Noise Assessment for Peaking Plant Facility – Saltholme North, Middlesbrough

Statera Energy Limited

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Quality Management

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1 Introduction

1.1 RPS Planning and Environment has been commissioned by Statera Energy Limited to undertake a noise assessment for a proposed gas-fired peaking plant facility at land west of the A1185, north of Middlesbrough. The site will be known as Saltholme North and comprises a block of four gas-fired engines with a total output of 49.99 MW. The Application Site is located within the administrative area of Stockton-On-Tees Borough Council (SoTDC).

1.2 This assessment builds on the assessment presented in reports JAT10500-REPT-05-R3 “Noise Assessment for Peaking Plant Facility: Saltholme North” and JAT10500-REPT-06-R3 “Noise Assessment for Peaking Plant Facility: Saltholme South”, produced by RPS 23rd August 2018 for input into the planning process.

1.3 The proposed development is for a gas-fired Peaking Plant Facility (PPF), which would operate at times of peak demand and, in accordance with the requirements of the Environmental Permit which will be required to operate the site, will be operational for no more than 3,500 hours in any one year. Typically, the PPF would be switched off but on standby awaiting an instruction from National Grid (NG) to power-up. These instructions could come as a result of system instability, which may occur every three to five days and would require the PPF to operate for a period ranging from one to seven hours, between 07.00 and 20.00 hrs. During the winter ‘peak’ periods (November to February), the facility may generate energy to reduce stress on the electricity transmission system; historically, these peaks, and hence additional generating times, last for up to three hours, between 16.30 and 19.30 hrs.

1.4 Outside of these hours, such as during a major power shortage or system stress event, NG may require the facility to step-in and provide generating support in an emergency situation. For example, there have been three NISM (Notice of Insufficient Margin) warnings in the last six years, all occurring in the early evening at peak demand. The likelihood of the facility being required to start up at night is extremely low but has been considered in this assessment in conjunction with use during the more likely times of the day and evening.

1.5 The assessment has been undertaken based upon appropriate information on the proposed development provided by Statera Energy Limited and manufacturer’s data. RPS is a member of the Association of Noise Consultants (ANC), the representative body for acoustics consultancies, having demonstrated the necessary professional and technical competence. The assessment has been undertaken with integrity, objectivity and honesty in accordance with the Code of Conduct of the Institute of Acoustics (IOA) and ethically, professionally and lawfully in accordance with the Code of Ethics of the ANC.

1.6 The technical content of this assessment has been provided by RPS personnel, all of whom are corporate (MIOA) or non-corporate, associate members (AMIOA) of the IOA (the UK's professional body for those working in acoustics, noise and vibration). Personnel and individual qualifications are provided within the Quality Management table at the start of this report and in Appendix A in accordance with the requirement of Section 12 of British Standard (BS) 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' [1].This report has been peer reviewed within the RPS team to ensure that it is technically robust and meets the requirements of our Integrated Management System.

2 Acoustic Terminology and Concepts

2.1 This section provides an overview of the fundamentals of how sound propagates away from a source.

2.2 Increasing the distance from a sound source normally results in the level of sound getting quieter, due primarily to the spreading of the sound with distance, analogous to the way in which the ripples in a pond spread after a stone has been thrown in. Another important factor relates to the type of ground over which the sound is travelling. Acoustically “soft” ground, (such as grassland, ploughed fields etc.) will result in lower levels of sound with increasing distance from the sound source as compared to acoustically “hard” surfaces (e.g. concrete, water, paved areas). The reduction in sound level depends, however, on the frequency of the sound.

2.3 Wind also affects the way in which sound propagates, with sound levels downwind of a source being louder than upwind. This is partly due to the sound ‘rays’ being bent either upwards or downwards by the wind in a similar way that light is bent by a lens, as shown in Figure 2.1. Varying temperatures in the atmosphere can also cause sound ‘rays’ to be bent, adding to the complexity of sound propagation.

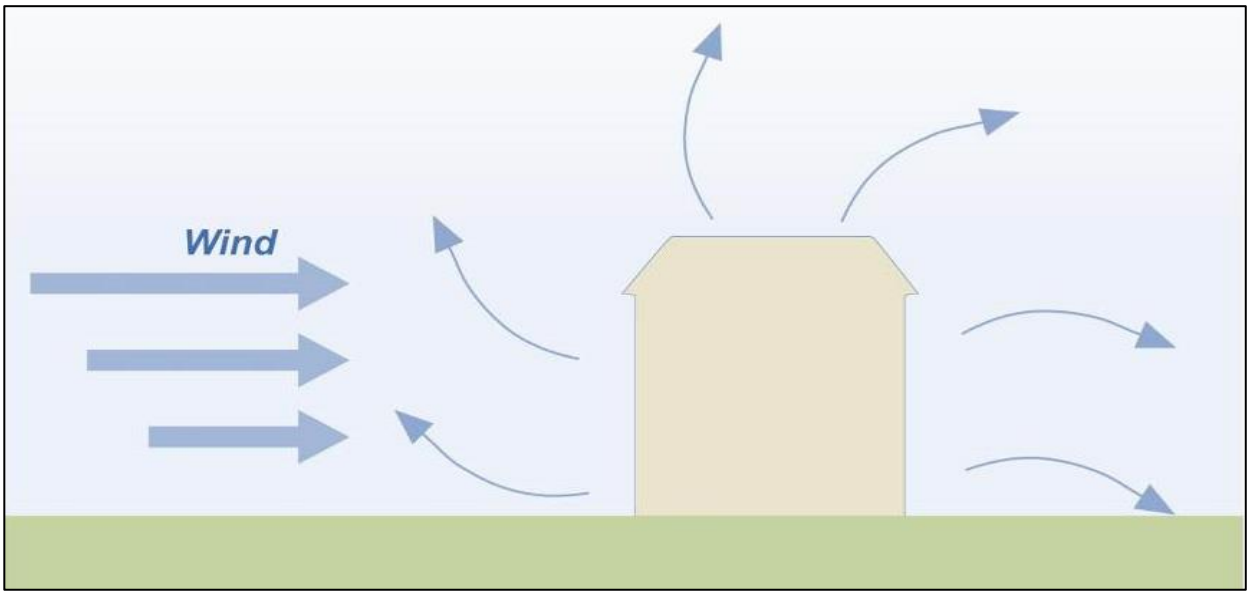

Figure 2.1 Refraction of Sound Waves Due to Wind Gradients (increasing wind speed with height)

2.4 Another attenuation mechanism is absorption of sound by the molecules of the atmosphere. Higher pitched (higher frequency) sounds are more readily absorbed than lower pitched (lower frequency) sounds. The factors affecting the extent to which the sound is absorbed are the temperature and the water content of the atmosphere (relative humidity).

2.5 The effect of varying temperature and humidity is usually minimal when compared to other factors, such as wind and ground effects. However, where high frequency sounds are encountered, there may well be a significant variation between measured sound levels on different days due to variations in temperature and humidity.

2.6 When hearing sound which occurs out in the open (e.g. from road traffic, aircraft, birds, wind in the trees etc.), it is common experience that the sound level is not constant in loudness but is changing in amplitude all of the time. Therefore, in order to numerically describe the sound levels, it is beneficial to use statistical parameters. It has become practice to use indices which describe the sound level which has been exceeded for a certain percentage of the measurement period, and also an index which gives a form of average of the sound energy over a particular time interval. The former are termed percentile noise levels and are notated L_{A90}, L_{A50}, L_{A10} etc. and the latter is termed the equivalent continuous noise level and is notated by L_{Aeq}. It is worth noting that if the noise level does not vary with time, then all the parameters, in theory, normalise to a single value.

2.7 With regard to the percentile levels, the L_{A90} is the sound pressure level which is exceeded for 90% of the measurement time. It is generally used as the measure of background sound (i.e. the underlying sound, sometimes referred to as background noise) in environmental noise standards.

2.8 The $L_{Aeq,T}$ is the A-weighted equivalent continuous noise level and is an energy averaged value of the actual time varying sound pressure level over the time interval, T. It is used in the UK as a measure of the noise level of a specific industrial noise source when assessing the level of the specific source against the background sound. It is also used as a measure of ambient sound (i.e. the “all-encompassing” sound field).

2.9 Other useful parameters for describing sound levels include the maximum and minimum sound pressure level encountered over the time period, denote L_{Amax} and L_{Amin} respectively.

2.10 The term 'A' weighting implies a measurement made using a filter with a standardised frequency response which approximates the frequency response of the human ear at relatively low levels of sound. The resulting level, expressed in 'A' weighted decibels, or dBA, is widely used in noise standards, regulations and criteria throughout the world.

2.11 For a more detailed analysis of the frequency characteristics of a sound source, then sound measurements can be made in bands of frequencies, usually one octave wide. The resulting levels are termed octave band sound pressure levels. The standard octave band centre frequencies range from 31.5 Hz (about three octaves below middle ‘C’ on the piano) to 8 kHz (about five octaves above middle ‘C’). This covers most of the audible range of frequencies (usually taken to be around 20 Hz to 20 kHz). Octave band sound levels are usually quoted as

linear data – i.e. without an 'A' weighting filter being applied. For more detailed analysis narrowband filters are useful for analysing tones.

2.12 The term decibel is a relative quantity and should always be referenced to an absolute level. In this report, all sound pressure levels (denoted L_P) are expressed in dB re 20 µPa. Hence, a sound pressure level of 0 dBA refers to a pressure level of 20 µPa, which is generally taken as the lowest level of sound that the human ear can detect. A negative dBA value usually implies that the sound is below the threshold of human hearing.

2.13 Subjectively, and for steady noise levels, a change in noise level of 3 dB is normally just discernible to the human ear. However, a noise change of less than 3 dB could be discernible if it has particular frequency characteristics or if it varies in loudness over time. A difference of 10 dB represents a doubling or halving of subjective loudness.

2.14 Sound power (denoted L_W) is the acoustical power radiated from a sound source. The advantage of using the sound power level, rather than the sound pressure level, in reporting noise from a source is that the sound power is independent of the location of the source, distance from the measurement point and environmental conditions. If the sound power of a source is known, then it is possible to calculate the sound pressure level at a distance away from the source, accounting for the attenuation due to propagation, as discussed above. Sound power levels are referenced to power rather than pressure; hence sound power levels are expressed in dB re 1 pW.

3 Summary of Relevant Policy, Consultation and Guidance

National Planning Policy

3.1 Appendix B provides a complete summary of the relevant guidance contained within national planning policy in the Noise Policy Statement for England (NPSE) [2], National Planning Policy Framework (NPPF) [3] and Planning Practice Guidance on Noise (PPG-N) [4]. These documents do not contain guidance in terms of numerical noise levels. Guidance is provided descriptively, which may be transposed to numerical noise levels for site-specific situations, using the methods contained within BSs. However, there is no specific guidance on this; the research that Defra promoted has apparently been inconclusive and is likely to vary by source.

3.2 Relevant experience and professional judgment are fundamental to all stages of the assessment that leads to the determination of the significance of a noise effect. The non-numeric guidance contained within the PPG-N, based upon the initial advice in the NPSE, is summarised in Table 3.1 below.

Table 3.1 Summary of Guidance from NPSE and PPG-N

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

3.3 The PPG-N states that there are many factors which should be considered when determining if a noise is of concern; one factor is the number of noise events and the frequency and pattern of occurrence of the noise.

Local Planning Policy

Stockton-on-Tees Local Plan

3.4 There are no policies within the currently adopted Stockton-on-Tees Local Plan that deal directly with noise. However, there is saved text contained within the 1997 Local Plan which does refer to noise. Objective 7 of the Stockton-on-Tess 1997 Local Plan states:

"2.80 To ensure that new development does not reverse the improvements to environmental quality already made, all proposals likely to cause noise, grit, dust, fumes, smoke or vibration

will be referred to the relevant pollution control agency for advice. Any controls necessary will be secured through the use of planning conditions or legal agreements."

3.5 The emerging Local Plan has yet to be formally adopted by the Council, however, it was subject to consultation in late 2016 and is expected to be fully adopted in Summer 2018. The document contains the following Policies which reference noise:

"Policy SD5 – Environment and Climate Change Strategy

To ensure the conservation and enhancement of the environment alongside meeting the challenge of climate change the Council will:

1. *Conserve and enhance the natural, built and historic environment through a variety of methods including:*

   …l. Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of ground, air, water, light or noise pollution or land instability. Wherever possible proposals should seek to improve ground, air and water quality."

"Policy ENV7 – Ground, Air, Water, Noise and Light Pollution

Development proposals that may cause groundwater, surface water, air (including odour), noise or light pollution either individually or cumulatively will be required to incorporate measures to prevent or reduce their pollution so as not to cause unacceptable impacts on human health, amenity or the environment."

3.6 On the basis of the above, if the assessment shows that the development does not adversely affect neighbouring uses due to noise, individually or cumulatively, then the development should be permitted.

3.7 In summary, compliance with the requirements of the local policies outlined above may be demonstrated if the results of the assessment, indicate that the development will not give rise to unacceptable adverse noise effects at neighbouring NSRs.

British Standard 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

3.8 The foreword to BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' provides the following introduction for the assessment of human response to sound:

3.9 "Response to sound *can be subjective and is affected by many factors, both acoustic and non-acoustic. The significance of its impact, for example, can depend on such factors as the margin by which a sound exceeds the background sound level, its absolute level, time of day and change in the acoustic environment, as well as local attitudes to the source of the sound and the character of the neighbourhood."*

3.10 BS 4142:2014+A1:2019 2014 primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound' from the proposed development) at residential NSRs. The specific sound level may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and this is then termed the 'rating level' (denoted as $L_{Ar,Tr}$), whether or not a rating penalty is applied. The 'residual sound' is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

3.11 The specific sound levels should be determined separately in terms of the $L_{Aeq,T}$ index over a period of one hour during the daytime and fifteen minutes during the night-time. For the purposes of the Standard, daytime is typically between 07:00 and 23:00 hours and night-time is typically between 23:00 and 07:00 hours.

3.12 BS 4142:2014+A1:2019 states that measurement locations should be outdoors, where the microphone is at least 3.5 m from any reflecting surfaces other than the ground and, unless there is a specific reason to use an alternative height, at a height of between 1.2 m and 1.5 m above ground level. However, where it is necessary to make measurements above ground floor level, the measurement position, height and distance from reflecting surfaces should be reported, and ideally measurements should be made at a position 1 m from the façade of the relevant floor if it is not practical to make the measurements at least 3.5 m from the façade.

3.13 With regard to the rating correction, paragraph 9.2 of BS 4142:2014+A1:2019 suggests the following subjective methods for the determination of the rating penalty for tonal, impulsive and/or intermittent specific sounds:

*"**Tonality***

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can

be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

NOTE 2 If characteristics likely to affect perception and response are present in the specific sound, within the same reference period, then the applicable corrections ought normally to be added arithmetically. However, if any single feature is dominant to the exclusion of the others then it might be appropriate to apply a reduced or even zero correction for the minor characteristics

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level should be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. … If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

3.14 BS 4142:2014+A1:2019 requires that the background sound levels adopted for the assessment be representative for the period being assessed. The Standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated. However, the Standard states that there is no 'single' background sound level that can be derived from such measurements. The accompanying note to paragraph 8.1.4 states that:

"A representative *level should account for the range of background sounds levels and should not automatically to be assumed to be either the minimum or modal value."*

3.15 BS 4142:2014+A1:2019 implies that measurements can be taken in wind speeds up to 5 m/s (i.e. it states "*Exercise caution when making measurements in poor weather conditions such as wind speeds greater than 5 m/s*"). It is considered that, by only using data obtained when wind speeds are at or less than 5 m/s, data will be obtained that is valid in this respect in accordance with BS 4142:2014+A1:2019.

3.16 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level of the specific sound. In the context of the Standard, adverse impacts include, but are not limited to, annoyance and sleep disturbance. Typically, the greater this difference, the greater is the magnitude of the impact:

- 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.
- 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.

3.17 Whilst there is a relationship between the significance of impacts determined by the method contained within BS 4142:2014+A1:2019 and the significance of effects described in the PPG-N, there is not a direct link. It is not appropriate to ascribe numerical rating / background level differences to LOAEL and SOAEL because this fails to consider the context of the sound, which is a key requirement of the Standard.

3.18 The significance of the effect of the noise in question (i.e. whether above or below SOAEL and LOAEL) should be determined on the basis of the initial estimate of impact significance from the BS 4142:2014 assessment with reference to the examples of outcomes described within the PPG-N and after having considered the context of the sound. It is necessary to consider all pertinent factors, including:

- the absolute level of the sound;
- the character and level of the residual sound compared to the character and level of the specific sound; and
- 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:
  - facade insulation treatment;
  - ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
  - acoustic screening.

World Health Organisation (WHO) Guidelines

Guidelines for Community Noise

3.19 The World Health Organisation (WHO) published guidance on the desirable levels of environmental noise in 2000. In this document, Guidelines for Community Noise (GCN) [5], the following advice is provided regarding external ambient sound levels during the daytime:

"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 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}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development."

3.20 The report goes on to state:

"At night, sound pressure levels at the outside façades of the living spaces should not exceed 45 dB LAeq and 60 dB LAmax, so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB."

Night Noise Guidelines

3.21 In 2009 a report was published presenting the conclusions of a World Health Organisation (WHO) working group responsible for preparing guidelines for exposure to noise during sleep entitled "Night Noise Guidelines for Europe" [6]. The document can be seen as an extension to the GCN. Various effects are described including biological effects, sleep quality, and well-being. The document gives threshold levels for observed effects expressed as $L_{max,\ inside}$ and $L_{night,\ outside}$. The L_{night} is a *year-long average* night-time noise level, not taking into account the façade effect of a building. In an exposed population a noise exposure of 40 dB $L_{night,\ outside}$ is stated as equivalent to the "lowest observed adverse effect level" for night noise. Above this level adverse health effects observed are self-reported sleep disturbance, environmental insomnia and increased use of somnifacient drugs and sedatives. Above 55 dB $L_{night,\ outside}$ cardiovascular effects become the major public health concern. Threshold levels for waking in the night, and/or too early in the morning are given as 42 dB $L_{Amax,\ inside}$. Lower thresholds are given that may change sleep structure.

3.22 It is relevant to note that taking into account typical night to night variation in noise levels that will often occur due to meteorological effects and the effects of a façade, the night noise guidelines

are similar to those previously given in the GCN (an external façade noise level of 45 dB L_{Aeq}), although defined in a different way.

3.23 The major concern in Europe is with respect to noise from transportation systems, and most of the studies on which these guidelines are based relate to this type of noise source. There can be no certainty that the same effects will be observed from noise of an industrial nature, but in the absence of any more detailed information some weight should be attached to the WHO guidance when assessing industrial noise as well.

Environmental Noise Guidelines for the European Region

3.24 In 2018, the WHO published new guidance titled 'Environmental Noise Guidelines for the European Region' (ENG) [7]. The guidelines are intended to be suitable for policy making in the WHO European Region and hence they do not specifically apply to individual noise assessments. They do however relate to protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise. The ENG document does not having specific consideration for noise from industrial sources and as such, this report considers the GCN and NNG documents only.

4 Baseline Conditions

Site Description

4.1 The proposed site is located to the north of Middlesbrough, in a predominantly industrial area. The residential Noise Sensitive Receptors (NSRs) in closest proximity to the site are:

- dwellings on Charlton Close, located approximately 1.9 km to the west;
- dwellings on Cowpen Bewley Road, located approximately 1.2 km to the north west;
- dwellings on Cowpen Lane, located approximately 1.2 km to the north west;
- Haverton Hill Hotel, located approximately 1.25 km to the south; and
- dwellings on Lime Tree Close, located approximately 1.35 km to the south.

4.2 The NSRs identified above have all been considered in the assessment and are considered to be of medium sensitivity in relation to noise effects. The approximate site location and nearest NSRs are identified in Figure 1 at the end of this document.

Sound Monitoring Dates and Locations

2018 Survey

4.3 To establish baseline conditions in the vicinity of the site, short term attended sound monitoring was undertaken from 21st to 22nd August 2018 at four locations around the site, which are identified in Figure 1. Measurements comprised of:

- 3 x 15 minute measurements during the day between 11:30 and 17:00;
- 2 x 15 minute measurements during the evening between 19:30 and 22:45; and
- 2 x 15 minute measurements during the night between 01:00 and 04:00.

4.4 Short-term sound monitoring position 1 (‘ST1’) was located on adjacent to Cowpen Lane, opposite the junction with Cowpen Bewley Road. The microphone was mounted on a tripod 1.2 m above ground level in a free-field location (at least 3.5 m from any reflecting surface, excluding the ground). The main sound source in the area was location road traffic and distant industrial noise.

4.5 Short-term sound monitoring position 2 (‘ST2’) was located on the entrance road to the RSPB Saltholme visitor centre. The microphone was mounted on a tripod 1.2 m above ground level in a free-field location. Due to issues with access, it was not possible to monitor at a location within

the wetlands area that was representative of the closest point to the proposed PPF site. Data collected at ST2 is therefore presented for reference only.

4.6 Short-term sound monitoring position 3 ('ST3') was located on Lime Tree Close, approximately 10 m from the junction with Port Clarence Road. The microphone was mounted on a tripod 1.2 m above ground level in a free-field location. The main sound source in the area was local road traffic.

4.7 Short-term sound monitoring position 4 ('ST4') was located on Charlton Close, approximately 20 m from the junction with Greenwood Road. The microphone was mounted on a tripod 1.2 m above ground level in a free-field location. The main sound source in the area was local road traffic and distant industrial noise.

Instrumentation

4.8 Sound level measurements were made using a 'Class 1' Rion NL-52 sound level meter in accordance with BS 7445-2:1991 [ ]. The monitor was programmed to measure various parameters including the LAeq, LAFmax and LA90 values, logging at 15 minute intervals.

4.9 The equipment calibration level was checked prior to and after the monitoring periods – no significant deviations were noted.

4.10 The measurements conformed to the requirements of BS 7445:2003 [ ].

Meteorological Conditions

4.11 Meteorological conditions were monitored and logged using a handheld anemometer. During the evening and night-time periods, wind speeds at survey locations ST2, ST3 and ST4 exceeded 5 m/s at times. As such, measurements undertaken during high wind periods have been removed from the dataset to ensure wind speed did not influenced the measurements.

4.12 There were no recorded periods of precipitation during the survey period.

Results and Discussion

4.13 A time history plot for the long-term monitoring location is provided in Appendix C.

4.14 A summary of the measured baseline sound levels at ST1, ST2, ST3 and ST4 are presented in Table 4.1, Table 4.2, Table 4.3 and Table 4.4 respectively. For the purpose of this assessment daytime is defined as 07.00 – 19.00 hrs, evening as 19.00 – 23.00 hrs and night-time as 23.00 – 07.00 hrs.

Table 4.1 Measured Baseline Sound Levels, ST1 Cowpen Lane

Statistical Parameter	Residual Sound Level, dB $L_{Aeq,T}$			Background Sound Level, dB $L_{A90,T}$			Maximum Sound Level, dB $L_{Amax,T}$		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
Range	52 - 54	46 - 54	43 - 43	37 - 38	38 - 41	38 - 39	69 - 77	70 - 79	53 - 66
Average	53	52	43	38	39	39	73	75	60

Table 4.2 Measured Baseline Sound Levels, ST2 RSPB Wetlands entrance

Statistical Parameter	Residual Sound Level, dB $L_{Aeq,T}$			Background Sound Level, dB $L_{A90,T}$			Maximum Sound Level, dB $L_{Amax,T}$		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
Range	44 - 47	*	42 - 42	40 - 41	*	38 - 38	58 - 67	*	56 - 56
Average	46	*	42	40	*	38	62	*	56

Table 4.3 Measured Baseline Sound Levels, ST3 Lime Tree Close

Statistical Parameter	Residual Sound Level, dB $L_{Aeq,T}$			Background Sound Level, dB $L_{A90,T}$			Maximum Sound Level, dB $L_{Amax,T}$		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
Range	60 - 65	49 - 49	45 - 46	43 - 53	41 - 41	39 - 42	77 - 87	68 - 68	69 - 69
Average	63	49	45	47	41	40	81	68	69

Table 4.4 Measured Baseline Sound Levels, ST4 Charlton Close

Statistical Parameter	Residual Sound Level, dB $L_{Aeq,T}$			Background Sound Level, dB $L_{A90,T}$			Maximum Sound Level, dB $L_{Amax,T}$		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
Range	55 - 61	50 - 50	48 - 51	41 - 48	45 - 45	45 - 48	73 - 88	73 - 73	63 - 66
Average	58	50	50	45	45	46	78	73	64

4.15 As can be seen from Table 4.1 and Table 4.4, measured background sound levels at ST1 and ST4 were lower during the day than in the evening and at night. Wind direction during the day was from the south west, this changed to a north westerly direction during the evening. Contributing noise sources downwind of the survey locations would therefore likely be different between periods and as such, have had an affect on the baseline noise environment. In addition, increased background sound levels during the evening and night-time periods may be as a result of a temporal increase in surrounding activity and not representative of a typical quiet period in these areas. Consequently, in order to ensure the assessment approach is precautionary and robust, it is considered appropriate to assume the lower daytime background L_{A90} sound level is representative of all time periods at ST1 and ST4.

2019 Survey

4.16 To further validate the baseline data, additional monitoring was carried out between Wednesday 13th November and Monday 2nd December 2019 at one location, also identified on Figure 1.

4.17 Long-term sound monitoring position 1 ('LT1') was situated in the garden of a property on Cowpen Lane. The microphone was mounted on a pole 1.2 m above ground level in a free-field location. While at the location, sources of sound affecting the location were noted to be distant road traffic movements and distant industrial sources.

4.18 Meteorological conditions were monitored and logged with a meteorological station deployed alongside the sound monitoring kit, and at a local meteorological monitoring station. Though wind speeds were low throughout the survey (lower than 2 ms^{-1}), there were several prolonged periods of precipitation, all of which have been removed from analysis.

4.19 A summary of the measured long-term sound levels at LT1 is shown in Table 4.5 below.

Table 4.5 Long term survey results

Statistical Parameter	Residual Sound Level, dB $L_{Aeq,T}$			Background Sound Level, dB $L_{A90,T}$			Maximum Sound Level, dB $L_{Amax,T}$		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
Range	41 - 61	39 - 59	34 - 53	37 - 52	35 - 47	31 - 50	52 - 94	51 - 81	44 - 75
25th percentile	47	43	40	42	39	37	61	56	52
Median	49	45	42	45	40	39	63	59	55
75th percentile	49	45	42	45	40	39	63	59	55
Average	50	47	44	45	41	39	64	59	55
Standard deviation	3	3	3	3	2	4	5	5	5

Establishing Representative Baseline Sound Levels

4.20 BS 4142:2014+A1:2019 requires that the background sound levels adopted for the assessment be representative for the period being assessed. The Standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated. However, the Standard states that there is no 'single' background sound level that can be derived from such measurements. It is particularly difficult to determine what is 'representative' of the night-time period is because it can be subject to a wide variation in background sound level between the shoulder night periods. The accompanying note to paragraph 8.1.4 states that *"a representative level ought to account for the range of background sounds levels and ought not automatically to be assumed to be either the minimum or modal value".*

4.21 For the purpose of this assessment it is considered appropriate to use the minimum measured L_{A90} values during the short term measurements, to characterise the background sound levels that have been used in the BS 4142:2014+A1:2019 assessment.

4.22 The 25th percentile values from the long term unattended monitoring have been used to characterise the background sound levels that have been used in the BS 4142:2014+A1:2019 assessment. These values are not the lowest sound levels encountered but are lower than those obtained using the average. It therefore represents somewhere in the range of lower sound levels that are likely to be encountered and therefore provides a precautionary assessment. Use of the 25th percentile also ensures that any periods during which higher wind speeds could have affected the measured baseline sound levels do not unduly affect the analysis.

4.23 Baseline ambient L_{Aeq} sound levels have been determined from the logarithmic average of the 15 minute L_{Aeq} measurements undertaken in the relevant period.

4.24 It is considered that the long term unattended measurements undertaken at ST1 are representative of the existing baseline sound environment at dwellings on Cowpen Bewley Road and dwellings on Cowpen Lane.

4.25 It is considered that the attended measurements undertaken at ST3 are representative of the existing baseline sound environment at Haverton Hill Hotel and dwellings on Lime Tree Close.

4.26 It is considered that the attended measurements undertaken at ST4 are representative of the existing baseline sound environment at dwellings on Charlton Close.

4.27 Table 4.6 below presents a summary of the baseline sound levels that have been adopted for the assessment at the identified receptors.

Table 4.6 Baseline Sound Levels Adopted for the Assessment

Receptor Location	Representative Survey Location	Baseline Ambient Sound Level, dB $L_{Aeq,T}$			Background Sound Level, dB $L_{A90,T}$		
		Day	Eve	Night	Day	Eve	Night
Cowpen Bewley Road	LT1	50	47	43	45	41	39
Cowpen Lane	LT1	50	47	43	45	41	39
Haverton Hill Hotel	ST3	63	49	45	43	41	39
Lime Tree Close	ST3	63	49	45	43	41	39
Charlton Close	ST4	58	50	50	41	41	41

5 Calculations and Modelling

Noise Source Data & Noise Model Methodology

5.1 Noise source data for the assessment has been based on manufacturers data provided to the project team by MAN Energy Solutions.

5.2 Manufacturer's data on the broadband sound power level of the transformers has been supplemented by a spectral shape from the RPS Source Term Library. The sound power level data used in the assessment are provided in Appendix D, and the noise model methodology is provided in Appendix E.

Description of Sound Sources

5.3 The design incorporates four gas engines with a total output of 49.99 MW, with all gas engines housed within a single enclosure, approximately 9.5 m in height. Each engine has an associated stack/exhaust terminating at 15 m above ground level (AGL), air inlet louvres at one end of the enclosure and air outlet louvres on the roof. The gas kiosks provide the connection from the main gas network to the facility.

5.4 The radiators are positioned 5.5 m AGL. The measurement data used for the assessment are representative of operating at 100% cooling capacity. As such, the predicted sound levels due to the radiators are a worst case and representative of the site operating at full capacity with ambient air temperatures in excess of 30 ºC. These conditions are unlikely to occur, particularly during the evening and even less so during the night-time. Consequently, the assessment is likely to be over precautionary for the evening and night-time periods.

5.5 Based on professional experience and review of available data, all sound sources associated with the engines, including the air inlets, outlets and radiators, are considered to produce sound with broadband frequency content. The transformers produce broadband sound with a tonal component at 100 Hz and harmonics thereof.

Operating Conditions

5.6 The proposed development is planned to operate during peak periods of electricity demand or to prevent system instability (i.e. typically for a period ranging from one to seven hours, between 08.00 and 20.00 hrs). However, there is the potential that the proposed development could be required to operate during a major power shortage or system stress events (e.g. a NISM) at any time of the day or night. It should be noted that the likelihood of the facility being required to start

up at night is extremely low as peak demand does not occur overnight. Figure 5.1 below indicates the anticipated average hours of operation per day in each month at an existing PPF site.

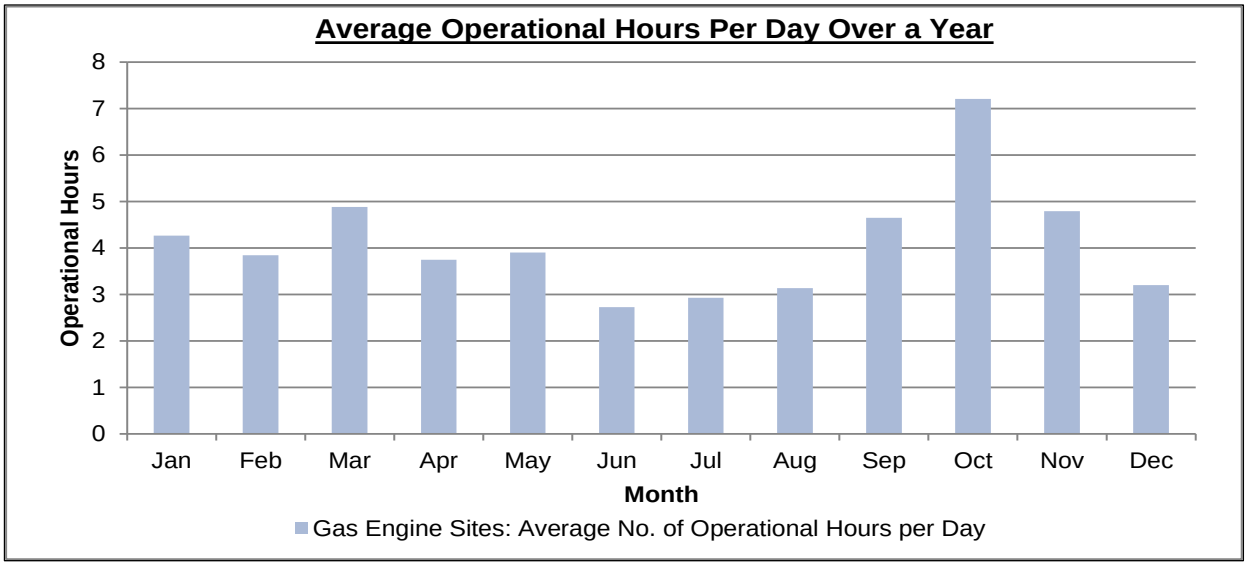

Figure 5.1 Average Operational Hours per day over a year (Source – Statera Energy Ltd.)

5.7 Table 5.1 presents the yearly breakdown of operating time for an existing PPF site owned by Statera Energy Ltd.

Table 5.1 Operational Breakdown of Existing PPF Site

Season	Period (Hours)	Percentage Total Operational Time	Approx. Operational Hours (assuming 3,500 hour yearly total)
Winter	0400 – 0700	1%	35
	0700 – 1600	19%	665
	1600 – 1900	27%	945
	1900 – 2300	6%	210
Summer	0400 – 0700	1%	35
	0700 – 1600	22%	770
	1600 – 1900	17%	595
	1900 – 2300	6%	210
All	2300 - 0400	<1%	7

5.8 As can be seen from Table 5.1 operational hours during night-time periods (2300 – 0700) account for less than 2% of the total operating hours over the course of a year, at a similar PPF site.

Incorporated Mitigation

5.9 Various mitigation measures have been incorporated within the design of the PPF with the specific purpose of minimising noise emissions from the facility and the resultant noise impact at NSRs; these include:

- enclosures surrounding the gas engines – four engines will be housed within a single enclosure. Statera has undertaken acoustic testing of various bespoke cladding systems in order to ensure that noise emissions from the acoustic enclosure are minimised. The model has assumed KS1000 RW 40 mm core thickness (outer layer), Danskin Quietslab 100 kg (100 mm thick, Grade SCX3) (acoustic barrier), 33 % open area perforated steel sheet (0.9 mm thick) (inner layer), resulting in an overall sound reduction of 43 dB R_w on all façades and the roof. This system incorporates an acoustically absorptive internal face which results in significant reductions in noise levels both inside and outside the enclosures.
- high specification exhaust silencers will be fitted to each of the gas engine exhausts; these attenuate sound levels from the exhausts in order for the overall sound power level of each exhaust to be 90 dBA;
- all external ductwork will be acoustically lagged;
- weatherproof acoustic louvres will be fitted to the air inlet/outlets on the building facades; and
- low noise transformer - standard transformers have a sound power level of around 87 dBA or more; the transformer specified for this project has a sound power level of 83 dBA.

5.10 Where feasible, low noise items have been specified to fundamentally minimise generated noise. Where not feasible, or practicable, measures have been included to attenuate noise emissions from the site through the use of enclosures and silencers. As such, noise levels at NSRs are considered to be as low as reasonably practicable.

5.11 It is considered that the above mitigation measures incorporated within the design demonstrate that Best Available Techniques (BAT) methods have been employed to minimise noise emissions and, combined, will act to significantly reduce noise levels at NSRs.

6 Results

Saltholme North

6.1 The predicted specific sound levels due to the operation of Saltholme North in isolation are provided in Table 6.2.

Table 6.1 Predicted Specific Sound Level at Residential Premises – Saltholme North

Location	Predicted Specific Sound Level, dBA
Cowpen Bewley Road	37
Cowpen Lane	38
Haverton Hill Hotel	35
Lime Tree Close	32
Charlton Close	24

Cumulative Scheme

6.2 The PPF has been assessed in conjunction with the neighbouring proposed gas-fired PPF, 'Saltholme South'. The sound power data used to model the adjacent facility is based on the same sound data and operating conditions as used in this assessment. The two developments have been modelled in accordance with the methodology provided in Appendix E.

6.3 The predicted specific sound levels due to the operation of both halves of the facility are provided in Table 6.2.

Table 6.2 Predicted Specific Sound Level at Residential Premises - Cumulative

Location	Predicted Specific Sound Level (Saltholme North only), dBA	Predicted Cumulative Specific Sound Level, dBA	Difference, dB
Cowpen Bewley Road	37	39	+2
Cowpen Lane	38	40	+2
Haverton Hill Hotel	35	37	+2
Lime Tree Close	32	36	+4
Charlton Close	24	27	+2

6.4 The model results indicating the partial sound pressure level contribution from each individual source of noise from the facility to the first floor level of all residential receptors is presented in Table 6.3.

Table 6.3 Predicted Partial Sound Levels at Residential Premises

Source	Cowpen Bewley Road	Cowpen Lane	Haverton Hill Hotel	Lime Tree Close	Charlton Close
Air Inlet	26	25	25	22	21
Air Outlet	24	24	23	21	19
Engine Enclosure	19	19	18	17	13
Exhaust Outlet	21	20	19	18	14
Exhaust Body & Ductwork	16	16	15	14	4
Radiators	37	38	35	33	21
Rupture Discs	34	34	31	30	18
Transformer	7	8	5	8	-
Gas Kiosk	-	-	-	-	-

6.5 The predicted source contribution levels given in Table 6.3, indicate that the transformer provides a negligible contribution to the overall noise level from the PPF. As it is considered that the only source of tonal noise from the PPF is from the transformer, it is most unlikely that noise levels at the nearby NSRs would be perceived or characterised as tonal.

6.6 Predicted noise contours are provided in Figure 2 and Figure 3 at the end of this report.

7 Assessment

BS 4142:2014+A1:2019 Assessment

7.1 An initial estimate of impact undertaken in accordance with BS 4142:2014+A1:2019 is shown in Table 7.1 for the daytime, evening and night-time periods.

7.2 The subjective method for determining rating penalties has been used to determine appropriate corrections for each receptor and assessment period. It is considered that the specific sound will not be characterised as intermittent or impulsive, therefore no penalties have been applied for intermittency or impulsivity. As it is considered that the only source of tonal noise from the PPF is from the transformer and the contribution from this source to the overall specific sound is negligible, it is most unlikely that noise levels at the nearby NSRs would be perceived or characterised as tonal. As such, no penalties have been applied for tonality.

Table 7.1 BS 4142:2014+A1:2019 Assessment: Initial Estimate of Impact

Location	Representative Baseline Sound Levels		Specific Sound Level, dB L_S	Rating Penalty, dB	Rating Level, dB $L_{Ar,Tr}$	Rating Level Difference, dB
	Background dB $L_{A90,T}$	Residual dB $L_{Aeq,T}$				
Day						
Cowpen Bewley Road	45	50	39	0	39	**-6**
Cowpen Lane	45	50	40	0	40	**-5**
Haverton Hill Hotel	43	63	37	0	37	**-6**
Lime Tree Close	43	63	36	0	36	**-7**
Charlton Close	41	58	27	0	27	**-14**
Evening						
Cowpen Bewley Road	41	47	39	0	39	**-2**
Cowpen Lane	41	47	40	0	40	**-1**
Haverton Hill Hotel	41	49	37	0	37	**-4**
Lime Tree Close	41	49	36	0	36	**-5**
Charlton Close	41	50	27	0	27	**-14**
Night						
Cowpen Bewley Road	39	44	39	0	39	**0**
Cowpen Lane	39	44	40	0	40	**+1**
Haverton Hill Hotel	39	45	37	0	37	**-2**
Lime Tree Close	39	45	36	0	36	**-3**
Charlton Close	41	50	27	0	27	**-14**

7.3 The results of the initial estimate of impact in Table 7.1 show that:

- During the daytime, when the PPF is most likely to operate, the predicted rating level is 5 dB below the background sound level at the most affected receptor, Cowpen Lane. This is 10 dB below the BS 4142:2014+A1:2019 threshold level at which adverse impacts are considered likely and 15 dB below the BS 4142:2014+A1:2019 threshold level at which significant adverse impacts are likely. At all other receptors, the predicted rating level is 6 dB or more below background sound levels. The results of the initial estimate of impact during the daytime are therefore indicative of levels below adverse impacts at all receptors, depending on the context.
- During the evening, the rating level is 1 dB below the background sound level at the most affected receptor, Cowpen Lane. This is 6 dB below the BS 4142:2014+A1:2019 threshold level at which

adverse impacts are likely and 11 dB below the BS 4142:2014+A1:2019 threshold level at which significant adverse impacts are likely. At all other receptors, the predicted rating level is at least 2 dB below background sound levels. This is indicative of below adverse impacts at all receptors, depending on the context.

- During the night-time, when the PPF is least likely to operate, the rating level is 1 dB above the background sound level at the most affected receptor, Cowpen Lane. This is 4 dB below the BS 4142:2014+A1:2019 threshold level at which adverse impacts are likely and 9 dB below the BS 4142:2014+A1:2019 threshold level at which significant adverse impacts are likely. At the other receptor, the predicted rating level is at or below background sound levels. This is indicative of below adverse impacts at all receptors, depending on the context.

7.4 Whilst the initial outcome of the BS 4142:2014+A1:2019 assessment shows that no adverse impact is predicted at corresponding NSRs during all time periods, in accordance with the Standard and provide a thorough assessment, consideration of the context of the scenario has been undertaken. Consideration of the context is provided in terms of the assessment of the absolute noise levels and the change in ambient sound due to the specific sound as addressed below.

Likely Operating Conditions

7.5 Data which are currently available on the likely operating regime of the PPF indicates that it will only ever run during the night-time in exceptional circumstances when there is insufficient generation from alternative sources and there are significant unplanned outages in baseload generation. As can be seen from the operating times of a similar PPF site given in Table 5.1, night-time operating hours would be minimal.

7.6 The average operational hours per day provided in Table 5.1 indicate that, during the more sensitive warmer months (April to September) when people are more likely to have windows open or to be outside, the PPF will operate for a fewer hours on any given day. The cooler months (from October to March) are less sensitive because people are more likely to have windows closed or to be inside.

7.7 Local and national demand for energy infrastructure of this type is being driven by changes in how energy is generated, stored and distributed. Large, centralised, fossil fuel based energy generation is in decline and the decline is projected to continue. Recent projections indicate substantial increases in the proportion of energy which will be delivered by renewable energy sources in the near future [8]; however, renewable energy generation can be intermittent. As such, the demand for developments of this type which are able to step-in and provide support to the

network in periods of high demand has increased. The proposed PPF will be providing critical support to meet local demand and to balance the national grid.

Noise Change and Absolute Noise Level Assessment

7.8 The ambient sound levels, with and without the facility in operation, are shown in Table 7.2.

Table 7.2 Ambient Noise Level Change Assessment

Location	Baseline Residual Sound Level, dB $L_{Aeq,T}$	Specific Sound Level, dB $L_{Aeq,T}$	Combined Sound Level, dB $L_{Aeq,T}$	Change in Sound Level, dB
Day				
Cowpen Bewley Road	50	39	50	**0**
Cowpen Lane	50	40	50	**0**
Haverton Hill Hotel	63	37	63	**0**
Lime Tree Close	63	36	63	**0**
Charlton Close	58	27	58	**0**
Evening				
Cowpen Bewley Road	47	39	48	**+1**
Cowpen Lane	47	40	48	**+1**
Haverton Hill Hotel	49	37	49	**0**
Lime Tree Close	49	36	49	**0**
Charlton Close	50	27	50	**0**
Night				
Cowpen Bewley Road	44	39	45	**+1**
Cowpen Lane	44	40	45	**+1**
Haverton Hill Hotel	45	37	46	**+1**
Lime Tree Close	45	36	46	**+1**
Charlton Close	50	27	50	**0**

7.9 During the evening and night-time periods, a maximum increase of 1 dB above baseline residual sound levels would occur as a result of the operation of the proposed PPF at the most affected

receptors: Cowpen Bewley Road, Cowpen Lane, Haverton Hill Hotel and Lime Tree Close during the night-time, and Cowpen Bewley Road and Cowpen Lane during the evening. For a steady sound source with no discernible impulsive or tonal characteristics, a 3 dB change is generally taken as the minimum change which is perceptible to most people. As such, this change of 1 dB is unlikely to be perceptible. During all other time periods at all other receptors, there is no noise change predicted.

7.10 With regard to absolute sound levels presented in Table 7.2, the existing ambient sound levels with the PPF in operation during the daytime already exceed the 55 dB L_{Aeq} noise level specified in WHO guidance for the onset of annoyance during the daytime at Haverton Hill Hotel, Lime Tree Close and Charlton Close. Given that there is no change in sound level predicted at these receptors, the impact of the operation of the PPF will be negligible. At the receptors on Cowpen Bewley Road and Cowpen Lane, the combined ambient sound levels do not exceed the 55 dB L_{Aeq} guideline sound level. It is therefore considered that the site will not result in an adverse impact to amenity during the daytime at all receptors.

7.11 The level for the onset of sleep disturbance during the night-time (i.e. lowest observed adverse effect level) contained in the WHO Guidance is 45 dB L_{Aeq} (façade), equivalent to a free-field level of 42 dB L_{Aeq}. This threshold level is exceeded at all receptors in the absence of the PPF at all NSRs during the night-time period, by up to 8 dB. In addition, the maximum change in ambient sound level is +1 dB, which as previously discussed is below the typical threshold of perception. It is therefore considered that in this case, the operation of the PPF during the night will have little to no impact on night-time disturbance in the area.

Discussion

7.12 This assessment determines whether the Government's noise policy aims have been met for a proposed development.

7.13 It is the daytime and evening periods that are of greatest concern with respect to the impact on quality of life (amenity, enjoyment of property etc.). This is because people will tend to be indoors or asleep during the night, whereas, during the day and evening, they are more likely to be using outdoor spaces for amenity purposes. It should also be noted that, and with reference to Table 5.1, the PPF is not expected to operate frequently during the night-time.

7.14 It has been established that sound arising from the operation of the PPF will not result in a perceptible ambient noise level increase at any of the nearest NSRs during the daytime or evening periods. The facility will cause no increases in ambient noise during the night-time, except during major power shortages or system stress events, where a noise increase of up to +1 dB is predicted at Cowpen Bewley Road, Cowpen Lane, Haverton Hill Hotel and Lime Tree Close. This

is below the threshold at which ambient noise change is perceptible to most people. It is therefore considered that predicted noise changes due to the operation of the PPF result in a negligible to minor impact and it is unlikely that this would seriously affect the quality of life of those in close proximity to the site.

7.15 In terms of the absolute noise level assessment, preconstruction ambient noise will be above the WHO guideline level of 55 dB L_{Aeq} for the onset of annoyance during the daytime for Haverton Hill Hotel, Lime Tree Close and Charlton Close. At the receptors on Cowpen Bewley Road and Cowpen Lane, the combined ambient sound levels do not exceed the 55 dB L_{Aeq} guideline sound level. On this basis, sound from the PPF will not worsen, or give rise to, adverse impacts on these receptors.

7.16 During the night-time, baseline ambient sound levels exceed the WHO guideline level for the onset of sleep disturbance at all receptors. As discussed previously, the worst-case ambient noise change does not exceed the typical threshold of perception. Therefore, it is considered the impact from the operation of the PPF during the night both on the ambient sound level and on sleep disturbance will be negligible. It is also unlikely that the PPF will operate at night, as detailed in Table 5.1.

7.17 Taking both the change in noise levels and the absolute sound levels during the day and night into consideration, it is considered that sound from the facility will not result in any adverse impacts on the quality of life of residents nearby.

7.18 The BS 4142:2014+A1:2019 initial estimate of impact indicates that sound from the facility is unlikely to result in any adverse impacts during all time periods. This is considered an overestimate of the potential impact taking into account the results of the noise change assessment, the absolute noise level assessment, and the low likelihood of the PPF operating during the night-time.

7.19 On the basis of the above, it is concluded that levels of sound arising from the operation of the proposed PPF will not result in significant adverse impact at any of the nearby noise sensitive receptors and that noise from site has been mitigated and minimised through the application of best available techniques to be as low as practicable.

7.20 With regard to national and local planning policy, it is considered that the results of the assessment demonstrate that the proposed PPF has been mitigated to ensure that noise from the facility will not result in an adverse impact to amenity at the nearby receptors. It is therefore considered that the development is compliant with the requirements of the NPSE, NPPF, PPG-N, Policies SD5 and ENV7 from the emerging Stockton-On-Tees Local Plan.

8 Comparison with Previously Reported Levels

8.1 The following tables present a comparison between the levels predicted as part of the planning process (RPS reports JAT10500-REPT-05-R3 “Noise Assessment for Peaking Plant Facility: Saltholme North” and JAT10500-REPT-06-R3 “Noise Assessment for Peaking Plant Facility: Saltholme South”), and those presented in this updated assessment.

BS 4142 Comparison

Location	Levels for Planning						Updated Levels					
	Representative Baseline Sound Levels		Specific Sound Level, dB L_S	Rating Penalty, dB	Rating Level, dB $L_{Ar,Tr}$	Rating Level Difference, dB	Representative Baseline Sound Levels		Specific Sound Level, dB L_S	Rating Penalty, dB	Rating Level, dB $L_{Ar,Tr}$	Rating Level Difference, dB
	Background dB $L_{A90,T}$	Residual dB $L_{Aeq,T}$					Background dB $L_{A90,T}$	Residual dB $L_{Aeq,T}$				
Day												
Cowpen Bewley Road	37	53	42	0	42	**+5**	45	50	39	0	39	**-6**
Cowpen Lane	37	53	42	0	42	**+5**	45	50	40	0	40	**-5**
Haverton Hill Hotel	43	63	40	0	40	**-3**	43	63	37	0	37	**-6**
Lime Tree Close	43	63	39	0	39	**-5**	43	63	36	0	36	**-7**
Charlton Close Receptors	41	58	34	0	34	**-7**	41	58	27	0	27	**-14**
Evening												
Cowpen Bewley Road	37	52	42	0	42	**+5**	41	47	39	0	39	**-2**
Cowpen Lane	37	52	42	0	42	**+5**	41	47	40	0	40	**-1**
Haverton Hill Hotel	41	49	40	0	40	**-1**	41	49	37	0	37	**-4**
Lime Tree Close	41	49	39	0	39	**-2**	41	49	36	0	36	**-5**
Charlton Close Receptors	41	50	34	0	34	**-7**	41	50	27	0	27	**-14**
Night												
Cowpen Bewley Road	37	43	42	0	42	**+5**	39	44	39	0	39	**0**
Cowpen Lane	37	43	42	0	42	**+5**	39	44	40	0	40	**+1**
Haverton Hill Hotel	39	45	40	0	40	**+1**	39	45	37	0	37	**-2**
Lime Tree Close	39	45	39	0	39	**0**	39	45	36	0	36	**-3**
Charlton Close Receptors	41	50	34	0	34	**-7**	41	50	27	0	27	**-14**
Figures rounded to the nearest decimal place												

Noise Change Comparison

Location	Levels for Planning				Updated Levels			
	Baseline Residual Sound Level, dB $L_{Aeq,T}$	Specific Sound Level, dB $L_{Aeq,T}$	Combined Sound Level, dB $L_{Aeq,T}$	Change in Sound Level, dB	Baseline Residual Sound Level, dB $L_{Aeq,T}$	Specific Sound Level, dB $L_{Aeq,T}$	Combined Sound Level, dB $L_{Aeq,T}$	Change in Sound Level, dB
Day								
Cowpen Bewley Road	53	42	53	**0**	50	39	50	**0**
Cowpen Lane	53	42	53	**0**	50	40	50	**0**
Haverton Hill Hotel	63	40	63	**0**	63	37	63	**0**
Lime Tree Close	63	39	63	**0**	63	36	63	**0**
Charlton Close Receptors	58	34	58	**0**	58	27	58	**0**
Evening								
Cowpen Bewley Road	52	42	52	**0**	47	39	48	**+1**
Cowpen Lane	52	42	52	**0**	47	40	48	**+1**
Haverton Hill Hotel	49	40	49	**0**	49	37	49	**0**
Lime Tree Close	49	39	49	**0**	49	36	49	**0**
Charlton Close Receptors	50	34	50	**0**	50	27	50	**0**
Night								
Cowpen Bewley Road	43	42	45	**+2**	44	39	45	**+1**
Cowpen Lane	43	42	45	**+2**	44	40	45	**+1**
Haverton Hill Hotel	45	40	46	**+1**	45	37	46	**+1**
Lime Tree Close	45	39	46	**+1**	45	36	46	**+1**
Charlton Close Receptors	50	34	50	**0**	50	27	50	**0**
Figures rounded to the nearest decimal place								

9 Uncertainty

9.1 In all assessments, it is good practice to consider uncertainty which can arise from a number of different aspects. There are degrees of uncertainty associated with: instrumentation used for surveying; measurement technique and the variables influencing the measurement results such as transmission path and weather conditions; source terms used for modelling; calculation uncertainty; assessment uncertainty; and the subjective response of residents to noise sources.

9.2 Uncertainty due to instrumentation has been significantly reduced with the introduction of more modern instrumentation and is reduced further by undertaking field calibration checks on sound level meters before and after each measurement period and ensuring that all instrumentation is within accepted laboratory calibration intervals.

9.3 Based on professional judgement including substantial experience of acquiring and analysing baseline data for numerous sites in various locations, and a desk-based review of the site and surrounding area, it is considered that the baseline data acquired during the survey is typical of the area.

9.4 Calculation uncertainty and assessment uncertainty have been reduced by peer review of all baseline data, model input data, model results and assessment calculations, and by using the appropriate level of precision at each stage of the assessment calculations.

9.5 A quantitative assessment has been undertaken based on source levels provided by the plant manufacturer, measurement data, and data from the RPS Source Term Library. Where assumptions have been made, they have favoured a worst-case scenario.

9.6 With regard to subjective response, the noise standards adopted for the assessment will have been based upon the subjective response of the majority of the population or will be based upon the most likely response of the majority of the population. This is considered to be the best that can be achieved in a population of varying subjective response which will vary dependent upon a wide range of factors.

9.7 All areas and potential consequences of uncertainty have been minimised at every stage of the assessment process. On the basis of the above, and in the context of subjective response, the effects of uncertainty on the assessment are considered minimal.

10 Summary and Conclusions

Summary

10.1 The results of the noise assessment presented above can be summarised as follows:

- the BS 4142:2014+A1:2019 assessment indicates no adverse impacts at the nearest NSRs due to predicted noise from the PPF during any time period;
- the existing absolute ambient sound levels already exceed the guidance level for the onset of annoyance during the daytime at three of the nearest NSRs, therefore the operation of the PPF is predicted to have a negligible impact. At Cowpen Bewley Road and Cowpen Lane receptors;
- the existing absolute ambient sound levels already exceed the guidance level for the onset of annoyance during the night at the nearest NSRs. Therefore, the predicted absolute ambient sound levels when the PPF is in operation will also exceed the guidance level at the nearest NSRs, however the PPF is predicted to have a negligible contribution to this total; and
- the predicted change in ambient sound levels from the PPF will be below the minimum that is perceptible to most people during all time periods at the nearest NSRs.

10.2 Taking into account the various assessment approaches and the context, noise from the development forming the detailed consent is considered to be below the LOAEL with respect to the PPG-N.

Conclusions

10.3 Compliance with the requirements of the NPSE, the NPPF and the PPG-N have been demonstrated by showing that the proposed PPF developments will not result in adverse effects in accordance with BS 4142:2014+A1:2019 during all time periods.

10.4 The proposed development may be audible at times but is highly unlikely to result in annoyance for sensitive individuals during all time periods. If complaints occur, they are unlikely to be substantiated if reasonable best practice is demonstrated to mitigate and reduce noise to a minimum. It is therefore considered that the Government's noise policy aims can be achieved. Therefore, with regards to noise, there is no reason the development should not be permitted.

Figures

Survey Location

Approx. Site Location

Notes
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Client: Statera Energy Limited

Project: Noise Assessment for Peaking Plant Facility – Saltholme North, Middlesbrough

Job Ref: JAT11291-REPT-02-R0

File location: O:\Jobs_11000-12000\11291t\Deliverables

Date: 14 February 2020	**Revision:** Rev0
Drawn By: CB	**Checked By:** SJS

Figure 10.1: Sound Monitoring Locations

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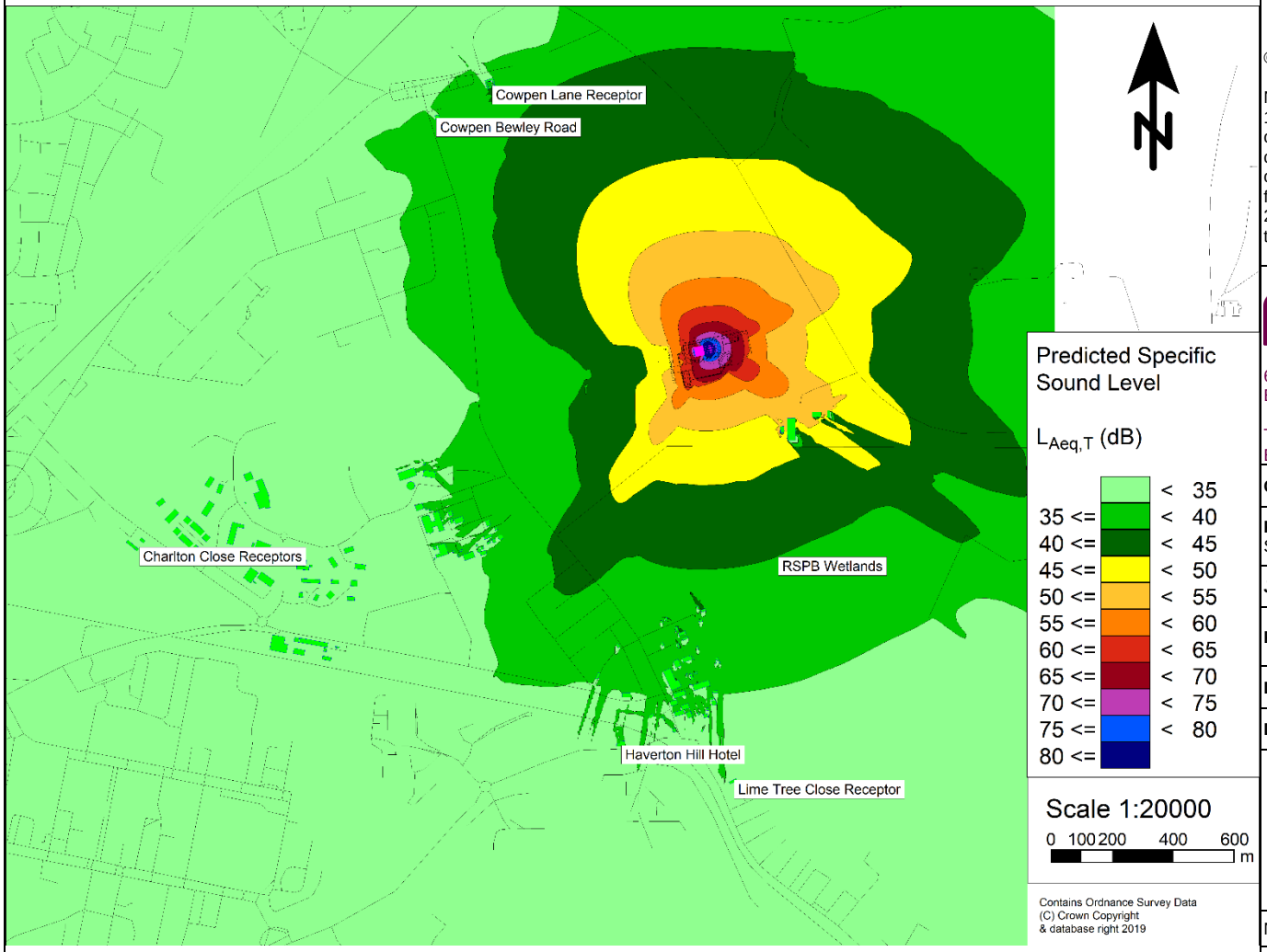

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Figure 10.2: Noise Contours at First Floor Level for the Saltholme North Development

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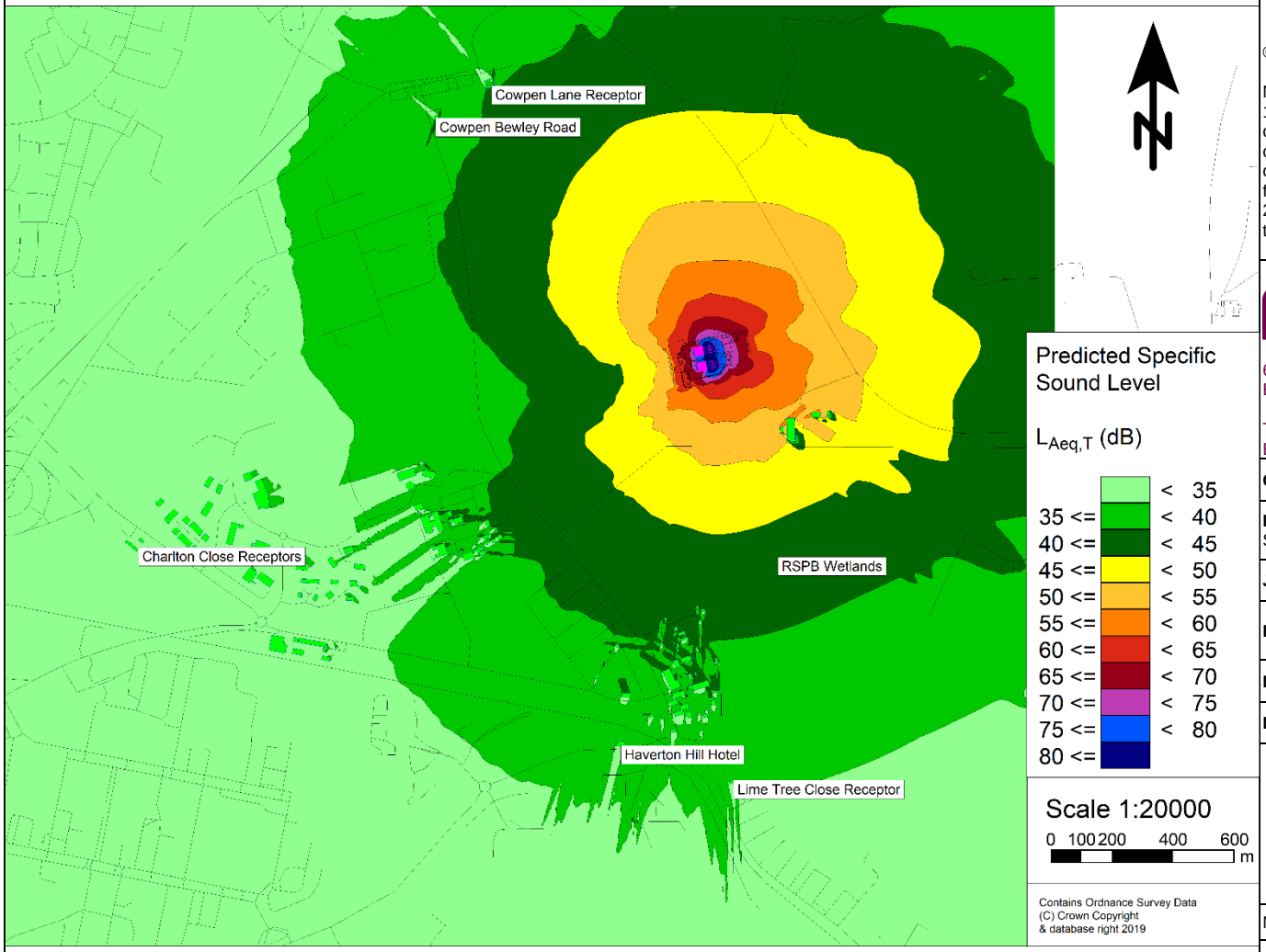

Notes
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Figure 10.3: Noise Contours at First Floor Level for the Saltholme Cumulative Development

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Appendices

Appendix A – Personnel and Individual Qualifications

Simon Stephenson – Technical Director – Acoustics

BSc (Hons) Physics; Chartered Engineer; Member of the Institute of Acoustics; Associate Member Acoustical Society of America

A.1 Simon is Technical Director of the RPS Acoustics Team. He is a specialist noise and vibration consultant with a wide range of experience gained in the UK and worldwide. He has gained particular experience in the fields of environmental noise, underwater acoustics, engineering noise control, acoustic design of plant and industrial noise management, working within the industrial, oil and gas, petro-chemical, power, renewables, construction, mineral extraction and waste industry sectors.

A.2 Simon is a leading expert on the subject of industrial noise and has published many technical papers on the subject. He was heavily involved with a research project for Defra to develop a new national method for the noise mapping of industrial sources. He has also been actively involved in providing technical advice to Defra regarding noise mapping of transportation sources and provided peer review and advice relating to CNOSSOS and industrial noise. He has also provided technical advice to the EA in relation to the effects of industrial and piling noise on birds. He has appeared as an expert witness on many occasions, representing both developers and local authorities at public inquiries and at parliamentary review.

A.3 Simon is currently a secretary of the Institute of Acoustics Noise and Vibration Engineering Group.

A.4 Simon has been involved in many BS 4142 noise assessments for both the previous and current 2014 version of BS 4142. He has given evidence at public inquiries where BS 4142 has been the primary assessment methodology. On the basis of Simon's overall experience in acoustics (particularly in relation to industrial noise) combined with particular focus on BS 4142, he is deemed competent for BS 4142 assessments.

A.5 For this project Simon has taken on the role of:

- Project Director responsible for overseeing and delivering the project.
- Technical Lead and has been responsible for reviewing all deliverables.

A.6 Simon was also responsible for

- reviewing and authorising the report.

Lise W. Tjellesen – Technical Director – Acoustics

MEngSc Acoustics; Member of the Institute of Acoustics; Member Acoustical Society of America; Member of Danish Acoustic Society; Member of Audio Engineering Society

A.7 Lise is Technical Director of the RPS Acoustics Team with 20 years of experience in acoustics. She is a specialist acoustic consultant with a wide range of experience gained in the UK, Denmark and worldwide. She has worked with electroacoustics, psychoacoustics, architectural acoustics, vibrations and environmental acoustics. She has gained particular experience in the fields of architectural acoustics (building and room) working with the construction industry on a variety of projects, including residential, commercial, education, health and entertainment.

A.8 Lise is an expert on the subject of room acoustics and room acoustic computer simulations, as well as a leading expert on the emerging field of archaeoacoustics. She has published several papers on the above subjects and on acoustics of offices.

A.9 Lise has been involved in many BS 4142 noise assessments for both the previous and current 2014 version of BS 4142. She has given evidence at public inquiries where BS 4142 has been the primary assessment methodology. On the basis of Lise's overall experience in acoustics (particularly in relation to environmental noise) combined with particular focus on BS 4142, he is deemed competent for BS 4142 assessments.

A.10 For this project Lise has taken on the role of:

- Project Manager and has been responsible for overseeing the project.

Peter Barling – Senior Consultant – Acoustics

BSc (Hons) Physics; PGDip Environmental Assessment and Management; Member of the Institute of Acoustics

A.11 Peter is an Acoustic Consultant and environmental acoustics specialist with 6 years' experience. He has a Degree in Physics and also has a Post Graduate Diploma in Environmental Assessment and Management. He has been a member of the Institute of Acoustics since 2013.

A.12 Peter has project managed and undertaken noise assessments for a variety of developments, including: large scale mixed-use developments, incorporating commercial, retail, leisure and residential elements; on-shore substations for off-shore windfarms; energy from waste facilities; manufacturing facilities; distribution centres; retail units; minerals extraction and exploration; solar farms; and petrol service filling stations. He has provided input into Environmental Impact Assessments (EIAs) and undertaken noise assessments to support planning applications and

discharge planning conditions. He has a Continuous Professional Development (CPD) Record to support this competency and experience.

A.13 Within the past two years Peter has been involved BS 4142 noise assessments for both the previous and current 2014 version of BS 4142. He is familiar with the Standard and has attended and participated in RPS CPD training seminars regarding the revised 2014 version of the Standard. On the basis of Peter's overall experience in acoustics, combined with particular focus on BS 4142 and with the assistance of more experienced colleagues, he is deemed competent for BS 4142 assessments.

A.14 For this project Peter has taken on the role of:

- undertaking a site visit;
- carrying out long term sound monitoring;
- downloading and processing the long term survey data; and
- reviewing the modelling.

Charlotte Birch –Consultant – Acoustics

MSci (Hons) Chemistry and Molecular Physics, MSc Atmospheric Physics, PGDip Acoustics and Noise Control, Associate Member of the Institute of Acoustics

A.15 Charlotte is an Acoustic Consultant and joined RPS in 2017. Since joining RPS she has undertaken acoustic surveying and assessments for a variety of commercial, residential, and industrial developments.

A.16 She has acoustic survey, data processing and noise modelling experience, and has a Continuous Professional Development Record to support this competency and experience.

A.17 For this project Charlotte has taken on the role of:

- Consultant responsible for carrying out the acoustic modelling, assessment and reporting.

A.18 Charlotte was also responsible for

- undertaking the assessment;
- undertaking the modelling; and
- preparing the report.

Zachary Simcox –Consultant – Acoustics

BEng (Hons) Acoustical Engineering; Associate Member of the Institute of Acoustics

A.19 Zach is an Assistant Acoustic Consultant and joined RPS in 2017. He is currently an Associate Member of the Institute of Acoustics (AMIOA) and has been since 2017.

A.20 Since joining RPS he has undertaken acoustic surveying and assessments for a number of commercial, residential, and industrial developments.

A.21 He has acoustic survey, data processing and noise modelling experience, and has a Continuous Professional Development Record to support this competency and experience.

A.22 For this project Zach has taken on the role of:

- undertaking a site visit;
- carrying out short term sound monitoring; and
- downloading and processing the short term survey data.

Appendix B – National Planning Policy

B.1 The National Planning Policy Framework (NPPF) set out the Government's planning policies for England and how these are expected to be applied. The emphasis of the Framework is to allow development to proceed where it can be demonstrated to be sustainable. In relation to noise, Paragraph 180 of the Framework states:

"Planning policies and decisions should 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:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from the development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

B.2 The point 'a)' refers to 'significant adverse impacts' which relates to the 'significant observed adverse effect level' (SOAEL) in the Noise Policy Statement for England (NPSE), though the term 'effect is used instead of the term 'impact' although these have been deemed to be interchangeable in this context. Therefore, given the comments above on the NPSE with regard to assessment methods and criteria, the current content of the NPPF does not require any change in previously adopted approaches.

Noise Policy Statement for England

B.3 The NPSE, published in March 2010 by Defra, aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion.

B.4 Paragraph 1.6 of the NPSE sets out the long-term vision and aims of Government noise policy:

"Noise Policy Vision

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

"Noise Policy Aims

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

B.5 The aims require that all reasonable steps should be taken to avoid, mitigate and minimise adverse effects on health and quality of life whilst also taking into account the guiding principles of sustainable development, which include social, economic, environmental and health considerations.

B.6 With regard to the terms 'significant adverse' and 'adverse' included in the 'Noise Policy Aims', these are explained further in the 'Explanatory Note' as relating to established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation which 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 human health and quality of life due to noise.

LOAEL – Lowest Observed Adverse Effect Level

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

B.7 Defra has then extended these concepts for the purpose of the NPSE to introduce the concept of:

"SOAEL – Significant Observed Adverse Effect Level

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

B.8 The accompanying explanation states:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available".

Planning Practice Guidance - Noise (PPG-N)

B.9 The Government has published Planning Practice Guidance on a range of subjects including noise (PPG-N). The guidance forms part of the NPPF and provides advice on how to deliver its policies. The PPG-N reiterates general guidance on noise policy and assessment methods provided in the NPPF, NPSE and British Standards (BSs) and contains examples of acoustic environments commensurate with various effect levels. Paragraph 006 of the PPG-N explains that:

"The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation."

B.10 According to the PPGN, factors that can influence whether noise could be of concern include:

- the source and absolute level of the noise together with the time of day it occurs;
- for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;
- the spectral content and the general character of the noise;
- the local topology and topography along with the existing and, where appropriate, the planned character of the area.
- where applicable, the cumulative impacts of more than one source should be taken into account along with the extent to which the source of noise is intermittent and of limited duration;

- whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time;
- in cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur;
- where relevant, Noise Action Plans, and, in particular the Important Areas identified through the process associated with the Environmental Noise Directive and corresponding regulations;
- the effect of noise on wildlife;
- if external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces; and
- the potential effect of a new residential development being located close to an existing business that gives rise to noise should be carefully considered. This is because existing noise levels from the business even if intermittent (for example, a live music venue) may be regarded as unacceptable by the new residents and subject to enforcement action. To help avoid such instances, appropriate mitigation should be considered, including optimising the sound insulation provided by the new development's building envelope. In the case of an established business, the policy set out in the third bullet of paragraph 123 of the NPPF should be followed.

B.11 The PPG-N provides a relationship between various perceptions of noise, effect level and required action in accordance with the NPPF. This is reproduced in Table 1 below.

Table 1: Noise Exposure Hierarchy Based On the Likely Average Response

Perception	Increasing Effect Level	Action
Not noticeable	No Observed Effect	No specific measures required
Noticeable and not intrusive	No Observed Adverse Effect	No specific measures required
	LOAEL	
Noticeable and intrusive	Observed Adverse Effect	Mitigate and reduce to a minimum
	SOAEL	

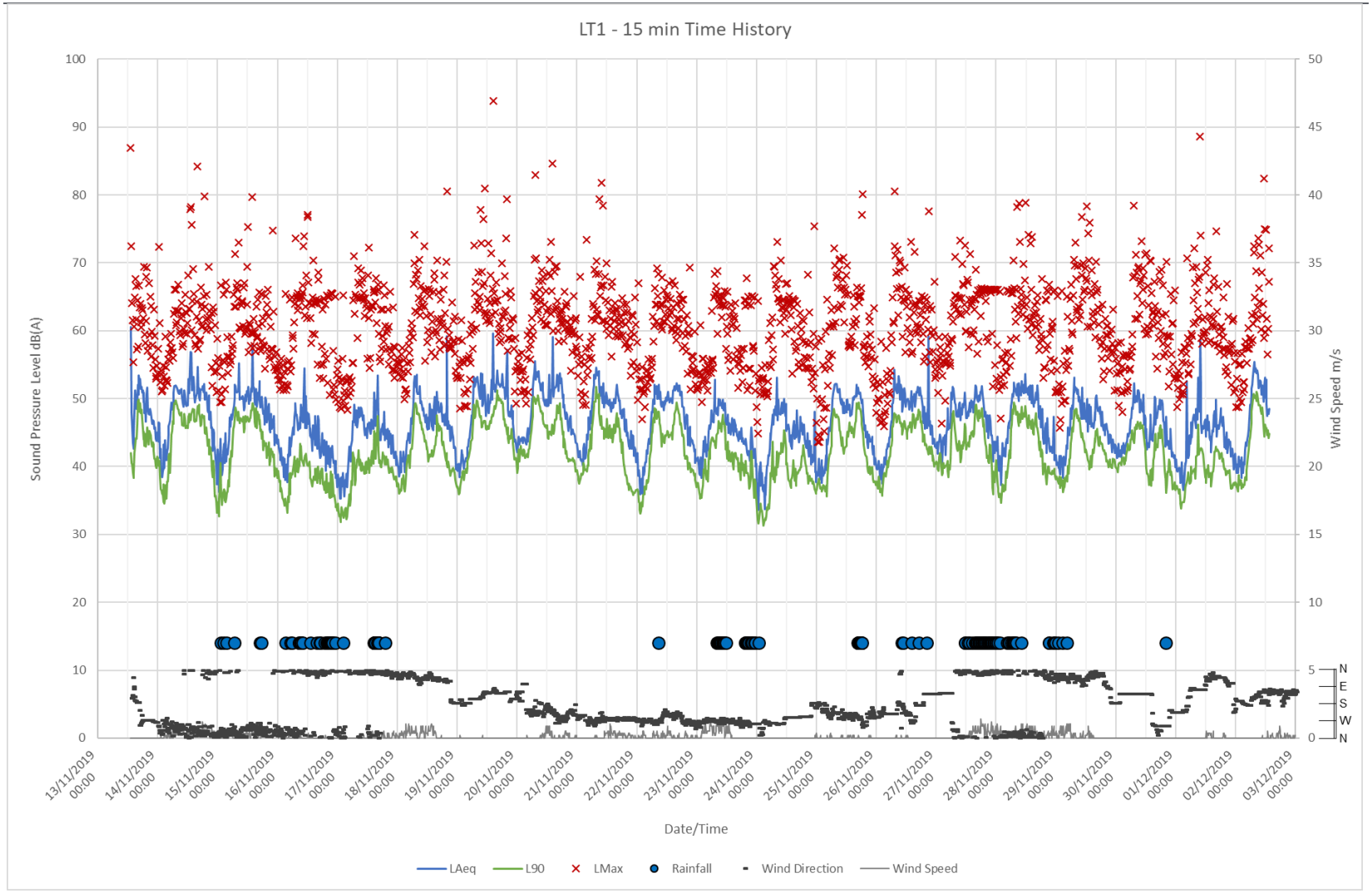
Perception	Increasing Effect Level	Action
Noticeable and disruptive	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Unacceptable Adverse Effect	Prevent

B.12 The PPG-N describes sound that is not noticeable to be at levels below the NOEL. It describes exposures that are noticeable but not to the extent there is a perceived change in quality of life as below the LOAEL and need no mitigation. With reference to the definition of noise in the NPSE, such immissions are 'sound' and not 'noise'. On this basis, the audibility of sound from a development is not, in itself, a criterion to judge noise effects that is commensurate with national planning policy.

B.13 The PPG-N suggests that noise exposures above the LOAEL cause small changes in behaviour. Examples of noise exposures above the LOAEL provided in the PPG-N is having to turn up the volume on the television; needing to speak more loudly to be heard; where there is no alternative ventilation, closing windows for some of the time because of the noise; or, a potential for some reported sleep disturbance. In line with the NPPF and NPSE, the PPG-N states that consideration needs to be given to mitigating and minimising effects above the LOAEL but taking account of the economic and social benefits being derived from the activity causing the noise.

B.14 The PPG-N suggests that noise exposures above the SOAEL cause material changes in behaviour. Examples of noise exposures above the SOAEL provided in the PPG-N are, where there is no alternative ventilation, keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present; and/or there is a potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. In line with the NPPF and NPSE, the PPG-N states that effects above the SOAEL should be avoided and that whilst the economic and social benefits being derived from the activity causing the noise must be taken into account, such exposures are undesirable.

Appendix C – Graphical Baseline Survey Results


LT1 - 15 min Time History
Sound Pressure Level dB(A)
Wind Speed m/s
Date/Time
LAeq
L90
LMax
Rainfall
Wind Direction
Wind Speed
N
E
S
W
N

Appendix D – Model Input Data

Noise Model Source Term Inputs

Source	Quanta	Source Type		Height above ground (m)	Overall, dBA	Spectral Shapes, dB									Comments
		Type	Index			31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Gas Engine (MAN Energy Solutions 20V 35/44 GTS)	4 per enclosure	Point	Lw	2.25	133	90	106	118	122	126	125	127	127	120	Based on sound pressure level measurement data and manually converted to a point source sound power level in order to input into the noise model.
Exhaust Outlet (Silenced)	1 per engine	Point	Lw	15	90	115	100	92	89	87	84	81	78	76	-
Radiator Field	1 per engine	Area	Lw	5.5	104	-	106	100	100	100	102	94	88	83	The noise model assumes 2no radiator banks per engine, therefore in order to meet the correct sound power levels for the radiator fields per engine, the levels are reduced by 3 dB per each radiator bank.
Rupture Discs	2 per engine	Point	Lw	5	100	57	60	61	94	100	94	92	77	61	-
Power House Ventilation Outlet	1 per engine	Areas	Lw	11.7	90	112	110	97	91	81	82	80	81	80	-
Power House Ventilation Inlet	2 per engine	Point	Lw	2.9	87	109	107	94	88	78	79	77	78	77	-
Exhaust Body & Ductwork	1 per engine	Line	Lw	-	90	101	87	84	91	81	80	87	59	48	The model input has been converted to a sound power level per unit metre for ductwork and stack body length of 56.9 m in total.
Gas Kiosk	2	Point	Lw	1	72	-	79	76	64	68	68	65	42	32	-
Transformer	2	Point	Lw	1	83	-	79	84	83	83	77	72	67	60	-

Appendix E – Noise Modelling Methodology

C.1 The noise emissions from the facility have been modelled using the SoundPLAN 7.4 environmental noise prediction software package. The model calculates the contribution from each noise source at specified NSR locations. The contribution from each noise source is calculated based on the octave band sound power levels and the source type (e.g. point, line, area). The model predicts noise levels under light down-wind conditions based on hemispherical propagation, atmospheric absorption, ground effects, screening and directivity based on the procedure detailed in ISO 9613-2:1996.

C.2 Terrain contour data have been entered in the model based on OS land contours. The ground between the site and the receiver locations has been assumed to be soft although the site area has been assumed to be hard. The site buildings have been included and these provide some degree of screening as well as reflecting surfaces.

C.3 Receivers have been modelled at ground floor level at a height of 1.5 m above local ground level (AGL) and at first floor level at a height of 4 m AGL. The maximum predicted level at either floor level has been used in the assessment.

C.4 The same noise modelling techniques have been used by RPS on numerous sites in the UK and worldwide and there is a high degree of confidence in the model.

References

1 British Standards Institution. British Standard 4142:2014+A1:2019. Methods for rating and assessing industrial and commercial sound.

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7 Environmental Noise Guidelines for the European Region. World Health Organisation. 2018

8 Department for Business, Energy & Industrial Strategy. Updated Energy and Emissions Projections 2017. January 2018.

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