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Technical Appendix 10.3

EIA Assessment Methodology for Noise

Neshion Energy Park

Neshion Ltd

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1 Introduction

Chapter 10: Noise (EIAR Volume 2) presents the results of the Construction Noise Assessment and Operational Noise Assessment of the Proposed Development, which in turn feed into the Environmental Impact Assessment (EIA) assessment of noise. Specific detail in respect of the technical assessments is presented in **Technical Appendix 10.1 Construction Noise Report (EIAR Volume 4)** and **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4**).

The Proposed Development is a renewable energy development comprised of up to eight wind turbines, a Battery Energy Storage System (BESS) and associated infrastructure adjacent to Sullom Voe Oil Terminal (SVT) and the Shetland Gas Plant in Shetland, Scotland. The assessment is based on the Proposed Development as described in **Chapter 2: Proposed Development (EIAR Volume 2)**.

This Technical Appendix presents an overview of the technical assessment methodologies and sets out the assessment method adopted for the EIA.

2 Calculation Methods

2.1 Construction Noise Calculation Method

To predict the noise immission levels attributable to the construction of the Proposed Development, a series of noise propagation models have been produced using the propriety noise modelling software CadnaA. Within the software, complex models can be used to simulate the propagation of noise according to a range of international calculation standards, including BS 5228-1:2014 *Code of practice for noise and vibration control on construction and open sites. Noise*,[1] and ISO 9613-2:2024 *Acoustics - Attenuation of sound during propagation outdoors*.[2]

The BS 5228-1 prediction methodology is for the calculation of construction noise only, whereas, the ISO 9613-2:2024 prediction methodology can be used for the prediction of all, static, externally located sound sources.

BS 5228-1 states that caution is required when predicting noise using the BS 5228-1 model at distances greater than 300 m from the source, whereas the ISO 9613 2:2024 prediction model is verified for much greater distances, such as those that occur for this project. Accordingly, the ISO model has been used throughout the construction noise assessment.

The ISO model also takes into account of the following additional factors that influence sound propagation outdoors:

- atmospheric absorption and some meteorological conditions;
- topography;
- vegetation; and
- ground attenuation.

The model uses the octave band sound power level of the proposed plant as its acoustic input data, and calculates on an octave band basis, attenuation due to geometric spreading, atmospheric absorption, topography and barriers, and ground effects.

All noise level predictions have been undertaken using a receiver height of 1.5 m above local ground level. Ground attenuation values have been set dependant on the location in which the calculation occurs (as opposed to the use of a single value across all models). Soft ground (G=1) attenuation has been assumed for fields and similar land, whilst water bodies, construction compounds, hardstandings and tracks have been modelled with a ground attenuation of G=0 (hard ground).

Air absorption based on a temperature of 10 °C and 70 % relative humidity has been assumed throughout, as is industry standard practice in the UK.

2.2 Operational Noise Calculation Method

Noise predictions for operational noise have also been undertaken using the propagation model contained within ISO 961-2. The noise model was set using the parameters detailed in the Institute of Acoustics' (IOA) *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating*

[1] British Standard Institute (BSI) *Code of practice for noise and vibration control on construction and open sites' – Part 1: Noise.* BSI, 2014. BS 5228-1:2009+A1:2014.
[2] International Organisation for Standardisation. *Acoustics – Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors*. Geneva: ISO, 2024. ISO 9613-2:2024.

of Wind Turbine Noise (the IOA GPG), [3] including mixed ground attenuation (G=0.5), atmospheric attenuation relating to 70% relative humidity and 10°C, and receiver heights of 4 m.

The turbine noise immission levels are based on the LA90,10-minute noise indicator, in accordance with the recommendations in ETSU-R-97 *The Assessment and Rating of Noise from Wind Farms*. [4] These are obtained by subtracting 2 dBA from the calculated LAeq,10-minute levels.

Propagation across a valley (concave ground) increases the number of reflection paths, and in turn, has the potential to increase sound levels at a given receptor. Conversely, terrain screening effects (barrier corrections) act as blocking points, and reductions in sound levels at a given receptor can potentially be observed. Accordingly, and in line with the IOA GPG, an assessment has been undertaken to determine whether a concave ground profile correction (+3 dB) or barrier correction (-2 dB), is required due to the topography between the turbines and any residential receptors. A concave ground and barrier correction was found to be required for a number of turbines at a number of receptors, and this is detailed in Annex 6 of **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4)**.

Predictions of turbine noise for the Proposed Development were made based upon the sound power level (SWL) data for a single candidate turbine, the Vestas V172 7.2 MW with serrated trailing edge blades, which is considered representative of the type of turbine that would be installed at the Site. The exact model of turbine to be installed on the Site, however, would be the result of a future tendering process, should consent be granted. Achievement of the noise limits determined in this assessment would be a key determining factor in the final choice of turbine for the Proposed Development during the tendering process.

More information relating to the parameters for modelling operational noise discussed above, and on other topics such as Amplitude Modulation (AM) and Low Frequency noise (LFN), has been provided in **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4)**.

[3] Institute of Acoustics (IOA). *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*. UK: IOA, 2013.
[4] The Working Group on Noise from Wind Turbines. *ETSU-R-97 The Assessment and Rating of Noise From Wind Farms*. UK: Energy Technology Support Unit, 1996.

3 Technical Assessment Methods

3.1 Construction Noise Assessment Method

The construction noise assessment was undertaken using guidance contained in BS 5228-1. To undertake an assessment of the construction noise impact, the following steps have been undertaken:

- identify thresholds for significant effects, as defined in BS 5228-1;
- predict noise levels for various construction phases;
- compare predicted noise levels against the applicable thresholds;
- where necessary, develop suitable mitigation measures to minimise any significant adverse effects during the construction phase; and, if required
- assess any residual adverse effects taking into account any identified mitigation measures.

Annex E, part E.3.2 of BS 5228-1, sets criteria for assessing the significance of construction noise effects and gives examples of acceptable levels for construction noise.

Table E.1 of BS 5228-1 (reproduced here as **Table 3-1**) contains an example of the significance criteria that can be used to assess construction activities.

Three categories of thresholds are provided for varying assessment periods (night-time, evenings, weekends etc.). The appropriate category for any given receptor can be chosen after quantifying the existing ambient noise levels (rounded to the nearest 5 dB) at that location for the given assessment period. Therefore, the assessment of construction noise reflects a specific noise threshold for the locality for a particular period of the day, rather than an absolute noise level limit.

BS 5228-1 provides the following advice regarding the thresholds:

"Note 1: A potential significant effect is indicated if the LAeq,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 LAeq,T noise level for the period increases by more than 3 dB due to site noise.

Note 3: Applied to residential receptors only."

It should be noted that exceedance of the threshold does not in itself indicate a significant effect, rather, the standard states; *"If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect".*

Table 3-1: Example of Threshold of Potential Significant Effect at Dwellings

Significance of Effect	Threshold Value $L_{Aeq(t)}$ dB		
	Category A [A]	Category B [B]	Category C [C]
Night-Time (23:00 – 07:00)	45	50	55
Evenings and Weekends [D]	55	60	65
Daytime (07:00 – 19:00) & Saturdays (07:00 to 13:00)	65	70	75

Significance of Effect	Threshold Value $L_{Aeq(t)}$ dB		
	Category A (A)	Category B (B)	Category C (C)
(A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values; (B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values; (C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values; (D) 19:00-23:00 weekdays, 13:00-23:00 Saturdays and 07:00 – 23:00 Sundays.			

It should be noted that exceedance of the threshold does not in itself indicate a significant effect, rather, the standard states; '*If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect'*.

Noise immission levels would vary throughout the construction period as construction activities, plant and locations vary. For much of the working day the noise associated with construction activities would be less than predicted, as the assessment assumes all equipment is operating continually, at full power, and in locations closest to the receptors, whereas in practice, equipment load and precise location will vary throughout the day. This approach has been adopted to represent a worst-case assessment.

At this stage, a detailed plant list is not available, therefore, generic plant lists based upon experience of similar projects have been used. All modelled noise sources and associated SWL and sound pressure level (SPL) data is included in **Technical Appendix 10.1: Construction Noise Report (EIAR Volume 4)**.

For all construction activities, source noise level data is taken from Appendix C of BS 5228-1, which provides octave band SPL levels for a wide variety of construction plant and activities suitable for the estimation of noise immission levels.

Construction noise sources for any given activity would generally comprise of a mix of both moving and static sources. Mobile sources include mobile construction plant and Heavy Goods Vehicles (HGVs), while static construction plant could include generators, lighting rigs and pumps. Static equipment is usually located at a fixed location for an extended period of time.

All static items of plant and activities have been modelled as point sources.

All mobile plant (excavators, dozers, dumpers etc.) have been modelled as either a moving point source (line source) along their anticipated movement paths, or as a stationary point source located at the closest point of its anticipated work area to any given assessment location.

For both mobile and static plant, activity noise levels would be transient in nature due to changes in location, on/off periods, and fluctuations of load on any individual machine, therefore, the calculated noise levels can only provide an indication as to the likely levels of noise for a given snapshot in time.

3.2 Operational Noise Assessment Method

In Scotland, the Onshore Wind Policy Statement 2022[5] states:

[5] Scottish Government. *Onshore Wind: Policy Statement 2022* [Online] Available From https://www.gov.scot/publications/onshore-wind-policy-statement-2022/ [Accessed 23rd February 2026].

"The Assessment and Rating of Noise from Wind Farms' (Final Report, Sept 1996, DTI), (ETSU R 97) provides the framework for the measurement of wind turbine noise, and all applicants are required to follow the framework and use it to assess and rate noise from wind energy developments."

The document then refers to the IOA GPG stating that it supports:

"the use of ETSU-R-97 when designing potential windfarm schemes, and the monitoring of noise levels from generating sites. The Scottish Government recognises this guide as a useful tool which developers can use in conjunction with ETSU-R-97."

In June 2024, the UK Government Department for Energy Security and Net Zero (DESNZ) awarded a contract to Noise Consultants Limited to update ETSU-R-97. A draft update of new guidance *Assessment and Rating of Wind Turbine Noise* (2025) was published for consultation on 4th July 2025. There is no confirmed date for the publication of final guidance.

Given the draft status of the guidance and the recommendations included on the front page of the draft document itself, the consultation draft has not been considered in this assessment. This is in line with the Onshore Wind Policy Statement 2022, which refers to a potential update and states:

"The Scottish Government is aware that the UK Government has been considering the extent to which ETSU-R-97 may require updating to ensure it is aligned with the potential effects from more modern turbines. The Scottish Government supports this work and we anticipate the results of a short-term review project in due course.

Until such time as new guidance is produced, ETSU-R-97 should continue to be followed by applicants and used to assess and rate noise from wind energy developments."

Therefore, the Proposed Development operational noise assessment has been undertaken in accordance with ETSU-R-97 and the IOA GPG.

ETSU-R-97 provides a robust basis for determining acceptable noise limits for wind farm developments. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise levels at nearby noise sensitive properties would be above or below the noise limits derived in accordance with ETSU-R-97.

3.2.1 Setting Operational Noise Limits

Operational wind turbine noise limits differ between daytime and night-time periods. The daytime criteria are set based upon background noise levels measured during the 'quiet periods of the day' comprising:

- All evenings from 18:00 - 23:00;
- Saturday afternoons from 13:00 - 18:00; and
- All day Sunday from 07:00 - 23:00.

Nonetheless, the derived limits apply to the entire daytime period (07:00 – 23:00).

Night-time periods are defined as 23:00 - 07:00, with no differentiation made between weekdays and weekends.

ETSU-R-97 recommends that wind farm noise for the daytime period should either be limited to 5 dBA above the prevailing background or to a fixed minimum level (FML), within the range 35 - 40 dB LA90,10min, whichever is higher. The choice of FML depends on a number of factors, including:

- The number of dwellings in the neighbourhood of the wind farm (relatively few dwellings suggest a figure towards the upper end);

- The effect of noise limits on the number of kWh generated (larger sites tend to suggest a higher figure); and,
- The duration and level of exposure to any noise.

The noise level limits of other nearby consented wind turbine developments can also influence the setting of the FML, however, as the only cumulative scheme that is being considered is still in planning, there are no existing noise limits for neighbouring schemes that need to be reviewed.

With consideration of the three factors listed above, a FML of 40 dB has been used for the assessment. This is consistent with other wind turbine developments in Shetland, such as Viking Wind Farm and Beaw Field Wind Farm.

Accordingly, the noise limits for the Proposed Development have been set at;

- 40 dBA or background plus 5 dB, whichever is the greater, during the daytime period; and,
- 43 dBA or background plus 5 dB, whichever is the greater, during the night-time period.

These limits have already been agreed with Shetland islands Council (SIC) during consultation and at the scoping stage of the project. Further detail is presented within **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4)**.

The exception to the setting of both the daytime and night-time FML on the noise limits occurs where a property occupier has a financial involvement in the wind farm development. In this case the FML can be increased to 45 dBA and consideration can be given to increasing the permissible margin above background.

3.2.2 Consideration of Cumulative Operational Noise

The cumulative noise assessment is undertaken in three stages:

- Stage 1: establish a set of Total ETSU-R-97 Noise Limits for each Noise Assessment Location (NAL) using the measured background noise levels. The Total Noise Limits (TNL) are the limits that should not be exceeded from the cumulative operation of all wind turbines in an area;
- Stage 2: undertake noise modelling to determine whether noise predictions from the Proposed Development on its own are within 10 dB of the noise predictions from other turbines in the area; where turbine predictions are more 10 dB apart, no further consideration of the cumulative noise level is required; and,
- Stage 3: establish Site Specific Noise Limits (SSNL) for the Proposed Development through apportioning the TNL between the developments, and compare the operational noise from the Proposed Development on its own against the SSNLs.

The aim of the operational noise assessment, therefore, is to:

- establish a set of Total ETSU-R-97 Noise Limits;
- determine the likely cumulative impacts of the Proposed Development operating alongside other schemes at the nearest receptors; and
- derive appropriate Site Specific Noise Limits and demonstrate that the Proposed Development can meet those limits.

Each of the turbines modelled in the cumulative noise assessment (for Stage 2), are summarised in Annex 6 of **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4)**. Uncertainty in sound power data for the Proposed Development, and other cumulative developments, has been accounted for using the guidance contained within Section 4.2 of the IOA GPG, with uncertainty values for each

modelled turbine detailed within Annex 7 of **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4)**.

4 EIA Assessment Method: Significance Criteria

4.1 Sensitivity of Receptors

TAN 1/2011 Table 2.1 [6] provides examples of the sensitivities of various receptor types. Only residential receptors are considered in this assessment, which are the only nearby receptor types that have been identified within the Study Area. These are classified as having a high level of sensitivity.

4.2 Construction Noise: Magnitude of Impact

The assessment of construction noise is made against the threshold levels set in BS 5228-1, which cannot be used to determine a magnitude of impact. Rather, the assessment indicates the potential for a significant effect to occur and then additional factors such as duration of exposure, need to be considered. Although not explicit, BS 5228-1 suggests that a duration of exposure to noise levels above the thresholds for more than one month is likely to be significant

4.3 Operational Noise: Magnitude of Impact

ETSU-R-97 does not define significance criteria or provide a method to determine a magnitude of impact. Rather, it describes a framework for the measurement of wind farm noise and gives indicative noise levels considered to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development. Achievement of ETSU-R-97 derived noise limits ensures that turbine noise would comply with current Scottish Government guidance.

4.4 Construction Noise: Significance of Effects

With due regard to the above, the assessment criteria to determine the EIA significance of effects for construction noise levels are as detailed in **Table 4-1**.

Table 4-1: Level of Significance of Effects from Construction Noise

Construction Noise Level	Duration of Exposure	
	More than one month	Less than one month
Exceeding the BS 5228 threshold levels	Major	Moderate
Below the BS 5228 threshold levels	Minor	Minor
Below existing ambient noise levels	Negligible	Negligible

Significant construction noise effects are defined as **Moderate** or **Major**.

4.5 Operational Noise: Significance of Effects

The use of the term 'significance' in the EIA assessment in relation to operational noise, refers to compliance/non-compliance with the ETSU-R-97 derived noise limits. Accordingly;

- where predicted wind turbine noise meets or is less than the noise limits defined in ETSU-R-97, the noise effects are deemed to be not significant; and,

[6] The Scottish Government. *Technical Advice Note (TAN), Assessment of Noise*. Scotland: The Crown, 2011.

- any breach of the ETSU-R-97 derived noise limits attributable to the Proposed Development is deemed to result in a significant effect in terms of the EIA Regulations.