CALEDONIA
Offshore Wind Farm

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Volume 7E Proposed Development (Onshore) Appendices

Appendix 8-1 Summaries of Relevant Policy and Guidance

Caledonia Offshore Wind Farm Ltd

5th Floor Atria One, 144 Morrison Street, Edinburgh, EH3 8EX

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Acronyms and Abbreviations

ANC	Association of Noise Consultants
BNL	Basic Noise Level
BPM	Best Practicable Means
BS	British Standard
CRTN	Calculation of Road Traffic Noise
dB	Decibels
DMOY	Do minimum opening year
DMRB	Design Manual for Roads and Bridges
DSFY	Do something future year
DSOY	Do-something opening year
EPA	Environmental Protection Act
EU	European Union
ISO	International Organization for Standardization
LOAEL	Lowest Observed Adverse Effect Level
L_s	Sound Level
m	Metre
mms^{-1}	Millimetres per second
NR	Noise Rating
PAN	Planning Advice Note
PPV	Peak Particle Velocity
SOAEL	Significant Observed Adverse Effect Level
TAN	Technical Advice Note
UK	United Kingdom

WHO	World Health Organization
L_{day}	Time equivalent noise level over the daytime period
$L_{evening}$	Time equivalent noise level over the evening period
L_{night}	Time equivalent noise level over the night-time period
L_{den}	Time equivalent noise level over the daytime, evening and night-time period
$L_{Aeq,T}$	A-weighted time equivalent noise level over a reference period, T
$L_{A10,18hour}$ **$L_{A10,18h}$**	Tenth percentile noise index over an 18-hour period
$L_{Ar,Tr}$	Rating level, expressed over the rating period, T
$L_{A90,T}$	90^{th} percentile noise index expressed over a time period, T
T	Reference time interval
Tr	Rating time period

1 Introduction

1.1.1.1 This appendix provides a summary of policy and guidance documents referred to in the airborne noise and vibration assessment provided within Volume 5, Chapter 8: Airborne Noise and Vibration.

1.2 Planning Policy

1.2.1 Planning Advice Note PAN1/2011 (PAN1/2011)

1.2.1.1 Planning Advice Note (PAN) PAN1/2011 (Scottish Government, 2011a[1]), sets out a series of noise issues for planning authorities to consider when making decisions on planning applications. A Technical Advice Note (TAN) on Assessment of Noise (Scottish Government, 2011b[2]) has been published to accompany PAN 1/2011. In Appendix 1 of the TAN are codes of practice for the assessment of various sources of noise. It identifies British Standard (BS) BS 5228 (BSI, 2014a[3]) for guidance on construction site noise control, and as a method of prediction of noise from construction sites and BS4142 (BSI, 2019a[4]) as appropriate guidance for the evaluation of noise from industrial developments.

1.2.1.2 The TAN recommends that the daytime period includes the hours 07:00 – 23:00 and the night-time period 23:00 – 07:00.

1.2.1.3 The TAN suggests that equivalent continuous noise level over a time period, T ($L_{Aeq,T}$), is a good general purpose index for environmental noise; this index is commonly referred to as the 'ambient' noise level. It further notes that road traffic noise is commonly evaluated using the tenth percentile ($L_{A10,18hour}$) level using an 18h-hour period, and the $L_{A90,T}$ index is used to describe the 'background' noise level (the 90th percentile level, over a period, T).

1.2.1.4 The TAN recommends that residential noise sensitive receptors should be considered as having a high sensitivity to noise.

1.3 Guidance

1.3.1 BS5228:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 (noise) and Part 2 (vibration) (BS5228)

1.3.1.1 BS5228 (BSI, 2014a[3]; BSI, 2014b[5]) sets methods for predicting and evaluation potential noise and vibration effects from construction works.

1.3.1.2 Part 1 of BS5228[3] sets out techniques to predict the likely noise effects from construction works, based on detailed information on the type and number of plant items being used, their location and the length of time they are in operation.

1.3.1.3 The noise prediction methods can be used to establish likely noise levels in terms of the $L_{Aeq,T}$ over the core working day. This standard also documents a database of information, including previously measured sound pressure level data for a variety of different construction plant undertaking various common activities.

1.3.1.4 Three example methods are presented for determining the significance of construction noise impacts. In summary, these methods adopt either a series of fixed noise level limits, are concerned with ambient noise level changes as a result of the construction operations or a combination of the two.

1.3.1.5 One of the example methods for determining the significance of construction noise levels by considering the change in the ambient noise level that would arise as a result of the construction activities is the 'ABC method'. The method determines noise limits for construction activities by for various times of day depending on the prevailing noise level in the absence of construction noise. Where the prevailing level is higher, higher levels of construction noise are permitted. The noise limits during more sensitive times (evenings, weekends, night-time) are lower than during weekday daytimes. The method is shown in Table 1-1.

Table 1-1: Threshold of Potential Significant Effect at Dwellings (construction noise) – ABC Method.

Assessment and Threshold Value Period	Threshold Value in Decibels ($dBL_{Aeq,T}$)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends (19:00 – 23:00 all days, 13:00 – 19:00 Saturdays and 07:00 – 19:00 Sundays)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
NOTE 1: A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.			
NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than three decibels (dB) due to site noise.			
NOTE 3: Applied to residential receptors only.			

$dBL_{Aeq,T}$ = Time equivalent noise level, A-weighted and expressed over a period, T.

1.3.1.6 Category A is the most conservative of the three categories, which applies in the quietest noise environments where the baseline noise level is low.

1.3.1.7 Part 2 of BS5228[5] provides methods for predicting and evaluating vibration from construction activities, specifically from percussive piling and ground compaction. The response of human and building receptors to vibration are provided as threshold values.

1.3.1.8 Table B.1 of BS5228[5] Part 2 notes that a vibration level of 0.3 millimetres per second (mms^{-1}) Peak Particle Velocity (PPV) may be just perceptible in residential environments, and that 1.0 mms^{-1} PPV is likely to cause complaint. The onset of structural damage to buildings, even in the weakest of structures is not expected until vibration levels reach 20 mms^{-1} PPV.

1.3.1.9 Historical measured values from a range of piling activities are provided in a technical annex, set out at a range of separation distances from piling works.

1.3.2 British Standard BS4142:2014+A1:2019 (BS4142)

1.3.2.1 BS4142[4] sets out a method for rating and assessing sound of an industrial and/or commercial nature, including 'sound from fixed installations which comprise mechanical and electrical plant and equipment'.

1.3.2.2 The assessment procedure contained within BS4142[4] requires that initially the 'rating level' ($L_{Ar,Tr}$) that is (or would be) generated by the source under assessment is determined, externally, at the assessment location over the rating time period, Tr. Where this source does not include any acoustic features, such as tonality, impulsivity or intermittency etc., then the rating level equals the specific sound level (L_s), which is the sound pressure level produced by the source using the $L_{Aeq,T}$ noise index. Where the source under assessment does include acoustic characteristics, then a series of corrections are added to the specific sound level to determine the rating level. The degree of correction applied to determine the rating level depends upon the results of either subjective or objective appraisals.

1.3.2.3 The background sound level at the assessment location, measured using the $L_{A90,T}$ index, is then subtracted from the rating level. The result provides an indication of the magnitude of impact, where the greater the difference, the greater the magnitude of impact.

1.3.2.4 The following guidance is presented regarding the difference between the rating and background levels [4]:

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB 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; and
- The degree of impact is also dependent upon the context in which the sound arises. Factors that are considered with respect to context include: the absolute level of sound, and the character and level of the residual sound (that in absence of the source under assessment) compared to the character and level of the specific sound.

1.3.2.5 Regarding the absolute level, the BS4142[4] states: where background sound levels and rating levels are low, absolute levels might be as, or more relevant than the margin by which the rating level exceeds the background. This is especially true at night.[4]

1.3.2.6 The standard also makes the followings comments[4]:

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

- The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low;
- Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night;
- Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse;
- The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/ or commercial nature is likely to be perceived and how people react to it;
- 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.

1.3.2.7 Whilst the latest revision of BS4142[4] does not provide definition of low or very low background and rating levels the previous (BSI, 1997[6]) version considered that background levels of 30dB and rating levels of 35dB could be considered low. Numerous studies by Moorhouse, Berry, Flindell, etc. for the Health Protection Agency and for Defra (referenced within the Further Reading Section of BS4142[4]) and supported by the recent Association of Noise Consultants (ANC) Working Group report (Association of Noise Consultants Working Group, 2020[7]) on BS4142[4] application conclude that

impacts at rating levels below 35dB are unlikely. At night, particularly, where potential sleep disturbance is the key issue, a rating level of below 35dB results in internal levels substantially below the World Health Organization (WHO) guideline values (WHO, 2022[8]).

1.3.3 BS7445-1:2003 Description and Measurement of Environmental Noise. Guide to Quantities and Procedures (BS7445)

1.3.3.1 BS7445 (BSI, 2003[9]) provides guidance on appropriate environmental noise monitoring, including specification of equipment and appropriate calibration intervals, suitable weather conditions and observations to note regarding the nature of the noise environment.

1.3.4 British Standard BS8233:2014 – Guidance on Sounds Insulation and Noise Reduction for Buildings (BS8233)

1.3.4.1 BS8233 (BSI, 2019b[10]) provides suggested criteria, such as suitable sleeping/resting conditions and provides noise levels which satisfy these criteria for most people. The guidance contained within the standard relates to the control of noise within and around buildings and is applicable to the design of new buildings or existing buildings undergoing a change of use.

1.3.4.2 The criteria provided in BS8233[10] for residential properties are as follows:

- Living room 35 $dBL_{Aeq,16hour}$ daytime resting 07:00 - 23:00;
- Dining room 40 $dBL_{Aeq,16hour}$ 07:00 – 23:00;
- Bedroom 35 $dBL_{Aeq,16hour}$ daytime resting 07:00 - 23:00;
- Bedroom 30 $dBL_{Aeq,8hour}$ sleeping 23:00 - 07:00; and
- Outdoor amenity space, such as terraces or gardens 50 – 55 $dBL_{Aeq,T}$.

1.3.4.3 In addition to these criteria, BS8233[10] provides Noise Rating (NR) criteria, which form a graphical method, commonly used for rating noise from mechanical ventilation systems. The NR criteria provide a set of curves on a graph, where the highest curve which is entirely above the noise level of a given source in every octave band is designated as the NR rating of the source.

1.3.4.4 The BS8233[10] standard further provides advice on typical noise reduction levels provided by different construction methods and materials.

1.3.5 Calculation of Road Traffic Noise (CRTN)

1.3.5.1 CRTN (Department of Transport – Welsh Office, 1988[11]). provides a method for the prediction of noise levels due to road traffic based on traffic flows, road type and geometry. CRTN[11] may be used for determining the entitlement of existing properties to noise insulation where new roads are proposed and provides criteria for this purpose.

1.3.5.2 A 'shortened measurement procedure' is provided to enable the derivation of the $L_{A10,18hour}$ from the $L_{A10,3hour}$ value.

1.3.6 Method for Converting the UK Road Traffic Noise Index $L_{A10,18h}$ to EU Noise Indices for Road Noise Mapping

1.3.6.1 The study by TRL Ltd. (Abbott and Stephenson, 2006[12]) provides formulae for converting the tenth percentile ($L_{A10,18hour}$) noise index used in CRTN into the European Union (EU) noise indices for the daytime, evening and night-time and 24-hourday; termed the $L_{day,}$ $L_{evening}$, L_{night} and L_{den}, respectively. Various formulae are provided in the study, and these are applied according to the available traffic and measurement data.

1.3.7 Design Manual for Roads and Bridges (DMRB) – LA 111 Noise and Vibration

1.3.7.1 The DMRB (DMRB, 2020[13]) provides standards and advice regarding the assessment, design and operation of roads in the United Kingdom (UK). DMRB provides screening criteria, by which percentage changes in traffic flow can be related to a predicted change in road traffic noise and vibration. The guidance also provides significance criteria, by which the percentage of people adversely affected by traffic noise can be related to the total noise or vibration level due to road traffic, or the increase over an existing level.

1.3.7.2 Significance criteria are provided in DMRB[13] for evaluating the impact of changes in road traffic noise associated with construction works; the criteria refer to the 'Significant Observed Adverse Effect Level' (SOAEL) and the 'Lowest Observed Adverse Effect Level' (LOAEL) with reference to the Basic Noise Level (BNL) of the roads affected. The BNL is a function of the composition, flow and speed of traffic and the quality of the road surface. Changes in the BNL, arising from changes in traffic flow, may be used as a means of determining the significance of operational noise effects. The significance criteria provided in DMRB[13] for determining impact magnitude are provided in Table 1-2.

Table 1-2: Magnitude of Impact at Receptors (reproduction of Table 3.17 in LA 111 of DMRB)

Magnitude of impact	Increase in BNL of closest public road used for construction traffic, dB
Major	≥5
Moderate	≥3, <5
Minor	≥1, <3
Negligible	<1

1.3.7.3 DMRB provides a method for predicting the BNL, a measure of the source noise level of a road.

1.3.7.4 The following scoping criteria are provided for the evaluation of operational noise from a road [13]:

- Is the project likely to cause a change in the BNL of 1dB LA10,18hour in the do-minimum opening year (DMOY) compared to the do-something opening year (DSOY)?
- Is the project likely to cause a change in the BNL of 3dB LA10,18hour in the do-something future year (DSFY) compared to the DMOY?
- Does the project involve the construction of new road links within 600m [meters] of noise sensitive receptors?
- Would there be a reasonable stakeholder expectation that an assessment would be undertaken?

1.3.7.5 Regarding a 'reasonable stakeholder expectation' for an operational noise assessment, DMRB[13] notes an example where works involve changes to infrastructure but are not expected to give rise to significant environmental effect, such as smart motorway projects.

1.3.7.6 Where the response to any of the above scoping questions is 'yes' the scoping assessment shall make a recommendation on the scope of further assessment.

1.3.7.7 Regarding significance, DMRB[13] provides Table 3.58 which determines that a short-term magnitude of change of moderate or major will be significant and a magnitude of change of negligible or minor will be not significant.

1.3.8 ISO 9613: Attenuation of sound during propagation outdoors, Part 1 and Part 2 (ISO 9613)

1.3.8.1 ISO 9613 (International Organization for Standardization [ISO], 1993[14]; ISO, 2024[15]) describes a method for calculating the attenuation of sound during propagation outdoors to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent

continuous A-weighted sound pressure level under meteorological conditions.

1.3.9 NANR116: 'Open/closed window research' – Sound insulation through ventilated domestic windows (NANR)

1.3.9.1 NANR (The Building Performance Centre, 2007[16]) provides results of acoustic performance testing of different types of windows, including partially opened windows. The reported performance is detailed as octave band attenuation.

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144 Morrison Street
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EH3 8EX

www.caledoniaoffshorewind.com

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