Lead Road Peaking Plant, Ryton

Noise Assessment for Environment Agency

12th August 2020

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1. INTRODUCTION

1.1. Overview

inacoustic has been commissioned to prepare a Noise Assessment for the Gas Peaking Plant on Land at Lead Road, Ryton, for submission to the Environment Agency as part of a Permit Application. The Site benefits from planning permission, as granted by Gateshead Council (reference DC/19/00997/FUL). Condition 10 of the planning permission is relevant to noise.

In addition, the following drawings showing the site layout, elevations and details of the locations of the relevant noise-generating items associated with the site have been submitted alongside this noise assessment report:

Document Number	Drawing Title
21330B-0201 P14	General Arrangement

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 noise assessment can be summarised as follows:

- Detailed sound modelling using the CadnaA modelling suite and ISO9613[1] prediction methodology to predict sound levels at the closest noise-sensitive receptors to the Site;
- A detailed assessment of the suitability of the Site, in accordance with the relevant policy; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the Noise Policy Statement for England[2], Horizontal Guidance for Noise Part 2 – Noise Assessment and Control[3], BS4142:2014+A1:2019[4], BS8233:2014[5], and the World Health Organisation's *Guidelines for Community Noise*[6].

[1] International Standards Organisation, 1996. ISO 9613-2:1996: Acoustics - Attenuation of Sound During Propagation Outdoors.
[2] Department for Environment Food and Rural Affairs (DEFRA), 2010. Noise Policy Statement for England.
[3] Environment Agency, 2002. IPPC Horizontal Guidance for Noise Part 2 – Noise Assessment and Control.
[4] British Standards Institution, 2019. BS4142:2014+A1:2019: Method for Rating and Assessing Industrial and Commercial Sound.
[5] British Standard Institution, 2014. BS8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings.
[6] World Health Organisation, 1999. Guidelines for Community Noise.

2. ASSESSMENT FRAMEWORK

2.1. National Policy

2.1.1. IPPC Technical Guidance Note IPPC H3 Part 2

Integrated Pollution Prevention and Control (IPPC) was a regulatory system that employs an integrated approach to control the environmental impacts of certain industrial activities. The IPPC Regulatory System was superseded and incorporated into the Industrial Emissions Directive (IED). The Environment Agency have, however, retained the IPPC Technical Guidance Note H3 Part 2.

It involves determining the appropriate controls for industry to protect the environment through a single permitting process. To gain a Permit, Operators have to show that they have systematically developed proposals to apply the 'Best Available Techniques' (BAT) and meet certain other requirements, taking account of relevant local factors.

In terms of noise specifically, the use of BAT has to be considered and balanced within the wider context of other releases to different media (air, land and water) and taking issues such as usage of energy and raw materials into account. Noise cannot therefore be considered in isolation from other impacts on the environment.

The definition of pollution includes *"emissions which may be harmful to human health or the quality of the environment, cause offence to human senses or impair or interfere with amenities and other legitimate uses of the environment"*. BAT is therefore likely to be similar, in practice, to the requirements of the Statutory Nuisance legislation which requires the use of *"best practicable means"* to prevent or minimise noise nuisance. In the case of noise, *"offence to human senses"* may be judged by the likelihood of complaints. However, the lack of complaint should not necessarily imply the absence of a noise problem. In some cases it may be possible, and desirable, to reduce noise emissions still further at reasonable costs and this may therefore be BAT for noise emissions.

Consequently, the aim of BAT should be to ensure that there is no reasonable cause for annoyance to persons beyond the installation boundary.

In summary, the aim of BAT should be to achieve the following:

- Underpinning of good practice, a basic level of which the operator should employ for the control of noise including adequate maintenance of any parts of plant or equipment whose deterioration may give rise to increases in noise. For example, this would include bearings, air handling plant, the building fabric as well as specific noise attenuation measures associated with plant, equipment or machinery;
- Noise levels should not be loud enough to give reasonable cause for annoyance for persons in the vicinity, which is a more appropriate environmental standard than that of Statutory Nuisance and is normally the aim of most planning or other conditions applied by Local Authorities; and
- Prevention of 'creeping background' (creeping ambient), which is the gradual increase in sound levels as industry expands and areas develop.

The indicative requirements apply to both new and existing activities but it is more difficult to justify departures from them in the case of new activities.

Indeed, because the requirements for noise are likely to be strongly influenced by the local environmental conditions, new installations are expected to meet BAT from the outset and to

demonstrate that noise reduction or prevention has been built in to the process design. For most existing plant, especially where there are no existing noise limits, the focus is on good practice (BAT) and the need to ensure that there is no reasonable cause for annoyance. In assessing any noise impact it is more normal to monitor existing levels and apply corrections and calculations, rather than rely on predictions.

The guidance makes reference to BS4142:1997, BS8233:1999 and WHO guidance for absolute levels for protection of community annoyance. The two British Standards have been updated since the guidance was published and the latest versions have been considered in this assessment.

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)[7]. 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.

Paragraph 2.15 states, with regard to the third aim of the NPSE, that *"this statement expresses the long-term desired policy outcome, but in the use of "promote" and "good" recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations."*

[7] Department for Environment, Food and Rural Affairs (DEFRA), 2010. Noise Policy Statement for England. DEFRA.

2.1.3. National Planning Practice Guidance in England: Noise, 2014

Further guidance in relation to the NPPF and the NPSE has been published in the *National Planning Practice Guidance in England: Noise* (NPPG Noise)[8], 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.

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
Not Noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and Not Intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived 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 and/or attitude, 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 perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and Disruptive	The noise causes a material change in behaviour and/or attitude, 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
Noticeable and Very Disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of	Unacceptable Adverse Effect	Prevent

[8] Department for Communities and Local Government (DCLG), 2014. National Planning Practice Guidance for England: Noise. DCLG.

Perception	Examples of Outcomes	Increasing Effect Level	Action
	appetite, significant, medically definable harm, e.g. auditory and non-auditory		

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."*

Interpreting the guidance given in BS4142:2014+A1:2019, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10 dB above the background sound level is likely to be an indication of a **Significant Observed Adverse Effect Level**;
- A rating sound level that is +5 dB above the background sound level is likely to be an indication of a **Lowest Observed Adverse Effect Level**;
- The lower the rating sound 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 sound level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, and would therefore classified as a **No Observed Adverse Effect Level**.

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.

2.2.2. BS8233:2014

BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions. The guideline values provided are in terms of an average (L_{Aeq}) level.

The standard advises that, for steady external noise sources, it is desirable for internal ambient noise levels to not exceed the guidance values, as detailed below in Table 2.

TABLE 2: BS8233:2014 AMBIENT NOISE LEVELS

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

BS8233:2014 goes on to suggest that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions will still be achieved.

With regard to maximum noise levels, the standard identifies that regular individual noise events (such as passing trains or scheduled aircraft etc) can cause sleep disturbance. The standard does not provide a guideline design target, but simply goes on to suggest that a guideline value may be set in terms of SEL or $L_{Amax,F}$, depending upon the character and number of events per night. It goes on to suggest that more sporadic noise events could require separate values.

In respect of external noise levels, the guidance in BS8233:2014 suggests that "*it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments*".

BS8233:2014 provides a much more detailed narrative on noise levels in external amenity areas and acknowledges that it may not always be necessary or feasible to ensure that noise levels remain within these guideline values.

2.2.3. World Health Organisation - Guidelines for Community Noise

The WHO document Guidelines for Community Noise sets out guidance on external noise levels at which there will be an unacceptable impact on communities. This guidance considers many different types of noise sources. In paragraph 4.1.7 the impact of noise on dwellings is considered. The document states:

"During the daytime, few people are seriously annoyed by activities with (steady) L_{Aeq} levels below 55 dB; or moderately annoyed with L_{Aeq} levels below 50 dB. Sound pressure levels during the evening and night should be 5 to 10 dB lower than during the day (i.e. 45 to 50 dB serious annoyance; 40 to 45 dB moderate annoyance). It is emphasised that for intermittent noise (such as the skateboarding activities) it is necessary to take into account the maximum (i.e. the L_{Amax}) sound pressure level as well as the number of events."

2.3. Local Planning Authority Planning Condition

Planning Condition 10 associated with DC/19/00997/FUL, as permitted by Gateshead Council, relates to noise, and states the following:

"The noise rating level from the operation of the plant hereby approved shall not exceed the typical daytime background noise level, as measured at the façade of any noise-sensitive receptor, existing at the time of the granting of planning permission, when assessed in accordance with the methodology set out in BS 4142:2014:+A1:2019 Methods for rating and assessing industrial and commercial sound. Night time operation, 23:00 - 07:00 of the facility will be limited to emergency situations as defined by the National Grid.

Reason: To safeguard the amenities of nearby sensitive receptors in accordance with policy CS14 of the Core Strategy and Urban Core Plan and saved policies DC1, DC2 and ENV61 of the Unitary Development Plan."

3. Site Description

3.1. Site and Surrounding Area

The site is situated on a parcel of land to the north of Lead Road, to the immediate north of the existing Electricity Substation and around 1.6 km to the west of the village of Greenside, Ryton.

The development area can be seen in Figure 1, below, outlined in red, which illustrates the proximity of the Site to the nearest noise-sensitive receptors; primarily Goose Green Farm (E:412620 N:560930) to the east of the Development, situated approximately 570 metres away (NSRs 1 and 2); Brass Castle Farm (E:412562 N:560454), which is situated approximately 400 metres to the south-west of the Site (NSRs 3 & 4); and Bucks Nook Farm (E:411632 N:561025), which is situated approximately 600 metres to the north of the Site (NSR5). All residential receptor locations are 2-storey buildings.

The ambient sound environment across the area was influenced by local and distant road traffic noise, plus natural sources such as birdsong and wind induced vegetation movement.

Figure 1: Development Site and Surrounding Area

The development site is located on a parcel of land off Lead Road, Ryton, and the extent of the site is defined by the following grid references:

- North: E:412126 N:560601
- East: E:412165 N:560552
- South: E:412063 N:560485
- West: E:412024 N:560531

The receptors are the closest noise-sensitive receptors to the site, in terms of distance. There are other, more distant receptors, however, there is either significant distance and/or screening in the

intervening land, thus reducing the specific noise level associated with the site to a level where it is insignificant.

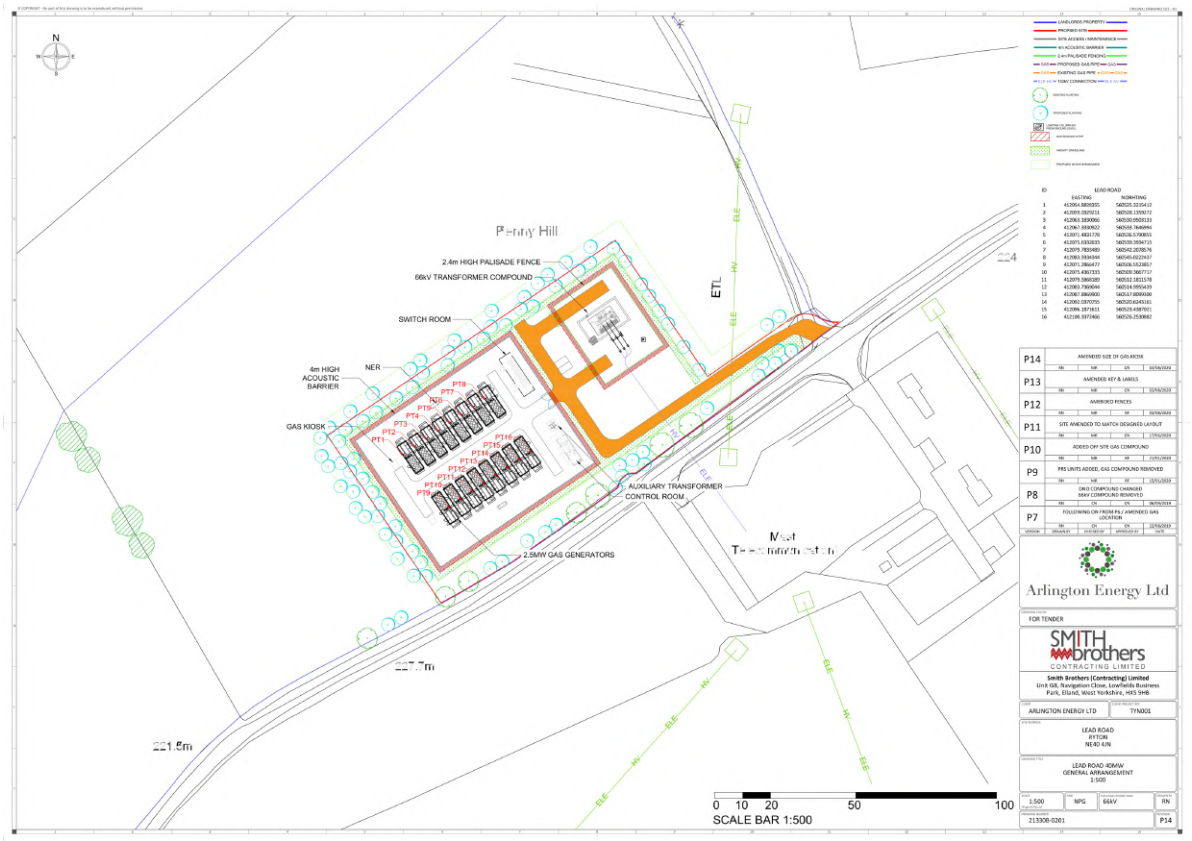
3.2. Development Overview

Peaking Power Generation Plants are designed to cover potential energy shortages, supplying electricity to the National Grid when necessary. As such, they have a short-term operational nature, and they are more likely to operate during peak load hours only, when the demand for electricity is higher, but they have potential to operate at any time.

The development proposals comprise 16 gas engine-driven electricity-generating sets. The engines are proposed to be housed within purpose-built containers, as supplied by the manufacturer.

An overview of the site layout can be seen below in Figure 2.

FIGURE 2: DEVELOPMENT LAYOUT



The site has been considered with the screening effects of a 4-metre high solid environmental barrier around the engine compound.

3.3. Noise Generating Elements

The Development has a mixture of external noise-generating elements, all of which are summarised below in Table 3.

TABLE 3: SUMMARY OF NOISE-GENERATING ELEMENTS

Description	Location	Operational Profile	Grid Coordinates	
			Easting	Northing
ARL 019-01 Genset	External	On Demand	412070	560507
ARL 019-02 Genset	External	On Demand	412073	560510
ARL 019-03 Genset	External	On Demand	412078	560513
ARL 019-04 Genset	External	On Demand	412082	560515
ARL 019-05 Genset	External	On Demand	412086	560518
ARL 019-06 Genset	External	On Demand	412090	560521
ARL 019-07 Genset	External	On Demand	412094	560524
ARL 019-08 Genset	External	On Demand	412099	560527
ARL 019-09 Genset	External	On Demand	412058	560525
ARL 019-10 Genset	External	On Demand	412062	560528
ARL 019-11 Genset	External	On Demand	412066	560530
ARL 019-12 Genset	External	On Demand	412070	560533
ARL 019-13 Genset	External	On Demand	412074	560536
ARL 019-14 Genset	External	On Demand	412078	560539
ARL 019-15 Genset	External	On Demand	412082	560542
ARL 019-16 Genset	External	On Demand	412086	560545
Aux Transformer	External	On Demand	412067	560494
66 kV Transformer	External	On Demand	412120	560574

4. Measurement Methodology

4.1. General

The prevailing noise conditions in the area have been determined by an environmental noise survey conducted during both daytime and night-time periods between 21st and 24th June 2018, inclusive of a weekend period. The survey was undertaken by RODEng Consulting LLP, with the results summarised in report reference: Lead Road (ENSO01), dated 19th September 2018. The results of this survey have been obtained in their raw format and re-analysed for the purposes of this assessment.

4.2. Measurement Details

All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672[9]. A full inventory of this equipment is shown in Table 4 below.

Table 4: Inventory of Sound Measurement Equipment

Position, Make, Model & Description	Serial Number	Calibration Certificate Number	Calibration Due Date
Brüel & Kjær 2250-L Sound Level Meter	3001350	CDK1698997	19/07/2019
Brüel & Kjær 2250-L Sound Level Meter	3002365	CDK1691099	06/06/2019
Brüel & Kjær 2250-L Sound Level Meter	3002367	CDK1609404	13/02/2019
Brüel & Kjær 4231 Acoustic Calibrator	2615338	03405/1	12/10/2018

The measurement positions are described in Table 5, with an aerial photograph indicating their locations shown in Figure 3.

Table 5: Measurement Position Descriptions

Measurement Position	Description	Grid Coordinates	
		Easting	Northing
MP1	An unattended daytime and night-time measurement of sound in the vicinity of Goose Green Farm.	412694	561137
MP2	An unattended daytime and night-time measurement of sound in the vicinity of Brass Castle Farm.	412620	560599
MP3	An unattended daytime and night-time measurement of sound in the vicinity of Bucks Nook Farm.	411954	561271

[9] British Standard 61672: 2013: *Electroacoustics. Sound level meters*. Part 1 *Specifications*. BSI.

FIGURE 3: MEASUREMENT POSITIONS

The summarised results of the environmental noise measurements are presented in Table 6, with full time histories presented under Appendix B. The L_{A90} statistics have been derived from an analysis of the spread of modal values of measured 15-minute values, throughout the entire survey period.

TABLE 6: SUMMARY OF NOISE MEASUREMENT RESULTS

Measurement Position	Period	Noise Level, dB	
		$L_{Aeq,T}$	L_{A90}
MP1	Daytime	50.6	36.0
	Night-Time	48.3	33.0
MP2	Daytime	50.7	35.0
	Night-Time	50.0	31.0
MP3	Daytime	51.3	29.0
	Night-Time	51.0	28.0

5. Operational Noise Assessment

5.1. Noise Modelling

5.1.1. Source Data

The A-weighted sound levels associated with the Proposed Development have been provided by the Applicant's equipment supplier; "Yellow Power" and can be seen below in Table 7.

Table 7: Sound Source Data

Plant	Quantity	Sound Pressure Level, L_{pA} (dB)	Sound Pressure Level Distance (m)
Genset Container	16	63.5	1
Genset - Inlet	16	63.9	1
Genset - Outlet	16	64.3	1
Exhaust	16	62.2	1
*Auxiliary Transformer	1	68.0	1
*Primary Transformer	1	65.0	1
Air Cooler	16	*61.6 / **64.6	1
*denotes free-field radiation **denotes hemispherical radiation			

The gensets will each be housed within a separate container. The vendor has advised that these enclosures will be designed for a maximum noise breakout of 64 dB(A) at 1 m. Exhaust silencers will be designed to provide adequate attenuation for the maximum exhaust stack Sound Pressure Level to be limited to 62 dB(A) at 1 m.

Consideration of the Best Available Techniques (BAT), with respect to the selection of plant noise emissions, can be seen below in Table 8.

Table 8: BAT Considerations

Source	Assumed % Operating Time	Periods of Operation	Applicable Best Available Techniques (BAT) [10]
Genset (Engine)	100 when operational	Day/Night	Low Noise Plant (Technique B) selected, typical plant is 11 dB higher in acoustic output. Appropriate Location of Equipment (Technique E) in the form of maximising the distance from the equipment to the receptors.
Genset (Exhaust)	100 when operational	Day/Night	Low Noise Plant (Technique B) selected, typical plant is 13 dB higher in acoustic output. Noise-control Equipment (Technique

[10] BAT17 of Best Available Techniques (BAT) Reference Document for Large Combustion Plants. Industrial Emissions Directive 2010/75/EU. Final Draft, December 2018.

Source	Assumed % Operating Time	Periods of Operation	Applicable Best Available Techniques (BAT) [10]
			D) in the form a silencer selected to reduce exhaust noise. Appropriate Location of Equipment (Technique E) in the form of maximising the distance from the equipment to the receptors.
Auxiliary Transformer	100 when operational	Day/Night	Appropriate Location of Equipment (Technique E) in the form of maximising the distance from the equipment to the receptors.
Primary Transformer	100 when operational	Day/Night	Appropriate Location of Equipment (Technique E) in the form of maximising the distance from the equipment to the receptors.
Genset (Air Cooler)	100 when operational	Day/Night	Low Noise Plant (Technique B) selected, typical plant is 12 dB higher in acoustic output. Appropriate Location of Equipment (Technique E) in the form of maximising the distance from the equipment to the receptors.

The details of the modelled height and directivity of the external noise sources can be seen in Table 9, below.

TABLE 9: NOISE SOURCE HEIGHT AND DIRECTIVITY

Source	Height Above Ground Level (m)	Directivity
Genset (Engine)	3.5	Omnidirectional
Genset (Exhaust)	6.25	Omnidirectional
Auxiliary Transformer	1.50	Omnidirectional
Primary Transformer	1.50	Omnidirectional
Genset (Air Cooler)	4.9	Omnidirectional

5.1.2. Calculation Process

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

5.1.3. Sound Data Assumptions

Given that the land between Development and nearest receptors is largely soft, the ground factor has been set to 0.8, within the calculation software.

The assessment considers a 4-metre high solid environmental barrier around the genset compound, to screen the surrounding area from the low-level sources within the site.

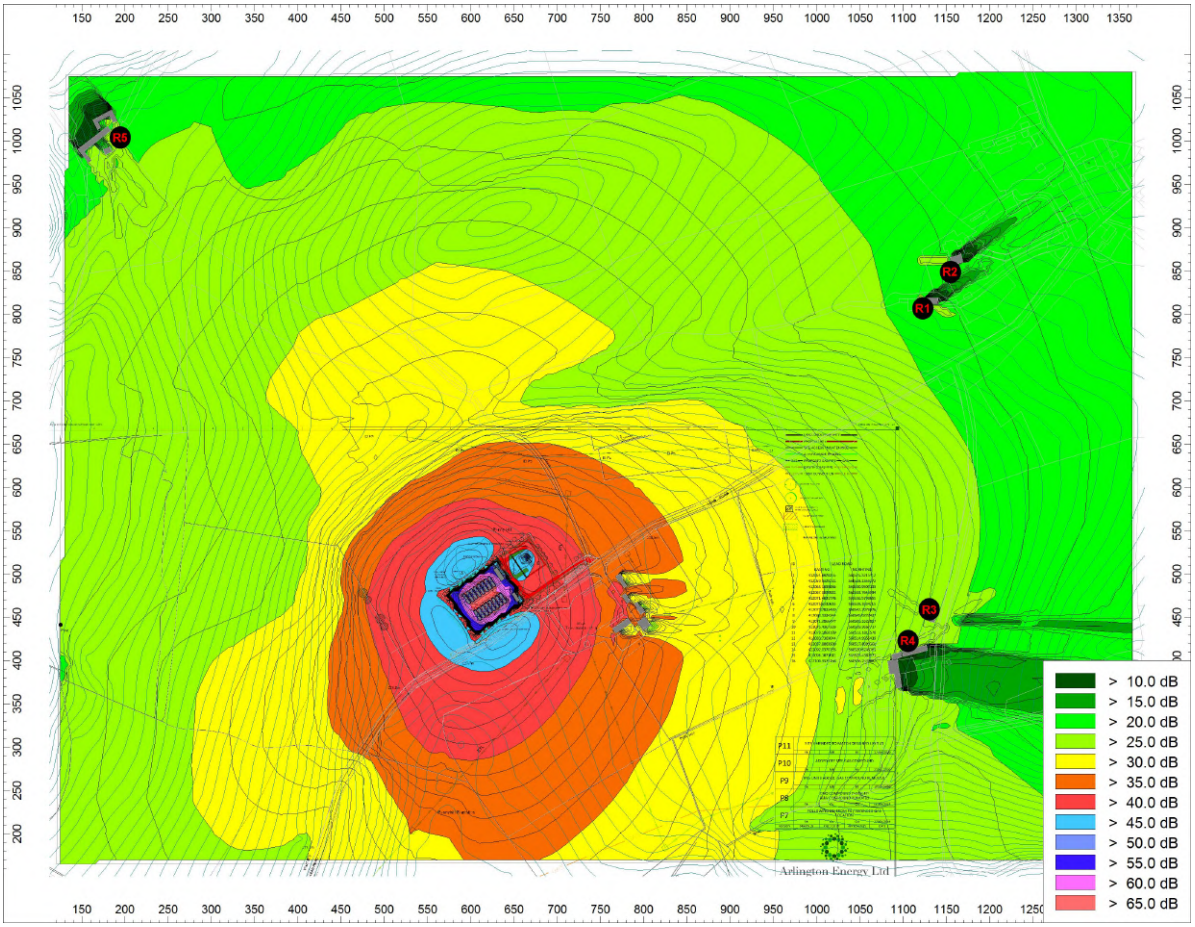
The area has been modelled on the basis of LiDAR data with a resolution of 1 m, as measured in May 2002.

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.

5.1.4. Specific Sound Level Map

The sound map showing the specific sound level emissions from the Development can be seen in Figure 4.

FIGURE 4: SPECIFIC SOUND LEVEL MAP



5.1.5. Specific Sound Level Summary

A summary of the predicted specific sound levels at the NSRs, based on the sound map shown in Figure 4 can be seen below in Table 10.

TABLE 10: PREDICTED SPECIFIC SOUND LEVEL SUMMARY

NSR	Specific Sound Level (dB)	
	Day – Grd Floor	Night – 1st Floor
1	24.5	24.5*
2	23.9	24.3
3	25.9	27.1
4	28.0	29.1
5	25.9	26.2
*denotes no upper floor		

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 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"*.

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."*

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."*

5.2.2. Rating Penalty Assessment

Considering the content of Section 5.2.1, an assessment of the various sound sources associated with the Development, in terms of whether any rating penalties are applicable, and has been detailed in Table 11 below.

TABLE 11: RATING PENALTY ASSESSMENT

Source	Tonality	Impulsivity	Intermittency	Other Sound Characteristics	Discussion
Gensets	+2 dB	0 dB	0 dB	0 dB	The gensets will operate as demand requires, however, once operating, do not cycle on and off. Tonality may be *"just perceptible"*, due to a 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.

Calculation Uncertainty

BS4142:2014+A1:2019 states that calculation uncertainty depends on a number of factors, including the following, which are applicable to the 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 12 below.

TABLE 12: CALCULATION UNCERTAINTY FACTORS

Calculation Uncertainty Factor Reference	Level of Uncertainty	Discussion
b)	0 dB	Sound power levels for all plant are based on manufacturer data, measured in accordance with BS EN ISO 3740 and BS EN ISO 3747, hence no correction.
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, a +1 dB has been included in the assessment, for calculation uncertainty.

5.2.4. Rating Sound Level Summary

A summary of the predicted rating sound levels at the NSRs, based on the sound map shown in Figure 4, and the Rating Penalty Assessment in Table 11, can be seen below in Table 13.

TABLE 13: PREDICTED RATING SOUND LEVEL SUMMARY

NSR	Rating Sound Level (dB)	
	Day – Grd Floor	Night – 1st Floor
1	27	27
2	26	26
3	28	29
4	30	31
5	28	28

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 all NSRs.

The resultant assessment summary, during the daytime period, can be seen in Table 14 below.

TABLE 14: 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	27	+1	36	-8
2	26	+1	36	-9
3	28	+1	35	-6
4	30	+1	35	-4
5	28	+1	29	0

The assessment in accordance with BS4142:2014+A1:2019 indicates that the development will have a *"Low Impact"* at the nearest noise-sensitive receptors during the daytime period, indicating that proposed development falls within the NOAEL range.

The resultant assessment summary, during the night time period, can be seen in Table 15 below.

TABLE 15: 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	27	+1	33	-5
2	26	+1	33	-6
3	29	+1	31	-1
4	31	+1	31	+1
5	28	+1	28	+1

The assessment in accordance with BS4142:2014+A1:2019 indicates that the development will have a *"Low Impact"* at the nearest noise-sensitive receptors during the night time period, indicating that proposed development falls within the NOAEL range.

5.3. BS8233:2014 and WHO Guidelines

The predicted specific sound levels have been compared against the recommended noise levels in BS8233:2014, and can be seen in Table 16 and Table 17, below.

TABLE 16: DAYTIME BS8233:2014 ASSESSMENT

Receptor	Specific Sound Level (dB)	Daytime Recommended Noise Levels (dB)	Excess of Specific over Daytime Recommended Noise Levels (dB)
1	25	50/55	-25/-30
2	24	50/55	-26/-31
3	26	50/55	-24/-29
4	28	50/55	-22/-27
5	26	50/55	-24/-29

TABLE 17: NIGHT TIME BS8233:2014 ASSESSMENT

Receptor	Specific Sound Level (dB)	Night Time Recommended Noise Levels (dB)	Excess of Specific over Night Time Recommended Noise Levels (dB)
1	25	45	-20
2	24	45	-21
3	27	45	-18
4	29	45	-16
5	26	45	-19

The predicted specific sound levels have been compared against the recommended noise levels in the WHO Guidelines, and can be seen in Table 18 and Table 19, below.

TABLE 18: DAYTIME WHO ASSESSMENT

Receptor	Specific Sound Level (dB)	Daytime Recommended Noise Levels (dB)	Excess of Specific over Daytime Recommended Noise Levels (dB)
1	25	50/55	-25/-30
2	24	50/55	-26/-31
3	26	50/55	-24/-29
4	28	50/55	-22/-27
5	26	50/55	-24/-29

TABLE 19: NIGHT TIME WHO ASSESSMENT

Receptor	Specific Sound Level (dB)	Night Time Recommended Noise Levels (dB)	Excess of Specific over Night Time Recommended Noise Levels (dB)
1	25	40/45	-15/-20
2	24	40/45	-16/-21
3	27	40/45	-13/-18
4	29	40/45	-11/-16
5	26	40/45	-14/-19

In all instances during the daytime periods, the predicted specific sound levels from the Site are below the criterion outlined in BS8233:2014 and the WHO Guidelines.

5.4. Discussion and Context

The assessment indicates that, in the context of BS4142:2014+A1:2019, BS8233:2014 and the WHO Guidelines, that the Site will have a *No Observed Adverse Effect Level* (NOAEL) on the nearest residential receptors.

The Noise Planning Policy Statement for England 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 Site clearly demonstrates compliance with the first two aims of the NPSE, given the impact is predicted to be in the NOAEL range. Indeed, the Site has adopted Best Available Techniques (BAT) with regard to some of the noise sources that were predicted to have a more significant impact than others, as detailed in Table 8.

Paragraph 2.15 of the NPSE states, with regard to the third aim, that *"this statement expresses the long-term desired policy outcome, but in the use of "promote" and "good" recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations."*

The NPSE recognises that, in some instances, some sources of noise are not able to objectively demonstrate compliance with this aim; this being the case in this instance. However, by using BAT in the design, the Site is responding to the constraints of the locality by selecting technology solutions that will have, in the long-term, a low impact and should promote a congruous relationship between the Site and the surrounding residential receptors.

6. CONCLUSION

inacoustic has been commissioned to prepare a Noise Assessment for a Gas Peaking Plant adjacent to the existing electricity substation on Lead Road, Ryton, for submission to the Environment Agency as part of a Permit Application.

When dealt with in the manner described in this report, the Site can be brought forward in compliance with the requirements of the IPPC Technical Guidance Note IPPC H3 Part 2, demonstrating BAT where possible, as outlined in Table 8.

In light of the above, it is considered that this report provides sufficient information to the grant the Application for a Permit for the Site.

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 20: 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 5: MEASURED TIME HISTORY – MP1

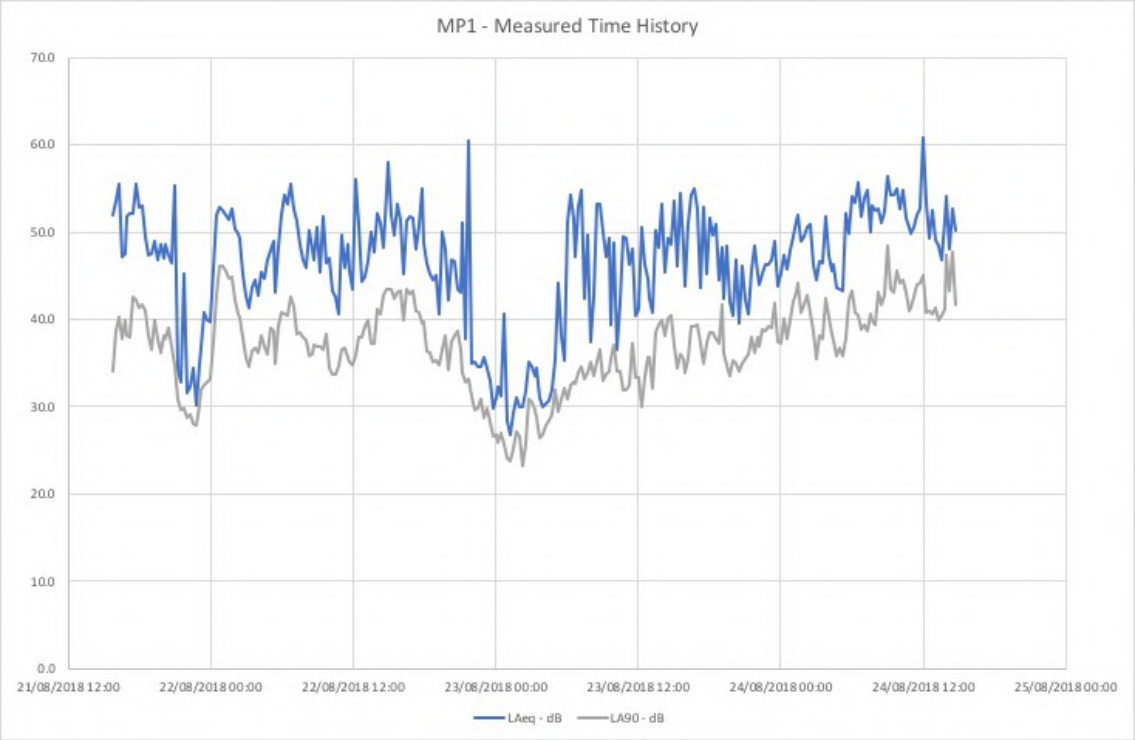


FIGURE 6: MEASURED TIME HISTORY – MP2

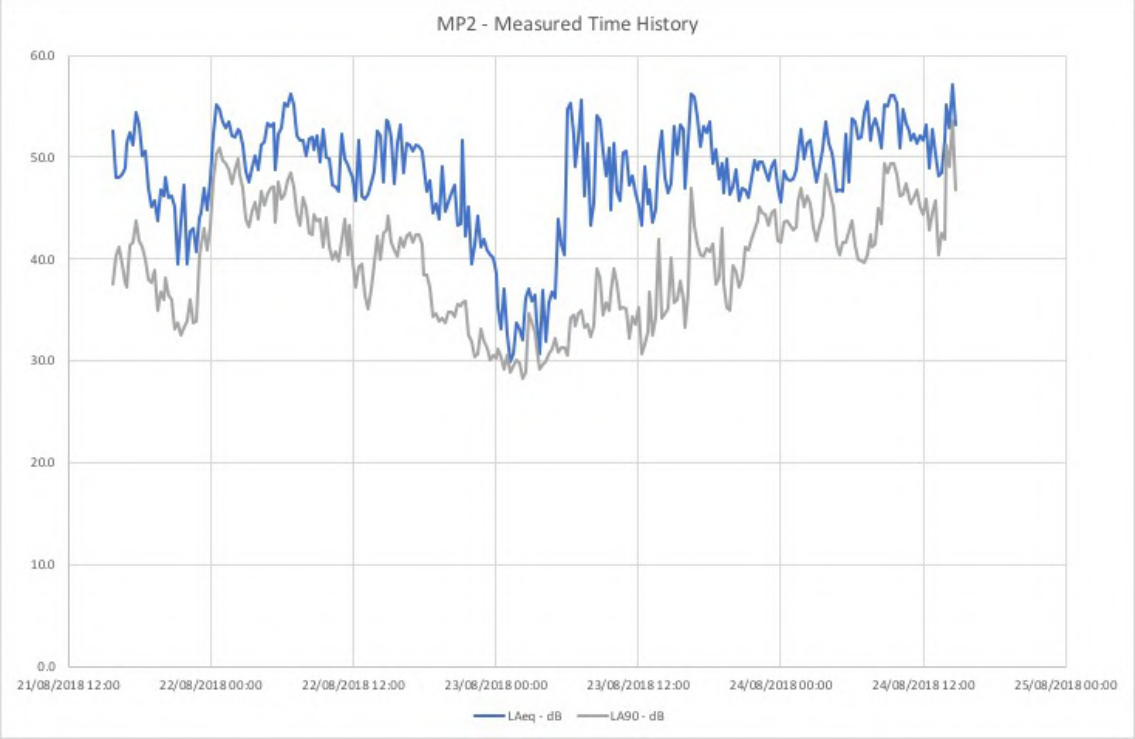
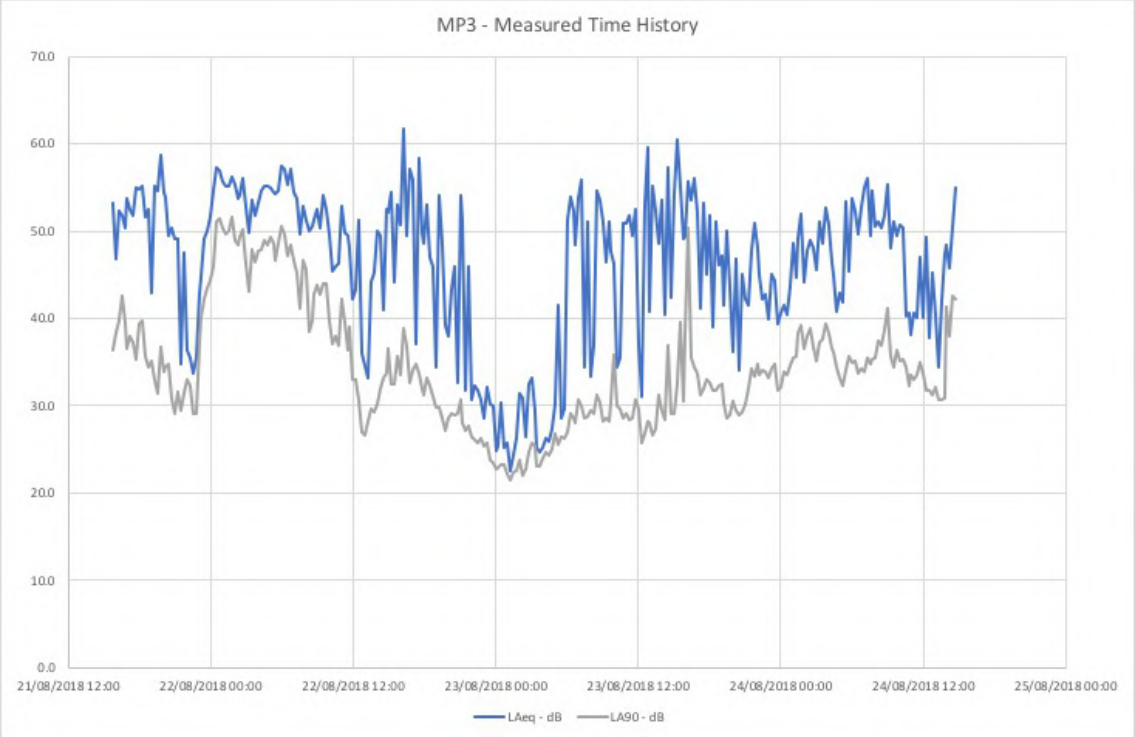


FIGURE 7: MEASURED TIME HISTORY – MP3



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