Westhide Solar Power Proposal

Noise Impact Assessment

8th December 2021

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1. INTRODUCTION

1.1. Overview

inacoustic has been commissioned to prepare a Noise Assessment Report for the proposed installation and operation of a grid connected solar farm, on land north of the village of Westhide, Herefordshire, HR1 3RL.

This report details the existing background sound climate at the nearest noise-sensitive receptors, as well as the potential sound emissions associated with the Proposed Development.

The assessment considers the potential noise generation from the plant associated with the Proposed Development, with respect to existing sound levels in the area. The assessment methodology contained in British Standard 4142:2014+A1:2019 *Method for rating and assessing industrial and commercial sound* has been used.

Accordingly, the following technical noise assessment has been produced to accompany the Planning Application to Herefordshire Council.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

1.2. Scope and Objectives

The scope of the report is summarised as follows:

- A sound monitoring survey was undertaken at discrete locations adjacent to the closest noise-sensitive receptors to the Site;
- A 3-dimensional noise modelling exercise, in order to quantify the potential noise generation of the proposed Site uses;
- An assessment of potential noise impacts with respect to the prevailing acoustic conditions at existing off-site receptors; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements BS4142:2014+A1:2019[1].

[1] British Standard 4142: 2014+A1:2019 *Method for rating and assessing commercial sound*. BSI

2. Legislation and Policy Framework

2.1. National Policy

2.1.1. National Planning Policy Framework, 2021

The *National Planning Policy Framework* (NPPF)[2] sets out the Government's planning policies for England. Planning policy requires that applications for planning permission must be determined in accordance with the development plan, unless material considerations indicate otherwise.

The NPPF is also a material consideration in planning decisions. It sets out the Government's requirements for the planning system and how these are expected to be addressed.

Under Section 15; *Conserving and Enhancing the Natural Environment*, in Paragraph 174, the following is stated:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

- *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability".*

Paragraph 185 of the document goes on to state:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- *a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason"*

Paragraph 185 refers to the Noise Policy Statement for England, which is considered overleaf.

[2] Ministry of Housing, Communities and Local Government (MHCLG), July 2021. National Planning Policy Framework. HMSO. London.

2.1.2. Noise Policy Statement for England, 2010

The underlying principles and aims of existing noise policy documents, legislation and guidance are clarified in *DEFRA: 2010: Noise Policy Statement for England* (NPSE)[3]. The NPSE sets out the *"Long Term Vision"* of Government noise policy as follows:

"Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development".

The NPSE outlines three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

- *"Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life".*

The guidance states that it is not possible to have a single objective noise-based measure that defines *"Significant Observed Adverse Effect Level (SOAEL)"* that is applicable to all sources of noise in all situations and that not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

2.1.3. National Planning Practice Guidance in England: Noise, 2019

Further guidance in relation to the NPPF and the NPSE has been published in the *National Planning Practice Guidance in England: Noise* (NPPG Noise)[4], which summarises the noise exposure hierarchy, based on the likely average response. The following three observed effect levels are identified below:

- Significant Observed Adverse Effect Level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur;
- Lowest Observed Adverse Effect Level: This is the level of noise exposure above which adverse effects on health and quality of life can be detected; and
- No Observed Adverse Effect Level: This is the level of noise exposure below which no effect at all on health or quality of life can be detected.

[3] Department for Environment, Food and Rural Affairs (DEFRA), 2010. Noise Policy Statement for England. DEFRA.
[4] Department for Communities and Local Government (DCLG), 2019. National Planning Practice Guidance for England: Noise. DCLG.

Criteria related to each of these levels are reproduced in Table 1.

TABLE 1: SIGNIFICANCE CRITERIA FROM NPPG IN ENGLAND: NOISE

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Noticeable	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Noticeable and Not Intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Noticeable and Intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and Disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and Very Disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

2.2. Assessment Criteria

2.2.1. BS4142:2014:+A1:2019

BS4142:2014+A1:2019 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142:2014+A1:2019 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

BS4142:2014+A1:2019 states: *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs"*. An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

- *"Typically, the greater this difference, the greater the magnitude of the impact."*
- *"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."*
- *"A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."*
- *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

During the daytime, the assessment is carried out over a reference time period of 1-hour, with a reference period of 15-minutes used for the night-time assessment. The periods associated with day or night, for the purposes of the Standard, are considered to be 07.00 to 23.00 and 23.00 to 07.00, respectively.

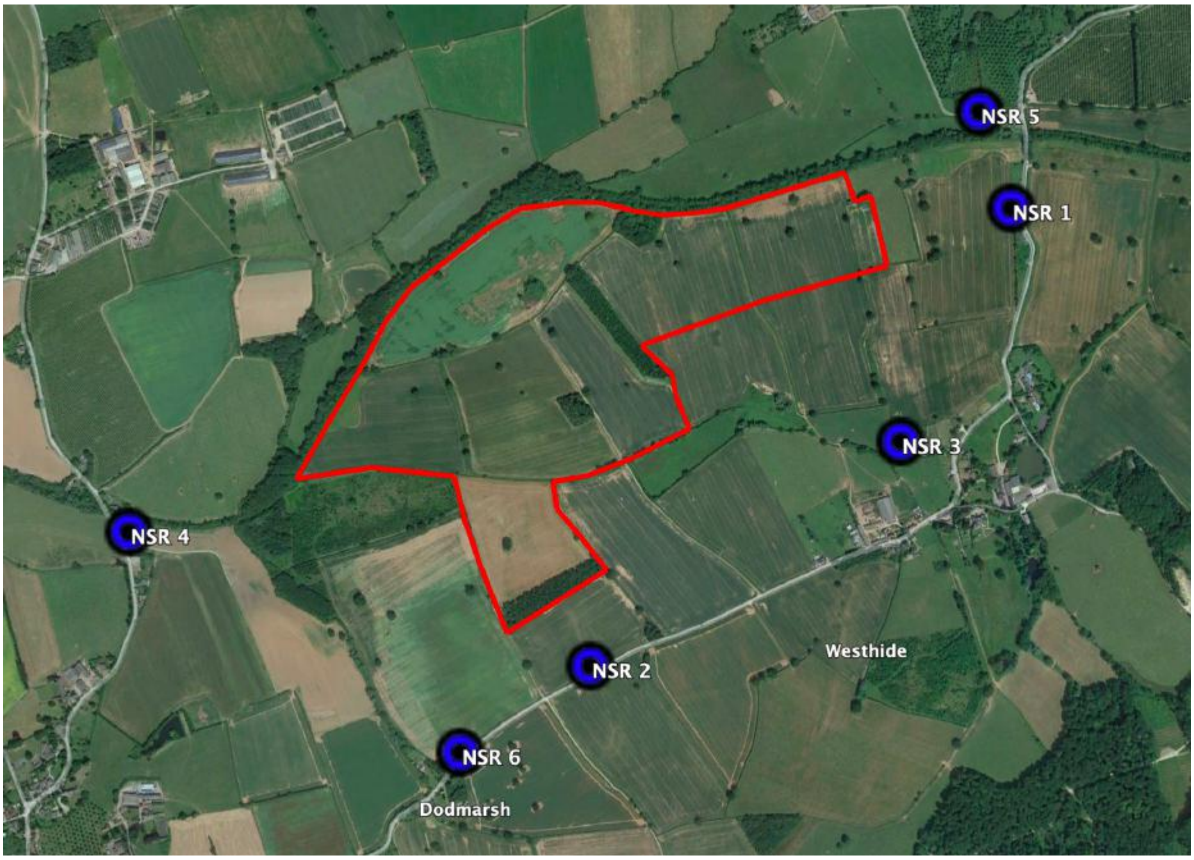
3. Site Description

3.1. Site and Surrounding Area

The site is situated to the north of the villages of Westhide and Dodmarsh, located in Herefordshire with the approximate postcode of HR1 3RL. The ambient sound environment across the area was sustained by road traffic travelling along the local road to the south of the Proposed Site as well other smaller surrounding roads leading into and out of the village.

The location of the Site in reference to the nearest noise sensitive receivers (NSRs) can be seen in Figure 1.

Figure 1: Site Location – Nearest Receivers



3.2. Proposed Development Overview

There are 14 inverter/transformer stations distributed throughout the solar farm development as well a substation compound. All equipment is likely to run for approximately 1-hour after sunset. The earliest the equipment will begin working is 04:30. This assumption is a worst-case scenario, as the times of operation are seasonally dependent.

FIGURE 2: SITE PLAN

4. MEASUREMENT METHODOLOGY

4.1. General

The prevailing background noise conditions in the area have been determined by an environmental noise survey conducted during both daytime and night-time periods between Thursday the 3rd of June and Tuesday the 8th of June 2021.

4.2. Measurement Details

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and in accordance with the principles of BS 7445[5].

All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672[6]. A full inventory of this equipment is shown in Table 2 below.

TABLE 2: INVENTORY OF SOUND MEASUREMENT EQUIPMENT

Position	Make, Model & Description	Serial Number
MP1	Rion NL-32 Sound Level Meter	1213696
	Rion NH-25 Preamplifier	11344
	Rion UC-59 Microphone	308056
MP2	Rion NL-31 Sound Level Meter	00110027
	Rion NH-21 Preamplifier	00129
	Rion UC-53A Microphone	100496
MP3	Rion NL-31 Sound Level Meter	531144
	Rion NH-25 Preamplifier	11344
	Rion UC-59 Microphone	308056
MP4	Rion NL-52 Sound Level Meter	00943360
	Rion NH-25 Preamplifier	43376
	Rion UC-59 Microphone	07154
MP5	Svan 955 Sound Level Meter	23676
	Svantek SV 12L Preamplifier	25615
	ACO 7052E Microphone	49543
MP6	Rion NL-52 Sound Level Meter	00943282
	Rion NH-25 Preamplifier	43298
	Rion UC-59 Microphone	07045
All	Cirrus CR:515 Acoustic Calibrator	72886

[5] British Standard 7445: 2003: *Description and measurement of environmental noise*. BSI.
[6] British Standard 61672: 2013: *Electroacoustics. Sound level meters*. Part 1 *Specifications*. BSI.

Measurement equipment used during the survey was field calibrated at the start and end of the measurement period. A calibration laboratory has calibrated the field calibrator used within the twelve months preceding the measurements.

The weather conditions during the survey were largely conducive to environmental noise measurement; being mostly dry, with low wind speeds.

The microphones were fitted with protective windshields for the measurements, which are described in Table 3, with an aerial photograph indicating their respective locations shown in Figure 3.

TABLE 3: MEASUREMENT POSITION DESCRIPTION

Measurement Position	Description
MP1	A largely unattended measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level. The dominant noise source was the distant sound of traffic travelling along the various main roads that surround Westhide, including the A417, the A4103 and the A465. The measurement site was stationed within the back garden of the Brick House property, which is situated approximately 310m to the west of the proposed site. The unnamed road that serves this property (Brick House) is situated directly to the east.
MP2	A largely unattended measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level. Road traffic travelling upon the unnamed road upon which Ash Grove is situated contributed to the sound environment. Traffic volume on this road is between 1-4 vehicles per hour. The measurement position was stationed within the back garden of the Ash Grove property, which is situated approximately 190m to the south of the proposed site. The unnamed road upon which Ash Grove sits is to the south of the microphone position, beyond the remainder of the garden area.
MP3	A largely unattended measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level. The dominant noise source whilst onsite was noise breakout from operations at the farm property that is situated approximately 100m south of the MP. Noise breakout at the time of the attended period consisted of chainsaw noise (although very distant). Additionally, distant sound of traffic travelling along the various main roads, as above, including the A417, the A4103 and the A465, also contributed to the sound environment.
MP4	A largely unattended measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level. The dominant noise whilst onsite was noise breakout from farm traffic and operations that were taking place on the same land at a distance of approximately 300m. Otherwise, the dominant background noise source on site was the distant sound of traffic travelling along the various main roads that surround Westhide including the A417, the A4103 and the A465.
MP5	A largely unattended measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level. The measurement site was stationed within the back garden of The Kymin property, which is situated approximately 300m to the north-east of the proposed site. Dominant noise was again from the A417, the A4103 and the A465. Other noise sources such as smaller surrounding roads, noise from vegetation and birds in nearby trees also made contributions to the underlying sound level.
MP6	A largely unattended measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level. The dominant noise whilst onsite was noise breakout from farm traffic and operations that were taking place on the land that is situated 500m to the west of the microphone position. Otherwise, the dominant background noise source on site was the distant sound of traffic travelling along the various main roads that surround Westhide, including the A417, the A4103 and the A465.

Figure 3: Measurement Positions

4.3. Summary Results

The summarised results of the environmental noise measurements are presented in Table 4, with full time histories and statistical analyses presented under Appendix B.

Table 4: Summary of Noise Measurement Results

Measurement Position	Period	Noise Level, dB			
		$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
MP1	Daytime	48	70	42	32
	Night-Time	44	70	42	32
MP2	Daytime	45	72	44	30
	Night-Time	49	75	47	33
MP3	Daytime	51	62	43	31
	Night-Time	44	66	47	33
MP4	Daytime	62	79	53	33
	Night-Time	48	69	51	34
MP5	Daytime	53	79	50	34
	Night-Time	55	81	56	37
MP6	Daytime	45	75	42	28
	Night-Time	40	67	39	30

*Background L_{A90} values have been derived using statistical analysis of periods during which the plant will be operational.

5. Operational Noise Assessment

5.1. Noise Modelling

5.1.1. Source Data

The sound source data associated with the Proposed Development can be seen below in Table 5. At this stage, these are considered candidate source noise levels to be achieved by scheme design. They represent the maximum sound power level required to achieve compliance at the nearest receptor and do not pertain to a specific model of central inverter.

Table 5: Sound Source Data

Plant	Quantity	Sound Power Level, L_{WA} (dB)
PV Inverters	14	86 (Day) 80 (Night)
Substation	1	71

5.1.2. Calculation Process

Calculations were carried out using iNoise 2021, which undertakes its calculations in accordance with guidance given in ISO9613-1:1993 and ISO9613-2:1996.

5.1.3. Modelling Data Assumptions

Given that the land between Proposed Development and nearest receptors is largely soft, the ground factor has been set to 0.8, within the calculation software. Full octave frequency spectrum has been used in the calculations. It has been assumed that all processes will occur simultaneously, representing a worst-case scenario.

In order to accurately model the land surrounding the development, an AutoCAD DXF drawing was produced, which was based on data provided by the Ordnance Survey, along with associated topographic contours provided by Defra.

The assessment considers open propagation from the Site, with no perimeter acoustic barrier.

5.1.4. Mitigations

In order to reduce any potential noise impact of the Proposed Development, an iterative assessment of suitable noise mitigation techniques has been undertaken. The following mitigations have been considered in the noise model and subsequent assessment of residual effects.

Table 5 shows the maximum sound power level required to achieve compliance at the nearest noise sensitive receptor. To achieve this, low noise inverters should be employed. Alternatively, the inverters should be fitted with a noise reduction kit comprising external acoustic baffles to the air inlets and outlets, or housed within an acoustic enclosure capable of reducing the total sound power level to those presented in Table 5.

This is a common scenario and the technical solution is typically addressed during the detailed design phase of the project, pre-construction. Further work is expected to be carried out during the post-procurement period to engineer a project-specific configuration that will achieve compliance at the site.

5.1.5. Specific Sound Level Map

The sound map showing the daytime and night-time specific sound level emissions from the Proposed Development, can be seen in Figure 4 and Figure 5 respectively representing the worst-case scenario.

FIGURE 4: SPECIFIC SOUND LEVEL MAP (DAYTIME)

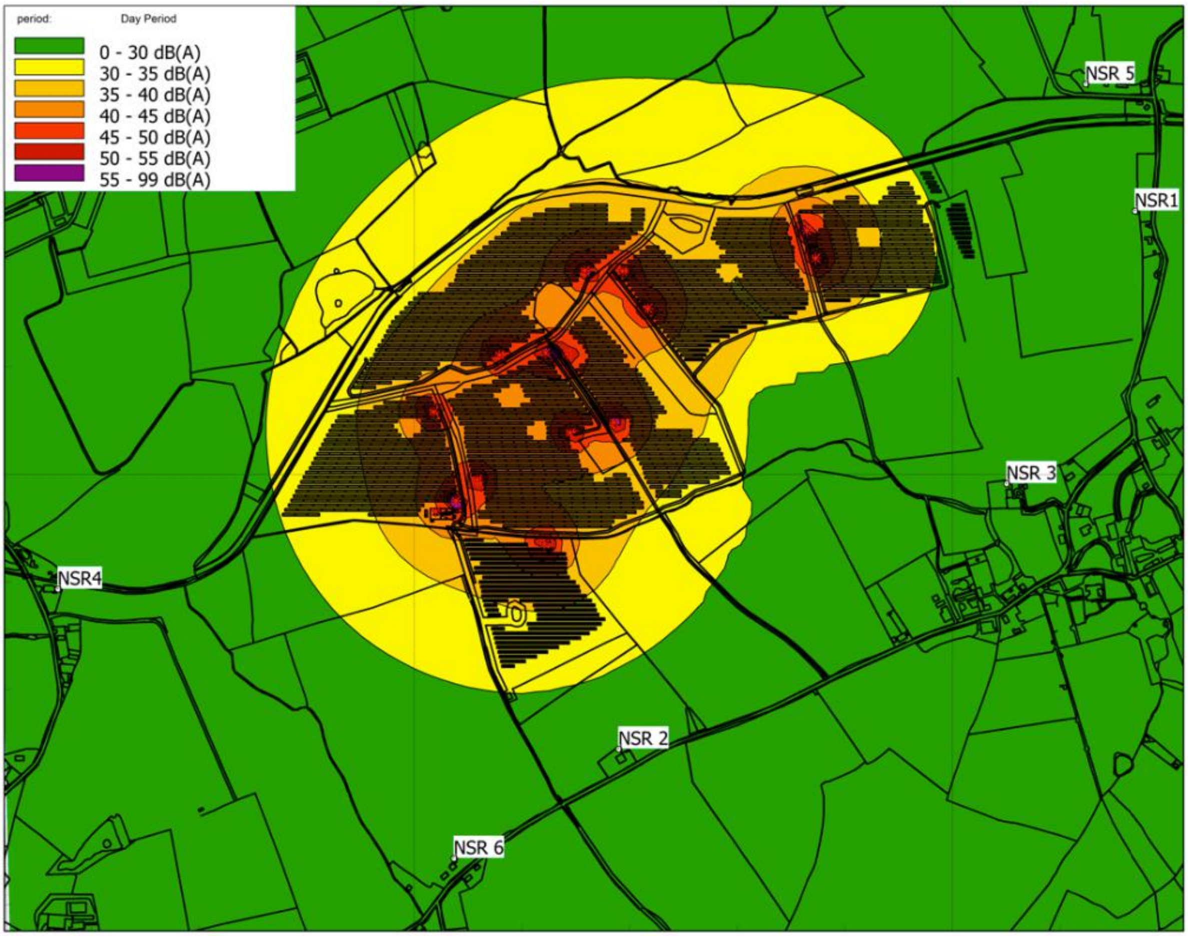
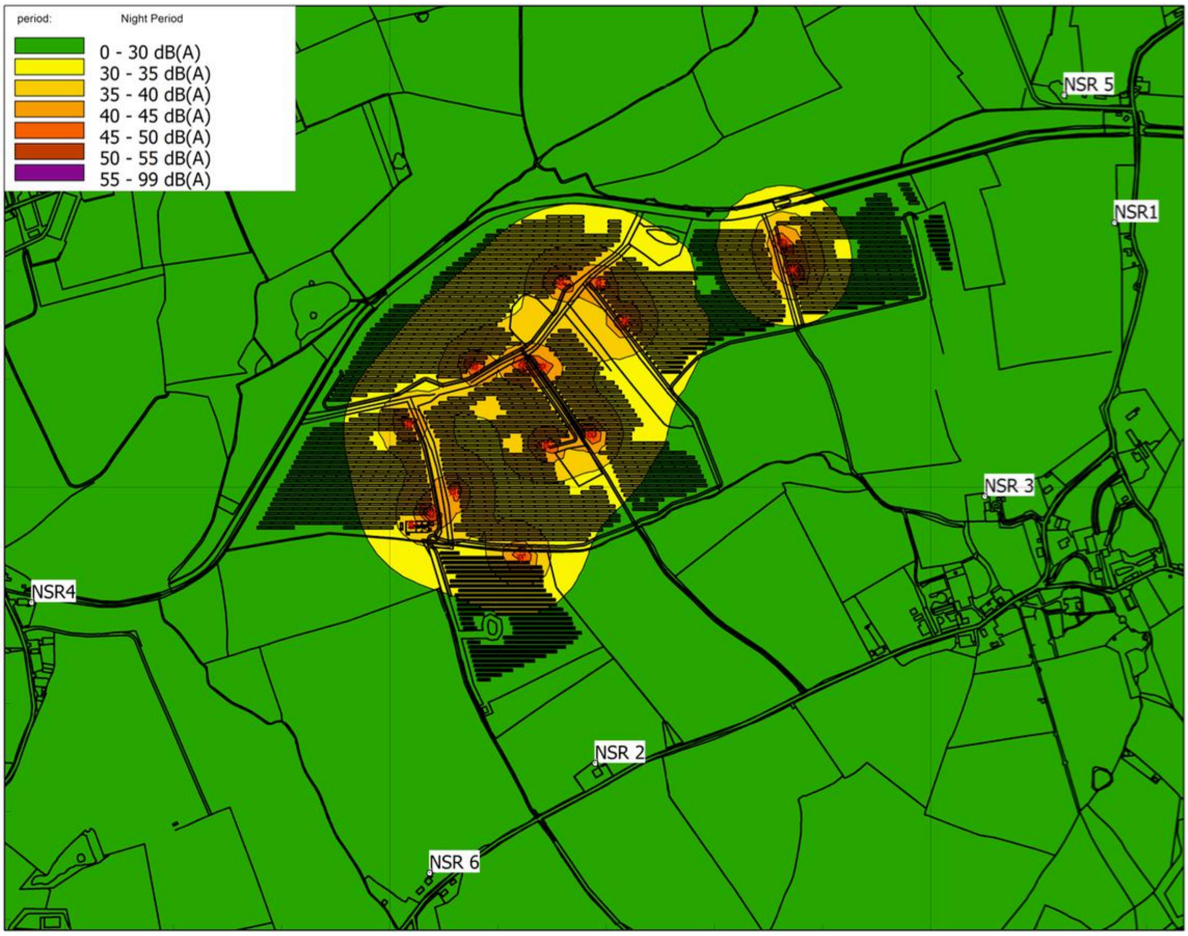


FIGURE 5: SPECIFIC SOUND LEVEL MAP (NIGHT-TIME)



5.1.6. Specific Sound Level Summary

A summary of the predicted specific sound levels at the NSRs, based on the sound maps shown in Figure 4 and Figure 5 can be seen below in Table 6.

TABLE 6: PREDICTED SPECIFIC SOUND LEVEL SUMMARY

NSR	Specific Sound Level (dB)	
	Day	Night
1	22	16
2	27	21
3	22	16
4	23	17
5	22	16
6	20	14

5.2. Assessment

5.2.1. Rating Penalty Principle

Section 9 of BS4142:2014+A1:2019 describes how the rating sound level should be derived from the specific sound level, by determining a rating penalty. BS4142:2014+A1:2019 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. This can be approached in three ways:

a) subjective method;
b) objective method for tonality;
c) reference method."

Given that the Proposed Development is not operational, the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142:2014+A1:2019, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed.

Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142:2014+A1:2019 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

Tonality

A rating penalty of +2 dB is applicable for a tone which is *"just perceptible"*, +4 dB where a tone is *"clearly perceptible"*, and +6 dB where a tone is *"highly perceptible"*.

Impulsivity

A rating penalty of +3 dB is applicable for impulsivity which is *"just perceptible"*, +6 dB where it is *"clearly perceptible"*, and +9 dB where it is *"highly perceptible"*.

Intermittency

BS4142:2014+A1:2019 states that when the *"specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time … if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied."*

Other Sound Characteristics

BS4142:2014+A1:2019 states that where *"the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied."*

5.2.2. Rating Penalty Assessment

Considering the content of Section 5.2.1, an assessment of the various sound sources associated with the Proposed Development, in terms of whether any rating penalties are applicable, has been detailed in Table 7 below.

TABLE 7: RATING PENALTY ASSESSMENT

Source	Tonality	Impulsivity	Intermittency	Other Sound Characteristics	Discussion
PV Inverters, Transformers and Substation	+2 dB	0 dB	0 dB	0 dB	The PV inverters and transformers will operate as demand requires, however, once operating, do not cycle on and off. Tonality may be *"just perceptible"*, due to a potential low-frequency bias at source, but the residual acoustic environment will substantially mask any significant tones.

In summary, a rating penalty of +2 dB has been included in the assessment.

5.2.3. Uncertainty in Calculations

BS4142:2014+A1:2019 requires that the level of uncertainty in the measured data and associated calculations is considered in the assessment. The Standard recommends that steps should be taken to reduce the level of uncertainty.

Measurement Uncertainty

BS4142:2014+A1:2019 states that measurement uncertainty depends on a number of factors, including the following, which are applicable to the Proposed Development:

" *...*

b) the complexity and level of variability of the residual acoustic environment;
...
d) the location(s) selected for taking the measurements;
...
g) the measurement time intervals;
h) the range of times when the measurements have been taken;
i) the range of suitable weather conditions during which measurements have been taken;
...
k) the level of rounding of each measurement recorded; and
l) the instrumentation used."

Each of the measurement uncertainty factors outlined above have been considered and discussed in Table 8 below.

Table 8: Measurement Uncertainty Factors

Measurement Uncertainty Factor Reference	Level of Uncertainty	Discussion
b)	0 dB	Residual acoustic environment is relatively constant, hence no correction for a complex residual acoustic environment.
d)	0 dB	Measuring at locations representative of the closest affected receptors to the Site has enabled the determination of robust background sound levels.
g)	0 dB	Measurement time intervals were set in accordance with BS4142:2014+A1:2019, hence no further correction needs to be made.
h)	0 dB	Measurements were undertaken over six consecutive daytime and night-time periods.
i)	0 dB	The weather was dry with low winds during the measurement period.
k)	0 dB	Measured values were rounded to 0.1 dB, therefore rounding would not have had a significant impact on the overall typical background sound levels.
l)	0 dB	The acoustic measurement equipment accorded with Type 1 specification of British Standard 61672.

In summary, no uncertainty budget has been included in the assessment, to account for measurement uncertainty.

Calculation Uncertainty

BS4142:2014+A1:2019 states that calculation uncertainty depends on a number of factors, including the following, which are applicable to the Proposed Development:

" *...*

b) uncertainty in the operation or sound emission characteristics of the specific sound source and any assumed sound power levels;
c) uncertainty in the calculation method;
d) simplifying the real situation to "fit" the model (user influence on modelling); and
e) error in the calculation process."

Each of the calculation uncertainty factors outlined above have been considered and discussed in Table 9 below.

TABLE 9: CALCULATION UNCERTAINTY FACTORS

Calculation Uncertainty Factor Reference	Level of Uncertainty	Discussion
b)	0 dB	Sound source levels for all plant are based on robust candidate plant data, to be achieved by the design.
c)	0 dB	Calculations were undertaken in accordance with ISO 9613-2, which is considered a *"validated method"* by BS4142:2014+A1:2019.
d)	0 dB	The real situation has not been simplified for the purposes of this assessment.
e)	+1 dB	ISO 9613-2 indicates that there is a ±3 dB accuracy to the prediction method, dependent upon input variables and propagation complexities.

In summary, an uncertainty budget of 1 dB has been included in the assessment, for calculation uncertainty.

5.2.4. Rating Sound Level

Incorporating the rating penalties detailed in Section 5.2.2 with the predicted specific sound levels, as detailed in Table 6, the rating sound levels have been derived and have been detailed in Table 10 below.

TABLE 10: RATING SOUND LEVELS

NSR	Specific Sound Level (dB)		Rating Sound Level (dB)	
	Day	Night	Day	Night
1	22	16	24	18
2	27	21	29	23
3	22	16	24	18
4	23	17	25	19
5	22	16	24	18
6	20	14	22	16

5.2.5. BS4142:2014+A1:2019 Assessment

The rating sound level, as calculated from the predicted specific sound level, has been assessed in accordance with BS4142:2014+A1:2019, at the closest NSRs.

The resultant assessment summary, during the daytime period, can be seen in Table 11 below.

Table 11: Daytime BS4142:2014+A1:2019 Assessment Summary

NSR	Rating Sound Level (dB)	Uncertainty (dB)	Daytime Background Sound Level (dB)	Excess of Rating over Daytime Background Sound Level (dB)
1	24	+1	32	-8
2	29	+1	30	0
3	24	+1	31	-6
4	25	+1	33	-7
5	24	+1	34	-9
6	22	+1	28	-5

It can be seen that the Proposed Development is likely to have a *'low impact'* at the nearest noise-sensitive receptors during the daytime period.

The resultant assessment summary, during the night-time period, can be seen in Table 12 below.

Table 12: Night Time BS4142:2014+A1:2019 Assessment Summary

NSR	Rating Sound Level (dB)	Uncertainty (dB)	Night Time Background Sound Level (dB)	Excess of Rating over Night Time Background Sound Level (dB)
1	18	+1	32	-14
2	23	+1	33	-9
3	18	+1	33	-14
4	19	+1	34	-14
5	18	+1	37	-18
6	16	+1	30	-13

It can be seen that the Proposed Development is likely to have a *'low impact'* at the nearest noise-sensitive receptors during the night-time period.

6. CONCLUSION

inacoustic has been commissioned to prepare a Noise Assessment Report for the proposed installation and operation of a grid connected solar farm, on land north of the village of Westhide, Herefordshire, HR1 3RL.

This report details the existing background sound climate at the nearest noise-sensitive receptors, as well as the potential sound emissions associated with the Proposed Development and has been produced to accompany the Planning Application to Herefordshire Council.

The assessment considers the potential noise generation from the plant associated with the Proposed Development, with respect to existing sound levels in the area. The assessment methodology contained in British Standard 4142:2014+A1:2019 *Method for rating and assessing industrial and commercial sound* has been used.

The assessment identifies that the Proposed Development will give rise to rating noise levels that are typically equal to or below the measured day and night-time background sound levels in the area, at the closest assessed residential receptors, thus giving rise to a Low Impact as per the significance criteria from NPPG in England: Noise.

Consequently, the assessment demonstrates that the development will give rise to impacts that would be categorised as *No Observed Adverse Effect Level (NOAEL)* within the PPGNoise guidance.

Given that the Proposed Development conforms to National and Local Planning Policy requirements, it is recommended that noise should not be a constraint to the approval of this Planning Application, providing that the plant is constructed and operated in accordance with the acoustic assumptions of this report.

7. Appendices

7.1. Appendix A – Definition of Terms

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE 13: TYPICAL SOUND LEVELS FOUND IN THE ENVIRONMENT

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source.

A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq}.

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

7.2. Appendix B – Full Measurement Results

FIGURE 6: MP1 - MEASURED TIME HISTORY

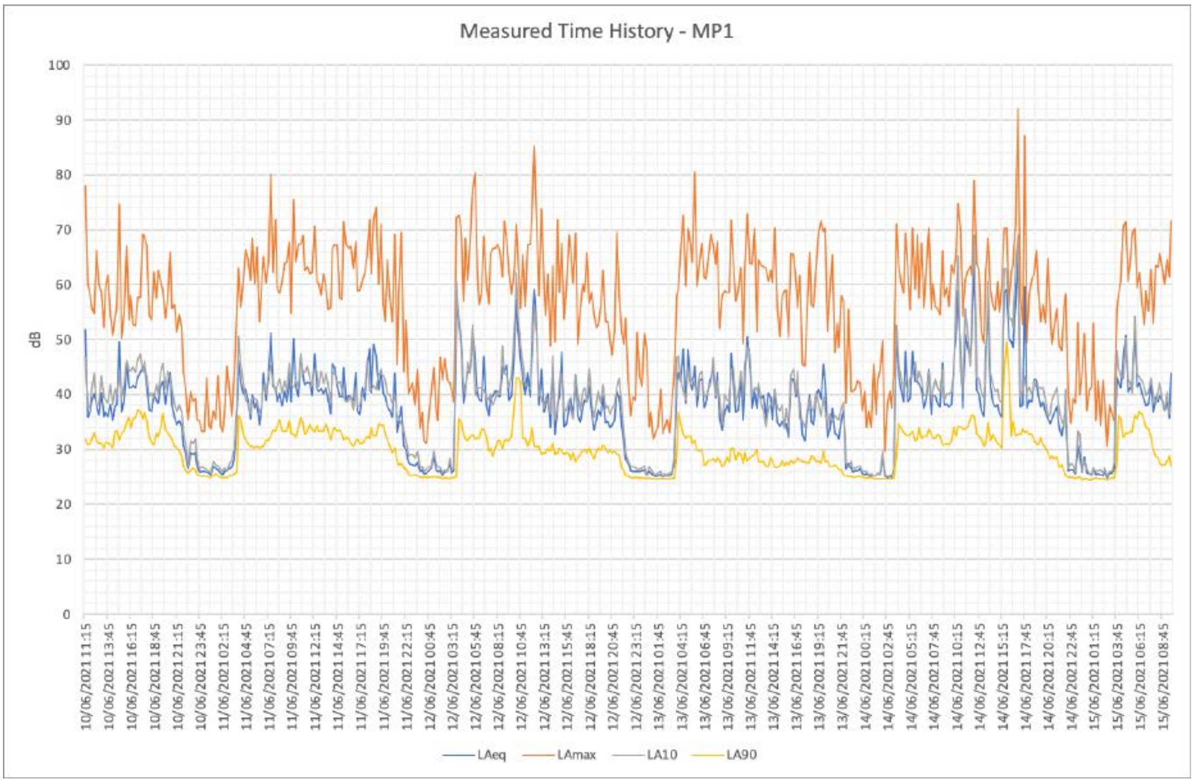


FIGURE 7: MP1 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – DAYTIME

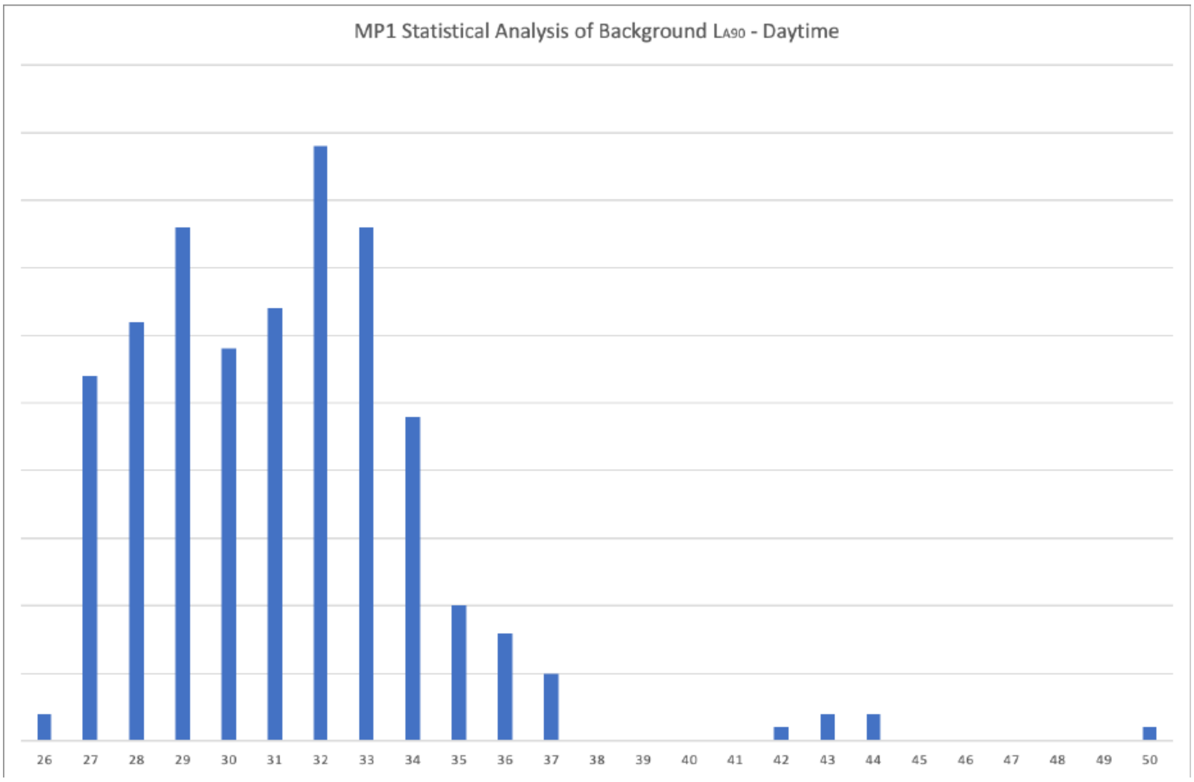


FIGURE 8: MP1 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – NIGHT-TIME

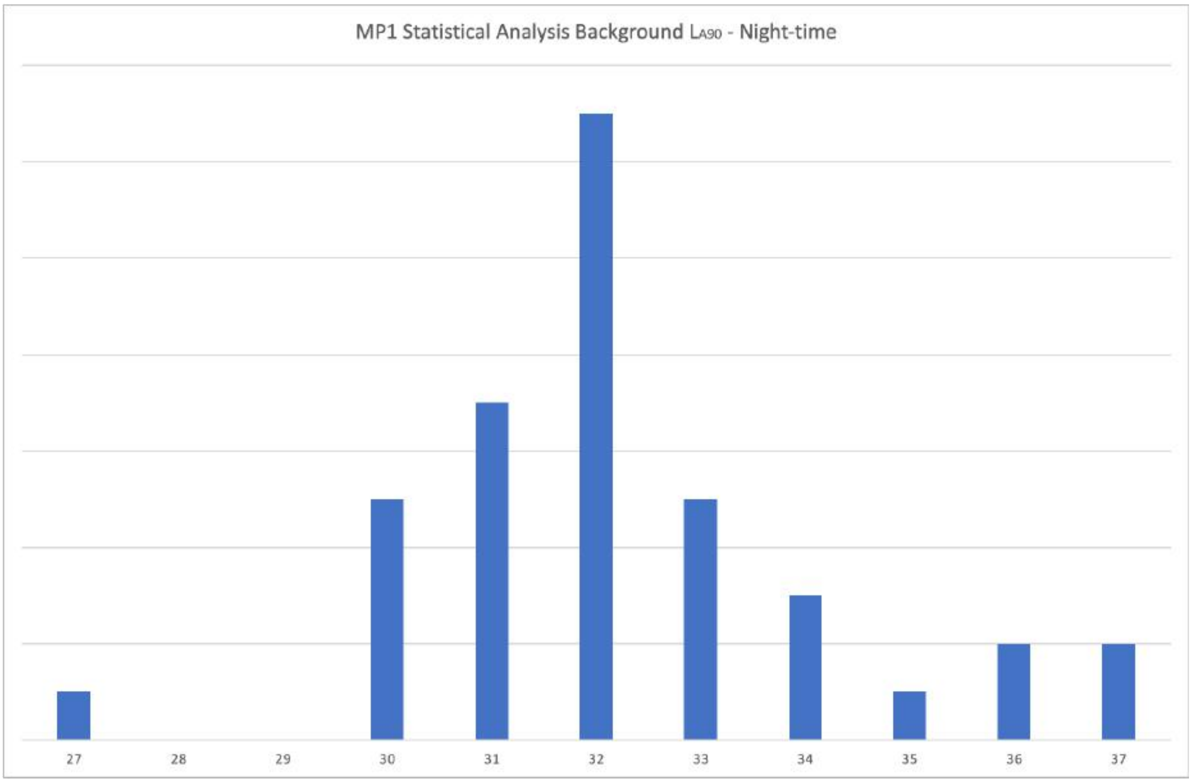


FIGURE 9: MP2 - MEASURED TIME HISTORY

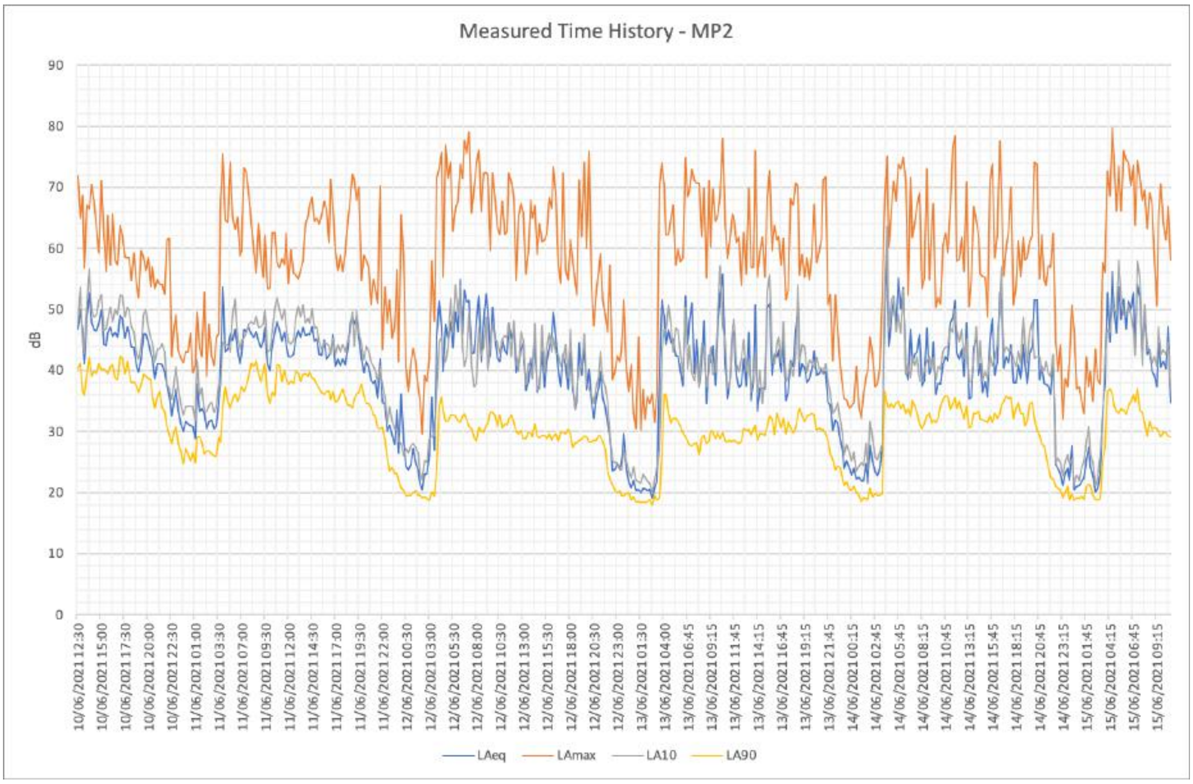


FIGURE 10: MP2 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – DAYTIME

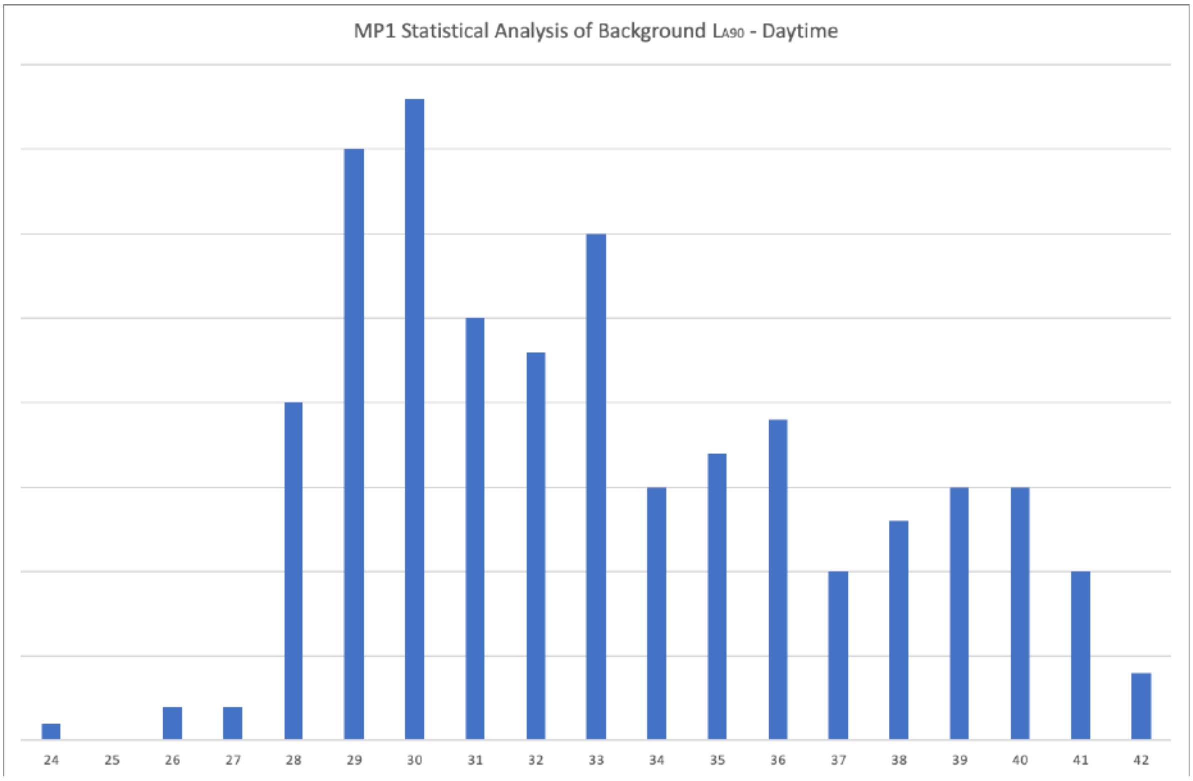


FIGURE 11: MP2 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – NIGHT-TIME

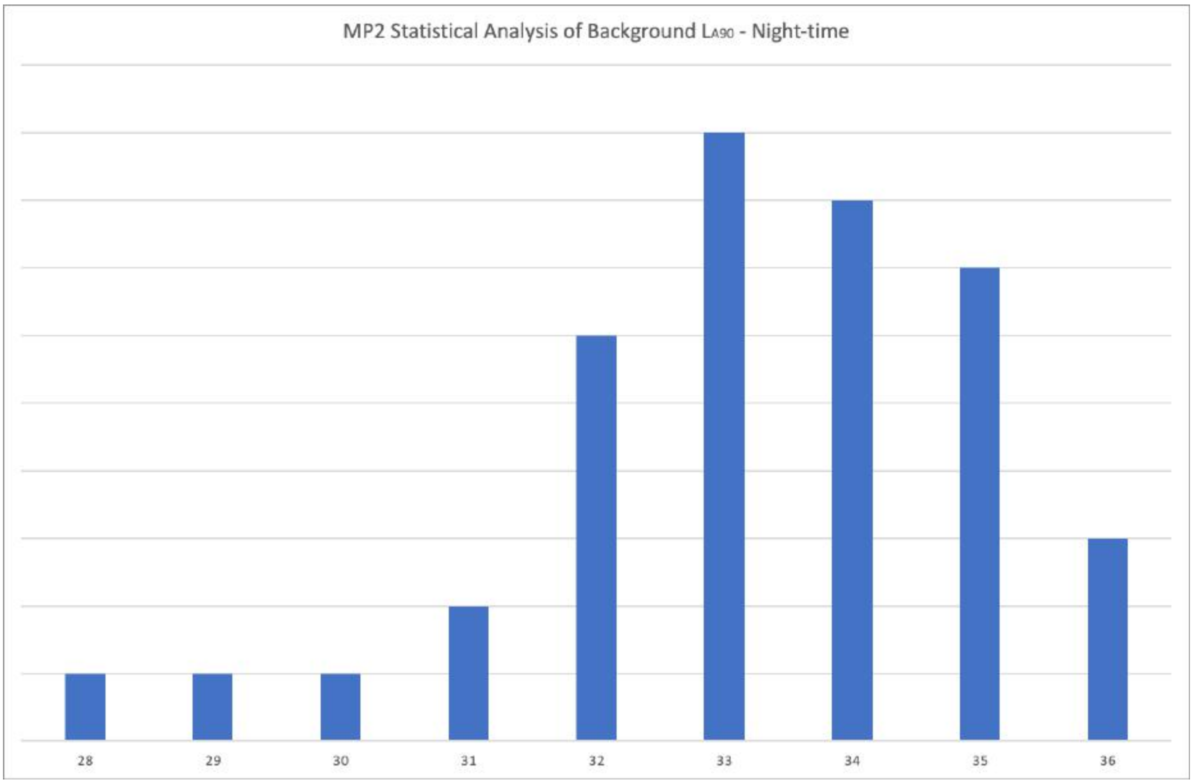


FIGURE 12: MP3 - MEASURED TIME HISTORY

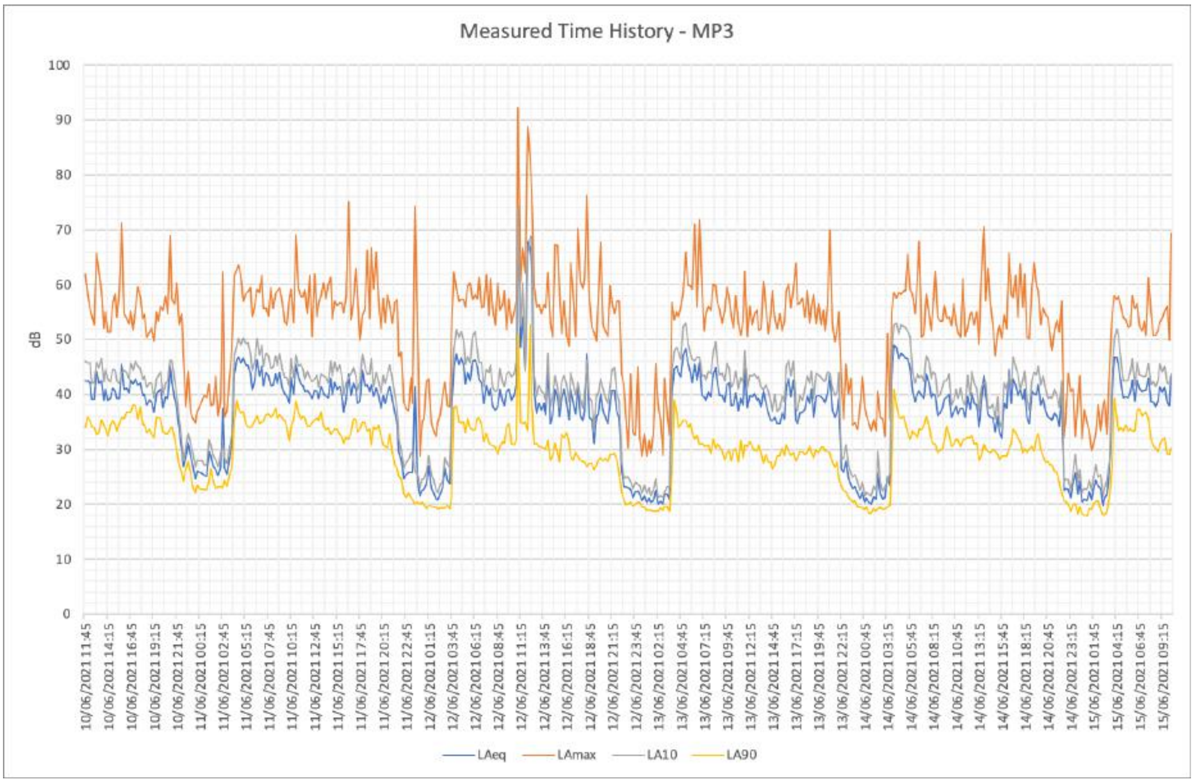


FIGURE 13: MP3 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – DAYTIME

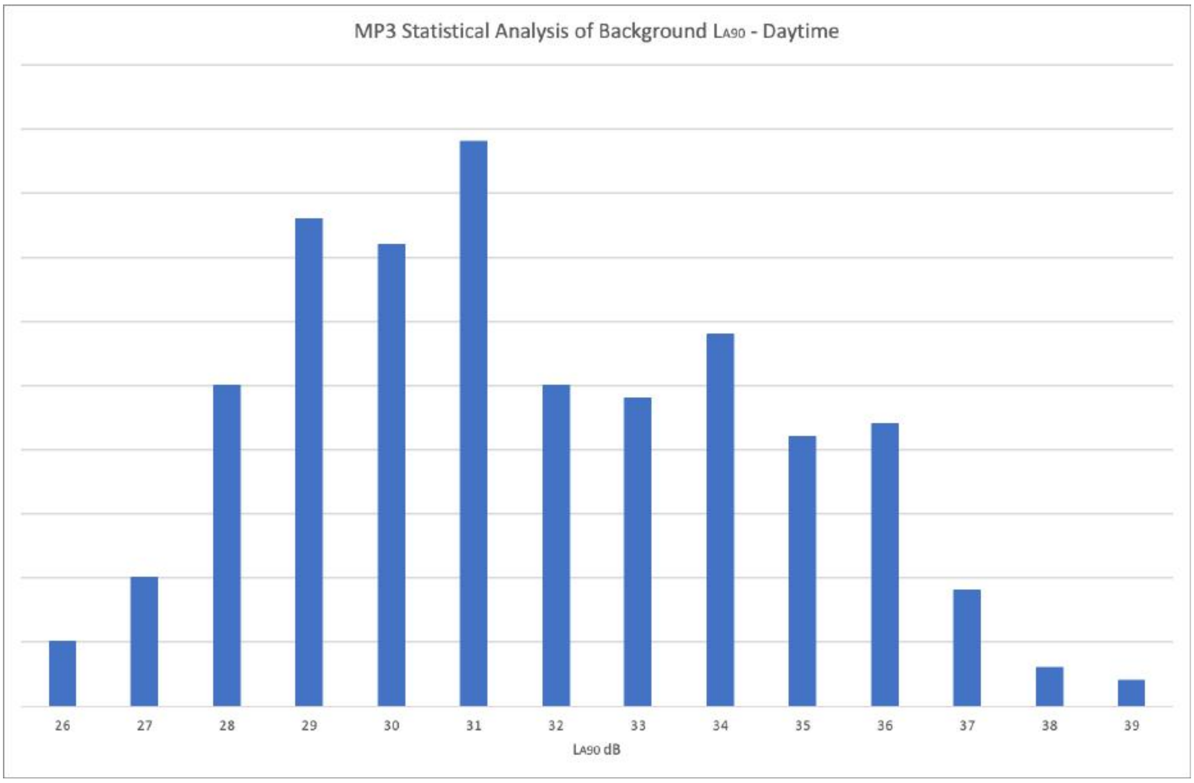


FIGURE 14: MP3 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – NIGHT-TIME

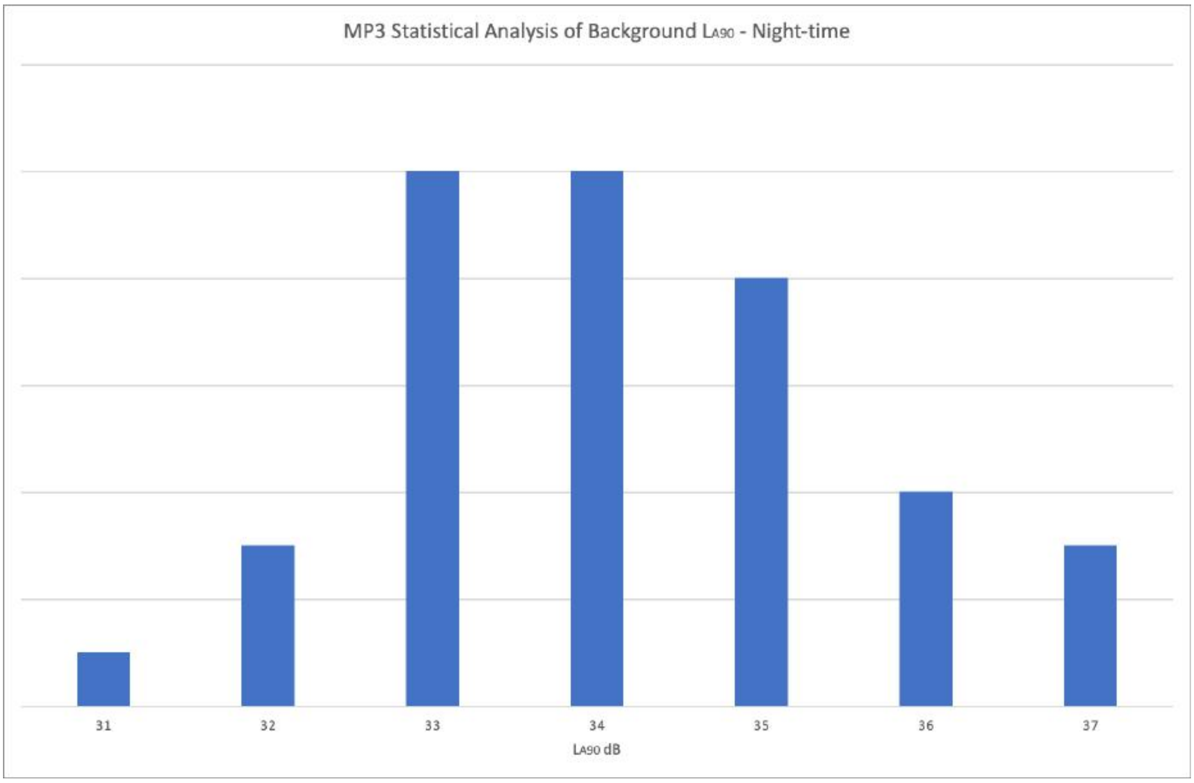


FIGURE 15: MP4 – MEASURED TIME HISTORY

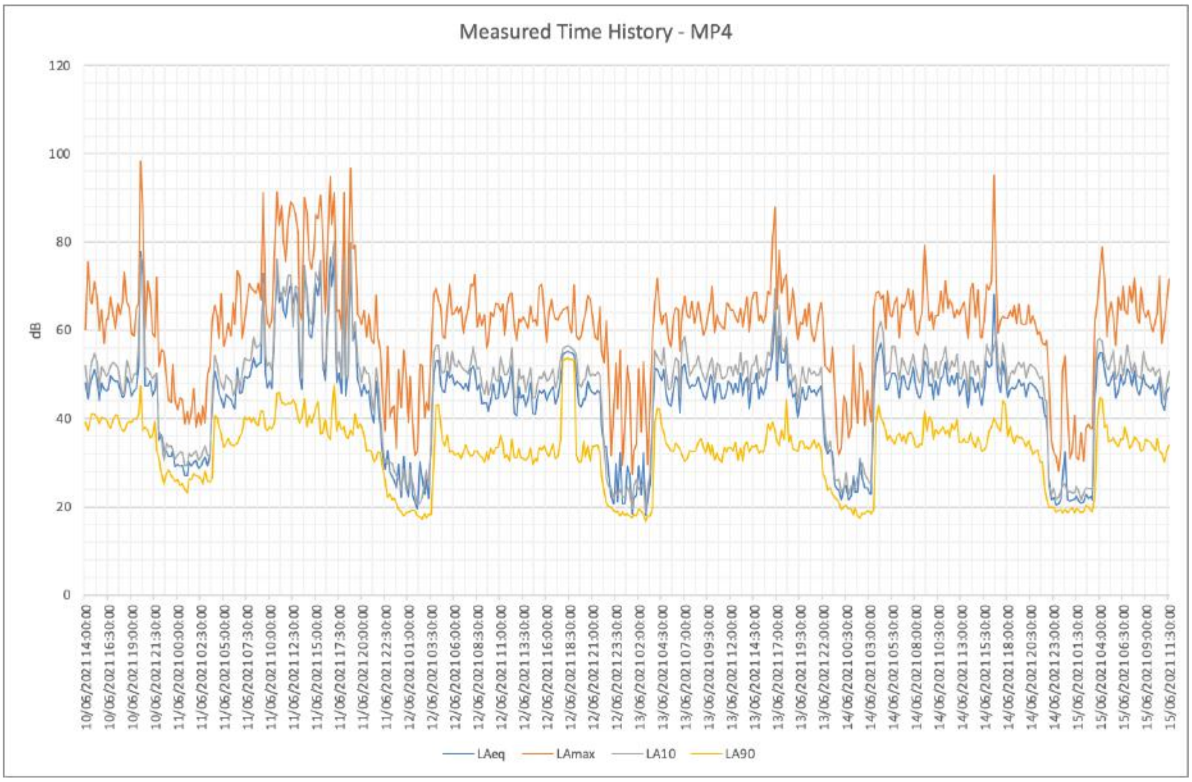


FIGURE 16: MP4 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – DAYTIME

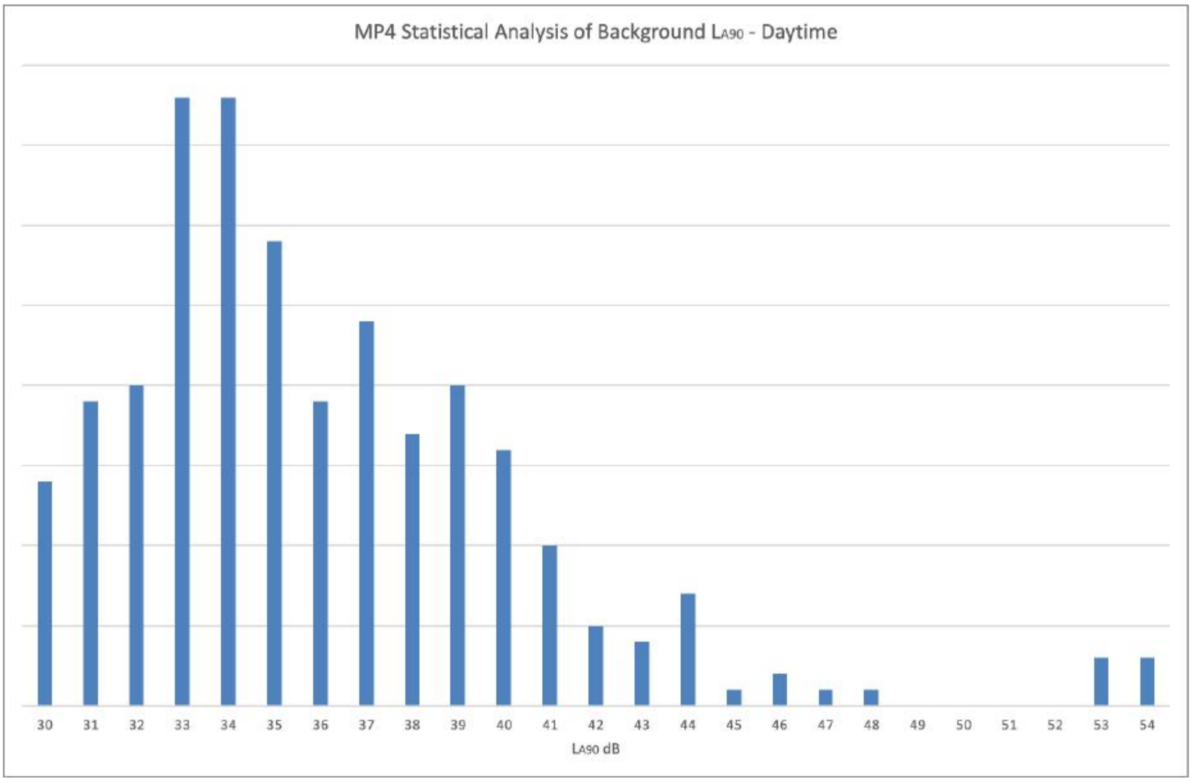


Figure 17: MP4 - Statistical Analysis of L_{A90} Background – Night-time

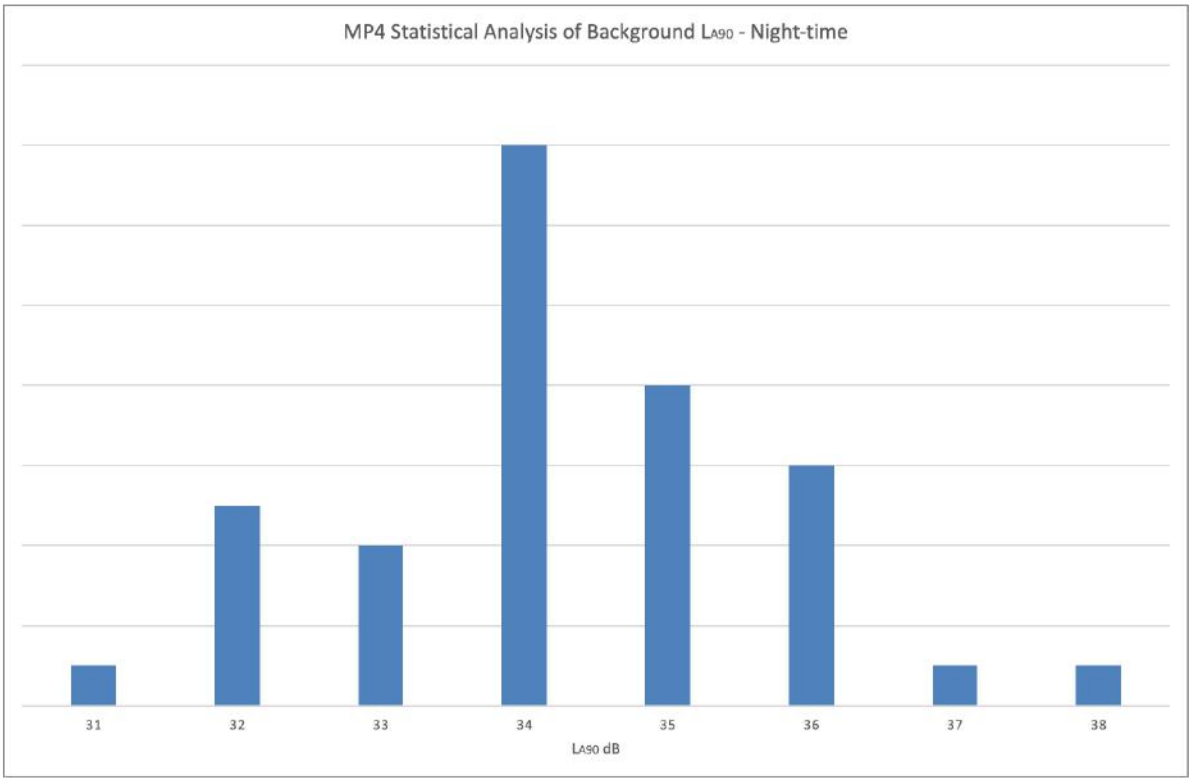


Figure 18: MP5 – Measured Time History

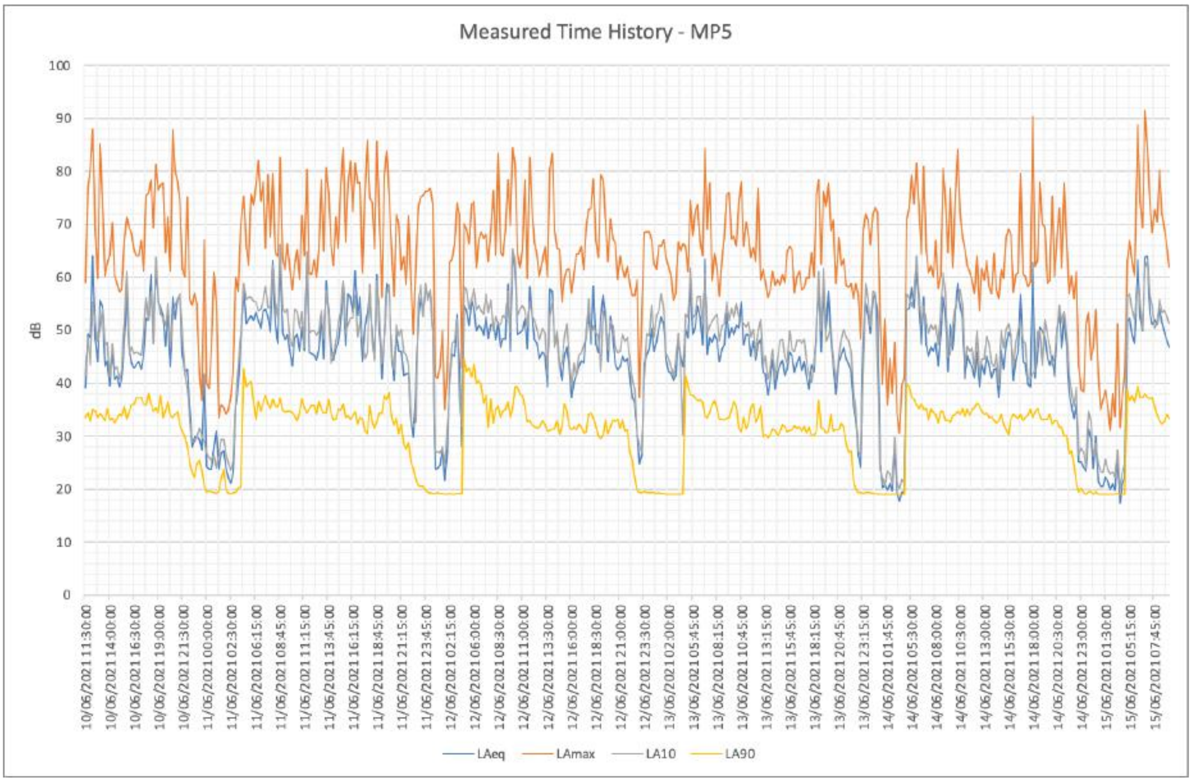


FIGURE 19: MP5 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – DAYTIME

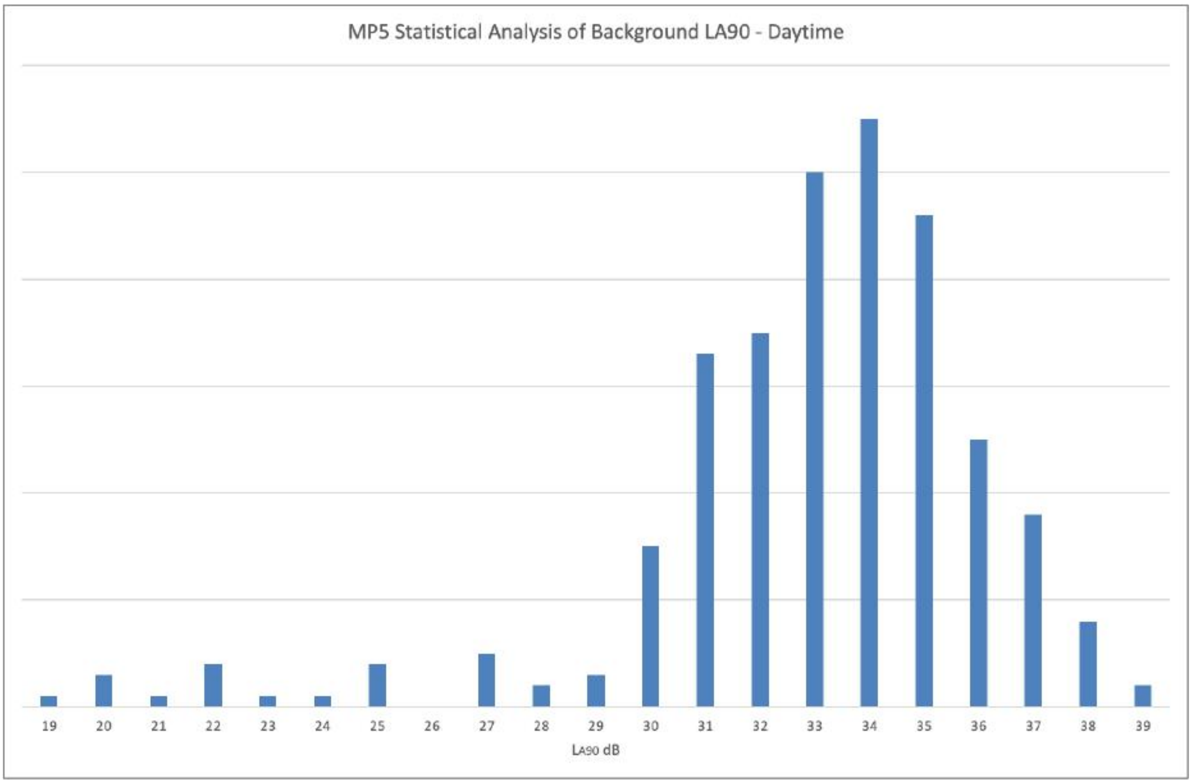


FIGURE 20: MP5 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – NIGHT-TIME

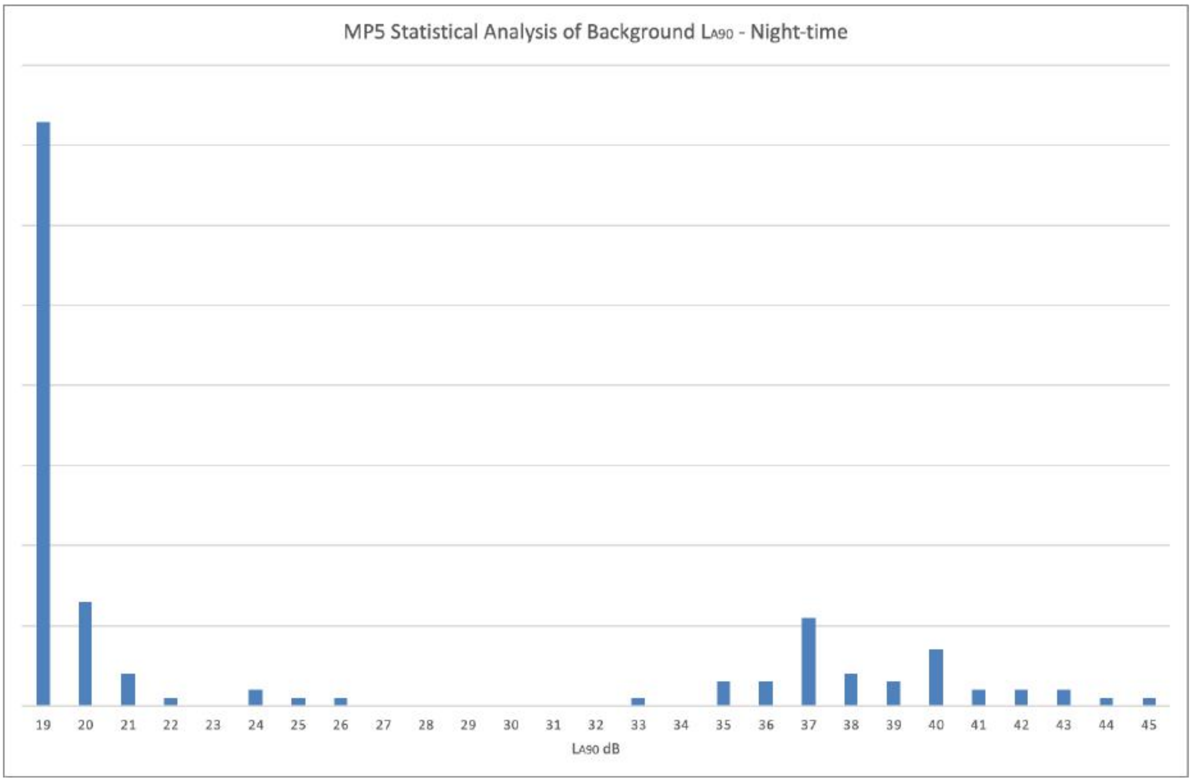


FIGURE 21: MP6 - MEASURED TIME HISTORY

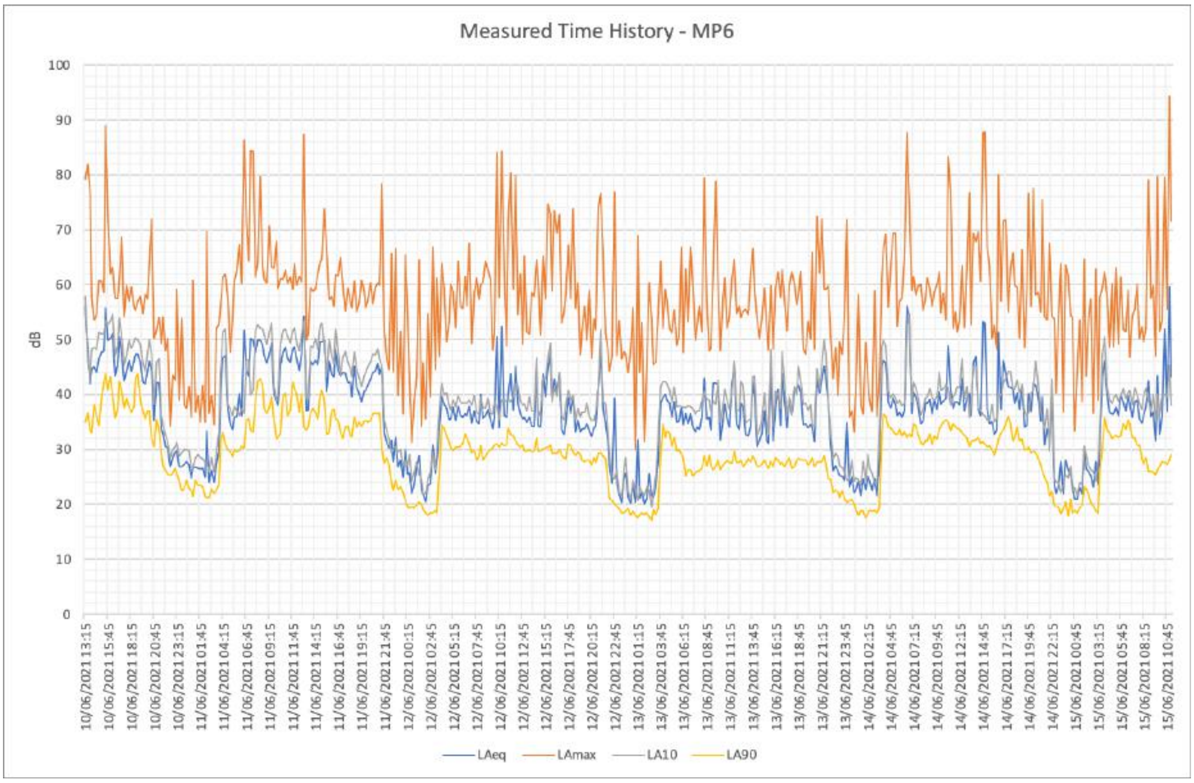


FIGURE 22: MP6 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – DAYTIME

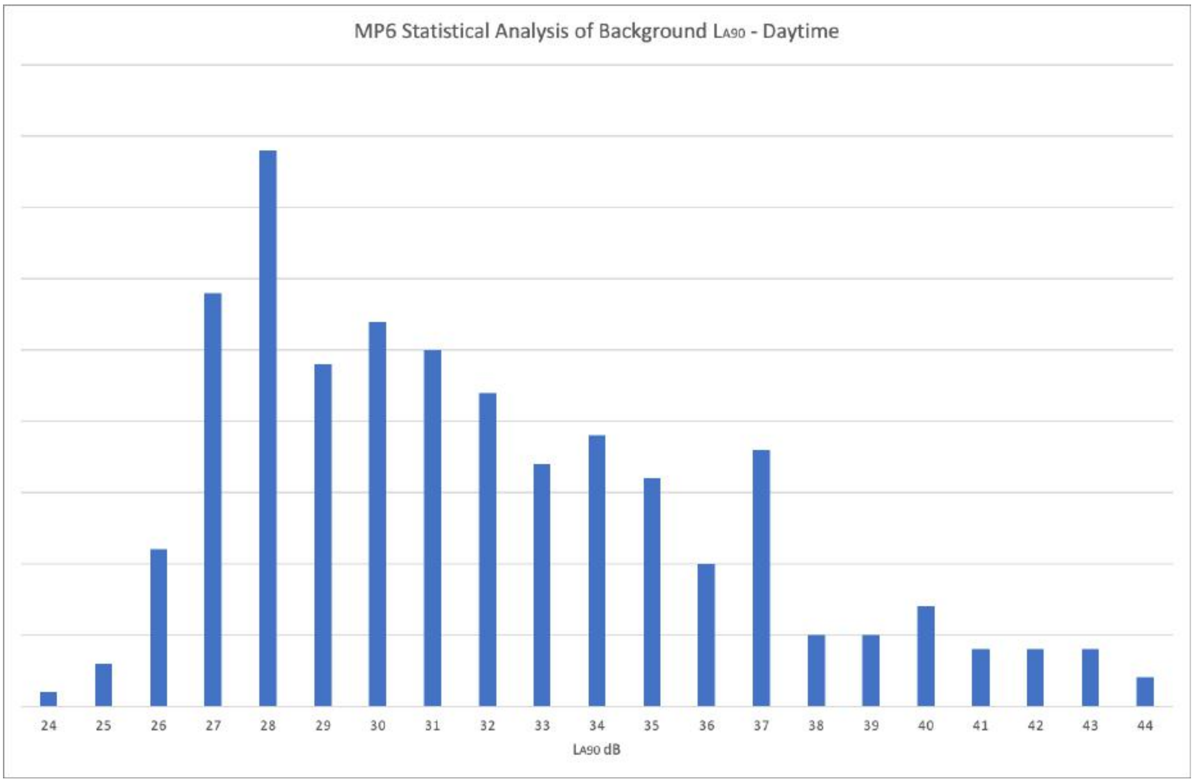


FIGURE 23: MP6 - STATISTICAL ANALYSIS OF L_{A90} BACKGROUND – NIGHT-TIME