SIMEC USKMOUTH POWER STATION

ENVIRONMENTAL STATEMENT

Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017

On behalf of Simec Uskmouth Power Ltd.

Appendix 11.1 – Noise; Planning Policy, Legislation and Guidance

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GLOSSARY

Term	Definition
WIMD	Wales Index of Multiple Deprivation
LSOA	Lower Super Output Area
HIA	Health Impact Assessment
WHO	World Health Organisation
CoCP	Code of Construction Practice
CEMP	Construction Environment Management Plan
PAH	Polycyclic Aromatic Hydrocarbons
PM	Particulate matter
NO_2	Nitrogen dioxide
CRF	Concentration-response functions
HRAPIE	Health Risks of Air Pollution in Europe
PAF	Population attributable fraction
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
FPMP	Fire Prevention and Mitigation Plan
HHRA	Human Health Risk Assessment
ERF	Energy Recovery Facility
CO_2	Carbon dioxide

Contents

APPENDIX 11.1

PLANNING POLICY, LEGISLATIVE CONTEXT AND CONSULTATION

Introduction

A.1 The assessment methodology is based on current national and local planning policy, guidance and British Standards (BSs), which are listed below:

1.1.1 National Planning Policy

- Planning Policy Wales (PPW) Edition 10
- Planning Guidance (Wales) Technical Advice Note (TAN) 11, Noise

1.1.2 Local Planning Policy

- Newport Local Development Plan 2011 - 26 Adopted Plan January 2015 (NLDP)

1.1.3 Legislation

- Control of Pollution Act 1974 (CoPA)
- Environmental Protection Act 1990 (EPA)

1.1.4 British Standards

- BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise'
- BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration'
- BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'
- BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'
- BS 6472-1:2008 ‘Guide to evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting’

1.1.5 Guidance

- Calculation of Road Traffic Noise (CRTN)
- Design Manual for Roads and Bridges (DMRB), Sustainability & Environment Appraisal, LA 111, Noise and vibration

National Planning Policy

1.1.6 Planning Policy Wales (Edition 10)

A.2 The 10th Edition of Planning Policy Wales (PPW) was issued by the Welsh Government in December 2018.

A.3 Within the section 'Framework for Addressing Air Quality and Soundscape' the document provides the following broad objectives (addressing air quality as well as noise):

"The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.

A.4 It then goes on to state:

"In proposing new development, planning authorities and developers must, therefore:

- *address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;*
- *not create areas of poor air quality or inappropriate soundscape; and*
- *seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes."*

'5.1.29 In taking forward these broad objectives planning authorities will need to consider the effects which proposed developments may have on air or soundscape quality and the effects which existing air or soundscape quality may have on proposed developments. In doing so, they should:

- *address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas, or areas where statutory nuisance are more likely to arise;*
- *not create new areas where pollution becomes a problem;*
- *consider the relationship between pollution sources and receptors (such as sensitive uses); and*
- *seek to incorporate measures which reduce overall exposure to airborne pollution and create appropriate soundscapes, including using best practice in terms of acoustic design and safeguarding tranquillity.*

To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a technical air quality and noise assessment to be undertaken by a suitably qualified and competent person on behalf of the developer.

Good design, for example setting back buildings from roads to avoid canyon effects and using best practice in terms of acoustic design to ensure the appropriate and intended acoustic environment of completed developments should be incorporated at an early consideration in the design and planning process. Other mitigation measures must be capable of being effectively implemented for their intended purpose, and could include those related to:

- *traffic management and road safety;*
- *ensuring progress towards a shift to low or zero emissions means of road transport, such as electrical charging points;*
- *supporting low or zero emissions public transport;*
- *providing active travel infrastructure; and*
- *incorporating green infrastructure, where it can improve air quality by removing air pollution and aiding its dispersal, reduce real or perceived noise levels by absorbing and scattering noise and introducing natural sounds to soften man-made noise, provide areas of relative tranquillity, and reduce exposure by putting a buffer between sources of pollution and receptors.*

1.1.7 Technical Advice Note 11, Noise

A.5 Further national planning guidance is contained within Technical Advice Note 11 (TAN 11) (Welsh Government 1997), and the update letter provided on 25 November 2015. The document refers to BS 5228-1:2009+A1:2014 for the assessment of construction noise and BS 5228-2:2009+A1:2014 for the assessment of construction vibration.

1.2 Local Planning Policy

1.2.1 Newport Local Development Plan (NLDP)

A.6 The Newport Local Development Plan establishes a vision based development strategy and policies to guide the development and use of land within Newport City Council.

A.7 General Policy 2 (GP2) 'General Development Principles – General Amenity' refers to noise and states that development will be permitted where:

"i) There would not be a significant adverse effect on local amenity, including in terms of noise, disturbance, privacy, overbearing, light, odours and air quality;"

A.8 General Policy 7 (GP7) 'General Development Principles – Environmental Protection and Public Health' states the following:

"Development will not be permitted which would cause or result in unacceptable harm to health because of land contamination, dust, instability or subsidence, air, heat, noise or light pollution, flooding, water pollution, or any other identified risk to environment, local amenity or public health and safety."

A.9 Waste Policy 2 (W2) 'Waste Management Proposals' refers to noise and states that development proposals fo sustainable waste management facilities will be permitted provided that:

"iv) There is no impact on amenity through noise, air pollution, odours, dust and emissions that cannot be appropriately controlled by mitigating measures."

1.3 Legislation

1.3.1 Control of Pollution Act (CoPA) 1974

A.10 Part III of the CoPA is specifically concerned with pollution. With regards to noise it covers construction sites; noise in the street; noise abatement zones; codes of practice and best practicable means (BPM).

A.11 Section 60, Part III of the CoPA refers to the control of noise on construction sites. It provides legislation by which local authorities can control noise from construction sites to prevent noise disturbance occurring. In addition, it recommends that guidance provided by British Standard (BS) 5228 be implemented to ensure compliance with Section 60.

A.12 The CoPA enables the local authority, in whose area work is going to be undertaken, or is being undertaken, the power to serve a notice imposing requirements as to the way in which construction works are to be carried out. This notice can specify, the plant or machinery that is or is not to be used, the hours during which the construction work can be carried out, the level of noise and vibration that can be emitted from the premises in question or at any specified point on these premises or that can be emitted during specified hours, or for any change of circumstances.

A.13 Section 61, Part III of the CoPA refers to prior consent for work on construction sites. It provides a method by which a contractor can apply for consent to undertake construction works in advance. If consent is given, and the stated method and hours of work are complied with, then the local authority cannot take action under Section 60.

A.14 Section 71, Part III of the CoPA refers to the preparation and approval of codes of practice for minimising noise.

A.15 Section 72, Part III of the CoPA refers to BPM, which is defined as:

"reasonably practicable, having regards among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications'. Whilst 'Means' includes 'the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structures."

A.16 If BPM is applied, then it can provide a defence against prosecution by the local authority.

1.3.2 Environmental Protection Act (EPA) 1990

A.17 The EPA deals with statutory nuisance, including noise.

A.18 Section 79, Part III of the EPA, 'Statutory nuisances and inspections therefor', places a duty on local authorities to regularly inspect their areas to detect whether a statutory nuisance exists. This section also considers and defines the concept of BPM, which originates from the CoPA.

A.19 Where the local authority is satisfied that a statutory nuisance does exist, or is likely to occur or recur, it must serve an abatement notice. Section 80, Part III of the EPA, 'Summary proceedings for statutory nuisances', provides local authorities with the power to serve an abatement notice requiring the abatement of the nuisance or prohibiting or restricting its occurrence or recurrence; and/or carrying out such works or other action necessary to abate the nuisance.

A.20 Section 82, Part III of the EPA, 'Summary proceedings by persons aggrieved by statutory nuisances', allows a Magistrates' court to act on a complaint made by any person on the grounds that he is aggrieved by a statutory nuisance, such as noise.

A.21 The procedures for appeals against abatement notices are detailed in the Statutory Nuisance (Appeals) Regulations 1995.

British Standards

1.3.3 British Standard 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' and British Standard 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'

A.22 BS 5228 is a two-part standard which comprises:

- BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise'; and
- BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'.

A.23 The Standard provides guidance, information and procedures on the control of noise and vibration from demolition and construction sites. There are no set standards for the definition of the significance of construction noise effects, however, for noise, example criteria are provided in BS 5228-1:2009+A1:2014 Annex E and for vibration, example criteria are provided in BS 5228-2:2009+A1:2014 Annex B. The assessment of whether changes in noise levels due to construction activity constitute significant effects will be dependent on the absolute levels of ambient and construction noise, as well as the magnitude, duration, time of occurrence and frequency of the noise change.

A.24 BS 5228-1:2009+A1:2014 provides basic information and recommendations for methods of noise control relating to construction and open sites where work activities/operations generate significant noise levels. It includes sections on: community relations; noise and persons on site, neighbourhood nuisance; project supervision; and control of noise. However, annexes include: information on legislative background; noise sources, remedies and their effectiveness (mitigation options); current and historic sound level data on site equipment and site activities; significance of noise effects; calculation procedures estimating sound emissions from sites and sound level monitoring; types of piling; and air overpressure.

A.25 BS 5228-2:2009+A1:2014 covers basic information and recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels. It includes sections on: community relations; vibration and persons on site; neighbourhood nuisance; project supervision; control of vibration and measurement. BS 5228-2:2009+A1:2014 refers to BS ISO 4866:2010 'Mechanical vibration and shock - Vibration of fixed structures - Guidelines for the measurement of vibrations and evaluation of their effects on

structures' [1]; BS 7385-2:1993 'Evaluation and measurement for vibration in buildings - Part 2: Guide for damage levels from groundborne vibration' [1]; BS 6472-1:2008 'Guide to evaluation of human exposure to vibration in buildings - Part 1: Vibration sources other than blasting' and BS 6472-2:2008 'Guide to evaluation of human exposure to vibration in buildings - Part 2: Blast-induced vibration' [1] for further advice on the significance of vibration.

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

A.26 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:

"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."

A.27 The note to paragraph 8.5 of BS 4142:2014+A1:2019 is relevant to the assessment of the Uskmouth Conversion Project , and states:

"Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation."

A.28 BS 4142:2014+A1:2019 primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound' from the Uskmouth Conversion Project) at residential noise sensitive receptors. 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 it is then termed the 'rating level', 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.

A.29 The specific sound levels should be determined separately in terms of the $L_{Aeq,T}$ index over a period of T = 1-hour during the daytime and T = 15-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.

A.30 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 facade.

A.31 The commentary to 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 rating 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.

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.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to 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."

A.32 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 should account for the range of background sounds levels and ought not automatically to be assumed to be either the minimum or modal value."

A.33 One approach which is commonly adopted is to use the 25th percentile (lower quartile) of the night-time background and ambient sound levels. This method has been adopted in order to characterise the baseline sound environment. This level excludes 75% of the noisier levels and, although it is not the lowest sound level encountered, it is typically lower than that obtained using the average, median or modal values. It therefore represents somewhere in the range of lower sound levels that are likely to be encountered over a defined period and consequently represents a precautionary assessment

A.34 Only data that were measured when the wind speeds are at or less than 5 m/s should be included in the dataset used to derive the baseline noise levels. 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.

A.35 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.

A.36 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.

A.37 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+A1:2019 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.

1.3.5 Calculation of Road Traffic Noise

A.38 CRTN describes the procedures for measuring and calculating noise from road traffic. These procedures are necessary to enable entitlement under The Noise Insulation Regulations [1.i] to be determined but they also provide guidance appropriate to the calculation of traffic noise for more general applications e.g. environmental appraisal of road schemes, highway design and land use planning. The document can also be used to generate scaling factors for expected increases in road traffic and expected levels of attenuation from barriers.

1.3.6 Design Manual for Roads and Bridges, Sustainability & Environment Appraisal, LA 111, Noise and vibration

A.39 Section LA111 of DMRB provides guidance on the appropriate level of assessment to be used when assessing the noise and vibration impacts arising from all road projects including new construction, improvements and maintenance.

A.40 Generally a project should be considered for assessment if it alters the alignment of any existing carriageways including new sections of road, additional junctions and slip roads or if there is a change in traffic volume, traffic speed, proportion of heavy vehicles or changes in infrastructure surrounding the road that could cause a change in noise level of more than 1 dB(A); and if there are

any dwellings within two kilometres of the project that would be subject to a change in noise or vibration.

A.41 The classification of magnitude of change to be used for traffic noise in the long term is provided in Table A11.1.

A11.1: Magnitude of Change - Long Term

Noise Change, $L_{A10,18hr}$	Magnitude of Impact
Major	Greater than or equal to 10.0
Moderate	5.0 to 9.9
Minor	3.0 to 4.9
Negligible	less than 3.0

A.42 Research into the response to changes in road traffic noise is largely restricted to daytime periods. For assessing the impact of noise from road traffic at night, the index $L_{night,outside}$, from the 'Night Noise Guidelines for Europe' should be used. Only long term effects for receptors subject to a noise level exceeding 55 dB $L_{night,outside}$ should be considered.

A.43 Appendix A of the document provides additional advice on procedures for the calculation of road traffic noise to that already published in CRTN. It draws upon more recent research which correlates to developments in road design, surface materials and noise mitigation measurements

1.4 Noise and Vibration Abbreviations

A.44 Noise is defined as 'sound which is undesired by the recipient'. The range of audible sound is from 0 dB to 140 dB. The frequency response of the ear is usually taken to be about 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency ranie than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dB(A) weighting. This is an internationally accepted standard for noise measurements.

A.45 For variable noise sources such as traffic, a difference of 3 dB(A) is just distinguishable. In addition, a doubling of a noise source would increase the overall noise by 3 dB(A). For example, if one item of machinery results in noise levels of 30 dB(A) at 10 m, then two identical items of machinery adjacent to one another would result in noise levels of 33 dB(A) at 10 m. The 'loudness' of a noise is a purely subjective parameter but it is generally accepted that an increase/decrease of 10 dB(A) corresponds to a doubling/halving in perceived loudness.

A.46 Groundborne vibration from construction sources, such as piling, can be a source of concern for occupants of buildings in the vicinity. The concern can be that the building may suffer some form of cosmetic or structural damage or that ground settlement may arise that could subsequently lead to damage. Research associated with BS 7385, concerned with vibration-induced building damage found that although a large number of case histories were assembled, very few cases of vibration-induced damage were found. However, structural vibration in buildings can be detected by the occupants and can affect them in many ways: their quality of life can be reduced, as also can their working efficiency, although, there is little evidence that whole-body vibration directly affects cognitive processes. It should be noted that there is a major difference between the sensitivity of people feeling vibration and the onset of levels of vibration that damage a structure.

A.47 **A-weighting** - weighting of the audible frequencies designed to reflect the response of the human ear to noise. The ear is more sensitive to noise at frequencies in the middle of the audible range than

it is to either very high or very low frequencies. Noise measurements are often A-weighted (using a dedicated filter) to compensate for the sensitivity of the ear.

A.48 **Airborne Noise** – noise radiated directly from a source, such as a loudspeaker or machine, into the surrounding air.

A.49 **Ambient Noise Level** – BS 4142 defines the ambient noise level as: 'Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.' It is sometimes used to mean an environmental noise level defined specifically in terms of the L_{Aeq} noise index. The terms ambient and background may be colloquially synonymous when describing environmental noise levels.

A.50 **Background Noise Level –** BS 4142 defines the background noise level as: 'The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 % of a given time interval, T, measured using time weighting, F, and quoted to the nearest whole number of decibels' (i.e. a noise level defined specifically in terms of the LA90 noise index). The terms ambient and background may be colloquially synonymous when describing environmental noise levels.

A.51 **Baseline Noise Levels** – The existing noise levels before construction or operation of a development commences.

A.52 **Decibel** – units of sound measurement and noise exposure measurement.

A.53 **dBA** – decibels A-weighted.

A.54 **Equivalent continuous sound pressure level (L_{AeqT})** – is defined in BS 7445 as the 'value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time'. In more straightforward terms, it is a measure of the noise dose or exposure over a period. It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. It is also the unit best suited to assessing community response.

A.55 **Façade/Free-field** – This applies to the positions for either measurement or prediction. A façade position is one that effectively represents noise levels at a building but is conventionally taken at a position 1 m from the building; this includes reflections from the building. A free-field position is one that is at least 3.5 m from a building where reflection effects are not significant. The difference between a noise level measured at a façade position and a free-field position, assuming that there is a specific noise source that causes reflections, is that levels are around 3 dB higher at the façade, due to the reflection effects.

A.56 **Frequency (Hz)** – the pitch of the sound, measured in Hertz. The tonal quality of a sound is described and measured in terms of the frequency content and is commonly expressed as octave or third octave bands, the latter being the division of the octave bands into three for finer analysis, across the frequency spectrum. The smaller the octave band or third octave band centre frequency number defined in terms of Hz, the lower the sound. For example, 63 Hz is lower than 500 Hz and is perceived as a deeper sound. The attenuation due to air absorption and natural barriers increases with frequency i.e. low frequencies are always the most difficult to control. Frequency ranges for commonly occurring sounds include:

- the low notes on a bass guitar are typically around 40 – 50 Hz;
- the lowest string on a guitar is typically about 80 Hz;
- middle C is about 250 Hz;
- the C above middle C is about 500 Hz;

- cars in a residential area generally around 250 and 500 Hz;
- Greenwich Mean-time signal (pips) is around 1 kHz;
- bird calls are generally around 2 to 5 kHz; and,
- a 'Shhh' noise made by the mouth is mostly around 4 kHz and above.

A.57 **Hz** – hertz, the unit of frequency.

A.58 **L_{AeqT}** – see "Equivalent continuous sound pressure level"

A.59 **L_{Amax}** – maximum value of the A-weighted sound pressure level, measured using the fast (F) time weighting (in dBA).

A.60 **L_{A90}** – This is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during quieter periods. It is used in the methodology contained within BS 4142 and is sometimes called the 'background noise level'. Horizontal Guidance H3 Part 2 Noise Assessment and Control describes the LA90 background noise level as: 'Whilst it is not the absolute lowest level measured in any of the short samples, it gives a clear indication of the underlying noise level, or the level that is almost always there in between intermittent noisy events.'

A.61 **Octave Bands** – Groups of frequencies defined by standards where the upper frequency of each band is equal to twice the lower frequency of the next higher band. Octave bands are usually named by their geometric centre frequency. For example, the octave band extending between 44.7 Hz and 89.1 Hz is called the 63 Hz octave band. The octave band extending between 89.1 Hz and 178 Hz is called the 125 Hz octave band. The full complement of octave bands in the audible frequency range is as follows: 31.5, 63, 125, 250, 500, 1,000, 2,000, 4,000, 8,000 and 16,000 Hz.

A.62 **Peak Particle Velocity (PPV)** – Peak particle velocity is defined as 'the maximum instantaneous velocity of a particle at a point during a given time interval' and has been found to be the best single descriptor for correlating with case history data on the occurrence of vibration-induced damage.

A.63 **Point / Line / Area Source** – Noise sources can be modelled as point, line, or area sources. Noise attenuation due to geometric spreading, which is the effect of acoustic energy being spread over an increasing surface with increasing distance from the source, can be different for the different types of source. When the distance from source to receptor is very much greater than the dimensions of the source, the attenuation due to geometric spreading from all source types is the same as for point sources.

A.64 **Rating Level, $L_{Ar,Tr}$** – BS 4142 defines the rating level as 'The specific noise level plus any adjustment for the characteristic features of the noise.'

A.65 **Reflection** – Sound can be reflected by hard surfaces and reflection effects can affect hence sound levels.

A.66 **Slow / Fast Time Weighting** – The response speed of the detector in a sound level meter. For Slow response, the response speed is 1 second. Slow time weighting is frequently used in environmental sound measurements. Fast response time is 1/8 second (0.125). This is less frequently used but will detect changes in sound levels more rapidly.

A.67 **Sound Pressure Level (SPL)** – Sound pressure is the dynamic variation of the static pressure of air and is measured in force per unit area. Sound pressure is normally represented on a logarithmic amplitude scale, which gives a better relationship to the human perception of hearing. The sound pressure level is expressed in decibels (dB) and is equal to 20 times the logarithm to the base 10 of the ratio of the sound pressure at the measurement location to a reference sound pressure. The reference sound pressure in air is normally taken to be 20 µPa, which roughly corresponds to the threshold of human hearing.

A.68 **Sound Power Level (SWL, L_w)** – A sound power level is a measure of the total power radiated as noise by a source in all directions. It is a property of the source and is essentially independent of the measuring environment. The sound power level of a source is expressed in decibels (dB) and is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to a reference sound power. The reference sound power in air is normally taken to be 10-12 watt.

A.69 **Source Term** – The acoustic properties of a source defined as a sound power level or as a sound pressure level under specific measurement conditions. Source terms are sometimes provided as a spectrum.

A.70 **Specific Noise Level** – BS 4142 defines the specific noise levels as 'The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.'

A.71 **Tonal** – Noise sources sometimes contain pure tone components that can be identified as hums, whistles etc. The presence of these tonal components is sometimes considered to add an extra, annoying quality to the noise.

A.72 **Vibration Dose Value (VDV)** – The effect of building vibration on people inside buildings is assessed by determining their vibration dose. Present knowledge indicates that this is best evaluated with the VDV, as promoted through British Standard 6472 Part 1 (BS 6472). VDV defines a relationship that yields a consistent assessment of intermittent, occasional and impulsive vibration, as well as continuous input, and correlates well with subjective response. The way in which people perceive building vibration depends upon various factors, including the vibration frequency and direction. The VDV is given by the fourth root of the integral of the fourth power of the acceleration after it has been frequency weighted.