



Noise Assessment

Gresley Gas-powered Standby Power Generation Facility

Land off Mount Road, Castle Gresley, Swadlincote, Derbyshire

For:

Sterling and Wilson Cogen Solutions Pvt Ltd

CRM.361.006.NO.R.001



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Non-technical Summary

Enzygo Limited has been instructed by Sterling and Wilson Cogen Solutions Pvt Ltd to undertake an environmental noise impact assessment to support a planning application for a proposed 7.56MW gas-powered standby power generation facility on land off Mount Road, Castle Gresley, Swadlincote, Derbyshire.

The assessment has been undertaken to assess compliance with the relevant standards at the nearest noise sensitive receptors in line with the equipment's proposed operational hours, and to provide outline mitigation advice where considered necessary.

The BS4142 assessment has shown that the predicted sound rating levels during the daytime and evening periods are well below the prevailing background noise levels at all locations assessed which would indicate that the specific sound levels from the proposed facility would have a **low impact** and fall into the **NOEL** threshold of impact.

The overnight BS4142 assessment has shown that the predicted sound rating levels would exceed the prevailing background noise levels at Mount Road (north) and Mount Road (west) indicating that there is a likelihood of an **adverse impact**, depending on the context. The context in this instance is that the facility would generally only operate during the daytime and early evening. It is unlikely that the facility would operate at night except during rare emergency situations. Furthermore, during the night-time period, residents are unlikely to be outdoors.

As BS4142 is not intended to be applied to the derivation of indoor noise levels arising from outdoor sound, a further assessment has been made against the guideline values for internal ambient noise levels in dwellings outlined in BS8233, specifically those relating to sleeping in bedrooms. The assessment has shown that, when considering a 15dB reduction for a partially open window, predicted internal noise levels would be significantly below the 30dB $L_{Aeq,8hr}$ noise level recommended and would therefore fall into the **NOEL** threshold.

Based on the findings of the assessment against the guidance contained in the relevant standards it is considered that the proposed facility, which would operate to support the National Grid during peak power demand periods predominantly between 07:30 and 20:30 hours, would be able to operate without adversely affecting nearby sensitive receptors in terms of acoustic impact.

During rare night-time emergency operations, the proposed facility would be able to operate without exceeding the internal guidance values for sleeping at any of the properties assessed subject to the assumptions made.

1 Introduction

1.1 Project Introduction

- 1.1.1 Enzygo Limited (Enzygo) has been commissioned by Sterling and Wilson Cogen Solutions Pvt Ltd (SWB) to undertake an environmental noise impact assessment to support a planning application for a proposed 7.56MW gas-powered standby power generation facility on land off Mount Road, Castle Gresley, Swadlincote, Derbyshire.
- 1.1.2 The assessment has been undertaken to assess compliance with the relevant standards at the nearest noise-sensitive receptors during the proposed operational hours of the equipment and to provide outline mitigation advice where considered necessary.
- 1.1.3 Details of the assessment methodology employed, together with the results of the baseline survey, assessment and conclusions are presented within this report.

1.2 Site Description

- 1.2.1 The proposed facility would be located on open land off Mount Road, Castle Gresley, Swadlincote. The site is centred at grid reference SK 27667 17950 approximately.
- 1.2.2 To the north of the site is open farmland as far as the A444 Burton Road, beyond which is residential development, Swadlincote Commercial Park and Cadley Hill & Appleby Glade Industrial Estate. To the east, adjacent to the site, is an existing substation with residential properties, open land and a furniture superstore beyond. To the south, running adjacent to the site is a freight railway line beyond, which is open farmland as far as Hillside Road; there are isolated properties on Mount Road and The Scotts. To the west is open farmland, the freight railway line and a solar farm.
- 1.2.3 The nearest noise sensitive receptors have been identified as:
 - 1. Properties on Home Farm Court, to the north;
 - 2. Residential properties on Mount Road, to the east; and
 - 3. The residential property on Mount Road, to the south.
- 1.2.4 The site and nearby noise-sensitive residential receptors are shown in Figure 1-1.

1.3 Project Description

- 1.3.1 The gas-powered standby power generation facility would produce 6MW of electricity to support the National Grid when required to cope with short-term peak energy demand. This would predominantly occur during the daytime, predominantly between 07:30 and 20:30 hours, but may, under extremely rare emergency situations, such as a National Grid power outage, operate at night. The facility, which will be contained within a 4m high acoustic fence, would comprise the following equipment:
 - 3no. 2.0MW and 1no. 1.56MW containerised gensets including roof mounted remote radiators and exhaust systems;
 - A gas skid;
 - A DNO room;
 - A welfare room; and

- A containerised switchgear room.

1.3.2 The manufacturers noise data for the gensets, radiators, etc., has been used to assess the potential noise effects of the facility at the nearest noise sensitive receptors.

Figure 1-1: Site Location Plan



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1.4 Consultation

1.4.1 Due to time constraints, Enzygo has not consulted with the local authority regarding their requirements for the noise assessment, but instead has based the assessment on our experience with similar sites and the requirements of other Local Planning Authorities. The noise assessment has therefore been undertaken in accordance with the guidance contained in BS4142:2014 with reference made to BS8233:2014/WHO guidance as an added safeguard for internal noise levels at night.

1.5 Noise Assessment Methodology

- 1.5.1 The noise assessment has been made in accordance with the guidance contained within British Standard 4142:2014 '*Method for rating and assessing industrial and commercial sound*' (BS4142), British Standard 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' (BS8233) and the World Health Organisation guidance document '*Guidelines for Community Noise*' (WHO Guidelines) where appropriate.
- 1.5.2 Noise levels generated by the proposed development during operations to support the National Grid power supply during peak demands/power outages, have been predicted to the nearby sensitive receptors using the calculation methodology outlined in ISO 9613:1996 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*' (ISO 9613) using the proprietary noise modelling software CadnaA.
- 1.5.3 The results of the noise predictions have been used to assess the potential impact at the nearby noise-sensitive receptors in accordance with the guidance contained in BS4142. Reference has also been made to the guidance levels for internal resting and sleeping during the night in accordance with the guidance contained in BS8233.
- 1.5.4 The assessment is based upon the results of a baseline noise survey undertaken at the nearby receptors over the representative daytime, evening and night-time periods.

2 Standards and Guidance

2.1 Planning Practice Guidance for Noise

2.1.1 The guidance contained within the Planning Practice Guidance for Noise indicates that noise should be considered when:

- New developments may create additional noise; and/or
- New developments would be sensitive to the prevailing acoustic environment.

2.1.2 The guidance indicates that Local Planning Authorities should take account of the acoustic environment and in doing so consider:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or is likely to occur; and
- Whether or not a good standard of amenity can be achieved.

2.1.3 The impact of noise is rated within the policy document in terms of the relative '*Observed Effect Level*'. The Planning Practice Guidance provides the matrix shown in Table 2-1.

Table 2-1: Planning Practice Guidance – Noise Exposure Hierarchy

Perception	Example 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	

Perception	Example of Outcomes	Increasing Effect Level	Action
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 and/or awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.2 British Standard 4142:2014 *Methods for rating and assessing industrial and commercial sound*

2.2.1 BS4142 provides a methodology for rating and assessing sound associated with both industrial and commercial premises. The purpose of the Standard is clearly outlined in the opening section where it states that the method is appropriate for the consideration of:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and,
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

2.2.2 The Standard is based around the premise that the significance of the noise impact of an industrial/commercial facility can be derived from the numerical subtraction of the background noise level (not necessarily the lowest background level measured, but the typical background of the receptor) from the measured/calculated rating level of the specific sound under consideration. This comparison will enable the impact of the specific sound to be concluded based upon the premise that typically *“the greater this difference, the greater the magnitude of the impact”*. This difference is then considered as follows:

- 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 upon context; and,
- 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.

2.2.3 BS4142 further states that “*where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact*” again depending upon the specific context of the site. The Standard further qualifies the assessment protocol by outlining conditions to the comparative assessment and stating that “*not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact*”, thus implying that all sites should be assessed on their own merits and specifics.

2.2.4 The Standard quantifies the typical reference periods to be used in the assessment of noise, namely:

Typical Daytime	07:00 – 23:00	1-hr assessment period
Typical Night-time	23:00 – 07:00	15-min assessment period

2.2.5 The Standard outlines methods for defining appropriate “*character corrections*” within the rating levels to account for tonal qualities, impulsive qualities, other sound characteristics and/or intermittency. These are a) the Subjective Method, b) the Objective Methods for tonality and c) the Reference Method. It is noted by the Standard that where multiple features are present the corrections should be added in a linear fashion to the specific level.

2.2.6 The Subjective Method is based on the following corrections:

Table 2-2: BS4142 Subjective Method Rating Corrections

Level of Perceptibility	Tonal Correction	Impulsivity Correction	Correction for “Other sound characteristics”	Intermittency Correction
No Perceptibility	+0 dB	+0 dB	Where neither tonal nor Impulsive but clearly identifiable +3 dB	If intermittency is readily identifiable +3 dB
Just Perceptible	+2 dB	+3 dB		
Clearly Perceptible	+4 dB	+6 dB		
Highly Perceptible	+6 dB	+9 dB		

2.3 British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings*

2.3.1 BS8233 provides guidance and recommendations for the control of noise from outside sources to maintain an internal acoustic environment appropriate for the intended use. The Standard suggests appropriate criteria and limits for differing situations which are, primarily, intended to guide the design of new or refurbished buildings undergoing a change of use rather than to assess the effect of changes to the external noise climate. However, it is considered that the guidance provides suitable criteria for the assessment of internal noise levels in this instance.

2.3.2 The Standard suggests suitable guidance values for residential dwellings shown in Table 2-2.

Table 2-3: BS8233 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 Hours	23:00 to 07:00 Hours
Resting	Living room	35dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$

- 2.3.3 Whilst it is considered desirable to achieve these internal noise levels with the windows open, it is not stipulated with the Standard which states:

"If relying on closes windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

- 2.3.4 The Standard suggests that the level of noise reduction provided by a partially open window would be approximately 15dB.

2.4 World Health Organisation – Guidelines for Community Noise

- 2.4.1 The World Health Organisation's (WHO) *Guidelines for Community Noise* document, with respect to external noise, states:

"4.2.7 Annoyance responses

During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55dB; or moderately annoyed with L_{Aeq} levels below 50dB. Sound pressure levels during the evening and night should be 5-10dB lower than during the day..."

- 2.4.2 For night-time noise sources the WHO guidelines recommend a night-time (23:00 – 07:00 hours) 8-hour noise level of 30dB L_{Aeq} inside bedrooms (for reasonably steady noise sources) to avoid sleep disturbance.

- 2.4.3 The WHO guidelines also recommend a night-time (23:00 - 07:00 hours) maximum noise level of 45dB $L_{Aeq,8hr}$ or 60dB L_{AFmax} outside bedrooms to avoid sleep disturbance.

2.5 ISO9613 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation

- 2.5.1 The noise levels generated by the operation of the proposed development have been predicted using the calculation methodology set out in ISO9613-2. The methodology considers the distance between the sources and the receptors and applies the amount of attenuation due to atmospheric absorption and other site-specific characteristics.

- 2.5.2 The methodology assumes downwind propagation, i.e. a wind direction that assists the propagation of noise from the source to all receptors.

3 Baseline Noise Monitoring Survey

3.1 Baseline Noise Survey

- 3.1.1 Baseline noise measurements were undertaken between Wednesday 3rd and Thursday 4th October 2018 to gather background and ambient noise levels at locations at or representative of the nearest residential receptor locations to the proposed development site.
- 3.1.2 The baseline noise survey was carried out in accordance with the requirements of British Standard 7445:1996 '*Description and measurement of environmental noise*', by a suitably qualified and experienced acoustic consultant, in accordance with the requirements of BS4142.
- 3.1.3 Measurements were taken over a single 1-hour period during the daytime, avoiding rush hour periods, and over single 30-minute periods during the evening and overnight.
- 3.1.4 Due to access issues, monitoring was undertaken at the nearest accessible locations which would provide representative noise data. The monitoring locations are detailed in Table 3-1 and shown in Figure 3-1 below.

Table 3-1: Noise Monitoring Location

Location Reference	Grid Ref (NGR)
MP1 – Mount Road (south)	427866, 317725
MP2 – Home Farm Court	427862, 318059
MP3 – Mount Road (north)	427873, 317891

- 3.1.5 The noise monitoring equipment used during the surveys is shown in Table 3-2 and was set to record the $L_{Aeq,T}$, L_{A90} , L_{A10} and L_{Amax} parameters.

Table 3-2: Noise Monitoring Equipment

Location	Equipment Description	Serial Number	Calibration Date
MP1	01dB Solo Class 1 sound level meter	065445	11/01/2018
MP2 & MP3	01dB Solo Class 1 sound level meter	065396	09/03/2018
All	Cirrus CR:515 Acoustic calibrator	59522	10/01/2018

- 3.1.6 The following set-up parameters were used on the sound level meter during all the noise measurements undertaken:

Time Weighting: Fast
Frequency Weighting: "A"

- 3.1.7 The sound level meter was field calibrated, using an electronic calibrator, prior to commencement and upon completion of the overall survey, no drift in calibration was observed. The external calibration documentation for the equipment used is available upon request.

Figure 3-1: Noise Monitoring Location Plan



(Image Source: ©Google 2018)

3.2 Weather

3.2.1 Weather conditions during the survey periods are detailed in Table 3-3 below:

Table 3-3: Weather Conditions

Period	Precipitation	Cloud Cover	Max. wind-speed	Temperature
Daytime	None, dry roads	0%	<5.0ms ⁻¹	17°C
Evening	None, dry roads	80%	<5.0ms ⁻¹	16°C
Night-time	None, dry roads	80%	Imperceptible	13°C

3.3 Survey Results

3.3.1 The results of the baseline surveys are summarised in Table 3-3 and can be found in full in Appendix A. Due to building works being undertaken nearby, daytime baseline noise monitoring could not be undertaken at MP3.

Table 3-3: Summary of Baseline Survey Results, dB

Location	Period	L _{Aeq,T}	L _{Amax}	L _{A90}	L _{A10}
MP1 Mount Road (south)	Day	42.8	69.4	35.5	41.5
	Evening	44.1	64.4	33.0	44.3
	Night	30.8	50.4	24.8	33.1
MP2 Home Farm Court	Day	-	-	-	-
	Evening	44.4	57.3	38.6	47.4
	Night	34.7	54.8	25.4	36.7
MP3 Mount Road (north)	Day	50.2	70.7	37.3	49.5
	Evening	42.1	63.8	33.3	44.0
	Night	32.5	54.1	22.9	33.3

3.4 Subjective Field Monitoring Notes

MP1 – Mount Road (south)

- 3.4.1 The noise climate during the daytime comprised background road traffic, occasional local traffic accessing properties, occasional aircraft overhead, wind in nearby trees, birdsong and cattle. During the evening the noise climate comprised background road traffic, occasional local traffic accessing properties, occasional aircraft overhead, wind in nearby trees, birdsong and cattle.
- 3.4.2 Overnight the noise climate comprised faint distant traffic. A faint buzzing was also noted either from the substation or a nearby electricity pylon.

MP2 – Home Farm Court

- 3.4.3 As stated above, due to building works being undertaken nearby, daytime baseline noise monitoring could not be undertaken at this location. The noise climate during the evening at this location comprised road traffic from the A444, occasional local traffic on Home Farm Court and local activities such as children playing.
- 3.4.4 Overnight the noise climate comprised occasional background road traffic movements on the A444.

MP3 – Mount Road (north)

- 3.4.1 The noise climate during the daytime comprised background road traffic, occasional local traffic accessing properties, occasional aircraft overhead, wind in nearby trees and birdsong. The noise climate during the evening comprised background road traffic, occasional local traffic accessing properties, wind in nearby trees and birdsong.
- 3.4.2 The noise climate overnight comprised background road traffic noise.

4 Noise Assessment

4.1 Introduction

- 4.1.1 This section of the report outlines the prediction and assessment of noise generated by the proposed facility at the nearest residential receptors.
- 4.1.2 The predictions have been made using the calculation methodology outlined in ISO9613 and the assessment of potential noise impacts has been undertaken in accordance with BS4142 and BS8233. Reference has also been made, where appropriate, to the guidance noise levels outlined in the WHO guidance documents *Guidelines for Community Noise* and *Night Noise Guidance for Europe*.
- 4.1.3 The significance of the calculated noise impact is then further referenced to the noise exposure hierarchy presented in Section 2. In terms of BS4142, BS8233 and WHO the following thresholds are proposed.

Table 4-1: Effect Levels relating to BS4142 Impact

Threshold	BS4142 assessment of impacts
NOEL	Indication of a low impact (rating level does not exceed the background level)
LOAEL	Indication of an adverse impact (rating level is around 5dB above the background level)
SOAEL	Indication of a significant adverse impact (rating level is around 10dB above the background level)

Table 4-2: Effect levels relating to BS8233 Night-time Internal Noise Limit Guidance

Threshold	BS8233 assessment of impacts
NOEL	Internal noise level below 30dB $L_{Aeq,8hr}$
LOAEL	Internal noise levels between 30dB and 35dB $L_{Aeq,8hr}$
SOAEL	Internal noise levels above 35dB $L_{Aeq,8hr}$

Table 4-3: Effect levels relating to WHO Guidance

Threshold	WHO assessment of impacts		
	Outdoor Living Area	Outside Bedrooms	
		L_{Aeq}	L_{Amax}
NOEL	<50dB	<45dB	<60dB
LOAEL	>50dB and <55dB	45dB	60dB
SOAEL	>55dB	>45dB	>60dB

4.2 Noise Emissions

- 4.2.1 As described in Section 1, the proposed facility will consist of 3no. 2.0MW and 1no. 1.56MW in individual containerised units. The noise emission specification for the equipment is shown in Table 4-4 below.
- 4.2.2 The proposed facility would also include ancillary items such as a switch room, welfare room, DNO room and gas skid. No significant noise emissions are expected from these plant items and therefore are not included within the following assessment.

4.3 Noise Modelling Protocols

- 4.3.1 The noise model was constructed using the proprietary noise modelling software package CadnaA. The potential noise impacts at the nearby residential properties have been predicted using the calculation methodology outlined in ISO9613.
- 4.3.1 The noise model was constructed utilising Google Earth geo-referenced 1:1 scaled aerial photography and noise source data supplied by the client. Table 4-4 shows the adopted sound power levels used within the noise model and the heights used for the sources.

Table 4-4: Modelled Source Emission Heights

Plant Noise Source	Sound Pressure Level, L _p dB	Source Height
Hi-spec Containerised Generator	62dB(A) @ 1m	3.0m max
Exhaust Outlet	62dB(A) @ 1m	10m
Low Noise Remote Radiator	38dB(A) @ 10m	4.4m max

4.4 Noise Modelling Assumptions

- 4.4.1 Modelled noise levels form the basis of the calculated specific sound level. Noise emissions from the site have also been plotted graphically and are shown in Appendix B.
- 4.4.2 The following assumptions have been made during the modelling process:
- All sources have a 100% on-time throughout the 1-hour daytime and 15-minute night-time assessment periods;
 - Wind and temperature gradient assisted sound propagation at all receptors; and
 - 100% soft ground between the sources and receptors.

4.5 Predicted Sound Levels

- 4.5.1 Noise levels generated by the proposed development have been predicted to the site-facing façade of the nearest receptors shown in Figure 4-1. The results are shown in Table 4-5. Predictions have been made to a height of 1.5m for ground floor/external amenity space and 4.0m for first floor windows.
- 4.5.2 The predictions include the attenuation provided by a proposed 4m high perimeter acoustic fence.

Figure 4-1: Noise Assessment Location Plan



(Image Source: ©Google 2018)

Table 4-5: Predicted Specific Sound Levels at the Assessment Locations

Location	Assessment Location	Assessment Height, m	Specific Sound Level $L_{Aeq,1hr}$ dB
AL1 – Mount Road (south)	Ground Floor	1.5	14.6
	1 st Floor	4.0	17.7
AL2 – Home Farm Court	Ground Floor	1.5	19.1
	1 st Floor	4.0	21.3
AL3 – Mount Road (north)	Ground Floor	1.5	22.6
	1 st Floor	4.0	25.2
AL4 – Mount Road (west)	Ground Floor	1.5	19.5
	1 st Floor	4.0	21.2

4.6 Sound Rating Level

- 4.6.1 In accordance with the guidance contained in BS4142 the specific sound level has been corrected for tonal, impulsive, intermittent or other acoustic characteristics which may be present at the receptors to determine the sound rating level.
- 4.6.2 Within the context of the prevailing noise climate, i.e. quiet rural location with minimal contributions from road traffic noise, etc., it is considered that the corrections for tonality, impulsivity and intermittency shown in Table 4-6 are appropriate for the assessment. During operation the sound source would be constant throughout therefore no impulsive or intermittent content would be present.

Table 4-6: Corrections for Tonality of Noise Sources, dB

Location	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
AL1 – Mount Road (south)	2	4
AL2 – Home Farm Court	0	2
AL3 – Mount Road (north)	2	4
AL4 – Mount Road (west)	2	4

- 4.6.3 It is noted that BS4142 assessments are undertaken using whole dB values with 0.5dB being rounded up. Table 4-6 details the derived sound rating levels based on the adjustments above.

Table 4-6: Sound Rating Levels

Location	Period	Floor	Specific Sound Level dB $L_{Aeq,T}$	Corrections Applied, dB	Sound Rating Level dB $L_{Ar,T}$
AL1 – Mount Road (south)	Day & Evening	Ground	15	2	17
	Night	1 st	18	4	22
AL2 – Home Farm Court	Day & Evening	Ground	19	0	19
	Night	1 st	21	2	23
AL3 – Mount Road (north)	Day & Evening	Ground	23	2	25
	Night	1 st	25	4	29
AL4 – Mount Road (west)	Day & Evening	Ground	20	2	22
	Night	1 st	21	4	25

4.7 BS4142 Assessment

- 4.7.1 A comparative assessment has been undertaken to determine the potential impact of the predicted sound rating levels at the nearest residential receptors upon the prevailing background noise levels. Table 4-7 details the results of the assessment.

Table 4-7: BS 4142 Assessment

Location	Period	Background Noise Level dB L_{A90}	Sound Rating Level dB $L_{Ar,T}$	Level Exceeding Background dB
AL1 – Mount Road (south)	Day	36	17	-19
	Evening	33	17	-16
	Night	25	22	-3
AL2 – Home Farm Court	Day	39	19	-20
	Evening	39	19	-20
	Night	25	23	-2
AL3 – Mount Road (north)	Day	37	25	-12
	Evening	33	25	-8
	Night	23	29	+6
AL4 – Mount Road (west)	Day	37	22	-15
	Evening	33	22	-11
	Night	23	25	+2

4.7.2 Table 4-7 shows that the predicted sound rating levels during the daytime and evening periods are well below the prevailing background noise level at all locations assessed indicating that the specific sound would have a **low impact**.

4.7.3 Due to the quiet nature of the area at night, the predicted sound rating levels during any rare overnight operations would be above the prevailing background noise levels at Mount Road (north) and Mount Road (west) indicating an **adverse impact**, depending on the context. The context in this instance is that the proposed development would generally only operate during the day and early evening periods if called upon. It is unlikely that the proposed development would operate at night except in rare emergency situations.

4.7.4 As it is considered unlikely that residents nearby would be using external amenity space at night, the predicted noise levels inside properties have been assessed in accordance with the guidance contained in BS8233, specifically those relating to sleeping in bedrooms.

4.8 BS8233 Indoor Noise Level Assessment, Emergency Night-time Operations

4.8.1 An assessment of the predicted internal noise levels, generated during rare emergency night-time operations at the proposed facility, has been made against the guideline values for internal ambient noise levels for sleeping in bedrooms outlined in BS8233.

4.8.2 Table 4-8 details the results of the assessment when considering a 15dB reduction for a partially open window.

Table 4-8: BS8233 Assessment

Location	Predicted Internal Noise Level dB L_{Aeq}	Guideline Value for Night-time Sleeping dB $L_{Aeq,8hr}$	Difference
AL1 – Mount Road (south)	7	30	-23
AL2 – Home Farm Court	8		-22
AL3 – Mount Road (north)	14		-16
AL4 – Mount Road (west)	10		-20

4.8.3 Table 4-8 shows that the predicted internal noise levels generated by the proposed facility during rare night-time operations would meet the guideline values for sleeping conditions in bedrooms at all locations.

4.9 WHO Guidance Assessment

4.9.1 The guidance contained in the WHO document *Guidelines for Community Noise* reflects the guidance outlined in BS8233, or vice versa, with respect to internal noise levels at night. It has already been shown that the predicted internal noise levels from the proposed facility would meet the BS8233 guideline values at all locations assessed.

4.9.2 The predicted maximum noise levels outside bedroom windows are well below the 60dB L_{AFmax} guideline level suggested by the WHO.

4.10 Assessment of Observed Effect Level

4.10.1 The significance of the calculated noise impact has been assessed in accordance with the Planning Practice Guidance for Noise using the definitions of NOEL, LOAEL and SOAEL shown in Tables 4-1, 4-2 and 4-3.

4.10.2 The daytime and evening BS4142 assessment has shown that the predicted sound rating levels at all locations would be well below the prevailing background noise levels indicating that noise from the proposed development would have a **low impact** and therefore fall into the **NOEL** threshold of impact.

4.10.3 Assuming windows would remain partially open for ventilation purposes, the BS8233 assessment has shown that the predicted internal noise level during rare emergency operations at night would be below the guideline values for resting and/or sleeping conditions in bedrooms at all locations assessed and would therefore also fall into the **NOEL** threshold.

4.10.4 Maximum noise levels would be well below the 60dB L_{AFmax} noise level suggested by the World Health Organisation and therefore also fall into the **NOEL** threshold.

5 Conclusion

5.1 Background

- 5.1.1 Enzygo Limited (Enzygo) has been commissioned by Sterling and Wilson Cogen Solutions Pvt Ltd (SWB) to undertake an environmental noise impact assessment to support a planning application for a proposed 7.56MW gas-powered standby power generation facility on land off Mount Road, Castle Gresley, Swadlincote, Derbyshire. It is proposed that the facility will be contained within a 4m high acoustic fence.
- 5.1.2 The assessment has been undertaken to assess compliance with the relevant standards at the nearest noise-sensitive receptors during the proposed operational hours of the equipment and to provide outline mitigation advice where considered necessary.
- 5.1.3 The assessment is based on the results of a series of noise predictions undertaken in accordance with the calculation methodology contained in ISO9613 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*' and the results of baseline noise surveys undertaken at locations representative of the nearest residential and business receptors close to the site.

5.2 Noise Assessment

- 5.2.1 Sound levels generated by the proposed development have been predicted using CadnaA and an assessment has been made in accordance with the guidance contained in BS4142, BS8233 and WHO Guidelines for Community Noise. Reference has also been made to the noise exposure hierarchy described in the planning practice guidance.
- 5.2.2 A site visit has been made to establish the prevailing background noise levels at locations representative of the nearby noise sensitive receptors.
- 5.2.3 The BS4142 assessment has shown that the predicted sound rating levels during the daytime and evening periods are well below the prevailing background noise levels at all locations assessed which would indicate that the specific sound levels from the proposed facility would have a **low impact** and fall into the **NOEL** threshold of impact.
- 5.2.4 The overnight BS4142 assessment has shown that the predicted sound rating levels would exceed the prevailing background noise levels at Mount Road (north) and Mount Road (west) indicating that there is a likelihood of an **adverse impact**, depending on the context. The context in this instance is that the facility would generally only operate during the daytime and early evening. It is unlikely that the facility would operate at night except during rare emergency situations. Furthermore, during the night-time period, residents are unlikely to be outdoors.
- 5.2.5 As BS4142 is not intended to be applied to the derivation of indoor noise levels arising from outdoor sound, a further assessment has been made against the guideline values for internal ambient noise levels in dwellings outlined in BS8233, specifically those relating to sleeping in bedrooms. The assessment has shown that, when considering a 15dB reduction for a partially open window, predicted internal noise levels would be significantly below the 30dB $L_{Aeq,8hr}$ noise level recommended and would therefore fall into the **NOEL** threshold.

5.3 General Conclusion

- 5.3.1 Based on the findings of the assessment against the guidance contained in the relevant standards it is considered that the proposed facility, which would operate to support the National Grid during peak power demand periods predominantly between 07:30 and 20:30 hours, would be able to operate without adversely affecting nearby sensitive receptors in terms of acoustic impact.
- 5.3.2 During rare night-time emergency operations, the proposed facility would be able to operate without exceeding the internal guidance values for sleeping at any of the properties assessed subject to the assumptions made.

Glossary of Terminology

Noise is defined as unwanted sound. The range of audible sound is known to be from 0dB (threshold of hearing) to 140dB (threshold of pain). Examples of typical noise levels relating to 'everyday' occurrences are given in Table G-1 below.

Table G-1: Typical Noise Levels

Source	Sound Pressure Level in dB(A)	Subjective Level
Gun shot	160	Perforation of eardrum
Military Jet take-off	140	Threshold of pain
Jet Aircraft at 100m	120	Very Loud
Rock Concert, front seats	110	Threshold of Sensation
Pneumatic Drill at 5m	100	Very Loud
Heavy goods vehicle from pavement	90	
Traffic at kerb edge	70 – 85	Loud
Vacuum Cleaner, Hair Dryer	70	
Normal conversation at 1m	60	Moderate
Typical Office	50 – 60	
Residential area at night	40	Quiet
Rural area at night, still air	30	
Leaves Rustling	20	
Rubbing together of fingertips	10	
	0	Threshold of hearing

The frequency response of the human ear to noise is usually taken to be around 18Hz (number of oscillations per second) to 18,000Hz. However, the human ear does not respond equally to different frequencies at the same level; it is more sensitive in the mid-frequency range than lower and higher frequencies and, because of this, when undertaking the measurement of noise the low and high frequency components of any given sound are reduced in importance by applying a filtering (weighting) circuit to the noise measuring instrument. The weighting which is widely accepted to correlate best with the subjective nature of human response to noise and is most widely used to quantify this is the A-weighted filter set. This is an internationally accepted standard for noise measurement.

For variable noise sources within an area an increase of 3dB(A) would be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10dB(A) corresponds to a doubling or halving in perceived loudness. The 'loudness' of a noise is a purely subjective parameter, dependant not only upon the sound pressure of the event but also on the dynamics of the listener's ear, the time of the day and the general mood of the person.

With regard to environmental noise levels (in the open air), these are rarely steady but rise and fall according to the activities being undertaken within the surrounding area at any given time. In an attempt to produce a figure that relates this variable nature of noise to human subjective response, a number of statistical noise metrics have been developed. These and other useful terminology and descriptors are presented in Table G-2 below.

Table G-2: Terminology

Term	Definition
Sound	Pressure fluctuations in a fluid medium within the audible range of amplitudes and frequencies which stimulate the organs of hearing.
Noise	Unwanted sound emitted from a source and received by the sensitive receptor.
Decibel (dB)	Unit most often used to describe the sound pressure level. A logarithmic number, it correlates closely to the way in which humans perceive sound. Its wide range of values helps quantify sound pressures from a large variety of magnitudes.
A-Weighting (dB(A))	Human perception of sound is frequency dependant. A-weighting applies a range of corrections at each frequency to provide a 'human-averaged'. Can be frequency band or broadband values.
Frequency (Hz)	The number of cycles per second, for sound this is closely related (and often mistaken for) pitch.
Frequency Spectrum	A more detailed analysis of the frequency components that comprise a sound source.
L_{A10,T}	The 10 th statistical percentile of a measurement period, i.e. the level that is exceeded for 10% of the measurement duration. Closely correlates with traffic sources, A-weighted.
L_{A90,T}	The 90 th statistical percentile of a measurement period, i.e. the level that is exceeded for 90% of the measurement duration. Used to describe background sound levels, as this value is affected less by short, transient sound sources, A-weighted.
L_{Amax}	The root mean square (RMS) maximum sound pressure level within a measurement period, A-weighted.
Ambient Sound	The total sound climate of all sources incident at one location, both in the near- and far-field (<i>The ambient sound comprises the residual sound and the specific sound when present</i>).
Ambient Sound Level L_a = L_{Aeq,T}	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level L_{A90,T}	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

Term	Definition
Equivalent Continuous A-weighted Sound Pressure Level $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation: $L_{Aeq,T} = 10 \lg_{10} \left\{ \left(\frac{1}{T} \right) \int_{t_1}^{t_2} \left[p_A \frac{(t)^2}{p_0^2} \right] dt \right\}$ Where p_0 is the reference sound pressure (20μPA); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time t.
Measurement Time Interval T_m	Total time over which measurements are taken (<i>This may consist of the sum of a number of non-contiguous, short-term measurement time intervals</i>)
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound, over a period of time, T .
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (This is 1hr during the day from 07:00 to 23:00 hours and a shorter period of 15-min at night from 23:00 to 07:00 hours).
Residual Sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Residual sound level $L_r = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound in a given situation at the assessment location over a given time interval, T .
Sound Pressure Level	The level of fluctuation in air pressure, caused by airborne sound sources. Measured in Pascals (Pa).
Sound Power Level	The rate at which sound is radiated by a source. This parameter is useful as it describes sound energy before environmental or decay factors. Quantified in dB and notated usually as L_w or SWL.
Specific sound level $L_s = L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T .
Specific Sound Source	Sound source being assessed.

Statement of Uncertainty

This report is based upon a range of measurements, a system of calculations and noise predictions. As such, this report attempts to quantify fluctuations in air pressure and is subject to the effects of meteorology, physical and perceived anomalies, tolerances within the measuring and monitoring equipment and accuracy margins within the noise modelling software. In the interests of repeatability, this report must be considered as being affected by common factors involved in the measurement and calculation of noise propagation.

All measurement values, outcomes and assumptions are subject to a margin of uncertainty. This has been quantified and assessed as follows:

- Rounding errors – systemic tolerance of $\pm 1\text{dB}$;
- Type 1 sound level meter – operational tolerance of $\pm 1.1\text{dB}$;
- Meteorology – allowance of $\pm 1.9\text{dB}$; and
- CadnaA noise propagation modelling software – operational accuracy of $\pm 2.1\text{dB}$

The most influential uncertainty factors for the assessment of noise are deemed to be equipment tolerances, meteorology and software accuracy. A root-sum-square statistical average has been used to provide an overall margin of uncertainty of $\pm 3\text{dB}$.

Appendix A – Baseline Noise Survey Data

Table A-1: Location MP1, Mount Road (south)

Meter	01dB Solo			
Period start	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
26/09/2018 12:02	40.7	59.3	36.0	41.9
26/09/2018 12:17	46.8	69.4	35.7	42.5
26/09/2018 12:32	38.3	51.2	35.1	40.1
26/09/2018 12:47	39.7	55.6	35.1	41.5
Overall	42.8	69.4	35.5	41.5
26/09/2018 18:24	46.7	64.4	32.9	50.6
26/09/2018 18:39	36.1	51.8	33.0	38.0
Overall	44.1	64.4	33.0	44.3
27/09/2018 00:40	29.9	41.2	24.7	33.4
27/09/2018 00:55	31.6	50.4	24.9	32.8
Overall	30.8	50.4	24.8	33.1

Table A-2: Location MP2, Home Farm Court

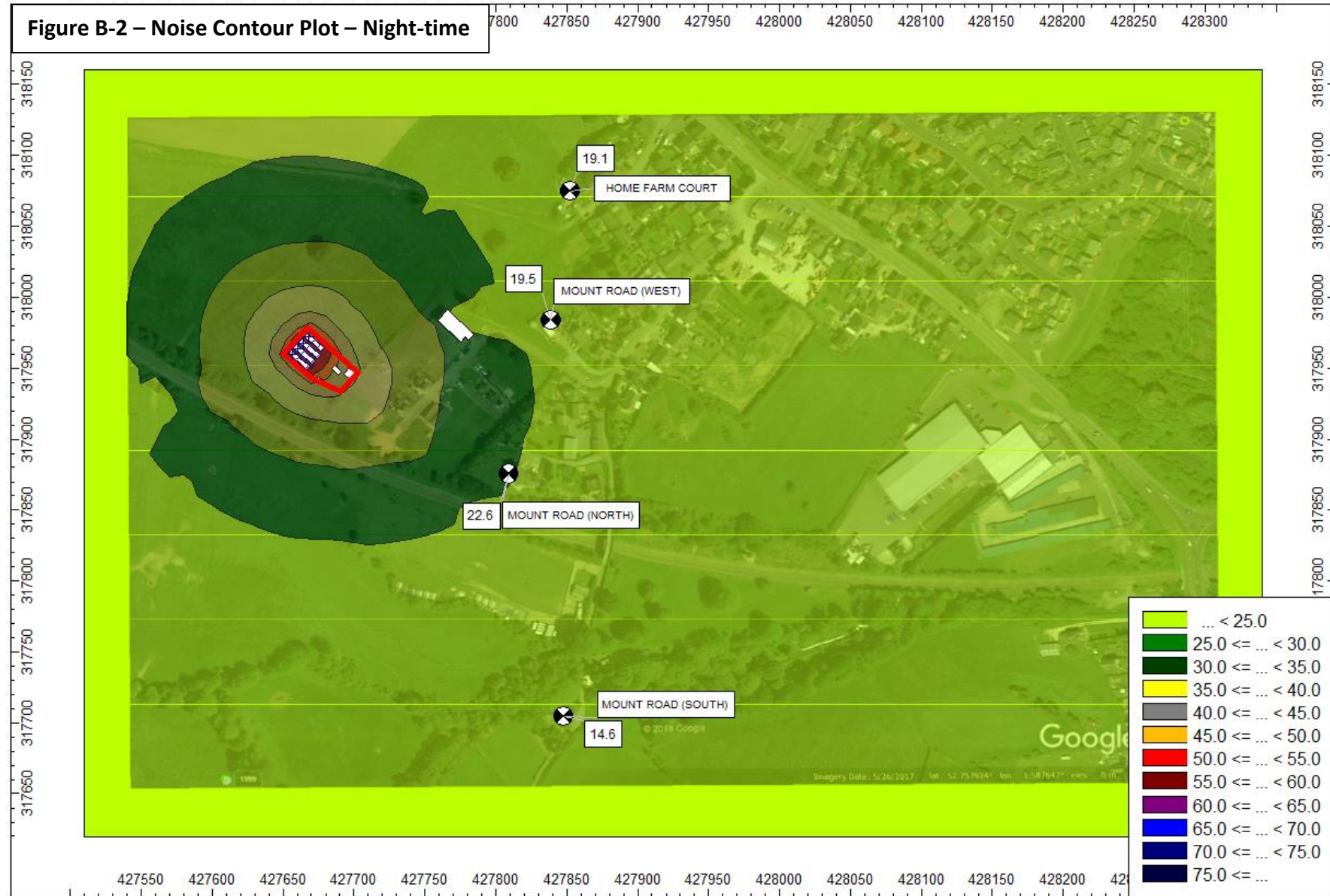
Meter	01dB Solo			
Period start	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
26/09/2018 19:04	45.3	57.3	38.9	48.3
26/09/2018 19:19	43.2	54.5	38.2	46.4
Overall	44.4	57.3	38.6	47.4
27/09/2018 01:17	35.5	54.8	25.7	37.0
27/09/2018 01:32	33.7	50.2	25.1	36.4
Overall	34.7	54.8	25.4	36.7

Table A-1: Location MP1, Location representative of Mount Road (north) and Mount Road (west)

Meter	01dB Solo			
Period start	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
26/09/2018 12:10	41.1	53.2	37.1	43.2
26/09/2018 12:25	53.3	70.2	37.6	51.7
26/09/2018 12:40	48.5	66.5	37.3	49.8
26/09/2018 12:55	51	70.7	37.2	53.4
Overall	50.2	70.7	37.3	49.5
26/09/2018 18:27	40.1	58.8	32.2	43.4
26/09/2018 18:42	43.4	63.8	34.3	44.6
Overall	42.1	63.8	33.3	44.0
27/09/2018 00:40	31.8	51.2	22.4	32.4
27/09/2018 00:55	33.1	54.1	23.4	34.1
Overall	32.5	54.1	22.9	33.3

Figure B-1 – Noise Contour Plot - Daytime







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