

NOISE IMPACT ASSESSMENT REPORT

PROPOSED PEAKING POWER PLANT FACILITY, LLAY ROAD, WREXHAM, LL12 0PQ

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This report has been prepared based upon a scope of works and associated resources agreed between the client and Philip Dunbavin Acoustics Ltd (PDA). This report has been prepared with all reasonable skill, care and diligence and has been based upon the interpretation of data collected. This has been accepted in good faith as being accurate and valid at the time of the collection. This report has been based solely on the specific design assumptions and criteria stated herein.



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1.0 SUMMARY

At the request of Biogas Technology Ltd a noise impact assessment has been undertaken for the proposed Peaking Power Facility located at land off Llay Road, Llay Industrial Estate in Wrexham.

We have been informed the site recently had planning consent for three 1MW generators venting mine gas however there are now proposals to replace them with a peaking power plant. The original planning consent has a planning condition relating to noise stating the rating level of noise generated by the development should not exceed pre-existing background noise levels determined to be 35dBA between 19:30 and 07:00 hours and 50 dBA between 07:00 and 19:30 hours at the nearest residential receivers. An assessment has therefore been carried out to determine whether the noise limits for the new plant and equipment can be achieved.

The proposed site will consist of 1 no. 2MW gas engine and 1 no. 1.5MW gas powered engine with associated auxiliary plant, resulting in a total output of 3.5MW. It is understood that proposed plant could be required to operate during the daytime (0700 – 2300) and potentially very infrequently during the night time (2300 – 0700) periods. The gas-powered engines would only operate at certain times when the National Grid requires reserve power with historical data suggesting peak times during the afternoon/early evening period (1600 – 1800).

Based upon manufacturer's noise level data and proposed plan drawings, a 3-dimensional noise model has been created using Soundplan noise modelling software. The noise propagation from the proposed gas engine site to the nearby dwellings has been predicted and an assessment has been undertaken in accordance with BS 4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'.

The results of these calculations have indicated that the rating level generated with all plant operating is 29dB L_{Ar} at the nearest noise sensitive property which does not exceed the lowest representative background noise limit which was 35dBA and therefore demonstrates compliance with the previous planning condition noise levels.

In addition it is noted that the assessment results indicate the rating level is -6dB below the background and therefore in accordance with BS4142 is below the level considered to be an adverse impact. Therefore based upon the estimated noise emissions provided within this report we would consider that the noise emissions from the new plant would not result in an adverse impact on the surrounding residential receivers.

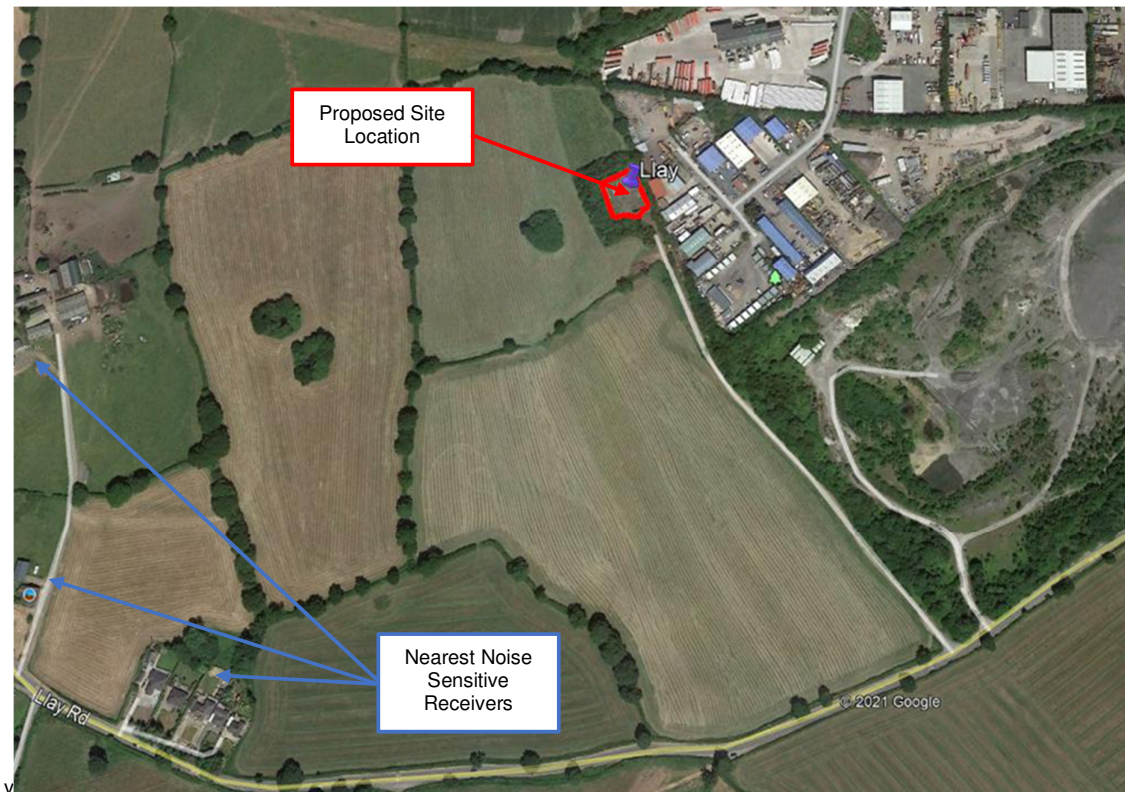
2.0 INTRODUCTION

The proposed development site is located at land off Llay Road, Llay Industrial Estate in Wrexham, LL12 0PQ.

The immediate local area consists mainly of open farmland to the north, south and west. Llay Industrial Estate bounds the eastern boundary of the proposed development site. Llay Road runs approximately 420m to the south of the proposed site boundary. The nearest residential receivers are located on Llay Road some 480m to the south of the proposed development site.

The proposed site layout showing the location of the site and surrounding local area including the closest residential receivers are shown in Figure 1 below.

Figure 1. Proposed Site Location (Site shown in red) with Nearest Residential Receivers



3.0 NOISE ASSESSMENT CRITERIA

3.1 Planning Condition 3

The original planning consent which dates back to 2003 has a planning condition relating to noise. Based upon the information provided within the Planning Permission (ref: LLA P/2002/0985 – Dated January 2003) states the following with respect to noise:

3. The rating level of noise generated by the development hereby permitted shall not exceed:

i) - Between 0700 and 1930 hours the pre-existing background level determined to be 50 dB(A), and

ii) - Between 1930 hours and 0700 hours the pre-existing background level, determined to be 35 dB(A),

as measured at the nearest noise sensitive premises, including Gwastad Farm house, Bryn Eurn and Manor View. measurements of noise levels and assessments of rating levels shall be made in accordance with BS 4142: 1 190 "Method of Rating Industrial Noise Affecting Mixed Residential and industrial Areas".

3.2 National Planning Policy Framework (NPPF)

National Planning Policy is guided by the National Planning Policy Framework (NPPF) updated in June 2019. With regard to Noise the Framework states the following;

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

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

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

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

The terms 'significant adverse impact' and 'adverse impact' are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE)' which states;

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The notes also offer an explanation of the term 'other adverse impacts' as follows;

... refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

It should be noted that no specific noise limits for LOAEL and SOAEL have yet been specifically defined; however guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework.

3.3 BS4142:2014

The effect of plant noise emissions on the nearest noise sensitive residences can be assessed in accordance with BS4142:2014 – 'Methods for rating and assessing industrial and commercial sound'.

The standard describes a method of determining the level of a noise of commercial or industrial nature, together with procedures for assessing the impact of such a noise outside nearby noise sensitive areas.

The standard provides a procedure for comparing the noise from commercial sources with background noise levels in the absence of the commercial noise and determining the likely impact of the noise on noise sensitive areas.

In accordance with BS 4142 the background noise level is the typical A-weighted sound pressure level at the assessment position that is exceeded for 90% of a given time interval (L_{A90}). The specific noise level is the equivalent continuous (L_{Aeq}) sound pressure level at the assessment position produced by the noise source over a given time interval.

Certain acoustic features can increase the impact over that expected from a simple comparison between the specific noise level and the background level. Where such features are present, these are considered by adding corrections to the specific noise level.

The corrections are applied based on whether the following features occur, or are expected to be present. The correction values can either be determined subjectively, or by various objective measurement procedures.

- The noise contains a distinguishable, discrete, continuous tone (whine, hiss, screech, hum, etc.).
0 – 6 dB penalty
- The noise contains distinct impulses (bangs, clicks, clatters, or thumps).
0 – 9 dB penalty.
- The noise is irregular enough to attract attention. 0 – 3 dB penalty.
- Other features. 0 – 3 dB penalty.

From the addition of the above penalties where appropriate the rating level is established, this being the value that is compared with the background noise.

According to BS 4142 an initial estimate of the impact is given for a rating level of:

- 10 dB(A) or more above the background is an indication of significant adverse impact, depending on the context.

- 5 dB(A) above the background is an indication of an adverse impact, depending on the context.
- where the rating level does not exceed the background level, this is an indication of the specific sound source having a low impact, depending on the context.

The above initial assessment may then be modified depending on the context to take into account;

- The absolute level of the sound.
- The character and level of the residual sound compared to the character and level of the specific sound.
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:
 1. Façade insulation treatment
 2. Ventilation and / or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
 3. Acoustic screening

3.4 BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

British Standard 8233:2014, *Guidance on Sound Insulation and noise reduction for buildings*, gives guidance on internal noise levels within dwellings, flats and rooms in residential use when unoccupied. The following criteria are for Living and Dining Rooms for daytime use and Bedrooms for night time.

Table 1. BS8233 recommended indoor ambient noise levels

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 L _{Aeq,16hour}	—
Dining	Dining room/area	40 L _{Aeq,16hour}	—
Sleeping (daytime resting)	Bedrooms	35 L _{Aeq,16hour}	30 L _{Aeq,8hour}

It should however be stressed that the above criterion relates to steady noise, in this case from road traffic etc., excluding unusual noise events departing from the typical noise character of the area.

3.5 WHO Guidelines for Community Noise

In 1999, the WHO (World Health Organisation) published Guidelines for Community Noise, stating the following internal noise levels are applicable to dwellings.

Table 2. WHO Guidelines for Community Noise criteria

Specific Environment	Critical Health Effect(s)	L _{Aeq} dB	Time Base (hours)*
Outdoor living area	Serious annoyance, daytime and evening	55	16
	Moderate annoyance, daytime and evening	50	16
Outside Bedrooms	Sleep disturbance, window open (outdoor values) night time	45	8

* Typically taken to be daytime/evening - 07:00 – 23:00 hours, and night time 23:00 – 07:00 hours.

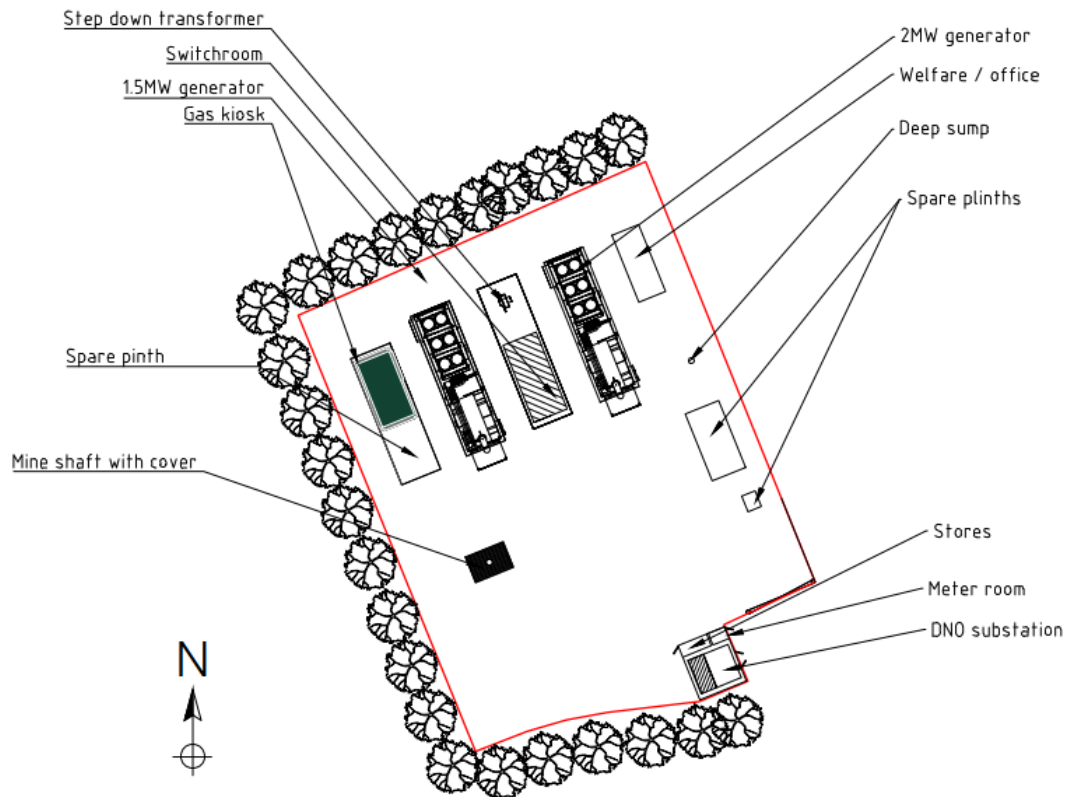
WHO guidelines state, 'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}.'

4.0 NOISE EGRESS ASSESSMENT

4.1 Proposed Plant

It is understood that the proposal is to install 1 no. 2MW gas engine and 1 no. 1.5MW gas engine on the site along with associated transformer and auxiliary equipment.

Figure 2. Phase proposed site plan drawing extract



Based on historical data of peaking power plants it has been assumed the gas engines will operate continuously for up to 2 hours in the daytime with the transformer assumed to be operational for 24 hours a day.

It is understood the gas-powered engines will operate within sound insulated containers. Based upon the manufacturers commitment that the containers will reduce sound pressure levels to 75 dB(A) at 1 metre and based upon the dimensions of the containers being (side facades (12.2m × 3.2m) 93 dBA SWL, Short facade (3m × 3.2m) 88 dBA SWL, Roof, (12.2m × 3m) 94 dB SWL) the total sound power level (SWL) of the enclosed engines has been calculated at 99 SWL. The single figure sound power level has been used for input into the noise model and adjusting the frequency spectra from previously obtained noise data for a containerised gas engine.

We understand there will be a cooling fan / radiator located on the top of each container. Based upon the manufacturers commitment that the cooling fans / radiators will reduce sound pressure levels to 75 dB(A) at 1 metre the cooling fans will have a sound power level of 83 SWL. The single figure sound power level has been used for input into the noise model and adjusting the frequency spectra from previously obtained noise data for cooling fans.

It is understood there will be an exhaust stack located above each container at a height of 10m above ground level. Based upon the manufacturers commitment that the exhaust will reduce sound pressure levels to 75 dB(A) at 1 metre the exhaust will have a sound power level of 83 SWL. The single figure sound power level has been used for input into the noise model and adjusting the frequency spectra from previously obtained noise data for an exhaust stack.

The Compound General Arrangement Plan indicates there will be a step down transformer and a Gas Kiosk. We have not been provided with noise data for this plant and have therefore used noise data from previous schemes. The sound power noise levels for all plant in the table below have been used for input into the noise model

Table 3. Sound Power Noise level spectra of above for input into noise model

Element	Sound Power Level dBA, Octave Band Centre Frequency Hz								dBA
	63	125	250	500	1k	2k	4k	8k	
Enclosed Engine	93	99	97	91	91	90	92	93	99
Radiator	63	70	75	78	79	78	72	65	83
Exhaust	74	93	90	31	40	41	39	29	83
Transformer	77	79	74	74	68	63	58	51	74
Gas Kiosk	55	57	60	73	68	72	80	78	83

Based upon previously obtained third octave band data for the plant items above there is no indication that the plant will emit any potential noise with high tonal components.

4.2 Calculated Plant Noise Levels – Residential Receivers

A 3-dimensional noise model has been created using Soundplan noise modelling software. The model is based upon the proposed site plan drawings [BN004-0-Llay-004] and [BN004-0-Llay-001] dated June 2021 provided by Biogas Technology Ltd.

The software uses the method of ISO 9613 'Acoustics – attenuation of sound during propagation outdoors – general method of calculation' and takes into account geometric spreading, ground effects, air attenuation, barrier attenuation and reflections. A ground absorption coefficient of 1 has been used representative of the the intervening ground between the proposed site and the receivers which is soft (open farmland, fields, grass, etc). The gas powered engines are modelled as point sources with the exhausts at a height of 10m, the containers at a height of 1.5m, the cooling fans at a height of 3m, the transformer at a height of 1.5m and the Gas Kiosk at a height of 1.2m. The sound power levels and frequency spectra are as detailed in Section 4.1. It is assumed that all units will be operating continuously and simultaneously.

The Soundplan model would suggest the following noise levels calculated at the closest existing noise sensitive receivers. For other receivers further away a lower noise level would be experienced due to greater distance attenuation provided. Noise levels are calculated at 1.5m for the ground floor level and an additional 2.5m where a first floor is occupied. Note the receivers located directly on Llay Road are bungalows and therefore have been calculated at ground floor level only. As a worst case assessment the properties boundary walls/fences have not been included within the calculations. Only the highest calculated noise level has been reported in the table below, calculated at either ground or first floor level.

Table 4. Calculated noise levels at worst case noise sensitive receiver

Location	Calculated noise level, dBA (All plant operating)
Worst Case Residential Receiver	29

Figure 3. Calculated noise levels at residential receivers



Therefore based upon the above calculation the worst case noise level will be 29dB(A) at the nearest residential receivers.

4.3 Initial BS4142 Assessment

Using the predicted noise levels detailed within Section 4.2 and the most stringent pre-existing background noise level indicated in the previous planning condition detailed within Section 3.1 we have compared the noise level with the requirements detailed within BS 4142:2014+A1:2019 "Methods for rating and assessing industrial and commercial sound".

Table 5. Comparison of Proposed Operations with Proposed Worst Case Noise Limit

Location	Predicted Specific Sound Level $L_{Aeq,T}$ (dB)	Rating Level L_{Ar} (dB) ¹	Planning Condition Worst Case Noise limit Background level (dB)	Difference between Rating Level and Background (dB)
Worst Case Residential Receiver	29	29	35	-6

Notes:

- 1 Based upon manufacturers supplied third octave band data for similar engine models there is no indication that the proposed plant will emit any tonal component. In addition, the specific noise level is below the background sound level and would likely be below the existing ambient sound climate. We would therefore consider that it is likely that the perceptibility of any potential tonal element will be further reduced due to masking noise provided by the existing noise climate. It is considered that the specific sound will not be characterised as impulsive and will not have any intermittency that will be readily distinctive against the residual acoustic environment. We would therefore consider that it would not be appropriate to apply penalties for potential acoustic features



It is noted that BS4142 indicates the following:

10 dB(A) or more above the background is an indication of significant adverse impact, depending on the context.

5 dB(A) above the background is an indication of an adverse impact, depending on the context.

Where the rating level does not exceed the background level, this is an indication of the specific sound source having a low impact, depending on the context.

The results of these calculations have indicated that the rating level generated with all plant operating is 29dB L_{Ar} at the nearest noise sensitive property which does not exceed the lowest representative background noise limit which was 35dBA and therefore demonstrates compliance with the previous planning condition noise levels.

As the assessment has indicated that the Rating Level is 6dB below the lowest representative Background Sound Level detailed within the previous Planning Condition 3, in accordance with BS4142:2014 an initial assessment estimate impact would indicate that the specific sound will be below a level that is considered to be an adverse impact and will have a low impact.

It should be noted however that that in accordance with BS4142:2014 this initial impact will need to be modified to account for context of the site. This is further discussed within Section 5.0.

4.4 Noise Impact Assessment – Absolute Levels

If comparison is made with the predicted specific noise levels described within Section 8.1 it can be seen that the predicted noise from the proposed scheme will be below the 50dB L_{Aeq} WHO guidance for the onset of moderate annoyance during the daytime.

With regards to the worst case noise limit period the rating noise level at the facade of the most noise sensitive dwelling was predicted to be 29 dB L_{Aeq} with all plant operational. Taking into account a 15dB reduction for an open window, the internal night-time noise levels is predicted to be 14 dB L_{Aeq} and as such, is likely to comfortably achieve the WHO and BS8233 recommended night-time internal noise level of 30 dB. In addition, it is noted that night-time operation is infrequent and as such, will further reduce the impact.

5.0 DISCUSSION OF RESULTS

The BS4142 initial estimate is described within Section 4.3, however it should also be noted that BS4142 indicates that this initial estimate of impact needs to be modified for context. With reference to the context BS4142 indicates that the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. BS4142 indicates that pertinent factors that could modify context would include: the absolute level of sound; the character and level of the residual sound compared to the character and level of the specific sound; the sensitivity of the receptor and whether dwellings or other premises used for residential purpose already incorporate design measurements that secure good internal and/or outdoor acoustic conditions.

With reference to context, I would comment as follows:

- As described within Section 4.4 the absolute noise level associated with the scheme is below the representative background noise level limit which gives a good indication would be significantly below the existing ambient noise climate and would therefore not contribute to the L_{Aeq} levels.
- The assessment is conservative, assuming that all noise sources are operating continuously and simultaneously however in reality based upon historical data the operation during night-time hours is highly unlikely. The gas engines will only run when the National Grid has a possible energy

shortage, therefore the operational times will likely be for short periods and have long intervals between operating times. The assessment assumes noise sources are operating continuously and simultaneously however due to the short operational nature of the plant it will likely reduce the impact on the noise sensitive receivers.

- The rating level is based on calculation only and that the noise model is likely to be a worst case scenario as it assumes favourable downwind propagation conditions and therefore it is considered reasonable that predicted noise levels can be expected to be lower reducing the risk of adverse impact further.

It should be noted that our assessment indicates that the noise level is already 6dB below the representative background and is therefore has a low impact in accordance with BS4142. We would consider that the context described above would reduce the impact of the scheme, however this would not further modify the outcome of the assessment.

It is noted that the NPPF requires that significant adverse impacts due to a new development should be avoided and other adverse impact should be mitigated and reduced to a minimum. Based upon the above assessment it is concluded that the sound levels arising from the operations of the proposed development will not result in an adverse impact and will therefore comply with the requirements of the NPPF.

6.0 UNCERTAINTY

BS4142 indicates that an assessment of noise impact should consider uncertainty within the assessment. This uncertainty can arise from: uncertainty in measurements; uncertainty in sound emission and sound power level; and uncertainty in calculation method.

6.1 Uncertainty in Measurements

It is understood the planning condition noise limits detailed in Section 3.1 which state the pre-existing background level have been likely based on noise survey data dating back to circa 2002. Based upon manual traffic count data utilised by the Department of Transport located on a stretch of the nearby A483 it is acknowledged that the volume of traffic during this period has increased and therefore it is a reasonable assumption that the variation of background noise level change during this period would more likely to have increased.

6.2 Uncertainty in Sound Power Levels

We would note that there could be a variation in some of the plant noise levels provided above and as such, the sound power levels used in our assessment are based on plant items which are considered to be suitable. Therefore, we would consider that the effect of uncertainty on the sound power levels will be low provided that the equipment is selected to meet the SWL levels detailed within this report.

6.3 Uncertainty in Calculation Method

It is noted that the calculations have been undertaken utilising a known prediction method and have utilised the standard ISO 9613. In addition calculations have been undertaken utilising commercial prediction software. We would therefore consider that this would minimise uncertainty in the assessment.



7.0 CONCLUSION

At the request of Biogas Technology Ltd a noise impact assessment has been undertaken for the proposed Peaking Power Facility located at land off Llay Road, Llay Industrial Estate in Wrexham.

An assessment of the noise emissions from the proposed units has been undertaken and compared with the guidelines contained within BS4142:2014 *"Methods for rating and assessing industrial and commercial sound"* WHO Guidelines for Community Noise and BS8233:2014 *"Guidance on sound insulation and noise reduction for buildings"*.

The results of these calculations have indicated that the rating level generated with all plant operating is 29dB L_{Ar} at the nearest noise sensitive property which does not exceed the lowest representative background noise limit which was 35dBA and therefore demonstrates compliance with the previous planning condition noise levels.

In addition the assessment indicates that the development will not result in an adverse impact at the nearest noise sensitive receivers in accordance with the recommendation described within BS4142:2014. This is therefore an indication that the proposed scheme is in accordance with the National Planning Policy Framework.



APPENDIX A – DEFINITION OF ACOUSTIC TERMS

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq} . Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq} . It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB L_{An} . It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) L_{max} , dB L_{Amax} , etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq} , L_{90} , L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.