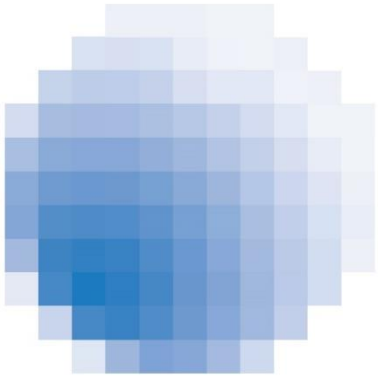

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Flexible Generation Facility
Barugh, Barnsley

Environmental Noise Impact Assessment
23 February 2018

PROJECT:	Flexible Generation Facility Barugh, Barnsley Environmental Noise Impact Assessment
CLIENT:	Reliance Energy 59 St Marks Road Henley on Thames Oxon RG9 1LP
DOCUMENT REFERENCE:	P1734-REP03-BDH
SIGNED:	 BRIAN HORNER
CHECKED:	 SIMON FERENCZI
DATE:	23 February 2018

CONTENTS

1.0 EXECUTIVE SUMMARY

This report provides an assessment of the environmental noise impact likely to be occurring at surrounding noise sensitive receptors, due to the operation of the proposed Flexible Generation Facility (FlexGen) located off Whaley Road in Barugh, Barnsley.

This environmental noise assessment is in part based on the results obtained from benchmark noise survey at the existing site and surrounding area as carried out during weekdays and weekend, daytime and night time periods between 20th April and 24th April 2017 (inclusive).

The assessment has shown that based upon the current proposed generators and ancillary plant, with manufacturer agreed noise mitigation (which has been developed specifically for this scheme and based upon previous review of the site and surrounding noise sensitive receptors), as well as noise from the proposed Liquefied Natural Gas (LNG) compound and LNG deliveries, the Rating Level expected from the site is not expected to exceed the pre-existing background noise levels at any of the identified existing and currently proposed residential developments during the weekday and weekend daytime periods, and also during the weekday night time periods. However, the predicted Rating Level is expected to very marginally exceed the existing background noise level by 1dB at a single Noise Sensitive Receptor (NSR) during the weekend night time period.

Whilst the identified worst case Rating Level marginal exceedance over the background noise level is not considered to be significant, it is possible to ensure that the predicted Rating Level from the site is not expected to exceed the existing background noise level at any NSR at any time by restricting LNG deliveries to the following times:

- Monday to Friday: Anytime
- Saturday and Sunday: 07:00 – 23:00 hours only

2.0 INTRODUCTION

Sol Acoustics Ltd (Sol) has been commissioned by Reliance Energy (RE), via GP Planning Limited (GP), to conduct an environmental noise assessment to establish the environmental noise impact likely to be occurring on the surrounding environment from the operation of the consented Flexible Generation Facility using liquefied Natural Gas (LNG) as fuel located on Whaley Road in Barugh, Barnsley. A previous assessment was carried out in respect of a natural gas fired flexible generator facility (The consented facility 2017/0615). This assessment factors in the LNG compound which comprises an LNG storage tank, Vaporisers and associated infrastructure.

The purpose of this assessment is as follows:

- To identify the nearest pre-existing noise sensitive housing to the site (i.e. receptors), which are most likely to be affected by environmental noise arising from plant and/or processes associated with the development site during the proposed operating periods (e.g. daytime and night time, weekdays and weekends).

- To determine the prevailing daytime and night time background noise climate at the nearest receptors (weekday and weekend periods).

- To identify all potentially significant proposed noise sources to be installed at the site and obtain suitable source noise level data.

- To calculate the resultant environmental noise contribution and impact arising at the nearest noise sensitive receptors to the site during the proposed hours of operation.

- To carry out an environmental noise assessment of the proposed development in accordance with the methodology prescribed in relevant Standards and guidance (i.e. British Standard 4142: 2014) to determine the significance of the potential environmental noise impact generated (likelihood of complaint).

- To advise on suitable noise mitigation measured to limit any identified potentially significant noise level impacts.

3.0 DESCRIPTION OF SITE

3.1 General Overview and Noise Sensitive Receptors (NSRs)

The proposed development site for the Flexible Generation Facility is located to the east of the existing industrial estate on Whaley Road in Barugh, Barnsley. The development site is currently open and undeveloped land.

The nearest existing noise sensitive premises to the development site are as follows:

- Residential estate located on Claycliffe Road located approximately 420 metres to the west of the site boundary.

- Residential estate located approximately 390 metres to the south east of the site boundary.

In addition to the above existing residential premises, a new residential estate is currently proposed and yet to be built albeit consented, Application Number: 2013/0280, to the north west of the of the site off Dearne Hall Road, at a distance of approximately 425 metres to the north west of the development site.

Figure 1 below indicates the location of the development site in relation to the nearest proposed and existing noise sensitive premises, and also the location of the noise monitoring positions used in order to inform the assessment (discussed in Section 4 of this report).

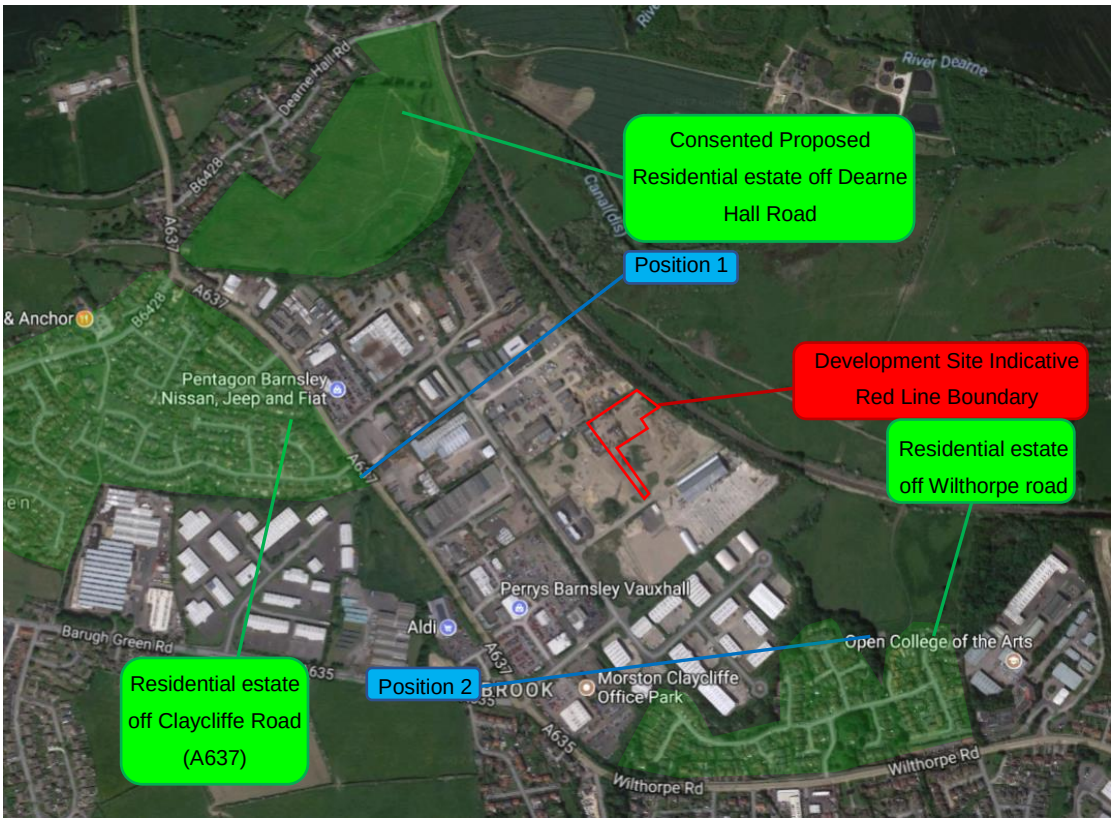


Figure 1: Proposed development site in relation to surrounding noise sensitive receptors

3.2 Characteristics of the Installation

3.2.1 Overview of the Site

The purpose of the development is to provide reliable power to the National Grid on demand and as required via an adjacent consented Flexible Generation Facility. The consented facility will use 20 x 1042 kW Perkins TRS2 gas powered generators which will be installed on the site. The generators would only be required to operate between the hours of 07:00 – 23:00 hours but could operate 7 days a week. The planning consent imposes a planning condition (Condition 4) restricting operation of the generators to between of 07:00 - 23:00 hours. It should be noted that the generators would only be expected to operate when there is a demand to do so and as such would not be expected to operate continuously.

The generators will be powered from Liquefied Natural Gas (LNG), which will be delivered to site via HGVs at a frequency of approximately two deliveries per day. The LNG shall be stored in a purpose-built compound located on the site.

In addition to the proposed generators and LNG storage compound, there will also be a transformer compound within the boundary of the Flexible Generation Facility, although there are no significant noise sources associated with the transformer compound.

Two applications have been previous been lodged to amend the layout of the Flexible Generation Facility (2018/0122 and 2018/0123).

Figure 2 shows a detailed view of the proposed development site indicating the location of each proposed generator, LNG compound and transformer compound.

Figure 2: Proposed site layout

3.2.2 Details of the Proposed Generators

Sol have been in discussions with Energy Circle (EC – the Supplier) and Lindenberg Anlagen (LA - the Manufacturer) in connection with the proposed 1042 kW Perkins TRS2 gas powered generators, so as to obtain accurate information about the layout and configuration of the units, as well as to obtain representative noise level data of the generators in order to inform the assessment.

Based upon these discussions, it is understood that, in basic terms, each permitted generator consists of a gas engine which is to be housed within an acoustic enclosure of dimensions: 12188mm (L) x 3001mm (W) x 2503mm (H). Intake air to the generator is provided via a roof mounted penthouse louvre. The air outlet is proposed to be mounted on the wall of the generator enclosure. The engine exhaust is to be roof mounted, with the exhaust tailpipe at a height of c.8.5 metres above local ground level. A single remote radiator will be mounted onto the roof of each generator enclosure in order to provide cooling for the engine.

The preliminary indicative general arrangement of each complete, packaged generator plant is provided in Figure 3.

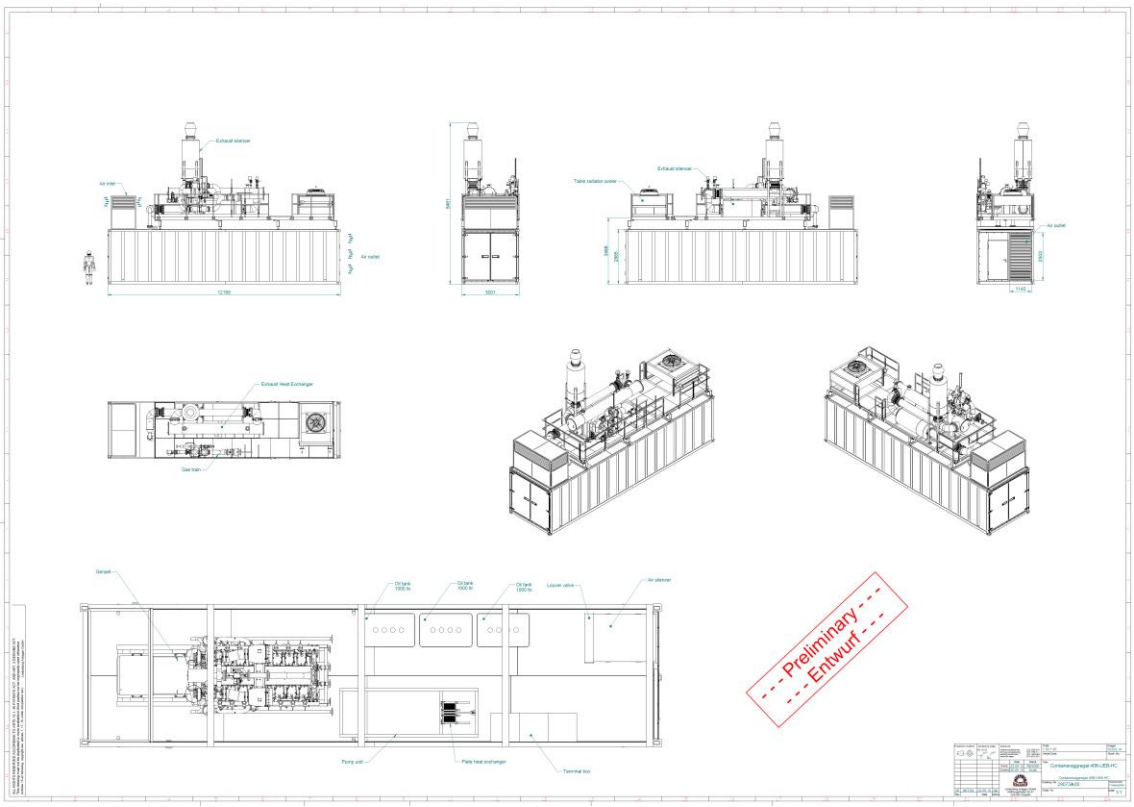


Figure 3: Preliminary general arrangement of the generators

With regards to plant noise level data, Sol have been in discussions with the manufacturer to review available noise data and to agree a suitable noise mitigation strategy for the scheme. It should be noted that the proposed noise mitigation has been developed specifically for this scheme, all as based upon previous review of the site and surrounding noise sensitive receptors. Lindenberg Anlagen (LA) have confirmed that the proposed plant can be attenuated to achieve the noise levels presented in Table 1:

Identified Noise Source	Sound pressure level, $L_{Aeq,T}$ at 1 metre
Generator Enclosure (including Air Outlet Louvre)	65dB
Air Inlet Penthouse Louvre	65dB
Engine Exhaust	65dB
Remote Radiator	60dB

Table 1: Assumed 1042 kW Perkins TRS2 gas powered generator noise level data

The manufacturer has confirmed that the above noise levels are subject to a measurement tolerance of ±2dB. For the purposes of this assessment, a correction of +2dB has been added to the noise levels reported in Table 1 to account for the measurement tolerance.

Sol is satisfied that the specific noise control scope and design, all as proposed by the manufacturer, is satisfactory and will achieve the required environmental noise levels, for an assumed good standard of finished construction. Specifically, this includes the detailed proposals in respect of the precise acoustic enclosure panel specifications and build ups (rolled hollow box steelwork frames), high performance vibration isolators to the engines and generators, high performance (bespoke) splitter type engine exhaust silencers and cooling inlet/discharge attenuator (90-degree mitred splitter types, with reduced noise fan selections), and inverter controlled remote radiators.

Details of the confirmed noise control, as provided by the manufacturer is presented in Appendix C of this report.

3.2.3 LNG Compound and Site deliveries

The LNG compound consists of a 49-tonne gas storage tank, eight vaporisers and two power block units. The key noise sources associated with the LNG compound are the vaporisers and the power blocks which will be required to operate continuously whilst the generators are in use (i.e. operate continuously for the daytime period).

It is understood that up to two deliveries of LNG will be required per day. At this stage it is understood that deliveries could occur at any time (daytime or night-time). Flogas Britain have confirmed that it can take between 1½ to 2 hours to fill the storage tank per delivery.

Sol have been provided with on-site source noise level measurement as conducted by Flogas Britain on a similar and existing LNG compound. It is understood that these measurements were conducted by Flogas Britain on 14 June 2017 with a Type 2 sound level meter (and as such full octave band noise level data is not currently available). A summary of the noise level measurements as conducted by Flogas Britain is presented in Table 2.

Operation	Sound Pressure Level, dB $L_{Aeq,T}$	Measurement Location / Distance	Flogas Comments
LNG Compound	59	Centre of compound	Normal operation
HGV line purge at tanker	49	15m	Only occurs during filling operation, to remove air from pipeline
HGV Pumping (with HGV engine running)	70	15m	Only occurs during filling operation, 1.5 to 2 hours duration
Vapour balance	51	15m	only during filling operation
Sounder	54	15m	dead man's alarm, couple seconds duration

Table 2: Summary of Flogas noise level measurements of existing LNG compound

In addition to the above noise sources, noise from the HGV movements on site will also need to be considered. Table 3 provides noise level data for a HGV movement as taken from the library of noise sources as presented in British Standard 5228-1:2009: *Code of practice for noise and vibration control on construction and open sites – Part 1: noise*.

Noise Source	Drive-By Maximum Sound Pressure Level, dB L_{Amax}	Measurement Location / Distance	Noise Source Ref.
44-tonne 6-axle HGV transit	80	10m	BS5228-1:2009 Table C.2 #34

Table 3: Noise data adopted for HGV movements on site

All of the above baseline noise level data will require validation by Sol, prior to finalisation.

3.2.4 Noise Source Utilisation

Table 4 presents the anticipated utilisation for each source associated with the LNG compound during the worst-case one-hour daytime assessment period, or worst-case fifteen-minute night time assessment period, assuming that deliveries could occur at any time, as used to inform this assessment:

Operation	**Number of units**	**Utilisation**	
		Daytime (07:00 – 23:00) T = 1hour	**Night time (23:00 – 07:00) T = 15min**
Generator Enclosure (including Air Outlet Louvre)	20	100%	-
Air Inlet Penthouse Louvre	20	100%	-
Engine Exhaust	20	100%	-
Remote Radiator	20	100%	-
LNG Compound	1	100%	-
HGV line purge at tanker	1	>1%	>1%
HGV Pumping (engine running)	1	100%	100%
Vapour Balance	1	10%	10%
Sounder	1	>1%	>1%
HGV transit	1	1 per period	1 per period

Table 4: Anticipated utilisation all proposed noise sources compound

4.0 DETAILS OF INVESTIGATION

In order to inform the assessment, an environmental noise survey has been conducted by Sol between 20th April and 24th April 2017. The purpose of these measurements was to determine the prevailing background noise levels expected at the nearest noise sensitive premises to the development site, for environmental noise benchmarking and assessment purposes.

Two environmental noise measurement positions were selected to inform the survey:

- **Noise Monitoring Position 1**: The measuring location was sited approximately 400m to the west the development site boundary, and just to the east of the residential premises on Medina Way. The microphone was installed at a height of approximately 2.4m above location ground level. The background noise levels measured at Position 1 are considered to be representative of those expected at the residential estate on the west side of Claycliffe Road.

- **Noise Monitoring Position 2**: The measuring location was sited approximately 420m to the south east the development site boundary, and approximately 20m to the east of the residential premises on Coppice Avenue. The microphone was installed at a height of approximately 3m above location ground level. The background noise levels measured at Position 2 are considered to be representative of those expected at the residential estate off Wilthorpe Road, as well as that expected at the proposed new residential development located off Dearne Hall Road.

The locations of the noise monitoring positions are as shown in Figure 1.

The noise survey was carried out using Type 1 Precision Grade noise monitoring equipment, and the complete measuring systems were field calibrated immediately prior to, and following the noise survey period. (Full details of the noise monitoring systems are retained on file by Sol, including traceable calibration records; these are available for review if needed).

During all environmental noise measurements, the prevailing weather conditions remained favourable for the purposes of environmental noise assessment throughout the entire survey period, with a light breeze (with a mean wind speed of 1m/s) and no rain occurring. Further details of the identified weather conditions are provided in Appendix A.

Notwithstanding the weather conditions recorded, the microphone systems were entirely weatherproofed and fitted with all-weather environmental windshields, each with bird spike.

5.0 NOISE SURVEY RESULTS SUMMARY

5.1 Background Noise Climate

Table 2 provides a basic summary of the typical overall, A-weighted noise levels measured at the various noise monitoring locations, in L_{Aeq} and L_{A90} terms, as during daytime and night time periods, weekdays and weekends. The specific, measured noise levels pertinent to the BS4142 environmental noise assessment are highlighted in ***bold, italic*** text. The key observations are provided below:

Position	Date	Daytime (07:00 - 23:00)		Night Time (23:00 – 07:00)	
		dB $L_{Aeq,16hour}$	**dB $L_{A90,15min}$ (Typical)**	**dB $L_{Aeq,8hour}$**	**dB $L_{A90,15min}$ (Typical)**
1	Thursday 20 April 2017	62*	***48***	58	***44***
	Friday 21 April 2017	62	50	57	***35***
	Saturday 22 April 2017	63	***44***	56	***35***
	Sunday 23 April 2017	62	***44***	57	36
	Monday 24 April 2017	64*	58	-	-
2	Thursday 20 April 2017	48*	***43***	49	39
	Friday 21 April 2017	53	***43***	48	***34***
	Saturday 22 April 2017	51	***37***	48	***32***
	Sunday 23 April 2017	49	38	49	***37***
	Monday 24 April 2017	64*	48	-	-
	***** Measurement not conducted for the full 16-hour assessment period				

Table 5: Summary of typical, measured broadband environmental noise levels

Appendix A provides further information, including detailed noise time-history graphs for all the measured receptor daytime, night time, weekday and weekend background noise survey data.

6.0 ENVIRONMENTAL NOISE IMPACT ASSESSMENT

6.1 BS4142 Assessment Methodology and Adopted Environmental Noise Targets

BS 4142: 2014: *Method for rating and assessing Industrial and commercial sound* (BS 4142) is intended to be used to assess noise of an industrial nature, which includes sound from fixed installations, which comprise mechanical and electrical plant and equipment.

The procedure contained in BS 4142 for assessing the impact is to compare the measured or predicted noise level from the source in question, the 'Specific Noise Level' immediately outside the noise sensitive premises, with the background noise level. Where the noise contains attention attracting characteristics such as tonal, impulsive, intermittent elements, it may be appropriate to apply a correction to the specific noise level to obtain the 'Rating Level'.

The Standard advises that where 'specific sound features' are present, a penalty can be applied to the Specific Sound Level (i.e. the total, calculated, aggregate plant noise level at each NSR in this instance, daytime and night time), in order to obtain the Rating Level.

BS 4142 states 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. Typically, the greater this difference, the greater the resulting environmental noise impact:

a) Typically, the greater this difference, the greater the likelihood of complaint.

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

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

The lower the Rating Level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the Rating Level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

For the daytime, this assessment is carried out over a one-hour period, and over a 15 minute period at night. The daytime and night-time periods are defined as occurring between 07:00 to 23:00 hours and 23:00 to 07:00 hours respectively.

Thus, in BS4142 assessment terms, it is considered appropriate to limit the combined *Rating Level* from the development site to not exceed the typical measured weekday and weekend daytime background noise levels.

On this basis, and based upon the results of the environmental noise survey, the following daytime maximum permissible Rating Level limits apply at the nearest noise sensitive premises:

Measurement Position	Associated Residential Premises	Assessment Period	Maximum Permissible Rating Level Limit, dB $L_{Ar,Tr}$
1	Claycliffe Road	Weekday Daytime (07:00 - 23:00)	48
		Weekend Daytime (07:00 - 23:00	44
		Weekday Night time (23:00 – 07:00)	44
		Weekend Night time (23:00 – 07:00)	35
2	Wilthorpe Road and proposed development off Dearne Hall Road	Weekday Daytime (07:00 - 23:00)	43
		Weekend Daytime (07:00 - 23:00	37
		Weekday Night time (23:00 – 07:00)	34
		Weekend Night time (23:00 – 07:00)	32

Table 6: Maximum permissible Rating Level limits at NSRs

7.0 NOISE IMPACT ASSESSMENT

7.1 Methodology and Basis for the Assessment

In order to predict the likely resultant environmental noise levels impinging noise sensitive receptors, 3D computer based environmental noise models were created using the DataKustik 'CadnaA' Noise Mapping software. The following assumptions have been made in the generation of the noise models:

- The noise model was set up to apply the noise prediction methodology set out in ISO 9613-2: *Acoustics – Attenuation of Sound propagation outdoors – Part 2: General Method of Calculation.*

- The model was set to include up to second order reflected noise from solid structures.

- The existing land topography of the development site and surrounding area up to and including the nearest noise sensitive premises has been taken into consideration in the assessment. 3rd party topographical information has been obtained from emapsite.com.

- Acoustic screening afforded by nearby buildings and solid structures located between the proposed Development Site and the noise sensitive receptors have been considered in the assessment.

- For the purposes of the assessment, and to present the worst case, it has been assumed that all consented generators are in full operation between the consented hours of operation 07:00-23:00hours, seven days a week.

- The generator enclosure has been modelled as a 5-sided 3D noise radiating object, based upon the dimensions stated for the unit, assuming uniform noise propagation from each surface. The sound power level of the unit was determined to ensure that the unit achieves a sound pressure level of 67 dB(A) at 1m (including 2dB measurement tolerance) within the model.

- The air intake penthouse louvre, exhaust and remote radiator have been modelled as separate and additional points sources, mounted at the appropriate height on top of the generator.

- The LNG compound has been modelled as an area source of dimension as shown on the site plan to produce a sound pressure level of 62dB(A) at 1m. A +3dB correction has been applied to predict the potential noise level impact from the proposed compound with 8 vaporisers.

- The Line purge, pumping vapour balance and sounder have been modelled as point sources located within the designated loading.

- With regards to LNG deliveries, and given that it takes up to two hours for the tanker to fill the LNG tanks, it is assumed that up to one HGV will either arrive at or depart from (but not both) during any given daytime one-hour assessment period or fifteen-minute night-time assessment period. The HGV movements for deliveries have been modelled as a moving point source (based upon the drive-by maximum sound pressure level as presented Table 3) as located along the proposed new access to the site and assuming an average speed of 12mph during transit.

- Full octave band noise level data for the proposed generator enclosures (including air inlet and outlet), exhaust, remote radiator and the LNG compound is not available at this stage. In the absence of full octave band noise data, the noise impact from these noise sources has been modelled a single A-weighted sound power level in the 250Hz octave band only. This assumption assumes that all of the sound energy generated by the noise source is created at low frequency only. This assumption, in effect, presents the worst case and would be expected to result in a noise impact that is higher than that expected based upon full octave band noise data. This assumption has been adopted for the following reasons:

    - Noise from generator engines are typically higher at lower frequencies, particularly towards the 250Hz octave band.

    - Low frequency noise can be more difficult to attenuate when compared to the mid and high frequencies.

    - Any acoustic screening afforded by any intervening buildings and barriers is typically lower at low frequency.

    - Attenuation due to atmospheric/environmental factors (such as air and ground absorption), is typically lower at low frequency.

7.2 Predicted Environmental Noise Level Impact at Receptors

Table 7 presents the predicted cumulative specific sound level at each NSR during both the daytime and night-time periods. The corresponding noise maps are presented in Appendix B of this report. In all cases, the noise levels have been predicted at 4m above local ground level.

NSR	Plant source	Calculated specific noise level at NSR	
		Daytime (07:00 - 23:00), T = 1hour	**Night time (23:00 – 07:00), T = 15min**
Residential Estate on Claycliffe Road	Generators (including casing, exhaust, remote radiator)	32	-
	LNG Compound	14	-
	LNG Delivery	26	26
	Cumulative Specific Sound Level	**33**	**26**
Residential estate off Wilthorpe Road	Generators (including casing, exhaust, remote radiator)	32	-
	LNG Compound	17	-
	LNG Delivery	28	29
	Cumulative Specific Sound Level	**33**	**29**
Proposed residential estate off Dearne Hall Road	Generators (including casing, exhaust, remote radiator)	33	-
	LNG Compound	16	-
	LNG Delivery	26	26
	Cumulative Specific Sound Level	**33**	**26**

Table 7: Predicted Specific Sound Level at each NSR

Based upon the predicted specific noise level at each NSR, Table 8 presents the predicted overall A-weighted, BS4142-defined 'Rating Level' at the identified noise sensitive receptors during weekday and weekend daytime and night-time periods. The predicted Rating Level is compared to the existing background noise level in each instance, for each NSR.

Note that a correction of +4dB has been applied to the Specific Noise Level to determine the Rating Level to account for any "clearly perceptible" tone associated with the noise level emissions expected from the generators, the LNG compound and from LNG deliveries.

The potential acoustic character associated with the impulsive operation of the generators has also been considered as part of the assessment, although no specific correction has been applied. It is reasonable to suggest that the intermittent operation of individual generators is not expected to be audible when the majority/all of the other generators are operating. Given that there are 20 permitted generators proposed, the combined noise level produced by all generators operating will be approximately 13dB higher than that produced by any individual generator, and as such the intermittent character of the noise of individual generators switching on/off is not expected to be discernible when the remainder of the generators are operating.

The acoustic character associated with the intermittent operation of generators could be expected to be more discernible when the majority/all of the other generators are switched off. However, in this instance, the specific noise level generated from the site would be lower and would not result in a higher noise level impact than that expected when all generators are operating. For example, applying an additional correction of +3dB for the intermittent operation of generators switching on/off but assuming that only up to, say, approximately 25% of the generators are operating (-6dB correction) would result in a lower Rating Level at the nearest noise sensitive premises than that expected when all generators are operating simultaneously.

On this basis, the assessment has assumed that all generators are operating simultaneously, with no correction applied for the acoustic character associated with the intermittent operation of generators as this scenario represents the worst case.

Residential Dwellings	Assessment Period	Predicted Rating Level, dB $L_{Ar,Tr}$	Typical Background Noise level, dB L_{A90}	Exceedance, dB
Residential Estate on Claycliffe Road	Weekday Daytime (07:00 - 23:00), T = 1hour	37	48	-
	Weekend Daytime (07:00 - 23:00), T = 1hour	37	44	-
	Weekday Night time (23:00 – 07:00), T = 15min	30	44	-
	Weekend Night time (23:00 – 07:00), T = 15min	30	35	-
Residential estate off Wilthorpe Road	Weekday Daytime (07:00 - 23:00), T = 1hour	37	43	-
	Weekend Daytime (07:00 - 23:00), T = 1hour	37	37	-
	Weekday Night time (23:00 – 07:00), T = 15min	33	34	-
	Weekend Night time (23:00 – 07:00), T = 15min	33	32	1
Proposed residential estate off Dearne Hall Road	Weekday Daytime (07:00 - 23:00), T = 1hour	37	43	-
	Weekend Daytime (07:00 - 23:00), T = 1hour	37	37	-
	Weekday Night time (23:00 – 07:00), T = 15min	30	34	-
	Weekend Night time (23:00 – 07:00), T = 15min	30	32	-

Table 8: Predicted operational noise levels at receptors, at 4m height

It can be seen from Table 8 that the predicted Rating Level is not expected to exceed the existing background noise level at any of the identified noise sensitive receptors during both the weekday and weekend daytime periods and during the weekday night time period. In accordance with BS4142, this is an indication that the development proposals will have a *low impact* on the nearest affected NSRs during the weekday and weekend daytime periods and during the weekday night time period.

However, the assessment indicates that predicted Rating Level is expected to exceed the existing background noise level at the existing residential estate off Wlithorpe Road by 1dB during the weekend night time period. In accordance with BS4142, this is still considered to be an indication that the development proposals will have a *low impact* on the nearest affected NSRs.

The main cause of this small noise level exceedance is the noise levels generated during LNG deliveries, in particular, the noise levels generated from the HGV pumping LNG into the compound. Whilst a 1dB exceedance is not considered to be significant, it is possible to ensure that the predicted Rating Level from the site is not expected to exceed the existing background noise level at any NSR at any time by restricting LNG deliveries to the following times:

- Monday to Friday: Anytime
- Saturday and Sunday: 07:00 – 23:00 only

8.0 CONCLUSION

Sol Acoustics Ltd (Sol) has been commissioned by Reliance Energy (RE) via GP Planning Limited (GP) to conduct an environmental noise assessment to establish the environmental noise impact likely to be occurring on the surrounding environment from the operation of the proposed Flexible Generation Facility located on Whaley Road in Barugh, Barnsley.

This environmental noise assessment is in part based on the results obtained from benchmark noise survey at the existing site and surrounding area as carried out during weekdays and weekend, daytime and night time periods between 20th April and 24th April 2017 (inclusive).

The assessment has shown that based upon the current permitted generators and ancillary plant, with manufacturer agreed noise mitigation (which has been developed specifically for this scheme and based upon previous review of the site and surrounding noise sensitive receptors) as well as noise from the proposed Liquefied Natural Gas (LNG) compound and LNG deliveries, the Rating Level expected from the site is not expected to exceed the pre-existing background noise levels at any of the identified existing and currently proposed residential developments during the weekday and weekend daytime periods, and during the weekday night time period. However, the predicted Rating level is expected to marginally exceed the existing background noise level by 1dB at a single NSR during the weekend night time period.

Whilst, the identified exceedance is not considered to be significant, it is possible to ensure that the predicted Rating Level from the site is not expected to exceed the existing background noise level at any NSR at any time by restricting LNG deliveries to the following times:

- Monday to Friday: Anytime
- Saturday and Sunday: 07:00 – 23:00 hours only

APPENDIX A
NOISE SURVEY DETAILS AND SUMMARY RESULTS

LOCATION

Barugh, Barnsley

DATES, TIMES AND WEATHER CONDITIONS

20th April 2017	12:00 hrs to 23:59 hrs	7 to 16°C, Wind: 1 m/s mean, 6 m/s max
21st April 2017	00:00 hrs to 23:59 hrs	7 to 16°C, Wind: 1 m/s mean, 7 m/s max,
22nd April 2017	00:00 hrs to 23:59 hrs	7 to 14°C, Wind: 1 m/s mean, 6 m/s max,
23rd April 2017	00:00 hrs to 23:59 hrs	10 to 16°C, Wind: 1 m/s mean, 5 m/s max
24th April 2017	00:00 hrs to 20:00 hrs	4 to 13°C, Wind: 1 m/s mean, 8 m/s max

No precipitation was recorded throughout.

PERSONNEL PRESENT DURING MEASUREMENTS

Mark Greenhalgh – Sol Acoustics

Darren Clucas – Sol Acoustics

INSTRUMENTATION

Position 1

Norsonic 118 Sound level meter (serial no. 28260)

Norsonic 1206 Microphone preamplifier (serial no. 30962)

Norsonic 1225 Microphone capsule (serial no. 29923)

Norsonic 1251 Calibrator (serial no. 29917)

Position 2

01 dB DUO Sound level meter (serial no. 10151)

01 dB DUO Microphone capsule (serial no. 136919)

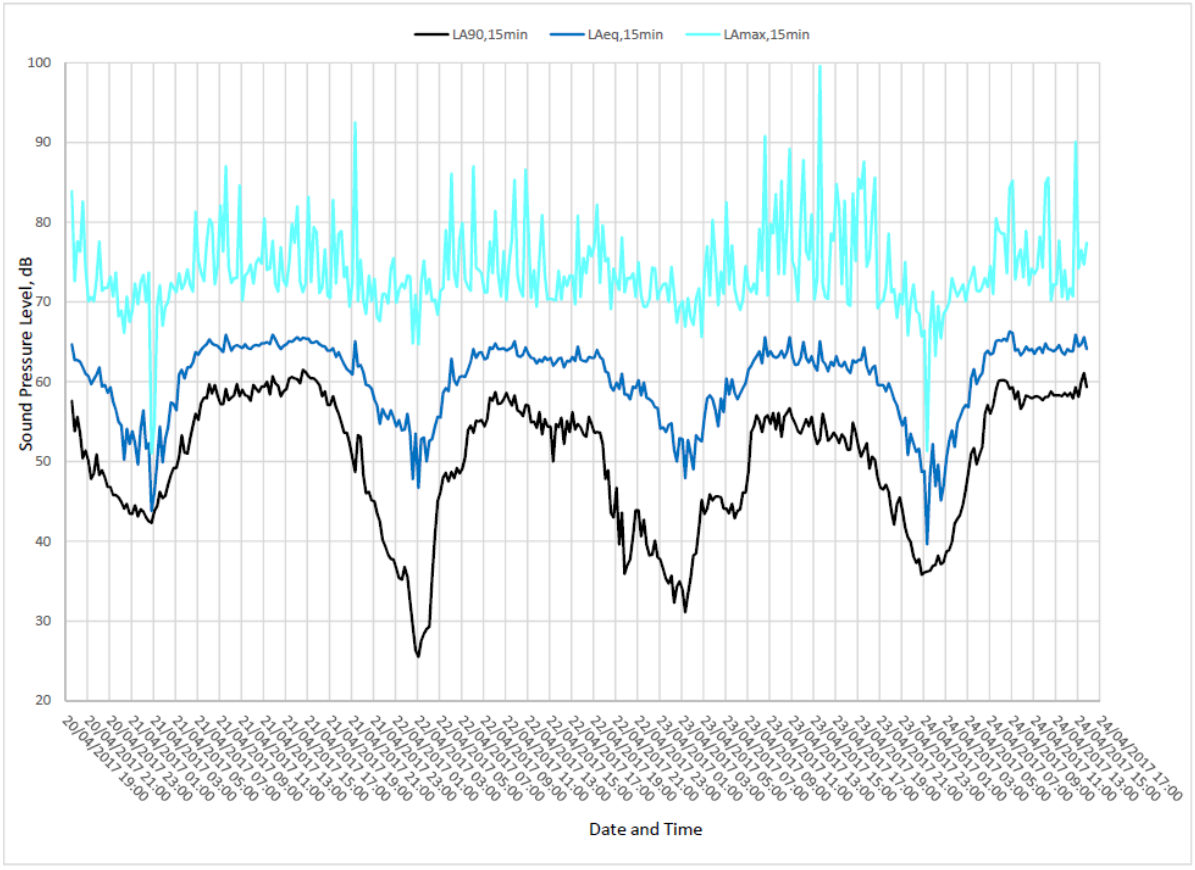
01 dB CAL 21 Acoustic calibrator (serial no. 35183003)

METHODOLOGY

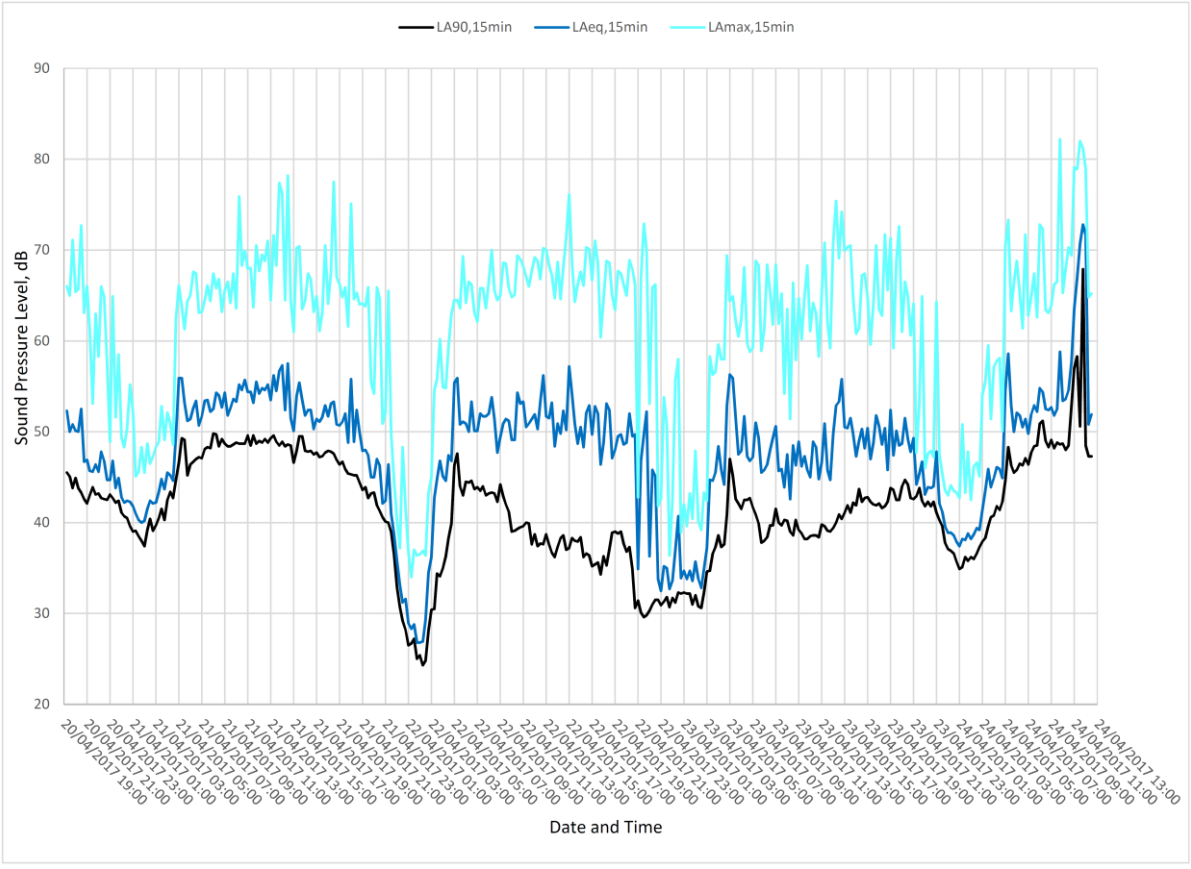
Before and after the measurements the noise monitoring equipment was calibrated to an accuracy of ±0.3dB using the Cal 21 Calibrator. The calibrator produces a sound pressure level of 94dB re $2x10^{-5}$ Pa @ 1kHz.

MEASUREMENT RESULTS

Graphs A1 and A2 summarise the results obtained at Monitoring Positions 1 and 2 respectively.



Graph A1: Position 1, 20th to 24th April 2017



Graph A2: Position 2, 20th to 24th April 2017

APPENDIX B

CADNAA NOISE MAP

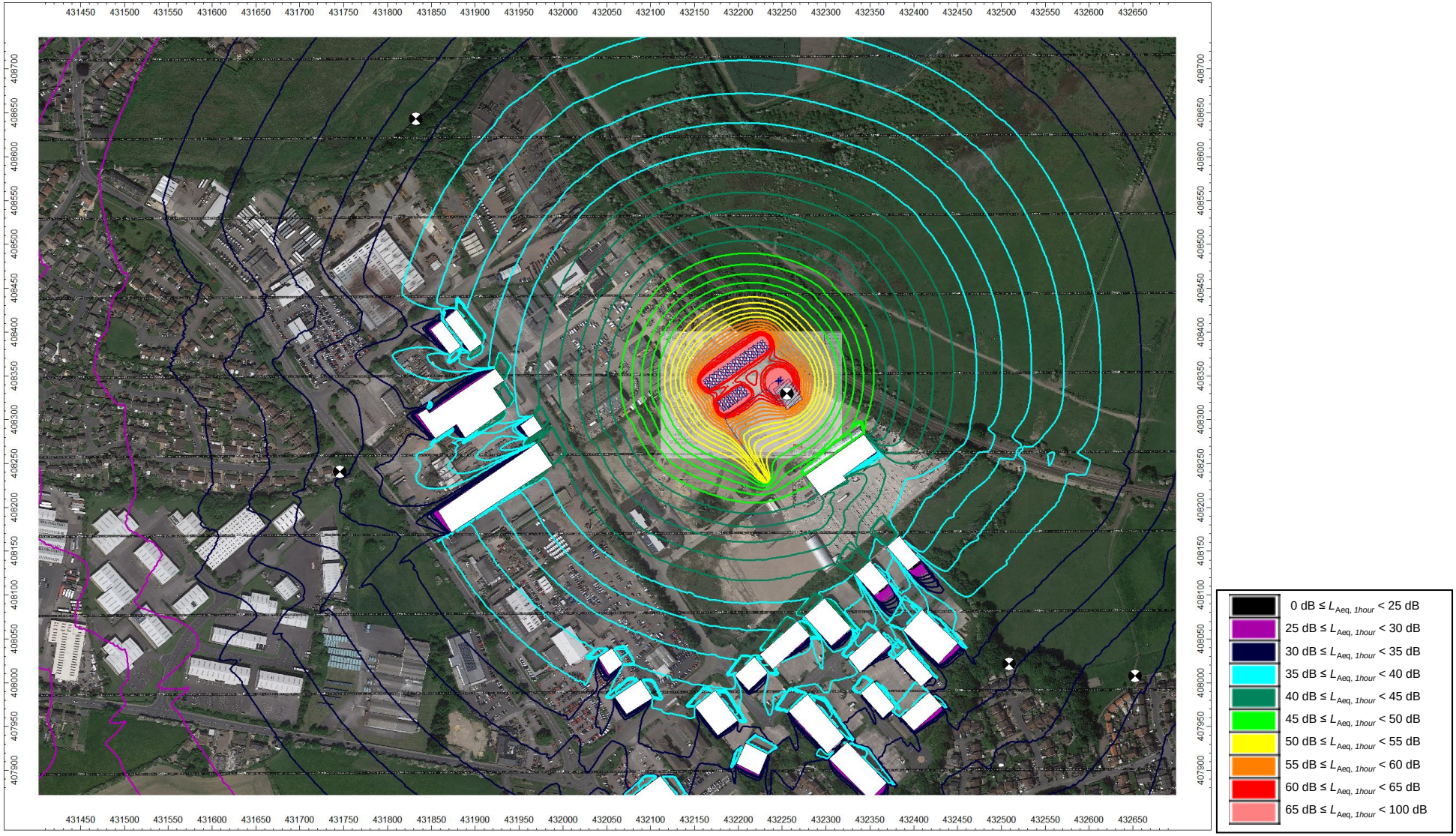


Figure B1: Predicted daytime $L_{Aeq,1hour}$ Specific noise level impact from the site at 4m above local ground level

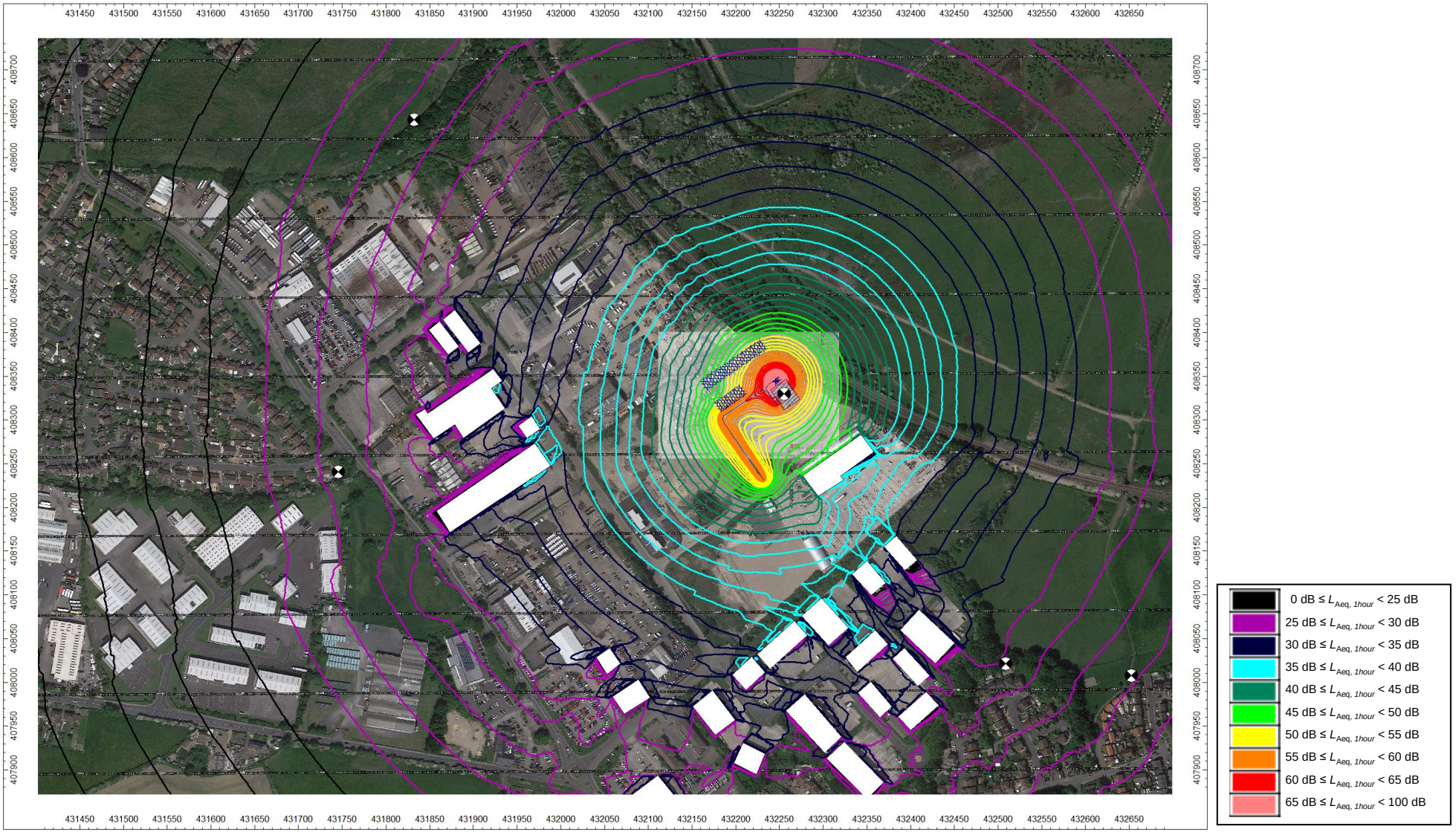


Figure B1: Predicted night time $L_{Aeq,15min}$ Specific noise level impact from the site at 4m above local ground level

APPENDIX C

DETAILS OF MANUFACTURER CONFIRMED NOISE MITIGAION

LINDENBERG-ANLAGEN GMBH

Stromerzeugungs- und Pumpenanlagen
Schaltanlagen

Energy Circle plc
33 St James´s Square
London SW1Y 4JS

Overath, Oct.,18th, 2017

Sound mitigation measures for 20MWe Barugh Project REV1

LIAG Project No. 11-170924

Dear Sirs,

Please find attached the results of a sound design calculation designed with below named components:

Engine:	Perkins 4016-61 TRS 2
Alternator:	Leroy Somer or equal
Container:	12.200 x 3.000 x 3.000 mm with additional sound mitigation measures WITHOUT concrete housings around container

Following sound mitigation measures are considered after technical discussion on Oct. 18th 2017 with Mr. Simon Ferenczi and Mr. Jameel Khan:

1. Thickness of side wall panels increased from 1,5mm to 3mm
2. Thickness of side wall insulation material (mineral wool) from 80mm to 100mm
3. Additional sound damping bitumen plates in side wall panels
4. Air inlet sound baffle length: 2.000mm until deflection, incl. 90° air deflection also equipped with sound baffles to increase overall baffle length (plant requires appr. 45.000 m³/h air for combustion and removal of radiated heat from engine, alternator and auxiliaries)
5. Rectangular exhaust gas silencer on rooftop with sound baffles as sound damping devices
6. Installation of 2pcs axial fans for air flow instead of 1pc.

In consideration of these measures, a sound pressure level of 65 dB(A) at 1 m should not be exceeded by engine exhaust silencer tailpipe noise level (and silencer casing radiated noise level), and acoustic enclosure radiated noise level as measured at any position (including at inlet and outlet louvres) for one single unit as described above.

Geschäftsführer:
Dipl.-Ing. Rainer van der Beek
Dipl.-Ing. Alejandro Held
Dipl.-Ing. Daniel Blank

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für MAN-Industrie- und Schiffs-
dieselmotoren

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Management System ISO 9001:2008 TÜVRheinland ZERTIFIZIERT

Bankverbindungen:

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IBAN: DE 44370626001507600014

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Stromerzeugungs- und Pumpenanlagen
Schaltanlagen

Below shown values are theoretical design values and under reservation.

Sound pressure Level Engine [dB in 1m]:	102
Sound pressure Level Exhaust [dB in 1m]:	118*
Sound pressure Level Fan [dB in 1m]:	99,9
Insertion loss air inlet silencer [dB]:	59,5
Insertion loss air outlet silencer [dB]:	59,5
Insertion loss rectangular exhaust silencer [dB]:	69,1

Please note:

1. These values are for one containerised unit and not for complete plant. For a detailed calculation of a sound design concept of complete plant we need to discuss several possibilities regarding the positions of every Genset in the general plant layout.
2. The insertion losses may change with every change of the design layout and are not applicable for any other kind of plant design.
3. Table cooler with slow running fans is not yet considered in this calculation. In general, sound pressure level of this coolers will not exceed 60 dB(A) in 1m.

Yours faithfully,
For: Lindenberg-Anlagen GmbH

Alejandro Held
Managing Director Sales & After Sales

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i.A Michael Hammes
Sales Power Division

*This value is no official value by engine manufacturer. After checking, engine manufacturer will NOT give or even confirm any value for exhaust sound of used engine.

Enclosures:
Attachment 1 Overview Results Sound Calculation 170924 REV2
Attachment 2 Example Container Layout 170924 REV2
Attachment 3 Sketch Draw Rectangular Exhaust Silencer
Attachment 4 Technical Information LIAG Machine Housings
Attachment 5 Sample Drawing of LIAG Machine Housing

Geschäftsführer:
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IBAN: DE 44370626001507600014

Zusammenfassung der Ergebnisse

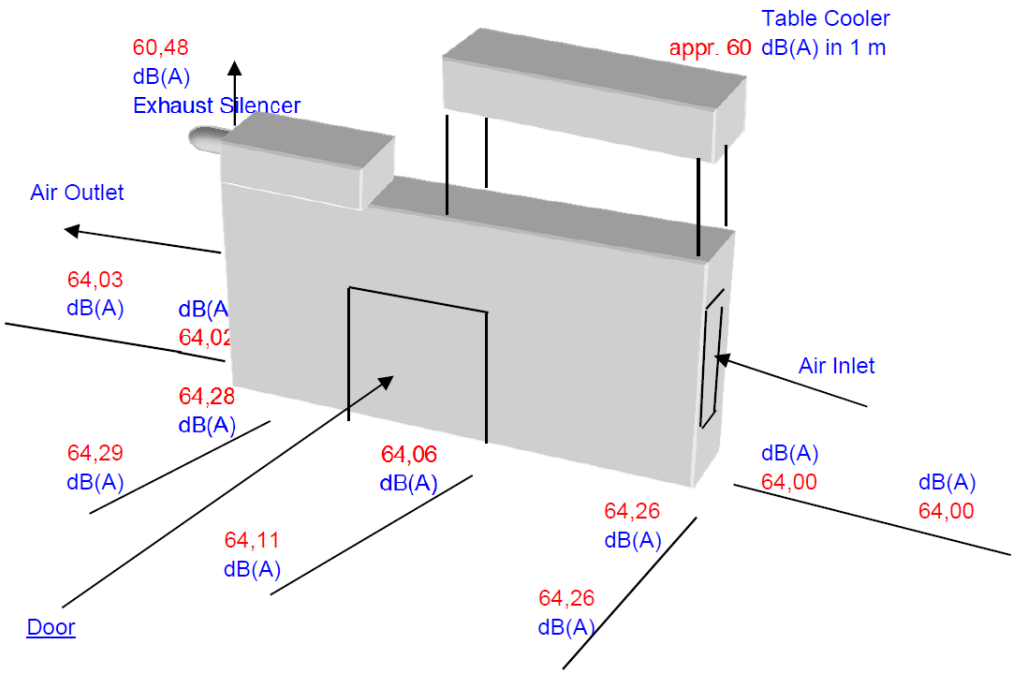
V:\06 STATIONÄR\02 Projekte\Projekte 17\Projekte\11-170924 MH UK 20 MW Peaking Plant Barugh with PEI

Lindenberg-Anlagen GmbH

Berechnung des Schalldruckpegels in einer bestimmten Entfernung bei Zu-Abluft in Front & Rückwand:

Abgas-Schalldämpfer auf Dach Version: D Seite - 2 -

Seitenansicht auf Aggregat mit Kühlanlage auf Dach



Order No	0,00	Arithmetisches Mittel			
Projekt-Nr.	170924	1,30	m	64,15	dB(A)
Engine	Perkins 4016 61 TRS 2	1,00	m	64,17	dB(A)
Engine Power @ Measurement		1042,00	KW		

in	0,00	m distance	0,00	m distance	
P1 in dB(A)	64,03	P9 in dB(A)	64,02	Delta in dB	0,00
P2 in dB(A)	64,29	P10 in dB(A)	64,28	Delta in dB	0,00
P3 in dB(A)	64,11	P11 in dB(A)	64,06	Delta in dB	-0,05
P4 in dB(A)	64,26	P12 in dB(A)	64,26	Delta in dB	0,00
P5 in dB(A)	64,00	P13 in dB(A)	64,00	Delta in dB	0,00
P6 in dB(A)	64,26	P14 in dB(A)	64,26	Delta in dB	0,00
P7 in dB(A)	64,11	P15 in dB(A)	64,06	Delta in dB	-0,05
P8 in dB(A)	64,29	P16 in dB(A)	64,28	Delta in dB	0,00

Sound pressure level inside	107,31	dB(A)	Delta in dB	43,14	in 7 m
Damping of hood/container	44,69	dbB(A)	Sound power	87,67	dB(A)
sm Meßentfernung in m:	1,00	m	Datum:		20.10.2017