITY

Susceptibility	Assessment Criteria
High	Little or no ability to accommodate the development without adverse consequences for the retention of the existing soundscape baseline i.e., a 'Significant Adverse' impact in accordance with BS 4142 after using BAT to minimise noise. Affects occupiers of residential properties, visitors to heritage or cultural assets, people engaging in sport where a quiet atmosphere is a key component (for example, golf).
Medium	Some ability to accommodate the development without adverse consequences for the retention of the existing soundscape baseline, i.e., a 'Adverse' impact in accordance with BS 4142 after using BAT to minimise noise. Affects receptors listed above (for a high susceptibility) and/or people staying in hotels or healthcare institutions, or camping sites.
Low	An ability to accommodate the development without adverse consequence for the retention of the existing soundscape baseline, i.e., a 'Low' impact in accordance with BS 4142 after using BAT to minimise noise. Affects receptors listed above (for a medium and high susceptibility) and/or Public Right of Way (PRoW) users, people travelling or commuting by car, bus, tram, or train.

TABLE 3.4 - IMPACT ON SOUNDSCAPE

		Value		
		High	Medium	Low
Susceptibility	High	High	High	Medium
	Medium	High	Medium	Low
	Low	Medium	Low	Low

3.4 PLANT SOUND LEVEL PREDICTIONS

Plant noise emissions from the Site operations were predicted using SoundPLAN v9.0; an industry-recognised computer software package that implements the sound propagation prediction method set out in ISO 9613-2 (5).

The noise model was constructed based on layout drawings and plant noise data provided by the Site design engineering team. These details are included in Appendix D.

Ground topography as well as the main buildings close to the Site have been included in the model. The area of hardstanding surrounding the Proposed Development is assumed to be an acoustically hard, reflective surface (G=0). Elsewhere (i.e., the surrounding fields), the ground is assumed to be acoustically absorbent (G=1).

Other modelling parameters are listed below and are based on guidance from the Environment Agency (6):

- building reflection loss 0.5 dB; and
- order of reflections 3.

Receiver heights of 1.5 m and 4 m have been used to represent the ground and first floors of residential buildings. In all cases, predicted levels at the first-floor level (4 m) are higher and have therefore been used in the assessment as the worst-case scenario.

3.4.1 MODELLING SCENARIOS

The Site will operate in either power plant mode or electrolyser mode. Power plant mode involves extracting hydrogen from the cavern to be used in the OCGT to produce power, while electrolyser mode involves the use of the electrolyser to produce hydrogen for storage. The Site may operate during the day and night in power plant mode according to grid demand. When in power plant mode, the majority of equipment associated with the electrolyser will not operate and vice versa. It has been assumed for the purpose of the assessment that the AHP may operate in electrolyser mode during the day and night-time.

Details of what plant items operate during each mode are provided in Appendix D.

The modelling assumes that all plant (per scenario) will operate consistently, at full duty and throughout the day and night-time periods. The calculations include the effect of noise control measures. Noise control measures are discussed further in Section 6.

4. BASELINE

4.1 NOISE MEASUREMENT

A baseline noise survey was carried out from 29th June to 18th July 2023 to quantify the existing background sound levels in the area. The full results of the baseline noise survey are provided in Appendix A.

The noise monitoring locations are shown in Figure 2.1. The measurement results for some monitoring locations were deemed to represent the noise environment at other NSRs, as listed below. Details of the rationale behind the selection process are provided in Appendix A.

- Low Farm House Cottage (R1) and Grange Farm Cottage (R2) from the results at Position N2b.
- Crossmere Hill Bungalow (R3) from the results at Position N3.
- Ringborough Farm West (R4) from the results at Position N4.
- Springfield Farm (R5), Bail View Farm (R6) and Millview Stables (R7) from the results at Position N6.
- The Bungalow (R8) and Church Farm Cottage (R9) from the results at Position N9.

Measurements were carried out using Rion NL-52 Class 1 sound level meters (SLMs) with WS-15 windshields, which were set to log L_{A90}, $L_{Aeq,T}$ and $L_{Amax,f}$ values continuously at 15-minute intervals. Equipment serial numbers and calibration certificates have been included in Appendix B.

The microphones were set at a height of approximately 1.5 m above the ground. Four of the five monitoring locations were in free-field conditions (i.e., at least 3.5 m from the nearest hard reflective surface). It was not possible to install the noise monitoring equipment at Measurement Position N3 in free-field conditions, and therefore an adjustment of -3 dB has been made to the measured levels (this is in line with BS 4142 guidance).

The SLMs were calibrated before, during and after the noise survey. No significant drift was identified during the calibration.

Noise levels at the NSRs were observed to consist of typical rural environmental sources (e.g. farm activities, birdsong, trees rusting in the wind etc.). Noise from the existing AGS site was audible at NSR locations nearby.

Photographs of the measurement positions have been included in Appendix A.

4.2 METEOROLOGICAL DATA MEASUREMENT

A Larson Davis weather station was set up at two locations to measure precipitation, wind speed and wind direction at one-minute intervals to identify and discard measurements affected by wind and rainfall[1]. Initially, the station was set up at Ringborough Farm West from 29th June to 11th July 2023. It was then moved to Church Farm Cottage for the rest of the survey (11th to 18th July 2023).

[1] Periods where the wind speed exceeded 5 m/s, and/or measurements made during significant rainfall were discarded during data analysis. This follows the guidance given in BS 4142.

The results are presented in Appendix C, which show that the weather during the survey included short periods of rainfall with no wind events above 5 m/s. Consequently, only a small proportion of the sound measurements had to be discarded.

Additional post-survey analysis was carried out using Microsoft Excel to filter out other possible anomalies in the data. This process is discussed further in Appendix A.

4.3 REPRESENTATIVE BACKGROUND SOUND LEVEL

The noise survey results in Appendix A were used to derive the representative background sound levels (RBSLs) at NSR locations.

The RBSLs were determined through statistical analysis in accordance with BS 4142 guidance. A detailed discussion on how the measurement data were used to derive the RBSLs is provided in Appendix A. The RBSLs per NSR are presented in Table 4.1.

TABLE 4.1 - REPRESENTATIVE BACKGROUND SOUND LEVEL

NSR Description	Representative Monitoring Location (Ref. Figure 2.1)	$L_{A90,T}$ dB	
		Daytime (0700-2300hrs)	Night-time (2300-0700hrs)
R1. Low Farm House Cottage	N2b[a]	33	28
R2. Grange Farm Cottage		33	28
R3. Crossmere Hill Bungalow	N3	31	29
R4. Ringborough Farm West	N4	41	32
R5. Springfield Farm	N6[a]	37	31
R6. Bail View Farm		37	31
R7. Millview Stables		37	31
R8. The Bungalow	N9[a]	33	23
R9. Church Farm Cottage		33	23

Notes:
[a] Justification for nominating representative measurement position provided in Appendix A.

5. NOISE IMPACT ASSESSMENT

5.1 NOISE MODELLING RESULTS

Plant noise emissions were predicted, as detailed in Section 3.4. The results of the noise modelling are presented in Table 5.1, which shows the highest predicted level from each of the modelled scenarios (see Section 3.4).

TABLE 5.1 - NOISE MODELLING RESULTS

Measurement Location Number, Ref. Figure 2.1	**Predicted Specific Level L_s Day and Night**
R1. Low Farm House Cottage[a]	32
R2. Grange Farm Cottage[a]	35
R3. Crossmere Hill Bungalow[a]	33
R4. Ringborough Farm West[a]	41
R5. Springfield Farm[b]	37
R6. Bail View Farm[b]	37
R7. Millview Stables[b]	34
R8. The Bungalow[a]	32
R9. Church Farm Cottage[a]	28

Notes:
[a] Based on Power Plant mode
[b] Based on Electrolyser mode

5.1.1 ACOUSTIC FEATURE CORRECTIONS AND RATING LEVEL

Acoustic feature corrections have been considered in the context of the Site to determine the rating level ($L_{Ar,Tr}$) at the NSR locations.

A tonal strategy will be adopted during detailed design and commissioning which will identify and mitigate any tonal equipment as far as reasonably practicable to minimise the likelihood of significant tonality at the receiver. The development will have relatively few potential sources of tonality and these sources will be mitigated to achieve the overall target, which would provide the opportunity to eliminate tonality, by taking into account the specific frequencies at which tones occur. The strategy will involve identifying potential sources of tonal noise and either removing the source of the tonal noise if possible or ensuring that the noise level from any such source is low compared to other sources resulting in masking of tonal elements. As a result, it is likely that tonality can be eliminated and therefore no correction for tonality is included in the noise predictions. The plant is not expected to exhibit significant impulsivity.

There is an industrial plant (AGS site) operating adjacent to the Site therefore it is unlikely that plant noise emissions from the Site will significantly alter the existing character of the acoustic environment. Therefore, no penalty for other sound characteristics has been applied.

5.1.2 INITIAL ASSESSMENT

The predicted rating levels ($L_{Ar,Tr}$) have been compared against the RBSL at each NSR to provide the initial assessment, as described in Section 3.1.1. The results are shown in Table 5.2.

The results of the initial assessment set out in Table 5.2 show that the worst-case time of the operations at each NSR is the night. This is expected given the low background sound levels during these times.

When assessing the results in accordance with BS 4142 guidance (see Section 3.1.1), noise impacts on the NSRs range between 'low' and 'adverse', depending on context.

5.1.3 CONTEXT

The context of the receiving environment is not considered to significantly alter the initial estimate of the impact during the daytime periods, for which the impacts remain low.

For night-time periods, the low background noise levels result in larger exceedances of background in the initial assessment despite the predicted noise emissions from the Site ranging between 28 and 41 dB $L_{Aeq,T}$, which are below the external levels implied by the design targets set out in British Standard 8233:2014 – *Guidance on sound insulation and noise reduction for buildings* (7) (as discussed further below). The guidance in BS 4142 acknowledges these scenarios, stating:

> "Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night"

BS 8233 provides an absolute internal design target for a bedroom at night of 30 dB $L_{Aeq,2300\text{-}0700hrs}$, based on preserving a good standard for sleep within the building, noting that in situations where development is considered necessary or desirable, a level 5 dB higher will still achieve reasonable internal conditions. BS 8233 suggests that the approximate sound reduction of a partially open window is 15 dB. Therefore, to achieve an internal level of 30 dB $L_{Aeq,2300\text{-}0700hrs}$, a reasonable external benchmark is 42 dB $L_{Aeq,\ 23:00\text{-}07:00}$ (free-field) taking account of the 3 dB reduction in noise between external façade noise levels and free-field noise levels.

On this basis, the predicted plant noise emissions are within BS 8233 guidance thresholds and it is therefore considered appropriate to amend the initial assessment outcomes to 'Low'.

TABLE 5.2 - INITIAL ASSESSMENT

NSR	Period	$L_{Ar,Tr}$, dB	RBSL	Difference	Initial Assessment Impact Level[c]
R1. Low Farm House Cottage[a]	Day	32	33	-1	Low
	Night		28	4	
R2. Grange Farm Cottage[a]	Day	35	33	2	Low
	Night		28	7	Adverse
R3. Crossmere Hill Bungalow[a]	Day	33	31	2	Low
	Night		29	4	
R4. Ringborough Farm West[a]	Day	41	41	0	Low
	Night		32	9	Adverse
R5. Springfield Farm[b]	Day	37	37	0	Low
	Night		31	6	Adverse
R6. Bail View Farm[b]	Day	37	37	0	Low
	Night		31	6	Adverse
R7. Millview Stables[b]	Day	34	37	-3	Low
	Night		31	3	
R8. The Bungalow[a]	Day	32	33	-1	Low
	Night		23	9	Adverse
R9. Church Farm Cottage[a]	Day	28	33	-5	Low
	Night		23	5	

Notes:
[a] Based on Power Plant mode
[b] Based on Electrolyser mode
[c] Final outcome will depend on context, as discussed in 5.1.3

5.1.4 FINAL OUTCOME

A tabulated summary of the assessment and final outcome is provided in Table 5.3 below.

TABLE 5.3 - FINAL ASSESSMENT SUMMARY

NSR	Period	L_s dB	$L_{Ar,Tr}$ dB	RBSL	Diff.	Initial	Context	Final Assessment Outcome
R1. Low Farm House Cottage[a]	Day	32	32	33	-1	Low	See Section 5.1.3	Low
	Night			28	4			
R2. Grange Farm Cottage[a]	Day	35	35	33	2	Low		Low
	Night			28	7	Adverse		
R3. Crossmere Hill Bungalow[a]	Day	33	33	31	2	Low		Low
	Night			29	4			
R4. Ringborough Farm West[a]	Day	41	41	41	0	Low		Low
	Night			32	9	Adverse		
R5. Springfield Farm[b]	Day	37	37	37	0	Low		Low
	Night			31	6	Adverse		
R6. Bail View Farm[b]	Day	37	37	37	0	Low		Low
	Night			31	6	Adverse		
R7. Millview Stables[b]	Day	34	34	37	-3	Low		Low
	Night			31	3			
R8. The Bungalow[a]	Day	32	32	33	-1	Low		Low
	Night			23	9	Adverse		
R9. Church Farm Cottage[a]	Day	28	28	33	-5	Low		Low

Notes:
[a] Based on Power Plant mode
[b] Based on Electrolyser mode

It can be seen from Table 5.3 above that the Site is considered to have a "Low" noise impact on the surrounding NSRs.

When comparing the final BS 4142 assessment outcome against the EA guidance definitions set out in Table 3.1, the EA defines the outcome as "*no noise, or barely audible or detectable noise".* The EA recommendation is that "*no action is needed beyond the basic appropriate measures or BAT*". Details of the noise control measures are provided in the following section.

6. NOISE CONTROL

6.1 MITIGATION TREATMENT

Plant design proposals were reviewed at the early stages of the Site to identify measures to reduce noise emissions as far as reasonably practicable.

A process for identifying mitigation measures has been carried out which follows the principles set out in the EA guidance. Noise levels were predicted for individual equipment items and ranked in order of their noise contribution at the receptor. This was used to focus mitigation effectively on items of equipment in order to give the greatest reduction in the overall predicted noise level. This process was carried out at various intervals as the design evolved.

Noise control measures have been considered for significant noise emitting equipment and noise emission limits will be specified where practicable during detailed design to limit noise levels. Details of the types of mitigation measures to be employed will be finalised during detailed design.

Table 6.1 presents the key items of noise emitting equipment during operation and the mitigation measures which are likely to be employed to meet the assumed noise levels.

A Noise Management Plan has also been produced that provides details of how the noise control measures will be implemented.

TABLE 6.1 - KEY ITEMS OF NOISE EMITTING EQUIPMENT DURING OPERATION AND INDICATIVE MITIGATION MEASURES

Equipment / Technology	Unmitigated / initial L_{WA}, dB	Indicative mitigation measures	Expected reduction, dB	Modelled Mitigated L_{WA}, dB
Electrolyser area				
The majority of equipment	- [c]	Housed within a building	- [c]	80
Transformers	97	Noise barriers / walls	~8 dB at NSRs	97[a]
O_2 vents	93	Silencers	5	88
Pipe bridge	96	-	-	96[a]
OCGT area				
Gas turbine (GT)	- [b]	Acoustic enclosure	- [b]	103
GT air intake	107	Acoustic lagging on the sides	11	96
GT ventilation inlet	- [c]	Acoustic lagging / louvres	- [c]	93
GT ventilation outlet	98	Acoustic lagging / louvres	7	91
SCR blower	117	Enclosure of the fan blower motors	16	101
Generator	107	Housed within a building	-	No longer significant
Stack outlet	118	Silencer	14	104
OCGT Transformer	110	Noise barriers	~8 dB at NSRs	110[a]
Other areas				
Fin fan block	- [c]	Low noise version / screening	- [c]	101
HP / LP Compressors	101	Enhanced acoustic enclosure	5	96
HP Compressor: HVAC	-	-	-	92
LP Compressor: HVAC	-	-	-	93

Notes:
[a] Shown as equal to the 'pre-mitigation' level noise is not being reduced at source, but rather via the transmission path.
[b] Initial modelling included an acoustic enclosure on the gas turbine, so no unmitigated noise source level available.
[c] This sound power level was assumed based on an initial starting point of 85 dBA SPL at 1m.

7. UNCERTAINTY

7.1 NOISE SURVEY DATA

There is inherent uncertainty on how the on-site noise survey results represent the existing acoustic environment. The following measures were taken to reduce the level of uncertainty:

- carrying out noise measurements over a long period of time, e.g. several weeks;
- deploying weather stations along with the sound measurement equipment to discard measurements carried out in adverse weather conditions; and
- conservative choices were made during the data analysis to select a lower background noise level (a lower RBSL sets more stringent BS 4142 thresholds for plant items).

7.2 SUPPLIER SOUND DATA FOR PLANT ITEMS

The modelling input data are based on the experience of the design team and represent realistic noise levels that are likely to be achievable.

7.3 NOISE MODELLING AND CALCULATIONS

Uncertainty may arise from inherent tolerances in calculation methods, assumptions.

To the reduce the uncertainty, the following measures were implemented:

- ensuring that the noise modelling software applications are recognised by the industry as being fit for purpose;
- ensuring that the modelling software applications are up to date;
- the ISO 9613 prediction method assumes worst-case downwind propagation; and
- following EA guidance on calculation configurations.

By adopting this approach, the assessment is likely to be conservative.

8. SOUNDSCAPE ASSESSMENT

A description of the existing site and the surrounding area is provided in Section 2 of this report. The acoustic environment was defined based on the results of the on-site noise survey, as detailed in Section 4 and Appendix A.

Whilst no questionnaires were provided to the local residents, detailed observations were made during the noise survey to characterise the soundscape at the NSR locations. To summarise, the acoustic environment consists of a combination of agricultural activities (i.e. farm machinery, animals, people). Industrial noise from the existing AGS site was audible in areas closer to the Site.

No distinctive cultural features unique to the location were observed.

The existing soundscape is therefore considered to be of 'Medium' value as it does not contain distinctive cultural features unique to the location. Nor is it designated as a Local Green Space prized for their tranquillity. However, it may be valued for its quiet, rural quality.

In terms of susceptibility, the existing soundscape is assessed to be 'Low'. The assessment of noise carried out in accordance with BS 4142 demonstrates that the Site would have a 'Low' impact and therefore that it can be accommodated without adverse consequence.

A 'Medium' value and 'Low' susceptibility results in an impact on the soundscape which is assessed to be Low.

9. NOISE IMPACTS ON ECOLOGICAL RECEPTORS

The nearest site of special scientific interest (SSSI) is Lambwath Meadows, located approximately 4.9 km north the Site. This is considered to be too distant to be impacted by the predicted changes in noise levels. The Greater Wash Special Protection Area (SPA) is located offshore, adjacent to the wider AGS Site. Features are limited to the marine environment with red-throated diver the only known species which occurs in notable numbers. These are typically more than 500 metres offshore and the changes in noise predicted herein would not be detectable.

The industrial nature of AGS site means it supports few ecology features. In and around the wider AHP Site biodiversity interests are limited to a small assemblage of widespread bird species, and small populations of legally protected species such as bats and great crested newt. While some of these have legal protection to safeguard from harm, none are considered to be of conservation importance at any more than a Site level and a detailed assessment of effects from noise is not necessary. Furthermore, any species occurring close to the AGS facility will have a degree of habituation to noise due to existing activities in the area, both from industrial and farming activities.

Overall, due to the lack of important features and small changes in noise predicted, potential effects on biodiversity interests from increases in noise levels are considered to be negligible.

10. CONCLUSIONS

This NIA was conducted for the proposed Aldbrough Hydrogen Pathfinder Project to evaluate the potential noise emissions from the facility and their effect on the nearby NSRs.

The assessment was carried out in accordance with the Environment Agency's guidance and British Standard BS 4142, focusing on providing a thorough understanding of the Site's noise implications in both power plant and electrolyser mode.

The assessment considers the difference between the predicted noise emissions from the Site and the measured background sound levels at the NSRs, as well as the context of the noise.

The BS 4142 assessment concludes that noise emissions from the Site are expected to maintain a low impact on surrounding noise sensitive receptors. The EA guidance on this assessment outcome suggests that "*no action is needed beyond basic appropriate measures or BAT*".

The impact from the Site operations on the soundscape is assessed to be 'Low'.

Noise impacts on ecological receptors have also been assessed. The potential effects on biodiversity from increases in noise levels are considered to be negligible.

A Noise Management Plan has also been produced that provides details of how the noise control measures will be implemented.

In summary, the Aldbrough Hydrogen Pathfinder Project is predicted to maintain a low noise impact on surrounding communities following the method in BS 4142, thereby aligning with relevant environmental permit conditions.

11. REFERENCES

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APPENDIX A NOISE SURVEY RESULTS AND DISCUSSION

A.1 INTRODUCTION

Baseline noise monitoring was carried out between 29th June and 18th July 2023, to quantify the sound environment at locations close to the Site. This section presents details of the data recorded during the survey and the analysis that has been carried out to derive the representative background sound level (RBSL) according to BS 4142.

A.2 MEASUREMENT POSITION N2A AND N2B

A sound level meter was installed at two locations to quantify the prevailing acoustic environment at Low Farm Cottage (R1) and Grange Farm Cottage (R2). Both measurement positions are shown in Figure 2.1.

The first measurement position, referred to as N2a is between Grange Farm Cottage and Ringborough Farm. Given that access to Grange Farm Cottage could not initially be arranged, measurements were carried out at this position to represent sound levels at Grange Farm Cottage.

It was noted that Grange Farm Cottage is located further away from the existing Aldbrough Gas Storage (AGS) facility, which means that it would be subject to less noise emissions from the AGS facility. The expected sound environment at Grange Farm Cottage was therefore emulated by placing the microphone behind a large farm building to acoustically screen noise emissions from the existing AGS facility. The total measurement period at Position N2a was approximately 13 days (Saturday 29th June to Thursday 11th July).

Access to Grange Farm Cottage was granted later during the survey period. Measurements were hence carried out at the second measurement position, referred to as N2b, for approximately 4 days (Wednesday 12th July to Sunday 16th July 2023).

Despite Position N2b being closer to Grange Farm Cottage, which would typically be considered a more favourable measurement location, it is noted that the total measurement period at Position N2b was significantly shorter than N2a. As such, it was considered appropriate to derive the representative background sound level based on an analysis of the results at both measurement positions, as discussed further below.

A.2.1 RESULTS

FIGURE A. 1 overleaf shows the monitoring equipment set-up at Measurement Position N2a.

Figure A. 2 presents the 15-minute sound measurements logged over the survey period for the key sound metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}. Figure A. 3 and Figure A. 4 presents the distribution of background $L_{A90,15mins}$ sound levels over the day and night-time throughout the survey period.

Figure A. 5 presents the 15-minute sound measurements (L_{Aeq}, $L_{Amax,f}$ and L_{A90}) logged over the survey period Measurement Position N2b. Figure A. 6 and Figure A. 7 present the distribution of background $L_{A90,15mins}$ sound levels over the day and night-time throughout the survey period.

Dominant sound sources at both measurement positions were observed to be wind blowing and trees rustling. Other sources of sound included the Aldbrough gas storage facility which was faintly audible in the background when no wind was blowing.

A.2.2 ANALYSIS

Position N2a

Figure A. 3 shows that L_{A90} measurements ranged between 22 and 60 dB during the day at Position N2a. A peak is evident at the modal value of 33 dB. The 50th percentile value is 34 dB. Figure A. 4 shows that L_{A90} measurements ranged between 23 and 47 dB. The modal value is 28 dB. The 50th percentile value is 30 dB.

Position N2b

Figure A. 6 shows that L_{A90} measurements ranged between 26 and 58 dB during the day at Position 2a. A peak is evident at the modal value of 53 dB. The 50th percentile value is 44 dB. Figure A. 7 shows that L_{A90} measurements ranged between 23 and 55 dB during the night. Three peaks are evident at the values of 24, 32 and 34 dB. The 50th percentile value is 37 dB.

The results in Figure A. 4 show that higher background sound levels were measured for a significant period of time, especially during night of the 15th July 2023 compared to other days. The sound meter was also set up to periodically record audio samples to help identify sources of sound. The recordings appeared to include high levels of sound which may have been due to wind or waves, which is consistent with its position close to the seashore.

Measurements carried out at Church Farm Cottage (Position N9 on Figure 2.1 of the main report body) also included the night of the 15th July 2023, which also showed comparatively high sound levels over this period. Measurements were logged for a longer period (seven days) at this location and elevated sound levels were not experienced during the rest of the survey period, nor were such levels apparent during the monitoring at the other locations which extended over a total period of 19 days. It is therefore possible that elevated background sound levels at this position are not representative of the baseline in the area.

Table A. 1 below summarises the key statistical measures of the L_{A90} baseline measurements carried out at the two locations considered potentially representative of the sound environment at Grange Farm Cottage.

TABLE A. 1 - SUMMARY OF LA90 BASELINE POTENTIALLY REPRESENTATIVE OF THE SOUND ENVIRONMENT AT MEASUREMENT POSITION N2A AND N2B

Period	**L_{A90} Sound Level, dB**	
	Mode (or peaks in distribution)	50th Percentile
Measurement Position N2a		
Day	53	44
Night	24, 32, 34	37
Measurement Position N2b		
Day	33	34
Night	28	30

The measurements carried out at Position 2b include a level of uncertainty due to the relatively short survey duration and comparatively high sound levels which were experienced for a significant proportion of the survey period.

The results at Position N2a confirmed that measured sound levels were generally lower and are based on a longer measurement period (which reduces the uncertainty of having measured during an atypical scenario of elevated sound levels).

Given the above, results at Position N2a are therefore considered to be representative, and have therefore been adopted as representative of the typical acoustic environment at Grange Farm (i.e., L_{A90} 33 dB during the day and 28 dB at night).

FIGURE A. 1 - NOISE MONITORING SETUP AT POSITION N2A

FIGURE A. 2 - NOISE MONITORING RESULTS AT POSITION N2A

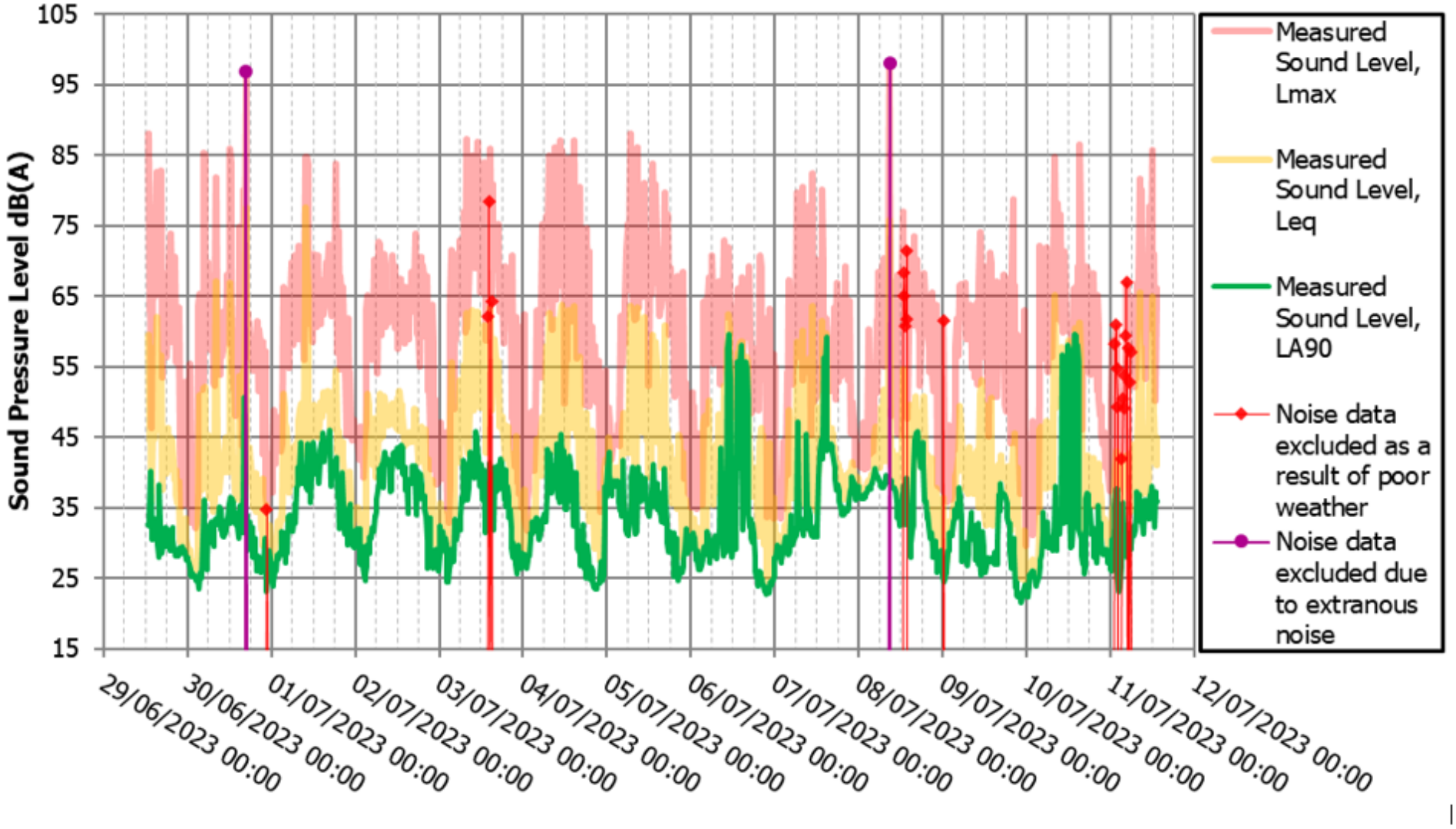


FIGURE A. 3 - DISTRIBUTION OF DAYTIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N2A

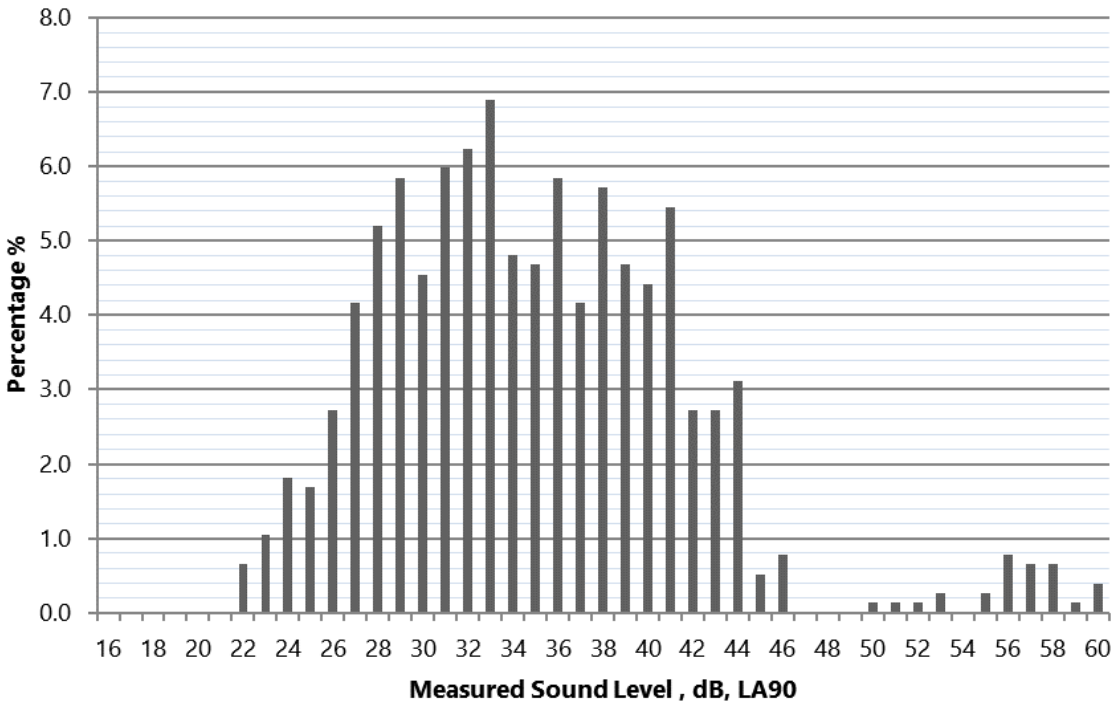


FIGURE A. 4 - DISTRIBUTION OF NIGHT-TIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N2A

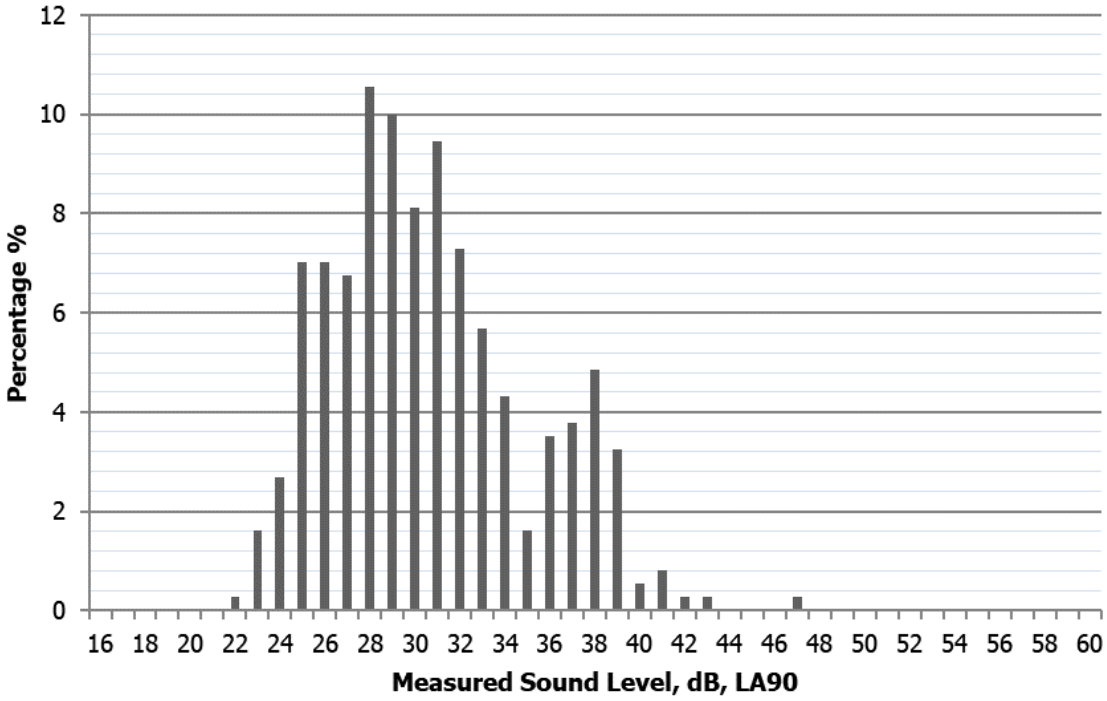


FIGURE A. 5 - RESULTS OF THE NOISE MONITORING AT POSITION N2B

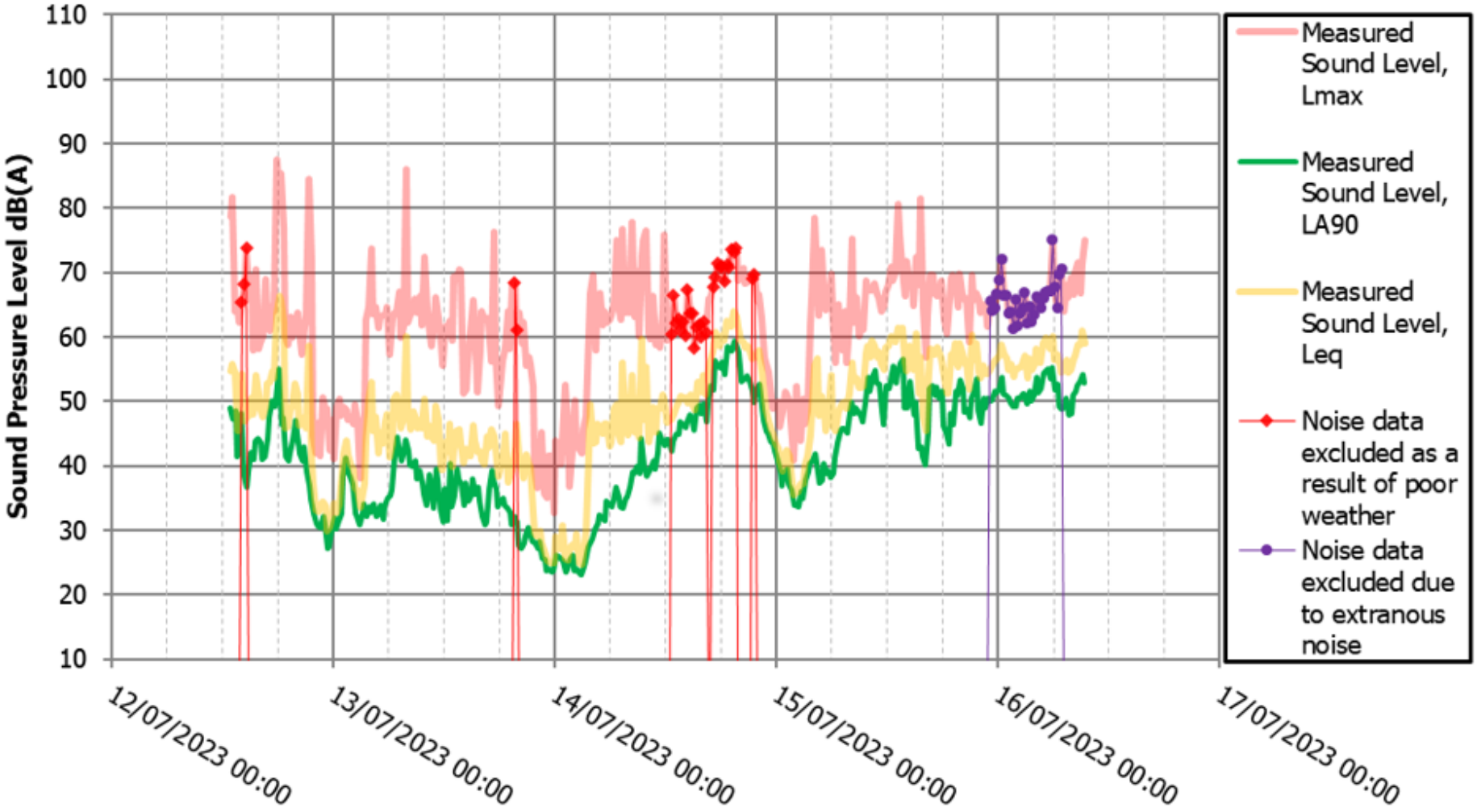


FIGURE A. 6 - DISTRIBUTION OF DAYTIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N2B

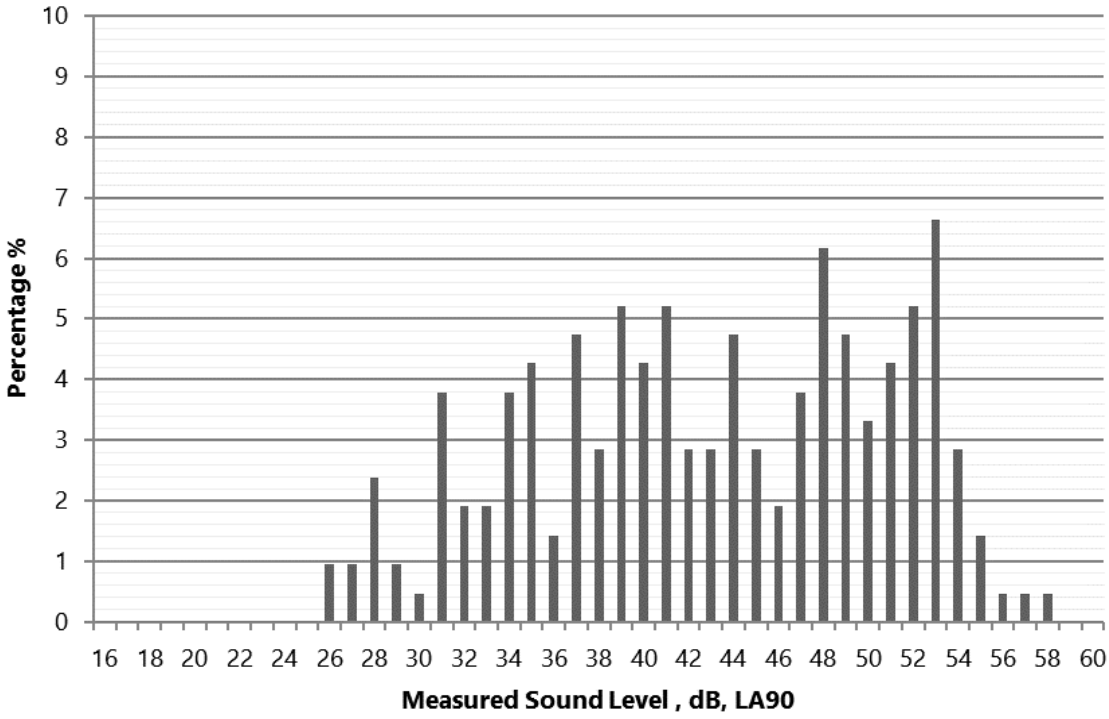
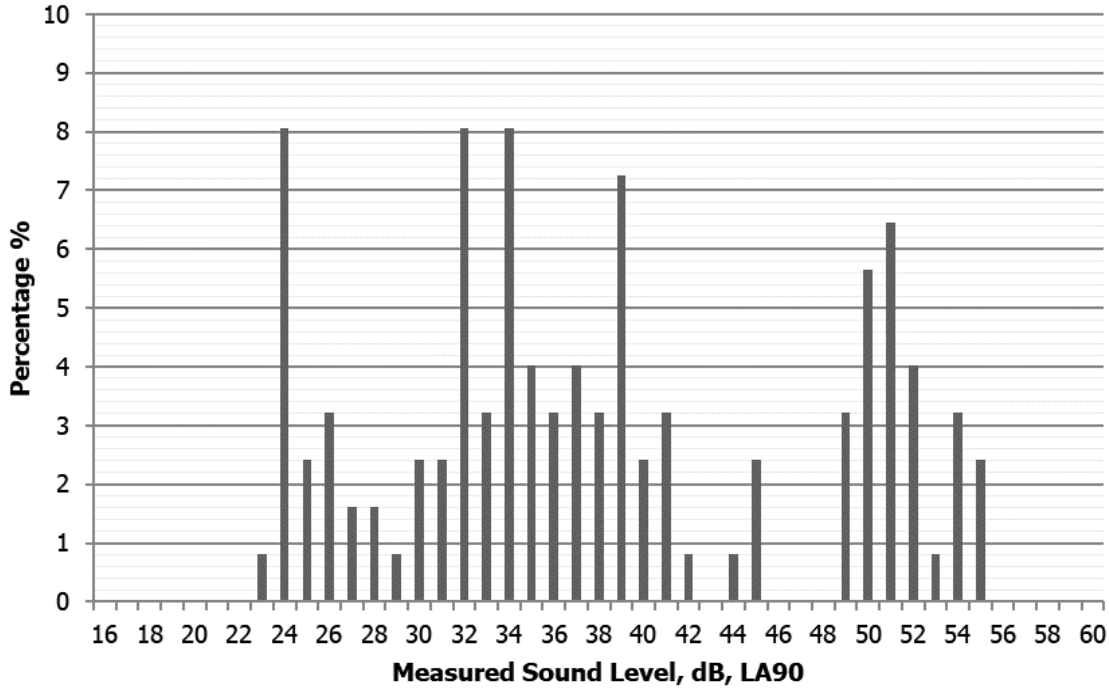


FIGURE A. 7 - DISTRIBUTION OF NIGHT-TIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N2B



A.3 MEASUREMENT POSITION N3

The sound meter was installed at Position N3 to measure baseline sound levels at Crossmere Hill Bungalow (R3). The total measurement period was 13 days.

It was not possible to set up the sound level meter in a free-field location. As can be seen from Figure A. 8, it was installed approximately 1.5 m from the corner of a brick wall. An adjustment of -3 dB has been made to the measured levels to account for this, in line with the guidance in BS 4142. As the sound level meter was not fully in front of the hard reflecting surface at a distance of 1 m, this adjustment is expected to be conservative

A.3.1 RESULTS

Figure A. 9 presents the 15-minute sound measurements logged over the survey period for the key sound metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}. Figure A. 10 and Figure A. 11 presents the distribution of background $L_{A90,15mins}$ sound levels over the day and night-time throughout the survey period.

It was noted that the dominant sound source was road traffic sound from the B-Road nearby. Other sources of sound included farm animals, trees rustling and birdsong. These sources did not dominate the sound environment, but all of them were clearly audible. There was also a water pump nearby which was just audible and had a low frequency characteristic.

A.3.2 ANALYSIS

Figure A. 10 shows that L_{A90} measurements ranged between 26 and 55 dB during the day. A peak is evident at the modal value of 34 dB. The 50th percentile value is 39 dB. As described above, an adjustment of -3 dB has been included as the measurements were not carried out in a free-field location. Taking the modal value and applying the adjustment results in a value of 31 dB which has been adopted as the RBSL.

Figure A. 11 shows that L_{A90} measurements ranged between 23 and 44 dB during the night. One peak is evident at the modal value of 34 dB. The 50th percentile value is 32 dB. Taking the 50th percentile value (which is conservative) and applying an adjustment of -3 dB (as outlined above) results in a value of 29 dB which has been adopted as the RBSL.

FIGURE A. 8 - NOISE MONITORING SETUP AT POSITION N3

FIGURE A. 9 - RESULTS OF THE NOISE MONITORING AT POSITION N3

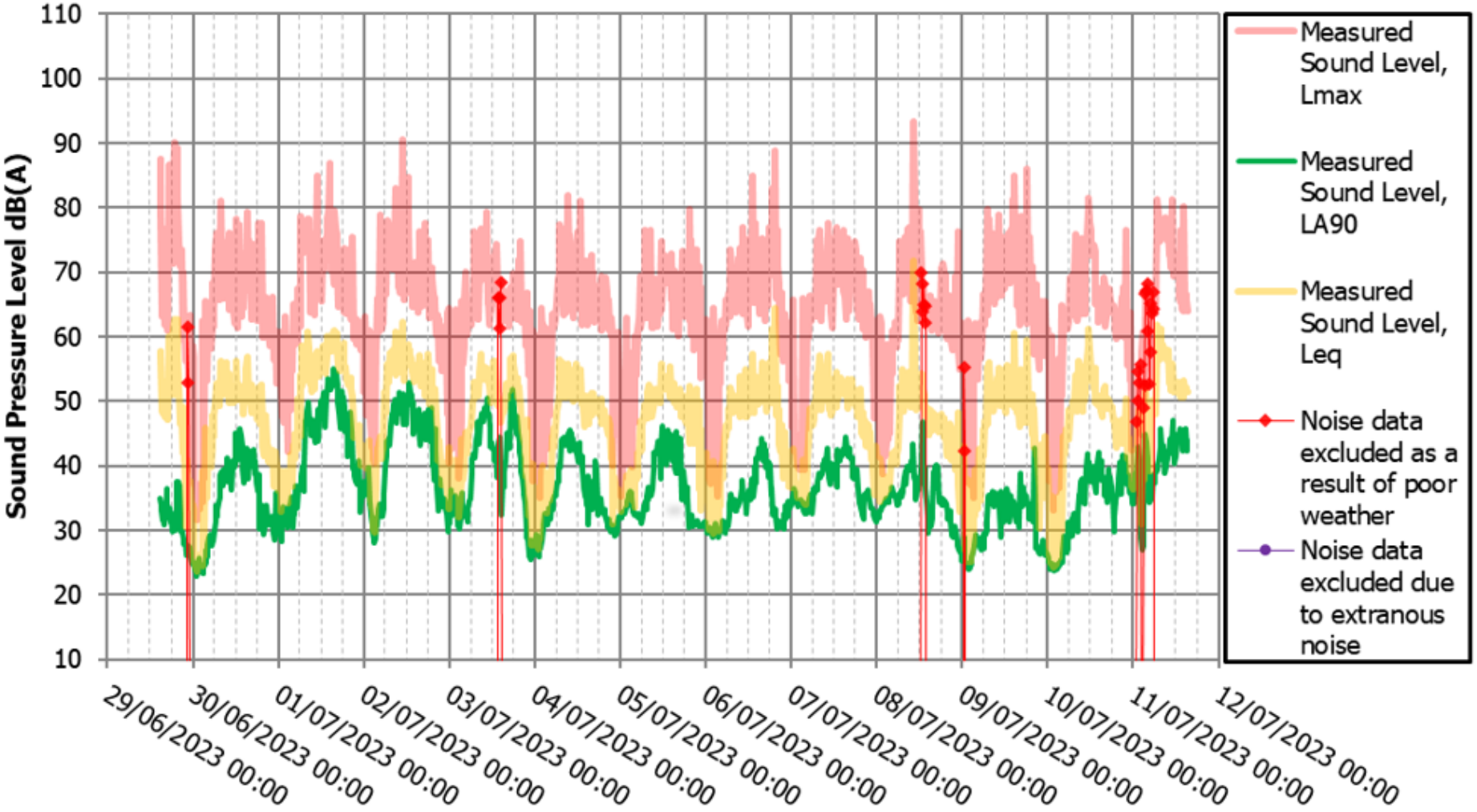


FIGURE A. 10 - DISTRIBUTION OF DAYTIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N3

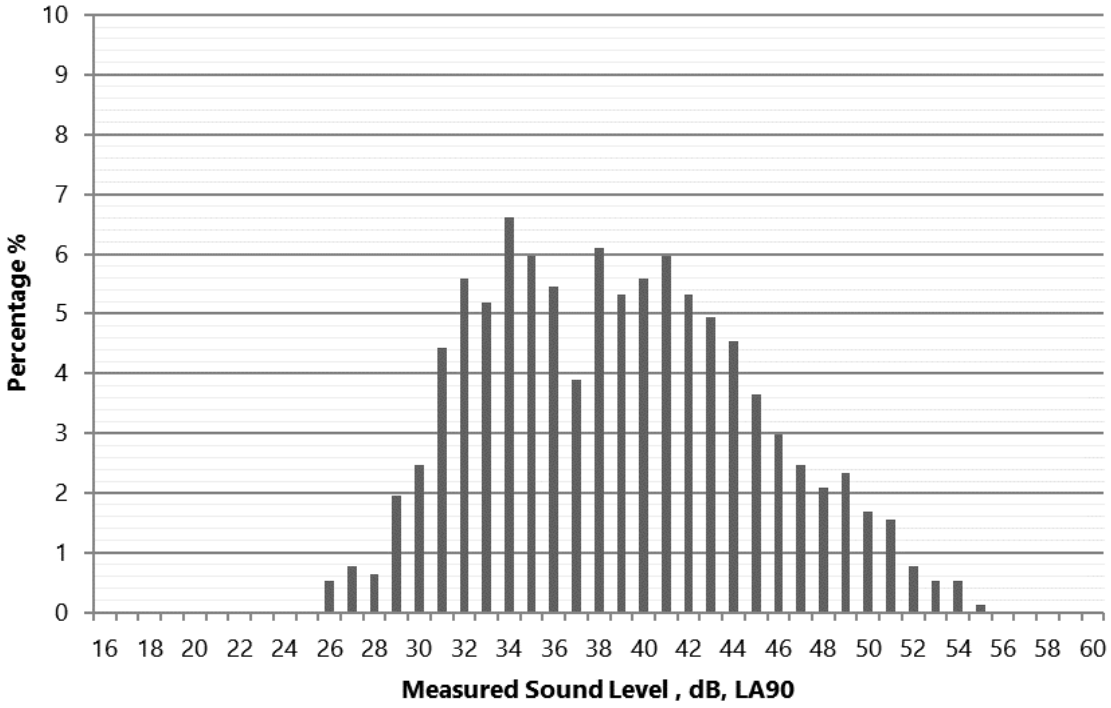
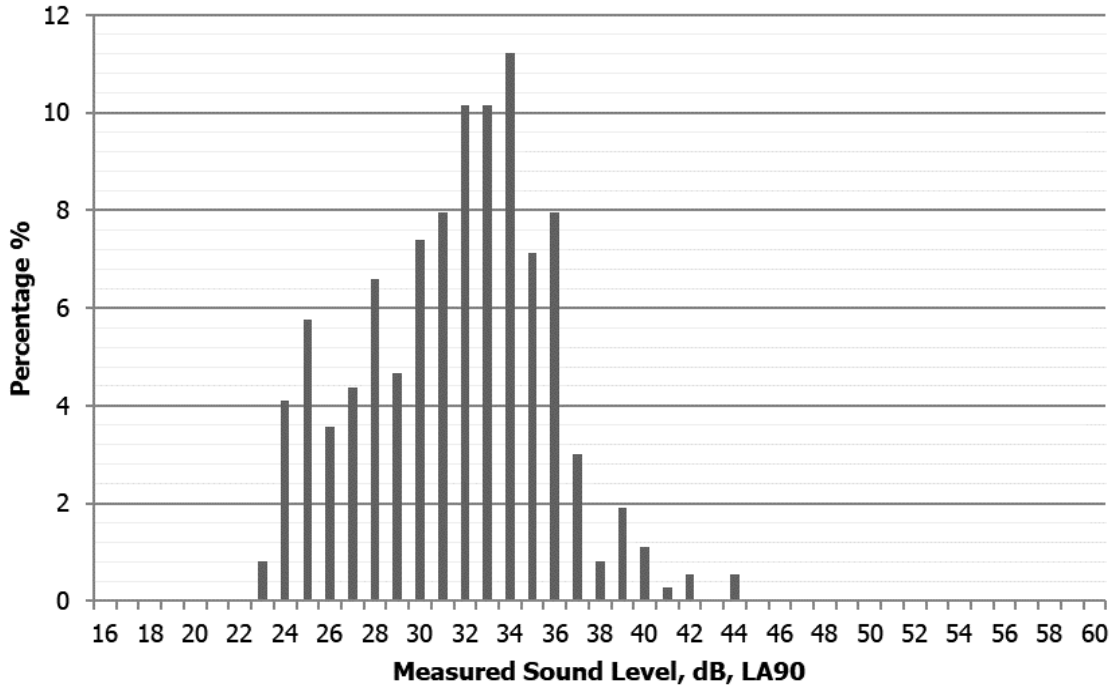


FIGURE A. 11 - DISTRIBUTION OF NIGHT-TIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N3



A.4 MEASUREMENT POSITION N4

The sound meter was installed at Position N4 to measure baseline sound levels at Ringborough Farm West (R4). The sound meter was installed at this location for seven days. Figure A. 12 shows the equipment setup.

During the attended elements of the survey, it was noted that the dominant sound sources were wind blowing and trees rustling. Other sources of sound included the Aldbrough gas storage facility which was clearly audible in the background if no wind was blowing.

A.4.1 RESULTS

Figure A. 13 presents the 15-minute sound measurements logged over the survey period for the key sound metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}. Figure A. 14 and Figure A. 15 presents the distribution of background $L_{A90,15mins}$ sound levels over the day and night-time throughout the survey period.

A.4.2 ANALYSIS

Figure A. 14 shows that LA90 measurements ranged between 26 and 54 dB during the daytime. A peak is evident at the modal value of 45 dB. The 50th percentile value is 41 dB. The 50th percentile value of 41 dB has conservatively been adopted as the RBSL.

Figure A. 15 LA90 measurements ranged between 29 and 47 dB during the night-time. Two peaks in the distribution are evident at the values of 32 and 35 dB. The 50th percentile value is 35 dB. The lower peak value of 32 dB has conservatively been adopted as the RBSL.

FIGURE A. 12 - NOISE MONITORING SETUP AT RINGBROUGH FARM WEST

FIGURE A. 13 - RESULTS OF THE NOISE MONITORING AT THE RINGBOROUGH FARM WEST

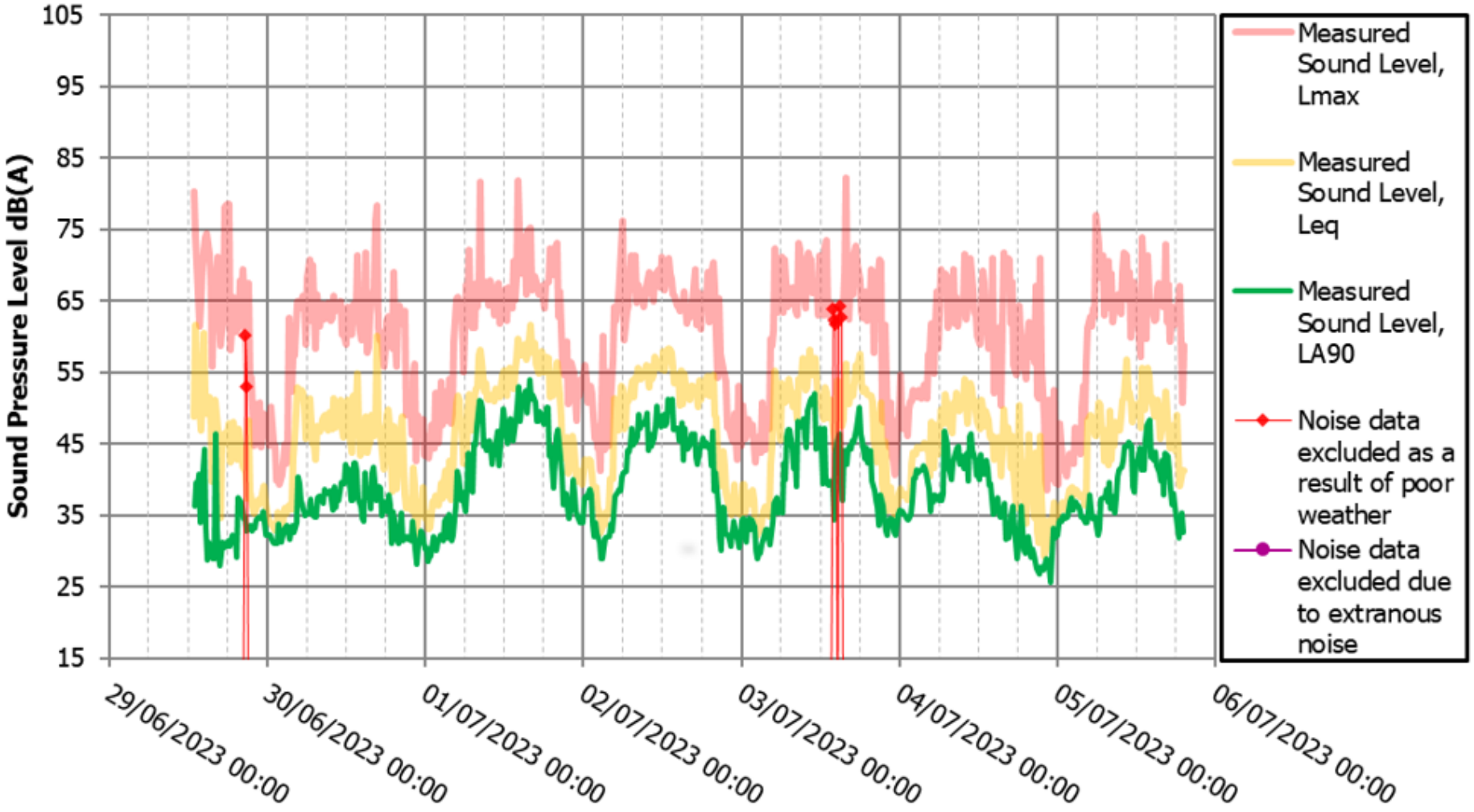


FIGURE A. 14 - DISTRIBUTION OF DAYTIME BACKGROUND LEVELS $L_{A90,15MINS}$

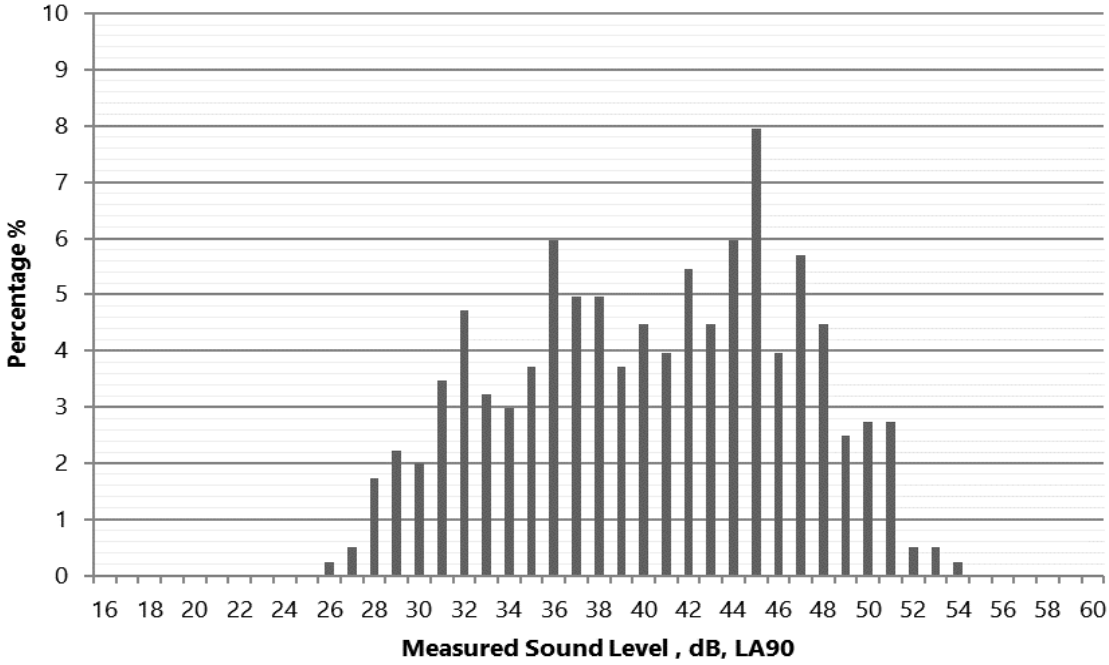
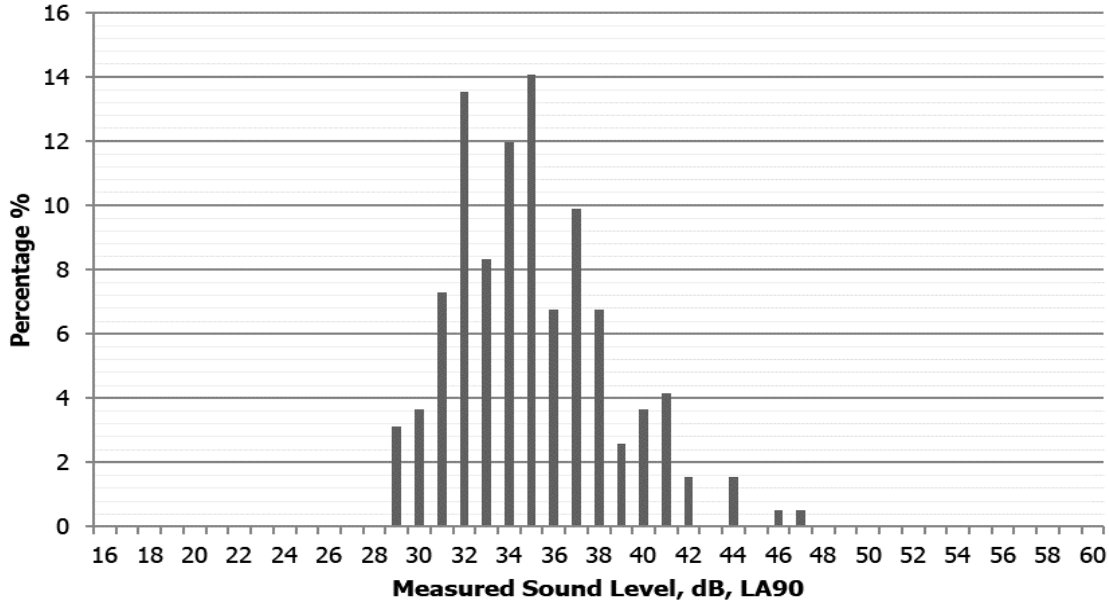


FIGURE A. 15 - DISTRIBUTION OF NIGHT-TIME BACKGROUND LEVELS $L_{A90,15MINS}$



A.5 MEASUREMENT POSITION N6

The sound meter was installed at Position N6 to measure baseline sound levels representative of Springfield Farm (R5), Bail View Farm (R6) and Millview Stables (R7). The sound meter was installed at this location for 13 days.

It was noted during the attended elements of the survey that the dominant sound source was road traffic sound from the B-Road. Other sources of sound included farm animals, residents, birdsong, and trees rustling. These were not dominant within the sound environment, but they were clearly audible. It was also noted that the noise levels and dominant sources did not vary significantly between R5, R6 and R7 so therefore Measurement Position N6 is considered representative of these locations.

A.5.1 RESULTS

Figure A. 16 shows the equipment setup. Figure A. 17 presents the 15-minute sound measurements logged over the survey period for the key sound metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}. Figure A. 18 and Figure A. 19 presents the distribution of background $L_{A90,15mins}$ sound levels over the day and night-time throughout the survey period.

A.5.2 ANALYSIS

Figure A. 18 shows that L_{A90} measurements ranged between 18 and 51 dB during the daytime. Two peaks in the distribution are evident at the values of 37 and 39 dB. The 50th percentile value is 38 dB. The lower peak value of 37 dB has conservatively been adopted as the RBSL.

Figure A. 19 shows that LA90 measurements ranged between 17 and 43 dB during the night-time. A peak is evident at the modal value of 36 dB. The 50th percentile value is 31 dB. The lower value of 31 dB has conservatively been adopted as the RBSL.

FIGURE A. 16 - NOISE MONITORING SETUP AT POSITION N6

FIGURE A. 17 - RESULTS OF THE NOISE MONITORING AT POSITION N6

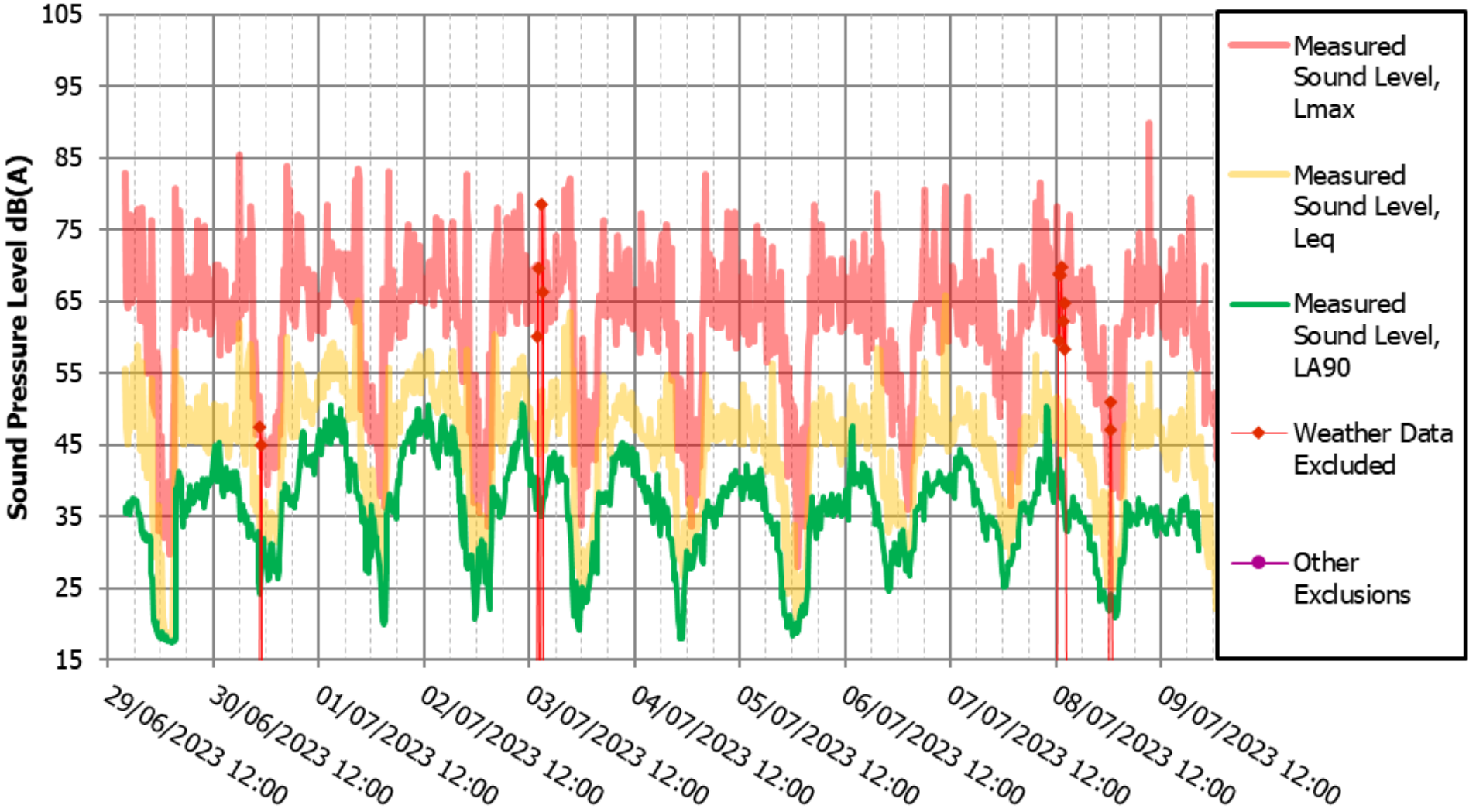


FIGURE A. 18 - DISTRIBUTION OF DAYTIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N6

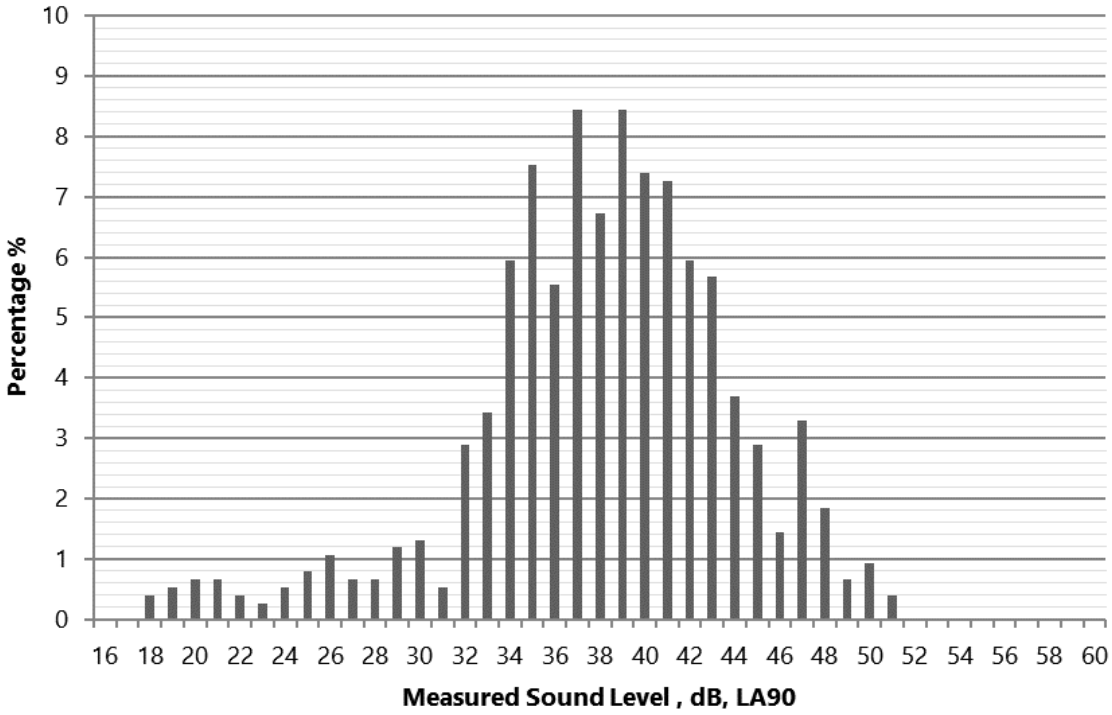
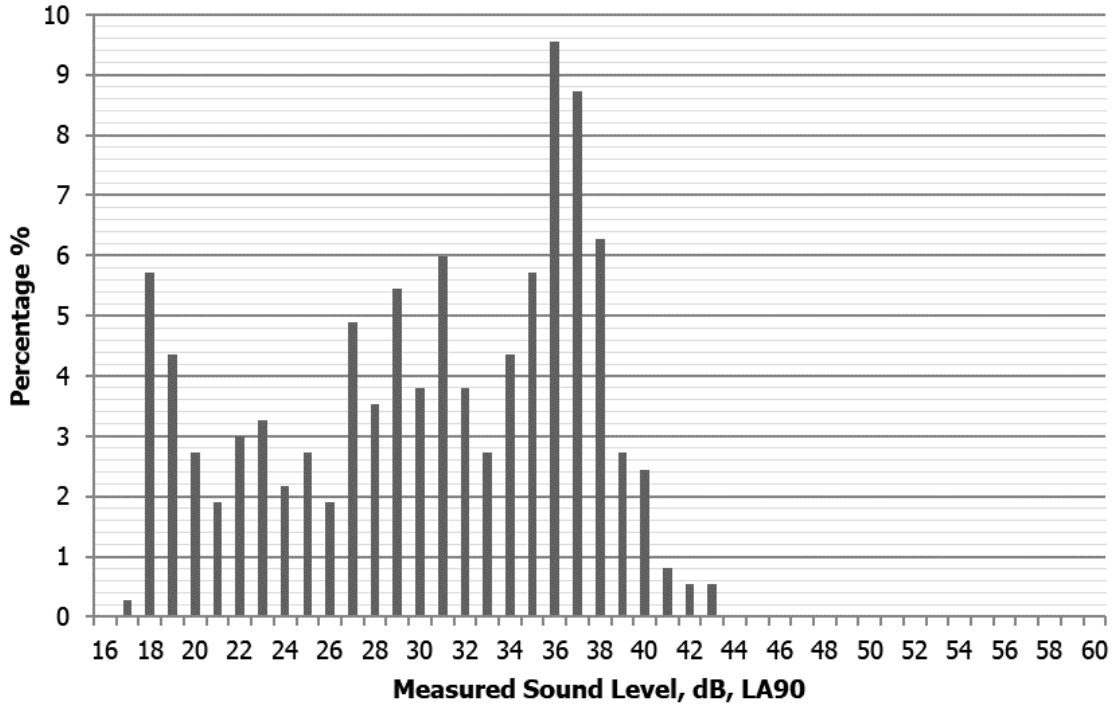


FIGURE A. 19 - DISTRIBUTION OF NIGHT-TIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N6



A.6 MEASUREMENT POSITION N9

The sound meter was installed at Position N9 to measure baseline sound levels representative of The Bungalow (R8) and Church Farm Cottage (R9). The sound meter was installed at this location for 7 days.

It was also noted that the noise levels and dominant sources did not vary significantly between R8 and R9 so therefore Measurement Position N9 is considered representative of these locations.

A.6.1 RESULTS

Figure A. 20 shows the equipment setup. Figure A. 21 presents the 15-minute sound measurements logged over the survey period for the key sound metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}. Figure A. 22 and Figure A. 23 presents the distribution of background $L_{A90,15mins}$ sound levels over the day and night-time throughout the survey period.

A.6.2 ANALYSIS

Figure A. 22 shows that L_{A90} measurements ranged between 19 and 48 dB during the daytime. Two peaks are evident at the values of 33 and 34 dB. The 50th percentile value is 34 dB. The lower peak value of 33 dB has conservatively been adopted as the RBSL.

Figure A. 23 L_{A90} measurements ranged between 17 and 46 dB during the night-time. One peak is evident at the modal value of 23 dB. The 50th percentile value is 27 dB. The lower peak modal value of 23 dB has conservatively been adopted as the RBSL.

As discussed previously in this appendix, comparatively high sound levels were measured over the night of the 15th of July, and it is unclear how typical they are. However, as sound measurements were logged over a period of seven days, these higher levels are unlikely to have significantly affected the adopted RBSL, which is considered representative of the typical sound environment.

FIGURE A. 20 - SOUND AND WEATHER MONITORING AT POSITION N9

FIGURE A. 21 - RESULTS OF THE NOISE MONITORING AT POSITION N9

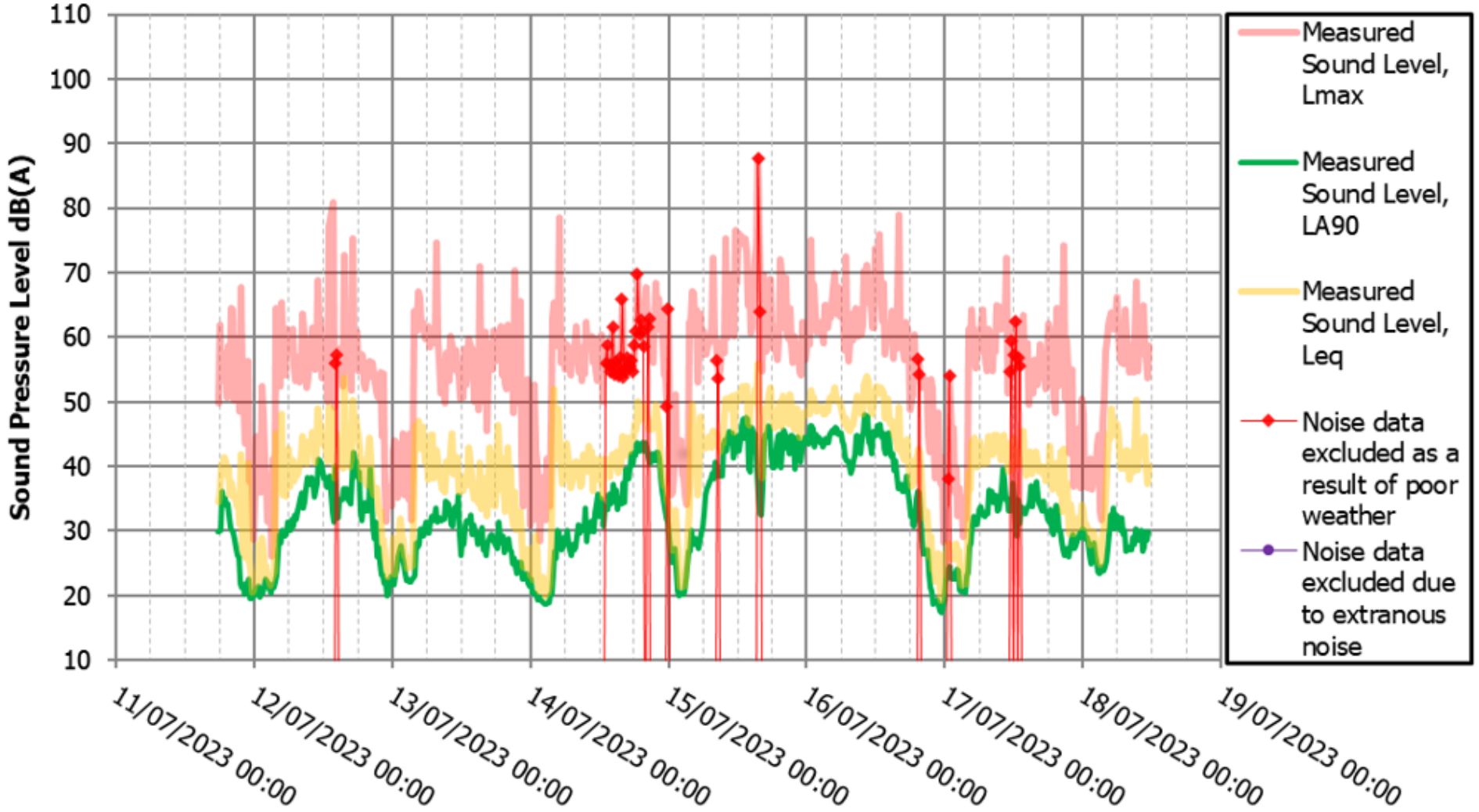


FIGURE A. 22 - DISTRIBUTION OF DAYTIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N9

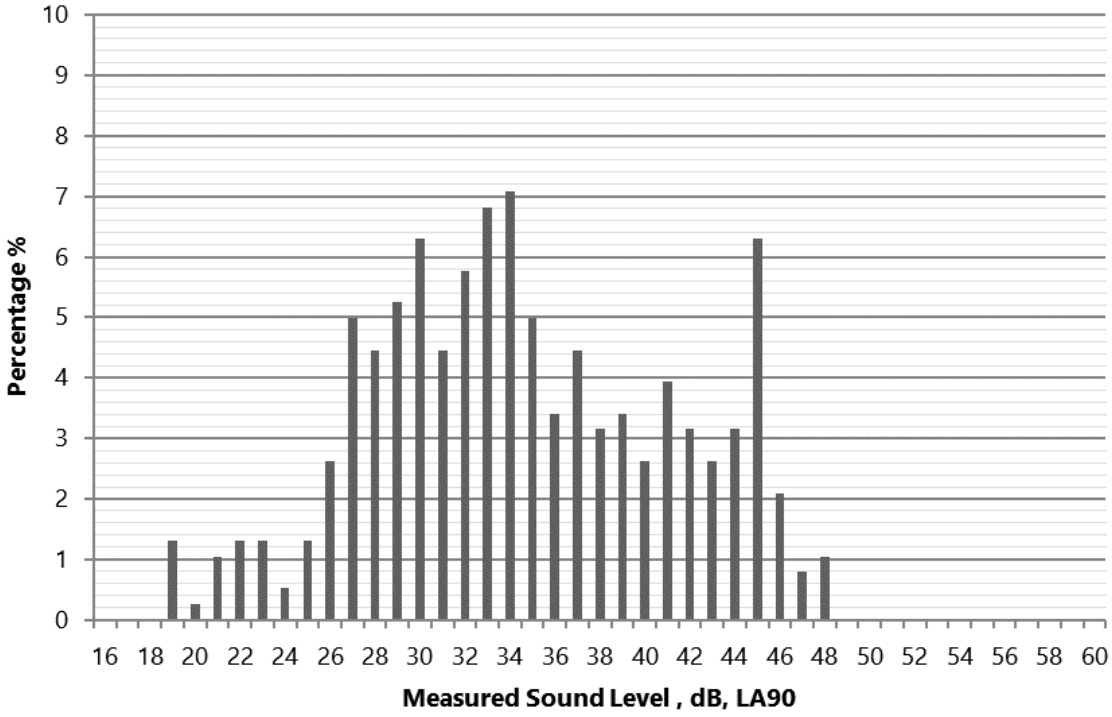
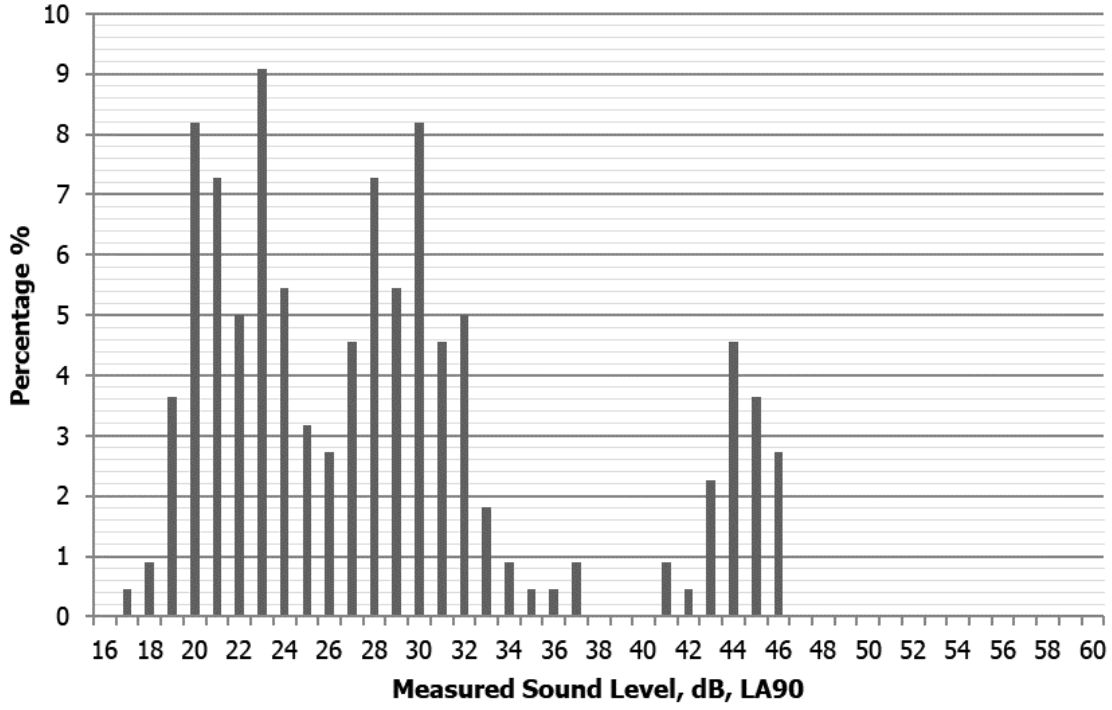


FIGURE A. 23 - DISTRIBUTION OF NIGHT-TIME BACKGROUND LEVELS $L_{A90,15MINS}$ AT POSITION N9



APPENDIX B CALIBRATION CERTIFICATES

CERTIFICATE OF CALIBRATION

Date of Issue: 18 May 2022 **Certificate Number: TCRT22/1304**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	Arcus Consultancy Services Ltd 7th Floor 144 West George Street Glasgow G2 2HG
Order No.	CAL-PB20220503
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	*Instrument*	*Type*	*Serial No. / Version*
Rion	Sound Level Meter	NL-52	01276548
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-25	76767
Rion	Microphone	UC-59	12603
Rion	Calibrator	NC-74	35105087
	Calibrator adaptor type if applicable		NC-74-002

Performance Class	1
Test Procedure	TP 10. SLM 61672-3:2013 *Procedures from IEC 61672-3:2013 were used to perform the periodic tests.*
Type Approved to IEC 61672-1:2013	Yes *If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013*
Date Received	18 May 2022 ANV Job No. TRAC22/05171
Date Calibrated	18 May 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	09 June 2020	TCRT20/1279	ANV Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number
TCRT22/1304

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	NL-52/NL-42 Description for IEC 61672-1		
SLM instruction manual ref / issue	No. 56034 21-03	Source	Rion
Date provided or internet download date	19 March 2021		

	Case Corrections	Wind Shield Corrections	Mic Pressure to Free Field Corrections
Uncertainties provided	Yes	Yes	Yes

Total expanded uncertainties within the requirements of IEC 61672-1:2013	YES		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Customers Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	18 May 2022		
Calibrator cert. number	TCRT22/1302		
Calibrator cal cert issued by Lab	ANV Measurement Systems		
Calibrator SPL @ STP	94.00	dB	Calibration reference sound pressure level
Calibrator frequency	1002.06	Hz	Calibration check frequency
Reference level range	Single	dB	

Accessories used or corrected for during calibration - None

Environmental conditions during tests	Start	End	
Temperature	23.82	24.17	± 0.30 °C
Humidity	55.4	54.0	± 3.00 %RH
Ambient Pressure	101.07	101.06	± 0.03 kPa

Indication at the Calibration Check Frequency			
Initial indicated level	94.1 dB	Adjusted indicated level	94.0 dB
Uncertainty of calibrator used for Indication at the Calibration Check Frequency ±			0.10 dB

Self Generated Noise

Microphone installed - Less Than 19.7 dB A Weighting

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	13.1	dB	UR	17.5	dB	UR	24.3	dB	UR

Self Generated Noise reported for information only and not used to assess conformance to a requirement

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by ISO.

Additional Comments

None

..... END .....

Calibrated by: B. Bogdan R 2

CERTIFICATE OF CALIBRATION

Date of Issue: 27 May 2022 **Certificate Number: TCRT22/1329**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	Arcus Consultancy Services Ltd 7th Floor 144 West George Street Glasgow G2 2HG
Order No.	CAL-PB20220503
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	*Instrument*	*Type*	*Serial No. / Version*
Rion	Sound Level Meter	NL-52	01276547
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-25	76766
Rion	Microphone	UC-59	12602
Rion	Calibrator	NC-74	34104515
	Calibrator adaptor type if applicable		NC-74-002

Performance Class	1
Test Procedure	TP 10. SLM 61672-3:2013
	Procedures from IEC 61672-3:2013 were used to perform the periodic tests.
Type Approved to IEC 61672-1:2013	Yes
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013
Date Received	27 May 2022 ANV Job No. TRAC22/05190
Date Calibrated	27 May 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	08 June 2020	TCRT20/1277	ANV Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number
TCRT22/1329

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	NL-52/NL-42 Description for IEC 61672-1				
SLM instruction manual ref / issue	No. 56034 21-03	Source	Rion		
Date provided or internet download date	19 March 2021				

	Case Corrections	Wind Shield Corrections	Mic Pressure to Free Field Corrections
Uncertainties provided	Yes	Yes	Yes

Total expanded uncertainties within the requirements of IEC 61672-1:2013	YES		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Customers Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	27 May 2022		
Calibrator cert. number	TCRT22/1327		
Calibrator cal cert issued by Lab	ANV Measurement Systems		
Calibrator SPL @ STP	93.98	dB	Calibration reference sound pressure level
Calibrator frequency	1001.65	Hz	Calibration check frequency
Reference level range	Single	dB	

Accessories used or corrected for during calibration - None

Environmental conditions during tests	Start	End	
Temperature	23.70	24.02	± 0.30 °C
Humidity	43.5	42.3	± 3.00 %RH
Ambient Pressure	101.45	101.46	± 0.03 kPa

Indication at the Calibration Check Frequency			
Initial indicated level	94.0 dB	Adjusted indicated level	94.0 dB
Uncertainty of calibrator used for Indication at the Calibration Check Frequency ±			0.10 dB

Self Generated Noise

Microphone installed - Less Than 19.1 dB A Weighting

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	12.3	dB	UR	17.4	dB	UR	23.7	dB	UR

Self Generated Noise reported for information only and not used to assess conformance to a requirement

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by ISO.

Additional Comments

Prior to calibration the instrument was re-aligned.

..... END .....

Calibrated by: B. Bogdan R 2

CERTIFICATE OF CALIBRATION

Date of Issue: 20 September 2022 **Certificate Number: TCRT22/1582**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

B. Bogdan

Customer	Arcus Consultancy Services Ltd Floor 7 144 West George Street G2 2HG Glasgow UK			
Order No.	CAL20220916BA			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00709257
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	09548
	Rion	Microphone	UC-59	17641
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002
Performance Class	1			
Test Procedure	TP 10. SLM 61672-3:2013 *Procedures from IEC 61672-3:2013 were used to perform the periodic tests.*			
Type Approved to IEC 61672-1:2013	Yes *If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013*			
Date Received	16 September 2022	ANV Job No.	TRAC22/09339	
Date Calibrated	20 September 2022			

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	23 September 2020	TCRT20/1563	ANV Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number
TCRT22/1582

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	NL-52/NL-42 Description for IEC 61672-1		
SLM instruction manual ref / issue	No. 56034 21-03	Source	Rion
Date provided or internet download date	19 March 2021		

	Case Corrections	Wind Shield Corrections	Mic Pressure to Free Field Corrections
Uncertainties provided	Yes	Yes	Yes

Total expanded uncertainties within the requirements of IEC 61672-1:2013	YES		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	05 September 2022		
Calibrator cert. number	UCRT22/2059		
Calibrator cal cert issued by Lab	ANV Measurement Systems		
Calibrator SPL @ STP	94.00	dB	Calibration reference sound pressure level
Calibrator frequency	1001.87	Hz	Calibration check frequency
Reference level range	Single	dB	

Accessories used or corrected for during calibration - None

Environmental conditions during tests	Start	End		
Temperature	24.17	24.23	± 0.30	°C
Humidity	38.9	37.7	± 3.00	%RH
Ambient Pressure	101.58	101.58	± 0.03	kPa

Indication at the Calibration Check Frequency				
Initial indicated level	94.3	dB	Adjusted indicated level	94.0 dB
Uncertainty of calibrator used for Indication at the Calibration Check Frequency ±				0.10 dB

Self Generated Noise

Microphone installed - Less Than 19.0 dB A Weighting

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	12.1	dB	UR	15.8	dB	UR	21.6	dB	UR

Self Generated Noise reported for information only and not used to assess conformance to a requirement

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by ISO.

Additional Comments

None

..... END .....

Calibrated by: PB/BB R 1

CERTIFICATE OF CALIBRATION

Date of Issue: 08 June 2022 **Certificate Number: TCRT22/1352**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	Arcus Consultancy Services Limited 7th Floor 144 West George Street Glasgow G2 2HG
Order No.	CAL-PB20220503
Test Procedure	Procedure TP 1 Calibration of Sound Calibrators
Description	Acoustic Calibrator

Identification	*Manufacturer*	*Instrument*	*Model*	*Serial No.*
	Rion	Calibrator	NC-74	34372738

The calibrator has been tested as specified in Annex B of IEC 60942:2003. As public evidence was available from a testing organisation (PTB) responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

ANV Job No.	TRAC22/06198	
Date Received	07 June 2022	
Date Calibrated	08 June 2022	
Previous Certificate	*Dated*	11 June 2021
	Certificate No.	TCRT21/1392
	Laboratory	ANV Measurement Systems

Measurements

The sound pressure level generated by the calibrator in its WS2 configuration was measured five times by the Insert Voltage Method using a microphone as detailed below. The mean of the results obtained is shown below. It is corrected to the standard atmospheric pressure of 101.3 kPa (1013 mBar) using original manufacturers information.

Test Microphone	*Manufacturer*	*Type*
	Brüel & Kjær	4134

Results

The level of the calibrator output under the conditions outlined above was

94.02 ± 0.10 dB rel 20 µPa

Functional Tests and Observations

The frequency of the sound produced was	1001.61	±	0.12 Hz
The total distortion was	1.28	±	0.09 % Distortion

During the measurements environmental conditions were

Temperature	24	to	25	°C
Relative Humidity	38	to	44	%
Barometric Pressure	99.4	to	99.5	kPa

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by the International Organisation for Standards (ISO).

The uncertainties refer to the measured values only with no account being taken of the ability of the instrument to maintain its calibration.

A small correction factor may need to be applied to the sound pressure level quoted above if the device is used to calibrate a sound level meter which is fitted with a free-field response microphone. See manufacturers handbook for details.

..... END .....

Note:

Calibrator adjusted prior to calibration?	NO	
Initial Level	N/A	dB
Initial Frequency	N/A	Hz

Additional Comments
None

CERTIFICATE OF CALIBRATION

Date of Issue: 18 August 2021 **Certificate Number: TCRT21/1573**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

B. Giles

Customer	Arcus Consultancy Services Ltd Floor 7 144 West George Street Glasgow G2 2HG
Order No.	CAL20210803BA
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	*Instrument*	*Type*	*Serial No. / Version*
Rion	Sound Level Meter	NL-52	00510130
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-25	10123
Rion	Microphone	UC-59	02831
Rion	Calibrator	NC-74	34536109
	Calibrator adaptor type if applicable		NC-74-002

Performance Class	1
Test Procedure	TP 2.SLM 61672-3 TPS-49

Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2002 YES Approval Number 21.21 / 13.02

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003

Date Received	06 August 2021	ANV Job No.	TRAC21/08320
Date Calibrated	18 August 2021		

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate

Dated	*Certificate No.*	*Laboratory*
31 July 2019	TCRT19/1614	ANV Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number
TCRT21/1573

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52
SLM instruction manual ref / issue	11-03
SLM instruction manual source	Manufacturer
Internet download date if applicable	N/A
Case corrections available	Yes
Uncertainties of case corrections	Yes
Source of case data	Manufacturer
Wind screen corrections available	Yes
Uncertainties of wind screen corrections	Yes
Source of wind screen data	Manufacturer
Mic pressure to free field corrections	Yes
Uncertainties of Mic to F.F. corrections	Yes
Source of Mic to F.F. corrections	Manufacturer
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes
Specified or equivalent Calibrator	Specified
Customer or Lab Calibrator	Lab Calibrator
Calibrator adaptor type if applicable	NC-74-002
Calibrator cal. date	03 August 2021
Calibrator cert. number	UCRT21/1937
Calibrator cal cert issued by	ANV Measurement Systems
Calibrator SPL @ STP	94.00 dB Calibration reference sound pressure level
Calibrator frequency	1001.95 Hz Calibration check frequency
Reference level range	25 - 130 dB

Accessories used or corrected for during calibration - None
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	23.64	23.60	± 0.30 °C
Humidity	47.8	44.6	± 3.00 %RH
Ambient Pressure	100.57	100.55	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.3 dB		Adjusted indicated level	94.0 dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10 dB

Self Generated Noise	This test is currently not performed by this Lab.
Microphone installed (if requested by customer) = Less Than	N/A dB A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A dB

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	12.4	dB	UR	17.2	dB	UR	23.8	dB	UR
Uncertainty of the electrical self generated noise ±							0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by ISO.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

..... END .....

Calibrated by: B. Bogdan R 2

Additional Comments
None

APPENDIX C METEOROLOGICAL DATA

TABLE C. 1 - 15-MINUTE LOGGED RAIN AND WIND DATA

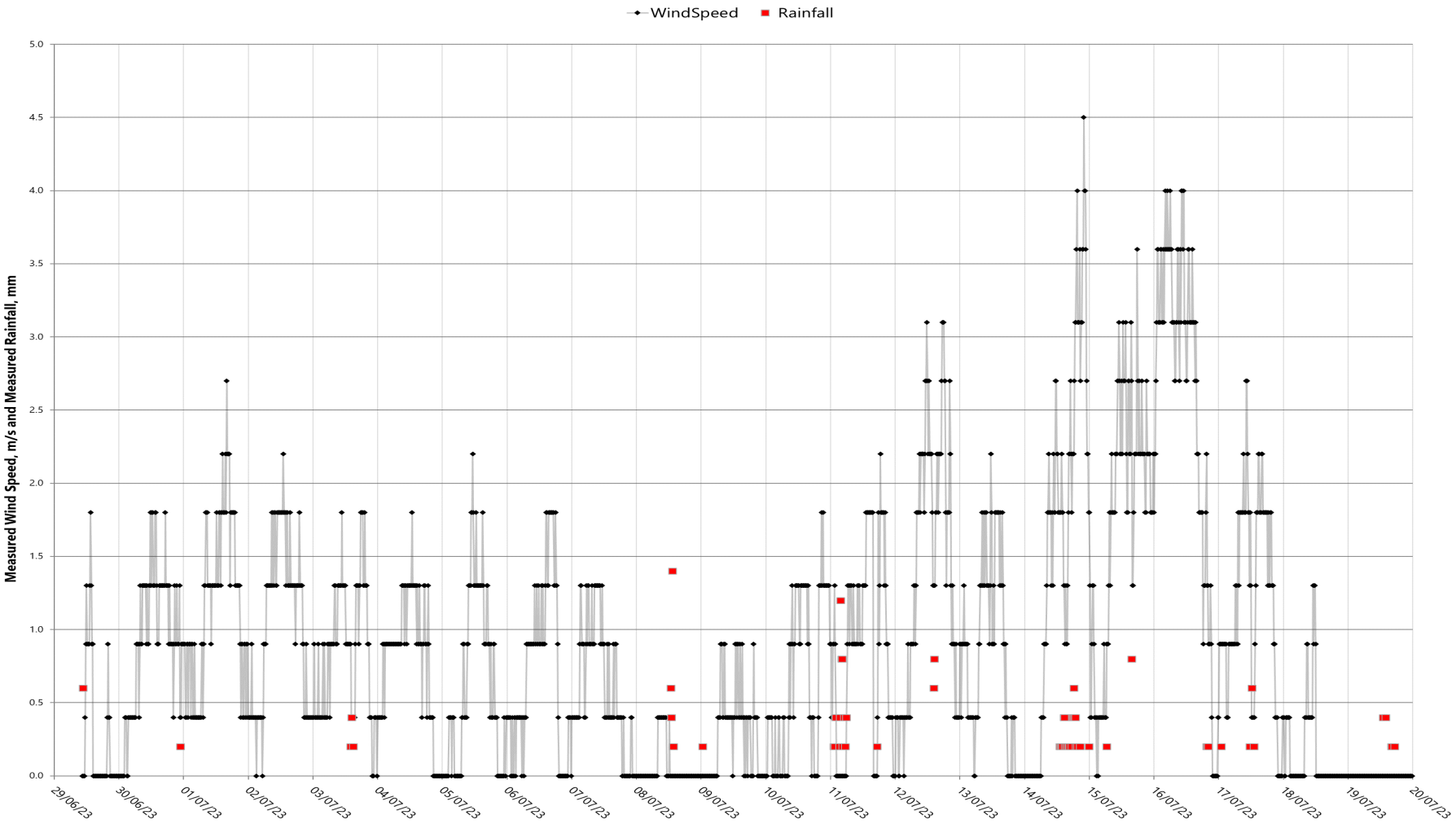
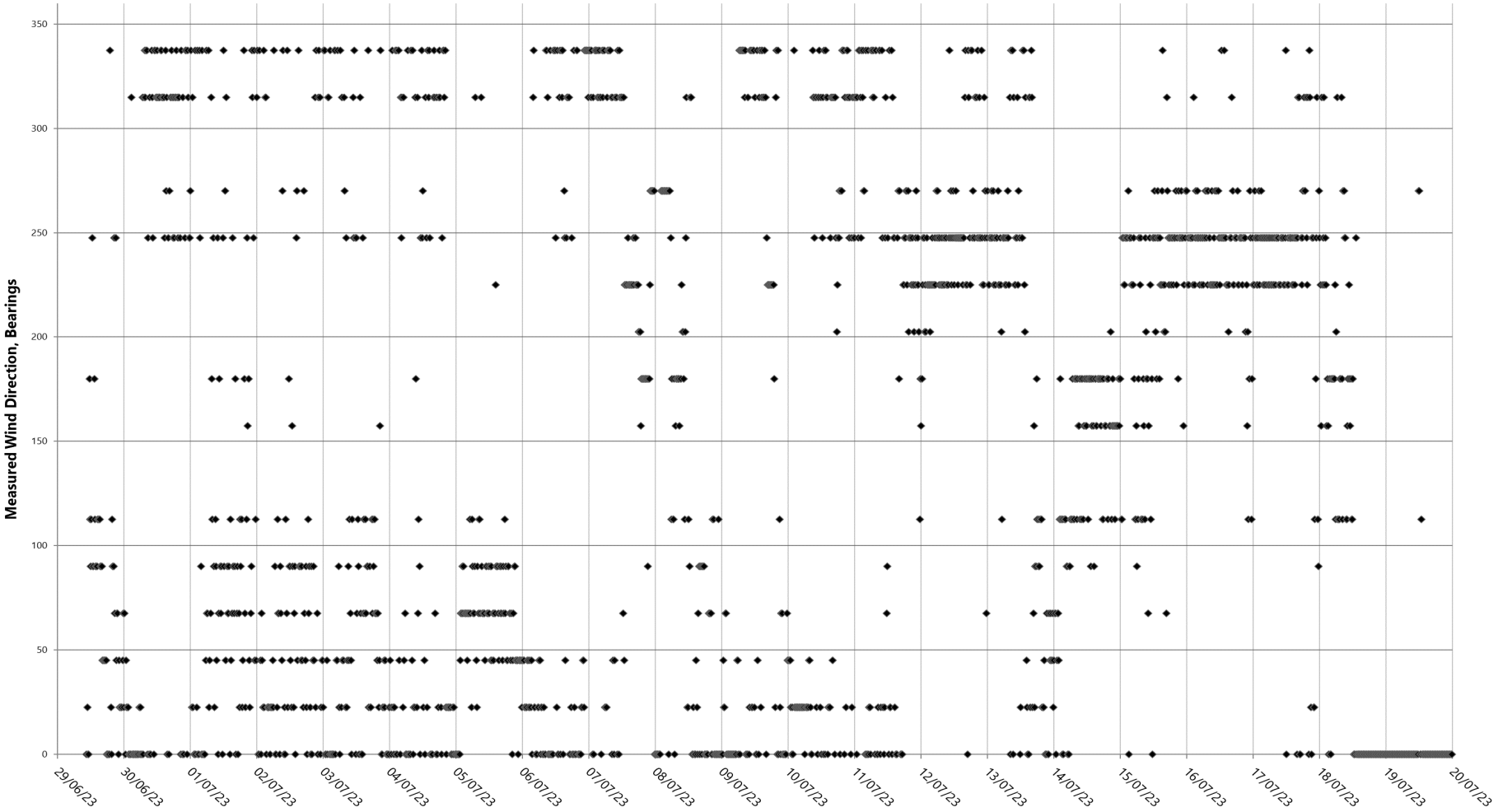


TABLE C. 2 - 15-MINUTE LOGGED WIND DIRECTION DATA



Note:

[a] 0 degrees shows north. A clockwise increase of 90 degrees would be east, whilst an increase to 180 would be south and so on

APPENDIX D SOUND MODELLING INPUT DATA

D.1 INTRODUCTION

This appendix provides details of the data inputs used in the operational sound modelling.

The sound input data used in the sound model is presented in **Table D.1.** The modelling has been based on the layout drawings listed below, as well as data provided by the Site design engineering team.

- 414543-0000-G1000. Rev D including additional markup (provided 12th May 2023);
- 416312-0000-G1000. Rev D Plot Plan (East Side) including additional markup (dated 03/06/23)
- 416312-0000-G2000 RevB Equipment Layout Process Area (dated 28/08/23); and
- 416312-0000-G2001 RevB Equipment Layout Utility Area (dated 28/08/23).
- E1B101206802 RevB SGT-800 Tender Layout Aldbrough Hydrogen Pathfinder Project
- 416312-0000-E2000 RevD Equipment Layout Power Distribution Centre (PDC) Building (dated 24/08/2023)
- 416312-0000-A4001 RevC Electrolyser Building Ground Floor Plan (dated 26/09/23)
- 416312-0000-A4002 RevC Electrolyser Building Ground Floor Plan (dated 26/09/23)
- 416312-0000-A4003 RevC Electrolyser Building Ground Floor Plan (dated 26/09/23)
- 416312-0000-A4004 RevC Electrolyser Building Ground Floor Plan (dated 26/09/23)
- 416312-0000-A4014 RevC Demin Building Ground Floor Plan (dated 27/10/23)
- 416312-0000-A4015 RevC Demin Building Ground Floor Plan (dated 27/10/23)
- 416312-0000-A4016 RevC Demin Building Ground Floor Plan (dated 27/10/23)
- 416312-0000-A4017 RevC Demin Building Ground Floor Plan (dated 27/10/23)

TABLE D. 1 - SOUND INPUT DATA USED IN THE SOUND MODEL

Equipment Name	Assumed Source Height (m)	Lw / Unit, dBA	Operation Mode	Units
Compressor area				
UNE01 Compressor	9	96	Electrolyser	1
UNE01 HVAC	9	92	Electrolyser	1
UNE01 Control valves and Piping	10	87	Electrolyser	1
UNE02 Compressor	10	95	Electrolyser	1
UNE02 HVAC	10	93	Electrolyser	1
UNE02 Control valves and Piping	10	88	Electrolyser	1
Electrolyser area				
Civil Main Building - West	8.6	77	Electrolyser	1
Civil Main Building - East	8.6	77	Electrolyser	1
Civil Water Treatment Area/Refinement Loop - West	3.4	66	Electrolyser	1
Civil Water Treatment Area/Refinement Loop - East	3.4	66	Electrolyser	1
Civil Rectifier Area (Rectifier Room) - West	8.6	70	Electrolyser	1
Civil Rectifier Area (Rectifier Room) - East	8.6	70	Electrolyser	1
Air Handling Unit - East	9.5	93	Electrolyser	2
HVAC Main Building - East	9.5	96	Electrolyser	1

Equipment Name	Assumed Source Height (m)	Lw / Unit, dBA	Operation Mode	Units
Air Handling Unit - West	9.5	93	Electrolyser	2
HVAC Main Building - West	9.5	96	Electrolyser	1
HVAC Rectifier Building – East	6.5	96	Electrolyser	1
HVAC Rectifier Building – West	6.5	96	Electrolyser	1
Piping Gas Cooler – East	5.5	86	Electrolyser	1
Pipe Bridge – East	5.5	96	Electrolyser	1
Piping Gas Cooler – West	6	86	Electrolyser	1
Pipe Bridge – West	6	101	Electrolyser	1
O2 Vents - West	9.5	88	Electrolyser	4
O2 Vents - East	9.5	88	Electrolyser	4
Ube Sil Mv Transformer	4.5	97	Electrolyser	2
Sleeper Way	0.25	96	Electrolyser and Power Plant	1
Chiller Unit for Rectifier Room HVAC (Compressor)	5	90	Electrolyser	2
HVAC Components with Chiller Unit (Air Intake)	5	87	Electrolyser	2
Gas Turbine Area				
Air Intake Filter House	6.6	96	Power Plant	1
Gas Turbine Enclosure	16	103	Power Plant	1
Gas Turbine Enclosure Ventilation Outlet	8.5	91	Power Plant	1

Equipment Name	Assumed Source Height (m)	Lw / Unit, dBA	Operation Mode	Units
Gas Turbine Enclosure Ventilation Inlet	8	93	Power Plant	1
Generator	6.6	107	Power Plant	1
Exhaust Bellows	4	94	Power Plant	1
Lube Oil Cooler	8	85	Power Plant	1
Oil Mist Outlet	8	83	Power Plant	1
Pressure Let Down Station	5	95	Power Plant	1
Stack Outlet	25	104	Power Plant	1
Stack Body	25	77	Power Plant	1
SCR Body / Turbine Exhaust Duct	9.5	98	Power Plant	1
SCR Blowers (One Unit Operating at Any One Time)	2.5 / 4.5 (Oddly Shaped)	101	Power Plant	1
OCGT Transformer	2.25	110	Power Plant	1
HVAC Units - LER	2.0	75	Electrolyser and Power Plant	4
HVAC Units – Battery Container	3.0	75	Electrolyser and Power Plant	6
Other Areas				
Nitrogen System	5	92	Electrolyser and Power Plant	1
Instrument Air System	2.5	92	Electrolyser and Power Plant	1
Hydrogen Enclosed Ground Flare	6	112	Electrolyser and Power Plant	1
LV Transformer	5	85	Electrolyser and Power Plant	1
Earthing Transformer	2.5	85	Electrolyser and Power Plant	1

Equipment Name	Assumed Source Height (m)	Lw / Unit, dBA	Operation Mode	Units
Deoxo	5	97	Electrolyser	1
Demineralisation Plant	6.15	100	Electrolyser	1
Fin Fan Block ACC	6	101	Electrolyser and Power Plant	1
H2 Dehydration (Dryer)	5	98	Electrolyser	1
PDC HVAC Units	1	100	Electrolyser and Power Plant	8
Station Service Transformer	2.25	65	Electrolyser and Power Plant	1

APPENDIX E PERSONNEL

RONNY OSPINA OROZCO

>6 years' experience working on the acoustic design of numerous development, construction and infrastructure schemes, from the conceptual design stages and through to completion.

Project Responsibilities

- Carrying out the assessment
- Authoring the report

Role

Senior Consultant (Acoustics)

Education

- DipIOA. Diploma in Acoustics and Noise Control, Institute of Acoustics, UK, 2022
- MSc. Environmental and Architectural Acoustics, London South Bank University, UK, 2019
- BSc (Hons). Sound Technology, University of South Wales, UK, 2014

Professional Affiliations and Registrations

- Corporate Member of the UK Institute of Acoustics (MIOA)

Fields of Competence

- Noise and vibration surveying (including sound insulation and reverberation testing)
- 3D modelling applications, e.g., CadnaA, SoundPLAN
- Noise and vibration assessments and technical report writing to support planning and licensing applications, including NIA, EIA, feasibility studies, planning condition discharge and post-completion compliance verification
- Sound insulation design of buildings, including façade noise ingress and egress design
- Building services and external mechanical plant noise control
- Reverberation control

JAMIE HOGG

>14 years' experience in undertaking environmental noise measurement surveys and assessments across multiple sectors

Project Responsibilities

- Technical review

Role

Principle Consultant (Acoustics)

Education

- DipIOA. Diploma in Acoustics and Noise Control, Institute of Acoustics, UK, 2007-2008
- MSc Music Technology, University of York, UK 1998–1999
- BSc (Hons) Environmental Science. University of Bradford, UK. 1993–1997

Professional Affiliations and Registrations

- Corporate Member of the UK Institute of Acoustics (MIOA)

Fields of Competence

- Environmental Impact Assessment (Sound, Noise and Vibration)
- Project Management
- Occupational Noise Assessment
- Design Noise Studies
- Noise and Vibration Control
- Noise and Vibration Monitoring and Modelling / Prediction

VASCO BAPTISTA

>2 years' experience in undertaking environmental noise measurement surveys and assessments across multiple sectors

Project Responsibilities

- Noise survey and writing respective appendix
- Noise modelling and writing the respective appendix

Role

Senior Associate Consultant (Acoustics)

Education

- MSc. Applied Acoustics, Solent University, UK, 2021
- BSc. Music Technology, Coventry University, UK, 2019

Professional Affiliations and Registrations

- Associate Member of the UK Institute of Acoustics (AMIOA)

Fields of Competence

- Environmental Impact Assessments
- Noise Impact Assessments
- Construction Applications
- Complaint Investigation
- Permitting Applications
- Mitigation and Control
- Planning Applications
- Screening Reports
- Baseline Surveys
- Scoping Reports
- Noise Modelling
- Compliance

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