

NOISE IMPACT ASSESSMENT REPORT

STANDBY GAS GENERATION PLANT, MARL ROAD, KNOWSLEY, KIRKBY

REPORT REFERENCE NO. J003246-5117-ECE-02

JANUARY 2022

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Document Control Sheet

Details of Assessment	
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Document Title	Noise Impact Assessment, Standby Gas Generation Plant, Marl Road, Knowsley, Kirkby
Report Reference	J003246-5117-ECE-02

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Issue	Date	Author	Remark	Status
01	31/08/2021	ECE	Initial Issue	Issued
02	14/01/2022	ECE	Updated to include commercial use	Issued

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This document has been prepared for the client only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law.

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 Forsa Energy Gas Holdings Ltd a noise impact assessment has been undertaken for the proposed Standby Gas Generator Plant at Marl Road, Knowsley, Kirkby.

A noise survey has been conducted at the nearest noise sensitive property to the proposed new development. The results of the survey have been used to assess the background sound at the nearest sensitive receptors and specify appropriate noise limits for the new plant and equipment.

The Assessment has been undertaken following the guidance contained within BS4142:2014 – 'Methods for rating and assessing industrial and commercial sound'.

The proposed development will comprise of 10 x 2.0MW standby gas generation plant and associated ancillary equipment. Based upon the noise emissions from the proposed plant we have undertaken noise modelling to assess the noise emissions at the nearest residential properties.

This predicted level has subsequently been compared with previous noise measurements undertaken at the site to assess the impact on the proposed scheme. Our assessment has indicated that the proposed plant will be 12 dB below the existing background sound level during the worst case time period and assessment location. This is based upon the mitigation described within Section 6.2 being implemented

It is noted that the recommendations within BS4142:2014 indicate that the following:

"A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

A difference of around +5 dB is likely to be 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."

In accordance with the requirements of The National Planning Policy Framework (NPPF) and the Noise Policy Statement for England (NPSE) indicates that planning policies 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. In addition the NPSE indicates 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. However the NPSE indicates that this does not mean that such adverse effects cannot occur.

Based upon the estimated noise emissions provided within this report and the guidance contained within BS4142 we would consider that the noise emissions from the new plant would not result in an adverse impact on the surrounding residential receivers. This is therefore compliant with the requirements contained within the NPPF and NPSE.

In addition the assessment has indicated that the predicted noise level for the commercial uses will not exceed the guidance levels derived from BS8233.

2.0 INTRODUCTION

2.1 Site Location

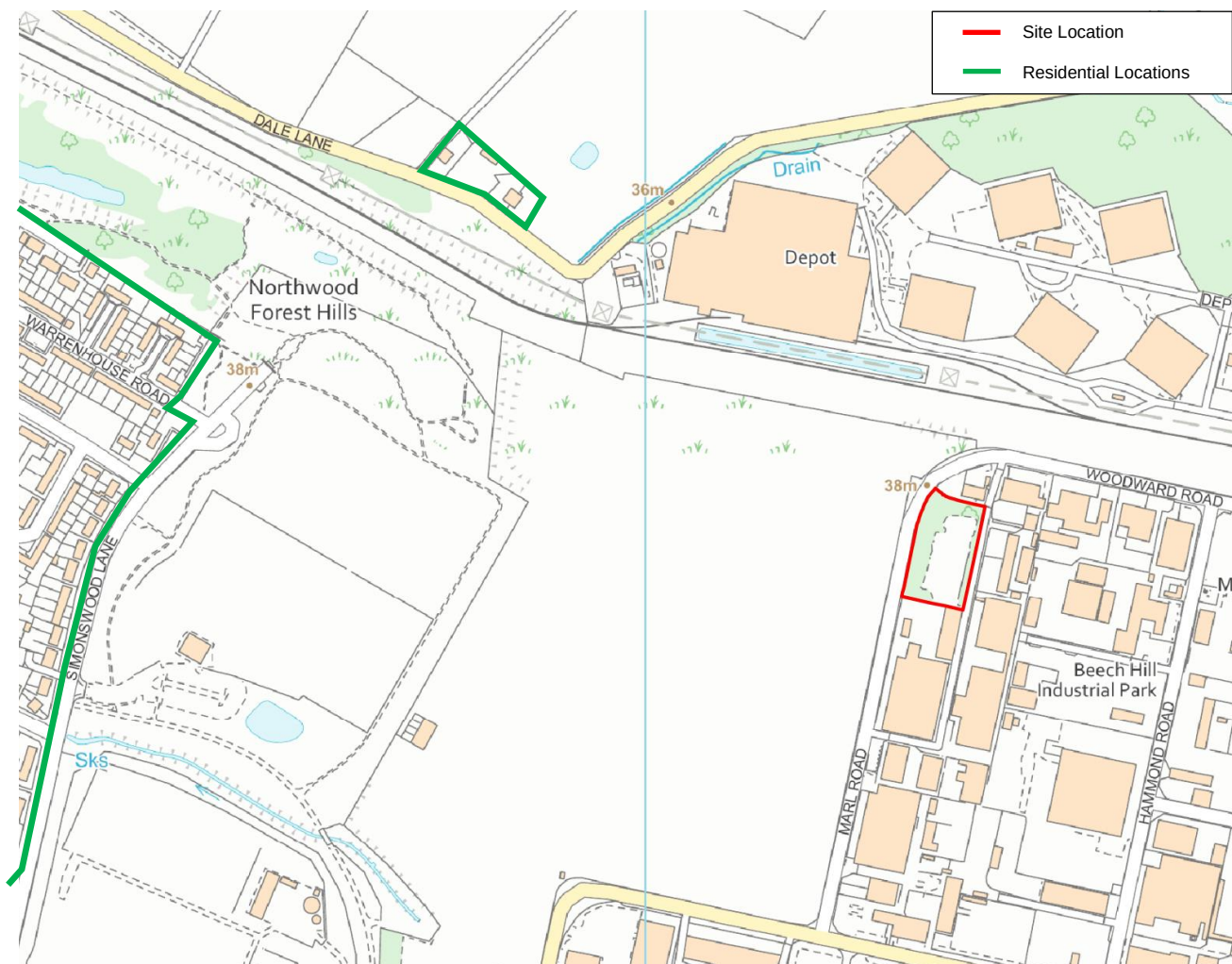
The Proposed Development is for the construction of 10 x 2.0MW standby gas generators on land to the east of Marl Road, Knowsley, Kirkby L33 7UH.

The immediate local area consists of commercial and industrial units. The nearest residential property is located approximately 400m northwest from the site boundary on North Perimeter Road.

The next nearest residential receivers are positioned approximately 650m to the west of the proposed site boundary on Simonswood Lane.

The proposed site layout showing the location of the site, surrounding local area and the noise sensitive receivers are shown in Figure 1 below.

Figure 1. Proposed Site Location with Nearest Residential Receiver



2.2 Background

It is understood that small scale gas fired standby electricity generation facilities are required to balance fluctuating power or high demand for power on the National Grid for short periods of the day. To highlight the periods where the proposed plant is most likely to be operational, information from the National Grids *Short Term Operating Reserve (STOR) Annual Market Report 2013/14* has been used as a guide.

There are six STOR seasons each year that the National Grid uses to separate and analyse usage.

Figure 2. STOR Windows for Year 7

Seasons 2013/14								
Season	Dates	WD		NWD		Hours/Day		Total
		Start Time	End Time	Start Time	End Time	WD	NWD	
1	05:00 on Monday 1st Apr 2013 - 05:00 on Monday 29th Apr 2013	07:00	13:30	10:00	14:00	218.5	32.5	251
2	05:00 on Monday 29th Apr 2013 - 05:00 on Monday 19th Aug 2013	07:30	14:00	09:30	13:30	1081	126	1207
3	05:00 on Monday 19th Aug 2013 - 05:00 on Monday 23rd Sep 2013	16:00	18:00	19:30	22:30			
4	05:00 on Monday 23rd Sep 2013 - 05:00 on Monday 28th Oct 2013	07:30	14:00	10:30	13:30	348	36	384
5	05:00 on Monday 28th Oct 2013 - 05:00 on Monday 3rd Feb 2014	16:00	21:30	19:00	22:00			
6	05:00 on Monday 3rd Feb 2014 - 05:00 on Tuesday 1st Apr 2014	07:00	13:30	10:30	13:30	330	32.5	362.5
		16:30	21:00	17:30	21:00			
		07:00	13:30	10:30	13:30	931.5	127.5	1059
		16:00	21:00	16:00	20:30			
		07:00	13:30	10:30	13:30	539	60	599
		16:30	21:00	16:30	21:00			
						3448	414.5	3862.5
						Total Hours		3862.5

Season	WD	NWD
1	23	5
2	94	18
3	29	6
4	30	5
5	81	17
6	49	8

For each full day there are 48 settlement periods with Settlement Period 1 relating to 00:00 to 00:30 and Settlement Period 2 relating to 00:30 to 01:00 and so on. The following graphs illustrate the STOR usage on high usage weekday and weekend days in this case Mondays and Sundays throughout year 7.

Figure 3. Total Utilised STOR Volume (MWh) for each settlement period for Mondays, per Season, during 2013/2014

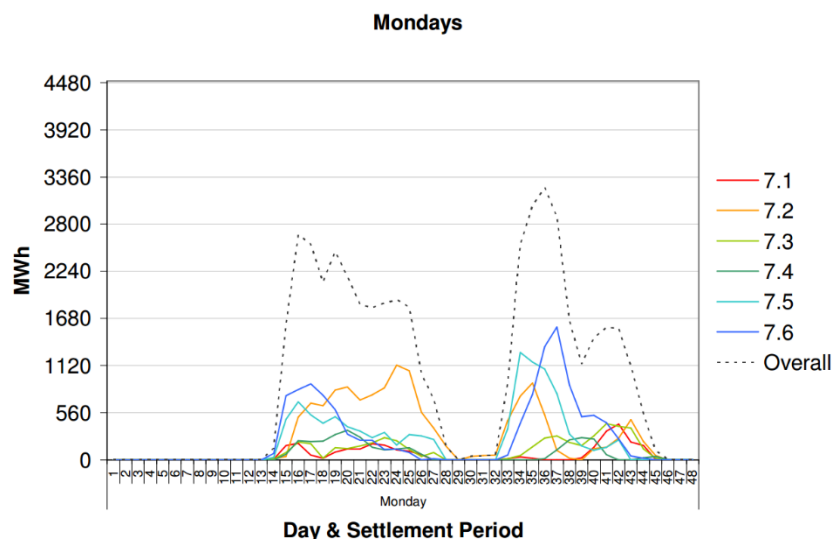
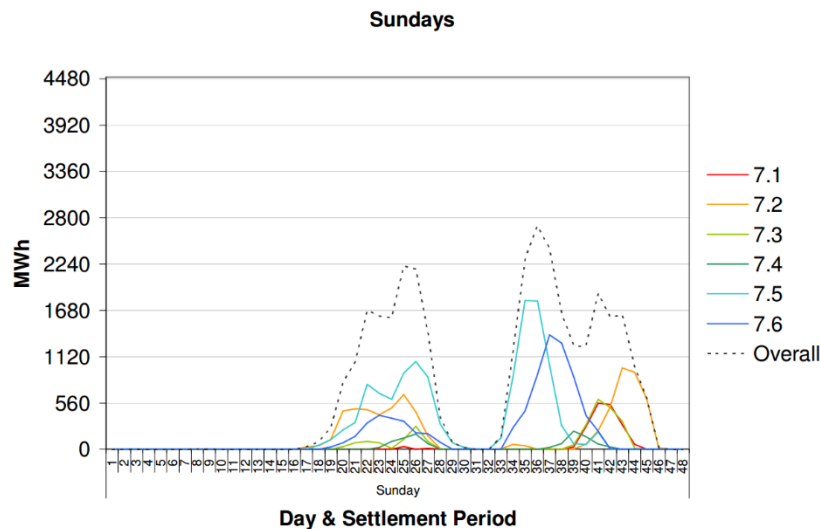


Figure 4. Total Utilised STOR Volume (MWh) for each settlement period for Sundays, per Season, during 2013/2014



The data indicates that:

- The main usage is during the winter months.
- The peak time is during the afternoon/evening between 1600 and 1800.
- There could be potentially some usage during nighttime hours between 0600 and 0700 although this is infrequent.

The Energy Act 2013 introduced the Capacity Market to help ensure security and flexibility of electricity supply. Since then it has undergone a number of iterations and legal challenges but has in principle remained the same but is now referred to as the Balancing Services Mechanism managed by National Grid. In 2019 the Government issued a Carbon Plan which promoted the use and support of low carbon electricity as the UK moves away from outdated fossil fuel supplies whilst at the same time managing increasing electricity demand from consumers.

Security of electricity supply can be at risk:

- During certain periods of the day and at certain times during the year UK electricity demand peaks. Typically, this is during the morning and evening peak periods and during the winter months (known as electricity stress).
- With the deployment of more renewable electricity generation there comes a risk that renewables are not able to generate due to a lack of wind or sun.

The Proposed Development acts as a balancing mechanism for National Grid to provide security of electricity supply when demand is greater, or supply is lower, than forecasted. Predominantly calls for this plant to generate from National Grid are during periods of electricity stress which are at specific daily times and yearly periods i.e. during morning and afternoon peaks and during the winter. However, there may be occasions outside of these times when the plant is called upon to generate to compensate for a lack of low carbon generation, but these are infrequent and less predictable. It should also be noted that during night time there is a lower demand for electricity which also reduces the call on the plant.

3.0 NOISE ASSESSMENT CRITERIA

3.1 National Planning Policy Framework (NPPF)

National Planning Policy is guided by the National Planning Policy Framework (NPPF) updated in July 2021. 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 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.

3.2 Planning Practice Guidance – Noise

The UK Planning Practice Guidance on noise offers further guidance on the typical levels which constitute the NOEL, LOAEL and SOAEL and is reproduced in the table below;

Table 1. Planning Practice Noise Level Guidance

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

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 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}.'

3.5 Commercial Guideline Noise Levels

British Standard 8233:2014, *Guidance on Sound Insulation and noise reduction for buildings*, gives guidance on internal noise levels within rooms where Study and work requiring concentration

Table 3. BS8233:2014 recommended indoor ambient noise levels in offices

Activity	Location	Design Range dB L _{Aeq,T}
Study and work requiring concentration	Staff/meeting room, training room	35 – 45
	Executive office	35 – 40
Typical noise levels for acoustic privacy in shared spaces	Open plan office	45 – 50

In addition the above further information is provided within the previous edition of BS8233:1999, *Sound insulation and noise reduction for buildings – Code of practice* gives guidance on internal ambient noise levels within industrial spaces when they are unoccupied. The following criteria are for reasonable industrial working conditions.

Table 4. BS8233:1999 recommended indoor ambient noise levels in industrial conditions

Criterion	Typical Situations	Design Range L _{Aeq} dB	
		Good	Reasonable
Reasonable industrial working conditions	Heavy Engineering	70	80
	Light Engineering	65	75
	Garages, Warehouses	65	75

4.0 BACKGROUND SOUND SURVEY DETAILS

4.1 Survey Times and Dates

The ambient noise measurements were made between 17:15 on the 24th August 2021 and 09:15 on the 25th August 2021.

With all measurements being made by Mr Stefan Fox Marshall and Mr Edmund Evenden of PDA Ltd.

4.2 Equipment Used

Throughout the survey measurements were undertaken with a Rion NL52 sound level meter. The meter is a precision grade Class 1 sound level meter (as per BS EN 61672-1: 2002) for which current calibration certificates are held. The meter was set to A-Weighted and fast response and measured continuously with 15-minute and 1-second time periods. The meter was calibrated directly before any measurement took place and immediately afterwards and no significant drift was observed.

The equipment used is detailed as follows:

Table 5. Equipment List

Equipment Type	Make	Model	Serial Number	Calibration Certificate Reference	Calibration Date
Sound Level Meter	Rion	NL-52	810315	UCRT19/2070	26/09/2019
Calibrator	Rion	NC74	34683835	04962/1	21/01/2021

4.3 Weather

24th – 25th August 2021

Temperature: 14 - 16°C
Wind Speed: Still
Wind Direction: North
Precipitation: No precipitation

Please note that the data above has been based upon observations made during equipment setup and collection.

4.4 Measurement Positions & Procedure

Measurements were undertaken at one position on the site. The microphone was mounted 1.5m above ground and at least 3.5m from any reflecting surface. A range of statistical noise indicators was measured, including L_{Aeq} and L_{A90} . Measurements were setup to log every 15 -minutes.

Definitions of the above terms are listed below:

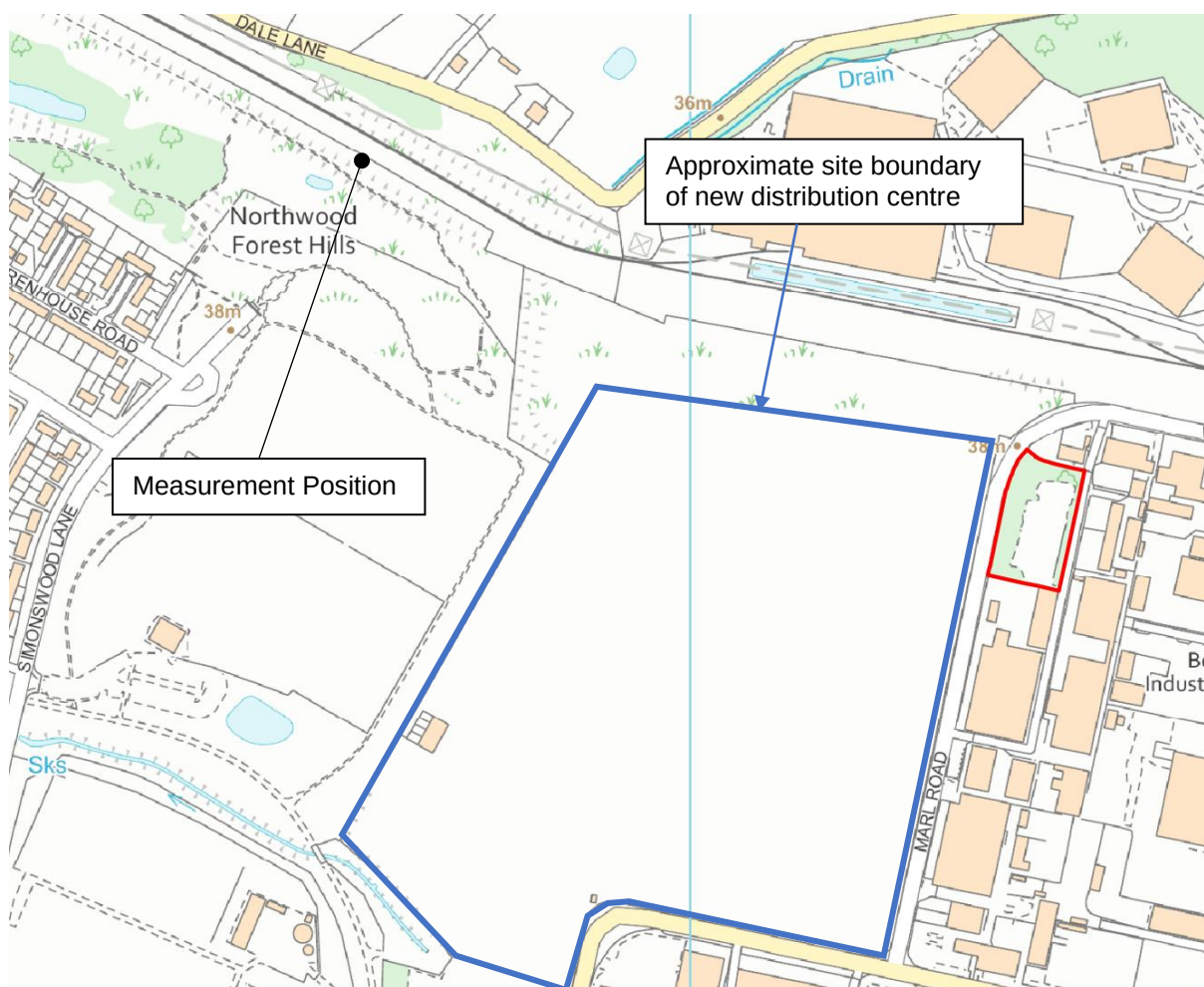
L_{Aeq} : The equivalent A-weighted noise level containing the same energy within the measured time period.

L_{A90} : This is a statistical parameter that is equivalent to the noise level that is exceeded 90% of the measurement period.

It should be noted that at the time of the measurements there was construction activity associated with a new distribution centre. The measurement location was selected to minimise the influence of this construction activity as it was shielded from the construction site due to the surrounding landform.

The measurement location is highlighted within the following figure:

Figure 5. Measurement Location



5.0 MEASURED RESULTS

A summary of the noise level measurements is given below. The levels presented in the tables have been rounded to the nearest decibel. The L_{Aeq} levels are the logarithmic average of all the measured noise levels. The L_{A90} levels have been shown as a minimum to maximum range.

Table 6. Measurement Position Baseline Noise Levels

Period	$L_{Aeq,T}$ (dB)	Range of $L_{A90,15mins}$ (dB)
Day (0700 – 2300)	56	38 – 48
Night (2300 – 0700)	44	36 – 46

5.1 Derivation of Background Sound

In accordance with the requirements of BS4142 the determination of background is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during relevant time periods. Within BS4142 it states the following:

“8.1.4 The monitoring duration should reflect the range of background sound levels for the period being assessed. In practice, there is no “single” background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed.

NOTE 1 To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value.”

Figures 3 – 4 below show the statistical analyses of the results within the separate measurements periods:

Figure 6: Statistical Analysis During the Day

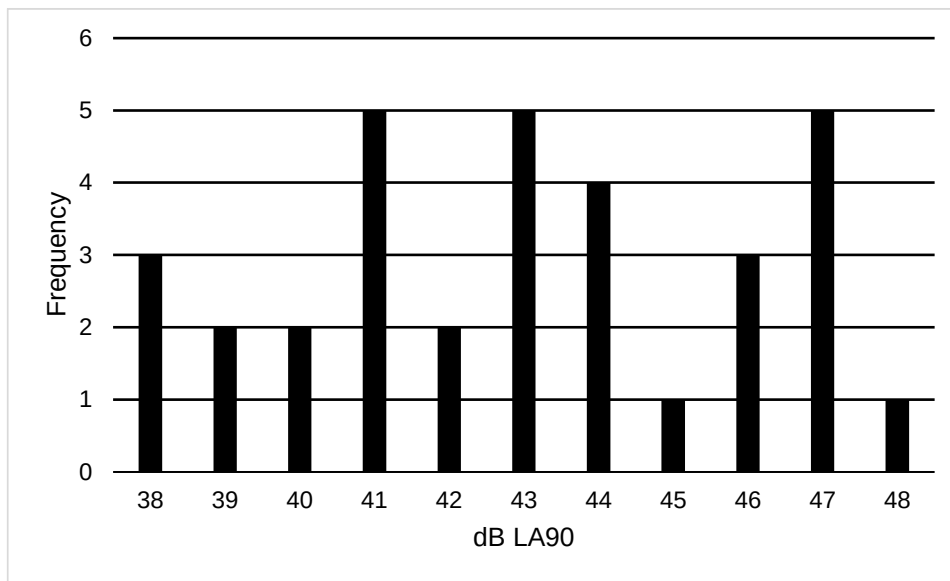
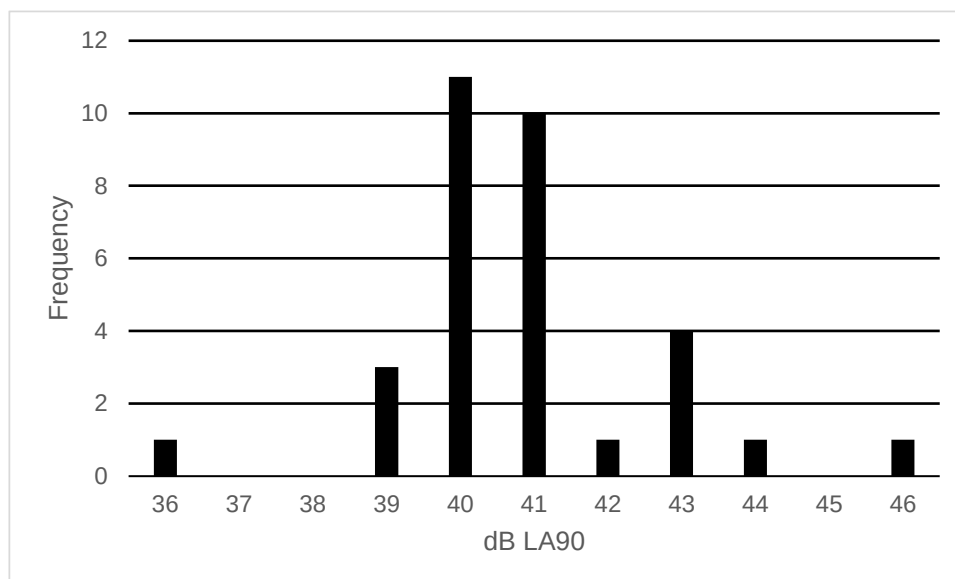


Figure 7: Statistical Analysis During the Night





Based upon the above figures I would consider that the representative background sound would be 41dB(A) during the day and 40dB(A) during the night.

5.2 Description of Background Sound

It was observed that the dominant noise was due to distant industrial noise and vehicle traffic on the surrounding road network. It is noted that some intermittent construction activity was audible from the adjacent new Distribution Centre during the daytime. In addition it was observed that there was some intermittent activity associated with the trainline adjacent to the measurement position.

As described within the definition of the L_{A90} described within Section 4.4, the background sound level only measures the lowest 10% of the sound climate. It is therefore considered that due to the intermittent nature of the noise sources associated with the Distribution Centre construction activity and the trainline that these measurements would not have impact on the background sound level.

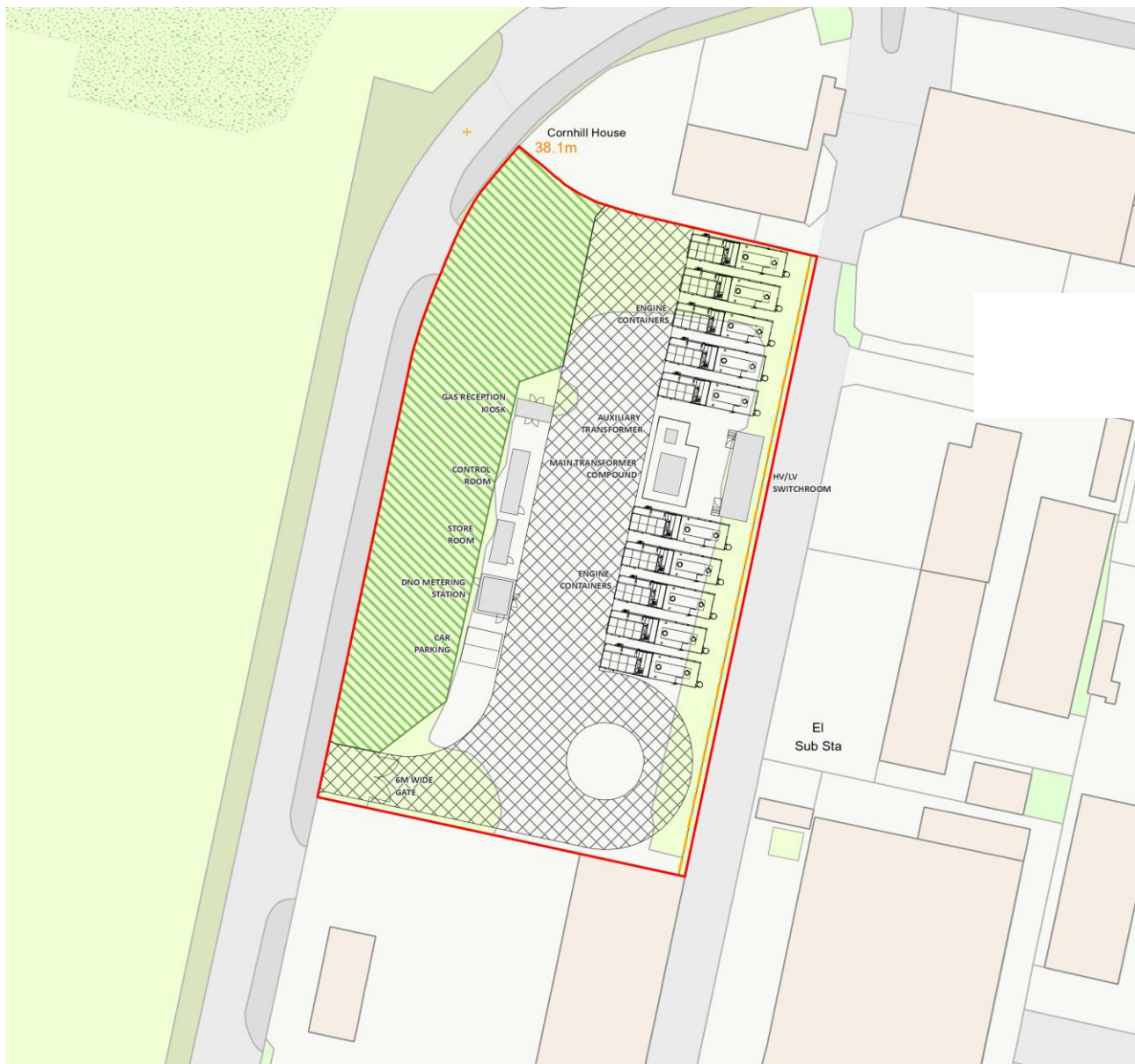
6.0 SPECIFIC NOISE LEVEL CALCULATION

The proposed scheme will consist of 10 x 2.0MW standby gas generation plant and associated ancillary equipment.

6.1 Proposed Site Plan

The proposed site plan is detailed within the following drawing:

Figure 8. Proposed Site Plan



6.2 Source Sound Power Levels

It is understood that the proposal is to install 10 no. Cummins C2000 N5CD gas engines on the site along with auxiliary equipment.

It is understood the gas-powered engines will operate within sound insulated containers. We have been provided with octave band noise data indicating the enclosed engines will have a single figure sound power level of 84 dB(A) SWL. The octave band data has been used for input into the noise model.

It is understood there will be a cooling fan / radiator located on the top of each container. We have been informed that the cooling fans will have a sound power level of 81 SWL. We have also been provided with the octave band data which has been used for input into the noise model.

We have been supplied information that the Gas Skid has a sound power level of 83 dB(A) SWL. We have also been provided with the octave band data which has been used for input into the noise model.

Details of the noise source information is detailed within the table below:

Table 7. Noise level spectra of above for input into noise model

Element	Sound Power Level (dB(A)), Octave Band Centre Frequency Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Enclosed Engine	52	68	73	73	76	76	78	77	84
Radiator	-	67	72	75	76	75	69	62	81
Main Transformer	53	68	74	80	77	73	68	49	83
Gas Skid	-	-	60	73	68	72	80	78	83

In addition to the above it is understood that there will be an exhaust stack located above each container with a height of 8m above ground level. Manufacturer's noise level data would suggest the following sound power levels for a single exhaust of the proposed engine.

Table 8. Unmitigated noise levels for proposed engine exhausts

Element	Sound Power Level (dB(A)), Octave Band Centre Frequency Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Exhaust	84	97	103	107	112	115	114	102	119

It is noted that the data provided within Table 6 above is the unmitigated sound power level from the exhaust. It will however need to be ensured that an exhaust silencer is installed to attenuate the acoustic emissions. The following silencer fitted onto the exhausts has been assumed:

Table 9. Required insertion loss for proposed silencer

Element	Insertion Loss (dB), Octave Band Centre Frequency Hz							
	63	125	250	500	1k	2k	4k	8k
Silencer	28	44	49	50	50	52	50	49

The insertion loss values stated in Table 7 can be achieved using an SM50P attenuator by IAC however, other products may be used provided they achieve the at a minimum the values stated above in each octave band.

Based upon the above tables the following mitigated exhaust noise sound power levels have been used for input into the noise model.

Table 10. Mitigated noise levels for proposed engine exhausts for input into noise model

Element	Sound Power Level (dB(A)), Octave Band Centre Frequency Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Exhaust w/ silencer	56	53	54	57	62	63	64	53	69

We have been provided with the following noise data for the unsilenced air inlet attenuator and air out louvre located at each end of the container.

Table 11. Unmitigated noise levels for proposed air outlet & inlet

Element	Sound Power Level (dB(A)), Octave Band Centre Frequency Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Air outlet & inlet	86	94	97	103	105	107	108	105	113

It is noted that the data provided within Table 9 above is the unmitigated sound power level from the air inlet and outlet. It will however need to be ensured that an attenuator is installed to reduce the acoustic emissions. The following attenuator performance has been assumed:

Table 12. Required insertion loss for proposed attenuator

Element	Insertion Loss (dB), Octave Band Centre Frequency Hz							
	63	125	250	500	1k	2k	4k	8k
Attenuator	15	22	30	40	47	50	47	45

Based upon Tables 9 & 10 the following mitigated air inlet and outlet noise sound power levels have been used for input into the noise model

Table 13. Mitigated noise levels for proposed air inlet / outlet for input into noise model

Element	Sound Power Level (dB(A)), Octave Band Centre Frequency Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Attenuated air inlet & outlet	71	72	67	63	58	57	61	60	76

6.3 Noise Propagation Calculations

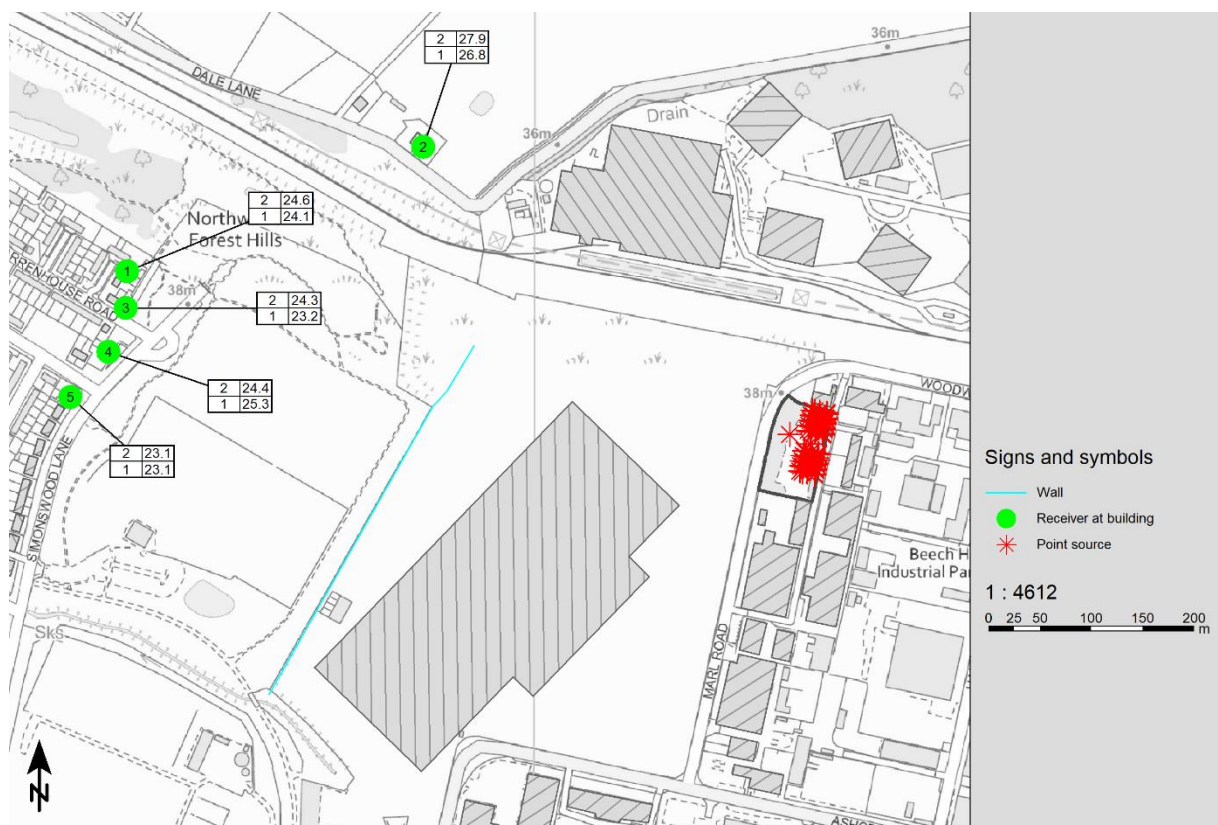
Utilising the source sound power levels and the sound insulation properties described above we have utilised Soundplan Essential v2.1 noise modelling software.

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. The ground conditions between source and receiver are mixed between soft ground associated with grass and fields and hard ground associated with the industrial areas. We have therefore utilised a ground absorption coefficient of 0 within the industrial areas, the proposed site and roads. A ground absorption coefficient of 1.0 has been used representative of areas of fields, grass and wooded areas.

The gas powered engines are modelled as point sources with the exhausts at a height of 8m, the enclosed engines at a height of 1.7m, the air intake at a height of 1.7m, the air outlet at a height of 1.7m, the radiator at a height of 3.4m, the transformer at a height of 1.5m and the Gas skid at a height of 1.2m. The sound power levels and frequency spectra are as detailed in Section 6.2. 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 noise sensitive receivers. Noise levels are calculated at 1.5m for the ground floor level and an additional 2.8m for the floors above.

Figure 9. Calculated Specific Noise Levels with all equipment operating



7.0 NOISE IMPACT ASSESSMENT

7.1 Initial BS4142 Assessment

Based upon the results of the modelling calculation described above we have compared these levels with the Background Sound Level derived within Section 4.0.

As highlighted within Section 2.2 the gas generators are highly unlikely to operate at night, therefore we have assessed the specific sound level of the transformers operating only during the night-time period.

Table 14. Comparison of proposed boiler house with background sound levels during the day

Location	Predicted Specific Sound Level $L_{Aeq,T}$ (dB)	Rating Level L_{Ar} (dB) ¹	Representative Background $L_{A90(15-min)}$ (dB)	Difference between Rating Level and Background (dB)
Position 1 (Simonswood Lane)	25	25	41	-16
Position 2 (North Perimeter Road)	28	28	41	-13

Table 15. Comparison of proposed boiler house with background sound levels during the night

Location	Predicted Specific Sound Level $L_{Aeq,T}$ (dB)	Rating Level L_{Ar} (dB) ¹	Representative Background $L_{A90(15-min)}$ (dB)	Difference between Rating Level and Background (dB)
Position 1 (Simonswood Lane)	25	25	40	-15
Position 2 (North Perimeter Road)	28	28	40	-12

Notes:

- 1 Based upon third octave band data for similar engine models there is no indication that the proposed plant will emit a prominent, discrete tone. This is based upon noise measurements undertaken at source. The effect of any potential tonality will be further reduced due to masking noise at the proposed receptor locations. In addition 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.

As the assessment has indicated that the Rating Level is 12dB below the representative Background Sound Level in the worst case time period, 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.

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.

7.2 Context

The BS4142 initial estimate is described within Section 6.1, however 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.

We would note that the character of the specific sound would be similar to the existing noise climate as it is already in an area characterised by industrial / commercial use.

It is also noted that the predicted noise levels will also significantly below the existing measured ambient noise levels and will not significantly increase the absolute sound level at this site.

It should be noted however that initial assessment already indicates the site would have a low impact and therefore we do not consider that context will impact on the assessment

7.3 Discussion

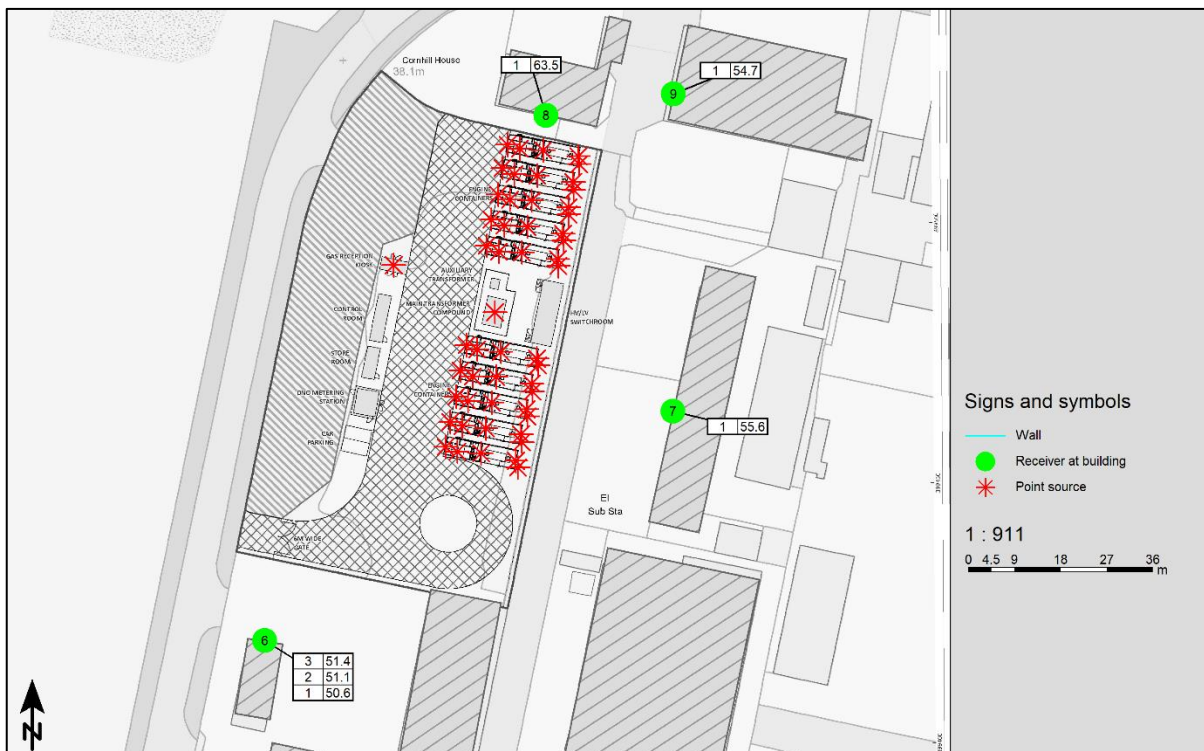
It is noted that the NPPF requires that significant adverse impacts due to a new development should be avoided and other adverse impact should be mitigated and reduced to a minimum. Based upon the above assessment it is concluded that the sound levels arising from the operations of the Proposed Development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

8.0 COMMERCIAL USE NOISE LEVELS

It is noted that the adjacent to the site are existing industrial and commercial premises and we have undertaken calculations to assess the noise level at these units. Please note that this has used the same source noise levels and model as described within Section 6 above. As the internal layout of the adjacent commercial units are currently unknown, for the purposes of the assessment we have assumed there will be window openings on the facades directly facing the proposed development to allow for a worst-case assessment.

The noise model would suggest the following levels calculated at the closest existing commercial unit. Noise levels are calculated at 1.5m for receptors 7 – 9 which are single storey buildings only. Receptor 6 is a three storey building and the noise level has been assessed at each floor. No boundary walls/fences have been included within the calculations.

Figure 10. Calculated noise levels at adjacent industrial units



Based upon a review of the different commercial premises from aerial photographs and Google Street View would indicate that receptors 6 and 9 could include office spaces and receptors 7 and 8 are industrial units. It is noted that the noise level described within Figure 10 are the external noise level

incident upon each receptor. However the guideline noise levels described within Section 3.5 are related to internal noise levels. We have therefore assessed the internal noise level by taking into account for a typical 15dB reduction for an open window as a worst case. The internal noise level is predicted to be as follows:

Table 16. Calculated internal noise level at closest industrial unit

Location	Calculated internal noise level, dB L _{Aeq}	BS8233 Guideline Level, dB L _{Aeq}
6	36	35 – 40 ¹
7	41	65 – 75 ²
8	49	65 – 75 ²
9	40	35 – 40 ¹

Notes:

- 1 The internal layout of the commercial offices is not known and therefore it has been assumed to be an executive office as a worst case.
- 2 We have used the guideline noise levels for light engineering, garages and warehouses.

Based upon the above it can the resultant predicted noise limits do not exceed the guideline levels described within BS8233.

9.0 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.

9.1 Uncertainty in Measurements

It is noted that the instrumentation used within this assessment conforms to Class 1 accuracy in accordance with IEC 61672. In addition, the instrumentation has been calibrated to national standards and was field calibrated at the time of the measurements.

We would therefore consider that the effect of uncertainty on the measurement of background sound would be minimal.

9.2 Uncertainty in Sound Power Levels

We have been provided with sound power levels for the proposed plant items. It will need to be ensured that the noise emissions match the levels quoted within Section 6.2.

9.3 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 utilising commercial and verified prediction software. In addition where there is uncertainty in the assessment, we have undertaken these on a conservative basis. We would therefore consider that this would minimise uncertainty in the assessment.

10.0 CONCLUSION

At the request of Forsa Energy Gas Holdings Ltd a noise impact assessment has been undertaken for the proposed new Gas Generator Plant at Marl Road, Knowsley, Kirkby.

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*”.



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 compliant with the requirements within the National Planning Policy Framework. This assumes that the mitigation measures described within Section 6.2 are implemented.

In addition the assessment has indicated that the predicted noise level for the commercial uses will not exceed the guidance levels derived from BS8233.

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.

APPENDIX B – MEASURED RESULTS

Position 1 Time History:

