



Noise Assessment

Development of a Standby Power Generation Facility

Land at Burghfield Road, Burghfield, Reading

For:

Enso Energy Limited

CRM.348.004.NO.R.001

'Experience and expertise working in union'



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Noise Assessment for a 20MW Standby Power Generation Plant Burghfield Road, Burghfield, Reading

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Non-technical Summary

Enzygo Limited has been commissioned by Enso Energy Ltd to undertake a noise impact assessment to support a planning application for their proposed 20MW standby power generation facility on land off Burghfield Road, Burghfield, Reading.

The operating hours of the proposed facility would be generally limited to daytime hours during peak demand periods, likely to be between 07:00 and 11:00 hours and 15:00 and 20:00 hours. It is unlikely that operations would take place outside of these hours except in response to emergency situations.

The BS 4142 assessment has shown that the daytime predicted sound rating levels at Lea Close are slightly above the prevailing background noise level which is an indication that it is **less likely** that the specific sound would have an adverse impact. At this level the impact is considered between the **NOEL** and **LOAEL** thresholds. During the evening at Lea Close the sound rating level is below the prevailing background noise level which shows an indication of a **low** impact.

The predicted sound rating levels during the daytime and evening periods at Holybrook Farm is below the prevailing background noise level which shows an indication of a **low** impact and therefore falling into the **NOEL** threshold.

As BS 4142 is only to be applied to the assessment of external noise levels, a further assessment of predicted internal noise levels has been made against the guideline values for internal ambient noise levels in dwellings outlined in BS 8233, 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 slightly above the 30dB $L_{Aeq,8hr}$ noise level recommended and therefore falling into the **LOAEL** threshold. However, it should be noted that existing internal noise levels are already predicted to be above the recommended noise levels due to rail traffic movements.

It is considered that the proposed standby power generation facility, which would operate to support the National Grid during peak power demand periods, predominantly between 07:00 and 20:00 hours, would be able to operate without adversely affecting nearby receptors.

During rare night-time emergency operations, the standby power generation facility would be able to operate without exceeding the predicted internal noise levels already incident on the nearby properties.

1 Introduction

1.1 Project Introduction

- 1.1.1 Enzygo Limited (Enzygo) has been commissioned by Enso Energy Ltd (Enso) to undertake a noise assessment to support a planning application for their proposed 20MW standby power generation facility on land off Burghfield Road, Burghfield, Reading.
- 1.1.2 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 receptors close to the site.
- 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 standby power generation facility would be located on land to the west of Burghfield Road and south of the Reading to Plymouth/Taunton Line railway, adjacent to the existing substation. The site is centred at grid reference SU 68210 71256 approximately.
- 1.2.2 A review of available aerial imagery shows that the nearest noise sensitive receptors are located on Lea Close, approximately 140m to the north of the site boundary, and properties at Holybrook Farm, approximately 140m to the south of the site boundary.

1.3 Project Description

- 1.3.1 The standby power generation facility would produce 20MW of energy to support the National Grid when required to cope with short-term peak energy demand. The generator compound would contain the following equipment:
 - 16no. Jenbacher J420 generators installed in purpose built acoustic container enclosures;
 - 4no. transformers;
 - Switchgear cabin;
 - DNO control room; and
 - Gas governor.
- 1.3.2 The manufacturers noise data for the generators and transformers has been used to assess the potential noise effects of the facility at the nearest noise sensitive receptors. The site location is shown in Figure 1-1 overleaf.

Figure 1-1: Site Location



(Image Source: ©Google)

1.4 Operational Hours

- 1.4.1 The operating hours of the proposed facility would be generally limited to daytime hours during peak demand periods, with these likely to be between 07:00 and 11:00 hours and 15:00 and 20:00 hours. It is unlikely that operations would take place outside of these hours except in response to emergency situations.

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*' (BS 4142), British Standard 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' (BS 8233) and the World Health Organisation guidance document '*Guidelines for Community Noise*' (WHO Guidelines) where appropriate.
- 1.5.2 Noise levels generated by the facility 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 9613-2) using the proprietary noise modelling software SoundPLAN.
- 1.5.3 The predicted noise levels have been used to determine the potential impact at the nearby residential receptors using the guidance contained in BS 4142. Reference has also been made to the guidance levels for internal resting and sleeping during the night in accordance with the guidance contained in BS 8233.
- 1.5.4 Where considered necessary and appropriate, outline mitigation measures have been suggested to ensure that noise levels generated by the proposed development have a minimum impact upon the nearby receptors.

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 below.

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 BS 4142 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 BS 4142 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: BS 4142 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 BS 8233 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: BS 8233 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 ISO 9613 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 ISO 9613-2. 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 Thursday 5th and Friday 6th April 2018 to gather background and ambient noise levels at a location representative of the nearest residential receptor locations to the application 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 BS 4142.
- 3.1.3 The monitoring location is shown in Figure 3-1 below. Due acoustic interference from a nearby construction site, the monitoring location at Holybrook Farm was revised slightly from that used during the daytime.

Table 3-1: Noise Monitoring Location

Location Reference	Period	Grid Ref (NGR)
MP1 – to the south of Lea Close	Day/Night	468121, 171400
MP2 - Holybrook Farm	Day	468181, 171109
	Night	468169, 171045

- 3.1.4 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

Equipment Description	Serial Number	Calibration Date
NTi XLA-TA Class 1 sound level meter	A2A-09328-E0	07/08/2017
Larson Davis CAL200 sound calibrator	13872	16/03/2018

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

Time Weighting: Fast

Frequency Weighting: "A"

- 3.1.2 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)

3.2 Weather

- 3.2.1 Weather conditions during the daytime were suitable for environmental noise monitoring. It was fine, dry and sunny with approximately 15% cloud cover. Temperatures were around 10°C throughout with very low wind speeds between 0 and 1ms⁻¹.
- 3.2.2 During the evening measurement period it remained overcast and dry with 100% cloud cover. Temperatures were around 11°C with wind speeds below 1ms⁻¹.
- 3.2.3 During the night-time measurement period it was fine and dry with approximately 25% cloud cover. The temperature was around 5°C throughout with windspeeds below 1ms⁻¹.

3.3 Survey Results

- 3.3.1 The results of the baseline surveys are summarised in Table 3-4 and can be found in full in Appendix A. Table 3-5 shows that average baseline noise levels of the entire measurement period and Table 3-6 shows the average baseline noise level over the expected operational periods.

Table 3-4: Summary of Baseline Survey Results, dB

Location	Period	L _{Aeq,T}	L _{Amax}	L _{A90}	L _{A10}
MP1 – Lea Close	Day	56.6	77.5	43.8	57.7
	Evening	61.5	81.6	50.0	59.9
	Night	53.3	75.9	43.1	46.4
MP2 – Holybrook Farm	Day	54.1	72.3	46.8	57.0
	Evening	54.3	69.8	49.7	56.8
	Night	48.1	63.2	42.9	48.9

3.4 Subjective Field Monitoring Notes

- 3.4.1 The daytime noise climate at both locations comprised constant birdsong, distant road traffic, passenger and freight trains, aircraft and distant dogs barking. At Holybrook Farm there was some contribution from mechanical construction equipment adjacent to the railway bridge and bird noise from the on-site aviary.
- 3.4.2 The evening noise climate at MP1 comprised constant birdsong, distant road traffic, passenger and freight trains, aircraft and natural sounds such as dogs barking, ducks and cow bellowing.
- 3.4.3 The evening noise climate at MP2 comprised mechanical construction plant adjacent to the railway bridge, bird noise from the on-site aviary, ducks quacking, cows bellowing, road traffic and a single train.
- 3.4.4 The night-time noise climate at MP1 comprised road traffic, distant construction site noise (generators powering lights), a single freight train, cows bellowing and ducks quacking.
- 3.4.5 The night-time noise climate at MP2 (adjusted position) included distant generator noise, road and rail traffic and cows bellowing.

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 standby power generation plant at the nearest residential receptors.
- 4.1.2 The predictions have been made using the calculation methodology outlined in ISO 9613 and the assessment of potential noise impacts has been undertaken in accordance with BS 4142 and BS 8233. 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 BS 4142 and BS 8233, the following thresholds are proposed.

Table 4-1: Effect Levels relating to BS 4142 Impact

Threshold	BS4142:2014 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 BS 8233 Guidance

Threshold	BS8233:2014 assessment of impacts
NOEL	Internal noise level below the guideline level
LOAEL	Internal noise levels at the guideline level
SOAEL	Internal noise levels above the guideline level

4.2 Noise Emissions

- 4.2.1 The proposed facility would comprise 16no. Jenbacher J420 generators installed within acoustically-treated containers, with roof-mounted exhaust silencers and dry coolers, and 4no. transformers. The noise emission data for the acoustic container and coolers are shown in Table 4-3. The noise emission levels from the exhaust outlet would be attenuated through exhaust silencers to 75dB L_{pA} when measured at 1m and the sound emission of the transformers are based on a level of 67dB L_{WA} .
- 4.2.2 The proposed facility would also include ancillary items such as a switch room and gas governor. No significant noise emissions are expected from these plant items and therefore are not included within the following assessment.
- 4.2.3 The design layout of the proposed facility includes the installation of a 4m high acoustic barrier surrounding the plant. The proposed layout is shown in Figure 4-1.

Figure 4-1: Proposed Site Layout

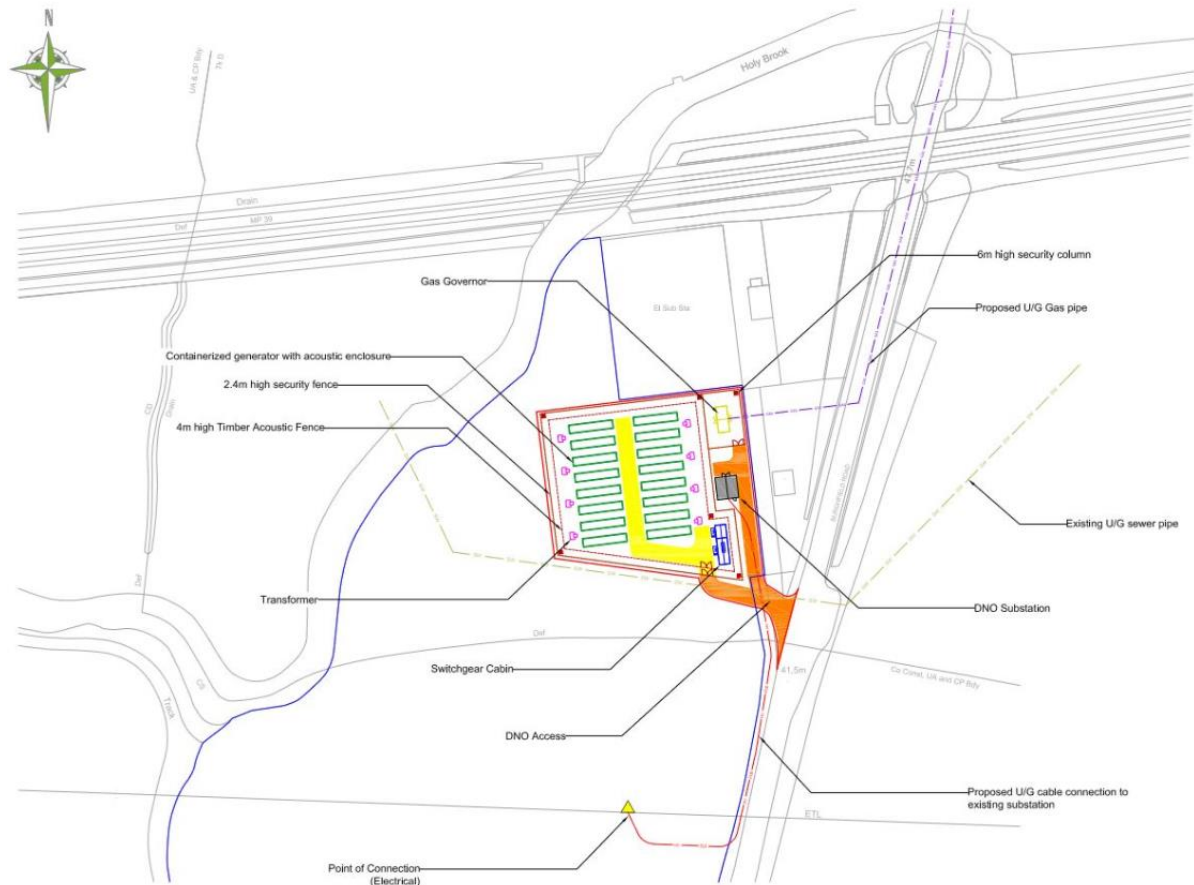


Table 4-3: Noise Source Data

Plant Noise Source	Sound Power Level, dB L _{WA}								Total
	63	125	250	500	1k	2k	4k	8k	
Containerised Generators	54.8	71.9	71.4	64.8	54.0	51.2	58.0	52.9	75.3
Radiators	26.8	36.9	44.4	45.8	47.0	45.2	38.0	34.9	52.1

4.3 Noise Modelling Protocols

- 4.3.1 The noise model was constructed using the proprietary noise modelling software package SoundPLAN v8.0. The potential noise impacts at the nearby residential properties have been predicted using the calculation methodology outlined in ISO 9613.
- 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 Power Level, dB L _{WA}	Emission height, m
Jenbacher J420 Containerised Generators	75.3	2.9
Container roof mounted Radiators	52.1	2.0
Jenbacher J420 Exhaust Outlet	83.0	7.0
Transformers	67.0	1.0

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;
- 90% soft ground between the sources and receptors (inputted as an average 0.9 α ground absorption coefficient); and
- Ground floor receivers at 1.5m AOD and first floor receivers at 4.0m AOD.

4.5 Predicted Sound Levels

4.5.1 Noise levels generated by the proposed standby power generation facility have been predicted to the site facing façade of the nearest residential properties shown in Table 4-5. The predictions are made to heights of 1.5m and 4m to represent a ground and first floor window respectively.

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

Location	Period (Location)	Specific Sound Level dB L _{Aeq,1hr}
Residential Receptors on Lea Close	Day (ground floor)	46.4
	Night (first floor)	46.8
Residential Properties at Holybrook Farm	Day (ground floor)	43.8
	Night (first floor)	44.4

4.6 Sound Rating Level

4.6.1 In accordance with the guidance contained in BS 4142 the specific sound level has been corrected for tonal, impulsive, intermittent or other acoustic characteristics which may be present at the receptor to determine the sound rating level.

4.6.2 Within the context of the prevailing noise climate, i.e. contributions from road traffic and rail traffic, it is considered that any tonal, impulsive or intermittent content of the noise sources within the proposed facility would not be distinguishable from those produced by existing

noise sources in the area, therefore no corrections are considered necessary for daytime operations.

- 4.6.3 During the night, on the rare occasions that the plant may operate, the noise source may have a just audible tonal content at the nearest receptor. However, as the sound source would be constant throughout its operation there would not be any impulsive or intermittent content. Therefore, a correction of +2dB has been applied.
- 4.6.4 It is noted that BS 4142 assessments are undertaken using whole dB values with 0.5dB being rounded up. Table 4-6 details the derived sound rating levels.

Table 4-6: Sound Rating Levels

Location	Period	Specific Sound Level dB $L_{Aeq,T}$	Penalties Applied, dB	Sound Rating Level dB $L_{Ar,T}$
Lea Close	Day/Evening	46	0	46
	Night	47	+2	49
Holybrook Farm	Day/Evening	44	0	44
	Night	44	+2	46

4.7 BS 4142 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 receptor upon the prevailing background noise levels. Table 4-7 details the results of the assessment.

Table 4-7: BS 4142 Assessment – Background Noise Levels

Location	Period	Background Noise Level dB L_{A90}	Sound Rating Level dB $L_{Ar,T}$	Level Exceeding Background dB
Lea Close	Day	44	46	+2
	Evening	50		-4
	Night	43	49	+6
Holybrook Farm	Day	47	44	-3
	Evening	50		-6
	Night	43	46	+3

- 4.7.2 Table 4-7 shows that the predicted sound rating levels during the daytime at Lea Close would be just 2dB above the prevailing background noise level. At this level it is **less likely** that the specific sound would have an adverse impact, according to BS 4142.
- 4.7.3 During the evening at Lea Close the sound rating level is below the prevailing background noise level which shows an indication of a **low** impact.
- 4.7.4 Overnight, should an emergency arise, the predicted sound rating level would be 6dB above the prevailing background noise level indicating a likely adverse impact. This is subject to the context of the prevailing acoustic environment at the site.

- 4.7.1 Table 4-7 also shows that the predicted sound rating levels during the daytime and evening periods at Holybrook Farm is below the prevailing background noise level which shows an indication of a **low** impact. Overnight, should an emergency arise, the predicted sound rating level would be 3dB above the prevailing background noise level which is between a level indicating a low impact and a level indicating a likely adverse impact. Again, subject to the context of the prevailing acoustic environment at the site.
- 4.7.2 The context in this instance is that the facility would generally only operate during the daytime for approximately 2000 hours per year. It is unlikely that the facility would operate at night except during rare emergency situations. During the night-time period occupiers of the properties are unlikely to be outdoors. Existing ambient noise levels at the properties are already well in excess of the background noise levels due to road and rail traffic in the area and predicted specific sound levels from the site would be well below these existing ambient noise levels.

4.8 BS 8233 Indoor Noise Level Assessment

- 4.8.1 It should be noted that BS 4142 is only applicable to the assessment of external noise levels, a further assessment of predicted internal noise levels has been made against the guideline values for internal ambient noise levels in dwellings outlined in BS 8233, specifically those relating to sleeping in bedrooms.
- 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: BS 8233 Assessment - Residential

Location	Period	Predicted Internal Noise Level L_{Aeq} dB	Guideline Value for Night-time Sleeping	Difference
Lea Close	Night	34	30	+4
Holybrook Farm		31		+1

- 4.8.3 Table 4-8 shows that the predicted internal noise levels, generated by rare emergency operations at the proposed facility, at the nearest residential receptors would be slightly above the guideline values for night-time sleeping conditions within bedrooms.
- 4.8.4 However, it should be noted that existing night-time noise levels, generated mainly by road and passenger/freight train traffic nearby, are already above the internal guideline values (38dB and 33dB respectively). It is considered the noise levels generated by the development would not be sufficient to cause night-time noise levels to increase at either location.

4.9 WHO Guidance Assessment

- 4.9.1 The guidance contained in the WHO document *Guidelines for Community Noise* reflects the guidance outlined in BS 8233, or vice versa, with respect to internal noise levels at night and it has already been shown that the predicted internal noise levels from the proposed development would exceed the BS 8233 guidance levels during emergency operation of the generator plant operates at night.

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 and 4-2.

4.10.2 The BS 4142 assessment has shown that:

- During the daytime at Lea Close the predicted sound rating level would be slightly above the background noise level indicating that it is less likely that there would be an adverse impact with the noise impact falling between the **NOEL and LOAEL** thresholds;
- During the daytime at Holybrook Farm the predicted sound rating level would be below the background noise level showing an indication of a low impact and therefore falling into the **NOEL** threshold;
- During the evening at both location the predicted sound rating level would be below the background noise level showing an indication of a low impact and therefore falling into the **NOEL** threshold; and

4.10.3 The BS 8233 assessment for the residential properties has shown that predicted internal noise levels at night would be slightly above the guideline values for resting and/or sleeping conditions and therefore fall into the **LOAEL** threshold. It should be noted however that existing ambient noise levels at night already exceed the guidance due to passing road and rail traffic. It is considered that noise levels generated by the development would not be sufficient to cause night-time noise levels to increase at either location.

5 Conclusion

5.1 Background

- 5.1.1 Enzygo Limited has been commissioned by Enso Energy Ltd to undertake a noise assessment to support a planning application for their proposed 20MW standby power generation facility on land off Burghfield Road, Burghfield, Reading.
- 5.1.1 The assessment has been undertaken to assess compliance with the relevant standards at the nearest noise sensitive receptor during the proposed operational hours of the equipment and to provide outline mitigation advice where considered necessary.
- 5.1.2 The assessment is based on the results of a series of noise predictions undertaken in accordance with the calculation methodology contained in ISO 9613 '*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 SoundPLAN v8.0 and an assessment made in line with BS 4142, BS 8233 and WHO guidelines and the noise exposure hierarchy described in the planning practice guidance.
- 5.2.2 A site visit has been made to establish background noise levels at a location representative of the nearby noise-sensitive receptors.
- 5.2.3 The BS 4142 assessment has shown that the daytime predicted sound rating levels at Lea Close are slightly above the prevailing background noise level which is an indication that it is **less likely** that the specific sound would have an adverse impact. At this level the impact is considered between the **NOEL** and **LOAEL** thresholds. During the evening at Lea Close the sound rating level is below the prevailing background noise level which shows an indication of a **low** impact.
- 5.2.4 The predicted sound rating levels during the daytime and evening periods at Holybrook Farm is below the prevailing background noise level which shows an indication of a **low** impact and therefore falling into the **NOEL** threshold.
- 5.2.5 As BS 4142 is only to be applied to the assessment of external noise levels, a further assessment of predicted internal noise levels has been made against the guideline values for internal ambient noise levels in dwellings outlined in BS 8233, 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 slightly above the 30dB LAeq,8hr noise level recommended and therefore falling into the LOAEL threshold. However, it should be noted that existing internal noise levels are already predicted to be above the recommended noise levels due to rail traffic movements. It is considered that noise levels generated by the development would not be sufficient to cause night-time noise levels to increase at either location.

5.3 General Conclusion

- 5.3.1 It is considered that the proposed standby power generation facility, which would operate to support the National Grid during peak power demand periods, predominantly between 07:00 and 20:00 hours, would be able to operate without adversely affecting nearby receptors.

- 5.3.2 During rare night-time emergency operations, the standby power generation facility would be able to operate without exceeding the predicted internal noise levels already incident on the nearby properties.

5.4 Uncertainty Statement

- 5.4.1 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.
- 5.4.2 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
 - SoundPLAN v7.4 noise propagation modelling software – operational accuracy of $\pm 2.1\text{dB}$
- 5.4.3 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 $\pm 3\text{dB}$.

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.
Equivalent Continuous A-	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-

Term	Definition
weighted Sound Pressure Level $L_{Aeq,T}$	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.

Table A-1: Location MP1, Lea Close, Daytime Noise Data

Meter	NTi XL2 – A2A-09328-E0			
Start	05/04/2018 12:57			
End	05/04/2018 14:16			
Weighting	A			
Data type	dB			
Unit	L _{Aeq}			
Period start	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
05/04/2018 12:57	77.5	57.9	42.4	58.5
05/04/2018 13:12	75.8	59.1	44.0	61.0
05/04/2018 13:46	74.2	54.0	43.8	56.8
05/04/2018 14:01	71.7	51.8	44.9	54.6
Overall	77.5	56.6	43.8	57.7

Table A-2: Location MP1, Lea Close, Evening Noise Data

Meter	NTi XL2 – A2A-09328-E0			
Start	05/04/2018 18:38			
End	05/04/2018 19:08			
Weighting	A			
Data type	dB			
Unit	L _{Aeq}			
Period start	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
05/04/2018 18:38	81.6	63.6	50.0	60.0
05/04/2018 18:53	74.9	57.5	50.0	59.7
Overall	81.6	61.5	50.0	59.9

Table A-3: Location MP1, Lea Close, Night-time Noise Data

Meter	NTi XL2 – A2A-09328-E0			
Start	06/04/2018 01:02			
End	06/04/2018 01:32			
Weighting	A			
Data type	dB			
Unit	L _{Aeq}			
Period start	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
06/04/2018 01:02	75.9	56.0	43.3	47.1
06/04/2018 01:17	50.6	44.3	42.9	45.7
Overall	75.9	53.3	43.1	46.4

Table A-4: Location MP2, Holybrook Farm, Daytime Noise Data

Meter	NTi XL2 – A2A-09328-E0			
Start	05/04/2018 14:38			
End	05/04/2018 15:56			
Weighting	A			
Data type	dB			
Unit	L _{Aeq}			
Period start	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
05/04/2018 14:38	72.3	55.7	46.6	58.7
05/04/2018 14:53	71.7	52.4	45.7	55.2
05/04/2018 15:26	71.0	53.8	47.3	56.9
05/04/2018 15:41	68.0	54.0	47.4	57.2
Overall	72.3	54.1	46.8	57.0

Table A-5: Location MP2, Holybrook Farm, Evening Noise Data

Meter	NTi XL2 – A2A-09328-E0			
Start	05/04/2018 19:26			
End	05/04/2018 19:56			
Weighting	A			
Data type	dB			
Unit	L _{Aeq}			
Period start	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
05/04/2018 19:26	63.1	53.3	49.0	56.0
05/04/2018 19:41	69.8	55.1	50.3	57.6
Overall	69.8	54.3	49.7	56.8

Table A-6: Location MP2, Holybrook Farm, Night-time Noise Data

Meter	NTi XL2 – A2A-09328-E0			
Start	06/04/2018 01:57			
End	06/04/2018 02:27			
Weighting	A			
Data type	dB			
Unit	L _{Aeq}			
Period start	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
06/04/2018 01:57	62.7	46.1	42.8	47.0
06/04/2018 02:12	63.2	49.4	43.0	50.7
Overall	63.2	48.1	42.9	48.9



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