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GLANLLYNFI GARTH WIND FARM

Draft Environmental Statement

Appendix 13A - Acoustic Terminology



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1. Acoustic Terminology

1.1 Noise terminology

- 1.1.1 Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 decibels (dB) (the threshold of perception) to 140 decibels (dB) (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.
- 1.1.2 The perception of noise may be determined by other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.
- 1.1.3 The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A' weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc, according to the parameter being measured.
- 1.1.4 The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

Table 1.1 Range of Sound Levels Commonly Found in the Environment

Sound Pressure Level (dB(A))	Location
140 dB(A)	Threshold of pain
110 to 130 dB(A)	Jet aircraft on take off
100 to 110 dB(A)	Burglar alarm at one metre (m) away
70 to 90 dB(A)	Inside factory
60 to 70 dB(A)	Typical high street
50 to 60 dB(A)	Inside a car
40 to 50 dB(A)	Typical office
30 to 40 dB(A)	Living room during the day
20 to 30 dB(A)	Quiet bedroom at night
0 dB(A)	Threshold of hearing

1.1.5 **Table 1.2** below presents the noise terminology relevant to this assessment.

Table 1.2 Noise terminology

Noise term	Description
AM	Amplitude modulation. A sound is modulated in amplitude when its level exhibits periodic fluctuations.
AAWT	Annual Average Weekday Traffic (18-hour). The average weekday traffic flow over the 18-hour period from 06:00 to 00:00 (midnight) and used for road traffic noise prediction in accordance with the Calculation of Road Traffic Noise (CRTN).
A-weighted	A filter that represents the frequency response of the human ear.
Background sound level	The level of sound rarely fallen below in any given location over any given time interval, often classed according to day, quiet day, evening or night periods.
BNG	British National Grid. The standard coordinate system used in Great Britain, which defines locations using easting and northing coordinates expressed in metres.
BNL	Basic Noise Level. The predicted road traffic noise level derived in accordance with the CRTN methodology, expressed as an $L_{A10,18h}$ noise level. The BNL is calculated from traffic flow, speed, and heavy vehicle composition.
dB	Decibel. The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2 \times 10^{-5} \text{Pa}$).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A'-weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Day	07:00 to 23:00 local time, including daylight savings where applicable.
Façade Level	A sound field determined at 1 m in front of a large sound reflecting object such as a building façade.
Fast time weighting	A time weighting used in the root mean square section of a sound level meter with a 125 ms time constant.

Noise term	Description
Free-field level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, as measured outside and away from buildings.
Frequency	The number of acoustic pressure fluctuations per second occurring about the atmospheric mean pressure (related to the 'pitch' of a sound).
Hz	Hertz. The unit of frequency equal to one cycle per second, used to describe the frequency or pitch of sound.
hh	Hub height. The height of the centre of the rotor of a wind turbine above ground levels around the wind turbine
km/h	Kilometres per hour
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated time period (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{A10,18h}$	The A-weighted noise level exceeded for 10% of the 18-hour period between 06:00 and 00:00 and is the standard descriptor used by the CRTN methodology for the assessment of road traffic noise.
L_{A90}	The A-weighted noise level exceeded for 90% of the measurement period (T), typically used as an indicator of background sound levels.
LLV	Lower Limiting Value. This is the value of the fixed element of the noise limit and which is not related to a margin above background sound levels but is set at a fixed value irrespective of wind speed.
LOAEL	Lowest Observed Adverse Effect Level
ms	Millisecond

Noise term	Description
m/s	Metre per second
Night	23:00 to 07:00 local time, including daylight savings where applicable.
Quiet day	Consists of periods of the day when background sound levels are often lower than other periods of the day. The quiet day consists of the following periods: evenings from 18:00 to 23:00, Saturdays from 13:00 to 18:00, and Sundays from 07:00 to 18:00.
Rated noise level	The level of wind turbine noise plus any adjustments ('penalties' or 'corrections') for the presence of tones or amplitude modulation characteristics.
Residual level	The level of sound measured at the assessment location not associated with the wind turbines being assessed.
SSNL	Site specific noise Specific Noise Limit. The noise limit applicable to the development being assessed, accounting for the total noise assessment criteria (TNAC) and cumulative wind turbine effects.
Slow time weighting	A time weighting used in the root mean square section of a sound level meter with a 1000 ms time constant.
SOAEL	Significant Observed Adverse Effect Level
Standardised wind speeds	Standardised wind speeds are wind speeds at turbine hub height, converted to a height of ten metres for standardisation purposes with a formula using a ground reference roughness length of 0.05 metres (in accordance with the IEC 61400-11 standard).
Tone	The concentration of acoustic energy into a very narrow frequency range.
TNAC	Total noise assessment criteria. The criteria to be used when assessing total cumulative operational wind turbine noise, from which the site-specific noise limits SSNLs are derived.
Typical Background Sound Level	Describes the typical variation of background sound with wind speed, as is derived from a linear or polynomial regression analysis fitted to the measured 10-minute background sound levels.
U_{hh}	Hub height wind speed

Noise term	Description
U_{10}	Standardised 10 m height wind speed
z_0	Standard ground roughness length of 0.05 m