Condition 37 Noise

Conjoined Public Inquiry: Craiginmoddie Wind Farm (WIN-370-4), Carrick Windfarm (WIN-370-5) & Knockcronal Wind Farm (WIN-370-6)

Operational Noise Planning Condition

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Final Agreed Version 7 2023-03-03

NOTE Schedule of Conditions: 7 April 2023.

This version 2 of the Schedule of Conditions addresses the comments from South Ayrshire Council (SAC) included in version 1 of the Schedule of Conditions dated 8th March 2023. SAC has not commented on the Applicant's further amendments (shown in red) to the conditions in columns 2 – 4 of Table 2, or the Applicant's responses to SAC's original comments in the final column of Table 2. This is currently under consideration by SAC. The Applicant's and SAC have agreed to continue to work together to narrow the issues that remain in dispute between the date of this submission (7th April 2023) and the hearing session on conditions (20 June 2023). In the interim, SAC has confirmed that it is content for this version 2 of the Schedule of Conditions to be submitted to the DPEA.

Save Straiton Amendments in RED to CONDITION 37 Operational WTN 19-06-2023 - William L Huson.

COMMENT

Conditions can only be a contingency in the event the applications are approved.

The Reporters should request that the background noise tables are completely reassessed due to ongoing non compliance of Hadyard Hill operational noise levels and the conjoined applicants unsound reliance on flawed data. See CD 17.23.

The rating level of noise immissions from the combined effects of the wind turbines hereby permitted (including the application of any tonal penalty and amplitude modulation (AM) penalty), when determined in accordance with the attached Guidance Notes, shall not exceed the values for the relevant integer wind speed set out in or derived from Table 1 and Table 2 attached to this condition at any ~~dwelling~~ noise sensitive receptor as reference CD012.016, which is lawfully existing or has planning permission at the date of this permission and:-

a) The wind farm operator shall continuously log data in accordance with Guidance Note 1(b) in a manner to be agreed in writing with the Planning Authority. The wind farm operator shall provide this data in comma separated values in electronic format to the Local Planning Authority and also to

an independent acoustic consultant commissioned/employed by a complainant on their request, within 14 days of receipt in writing of such a request.

b) There shall be no First Commissioning of the Development until the wind farm operator has received written approval from the Planning Authority of a list of proposed independent consultants who may undertake compliance measurements in accordance with this condition. Amendments to the list of approved consultants shall be made only with the prior written approval of the Planning Authority. The Planning Authority's approved list of independent consultants and any subsequent amendments must be made available on request, within 7 days of such a request to any interested party or complainant.

c) Within 21 days from receipt of a written request of the Planning Authority, following a complaint to it from an occupant of a dwelling alleging noise disturbance at that dwelling, the wind farm operator shall, at its expense, employ an independent consultant from the list approved under paragraph b) of this condition and provide a written protocol produced by the independent consultant to be approved in writing by the Planning Authority. The written request from the Planning Authority shall set out as far as possible the time and/or meteorological conditions to which the complaint relates and include a statement as to whether, in the opinion of the Planning Authority, the noise giving rise to the complaint contains or is likely to contain tonal characteristics or amplitude modulation. The protocol shall describe the procedure to assess the level and character of noise immissions from the wind farm at the complainant's property in accordance with the procedures described in the attached Guidance Notes and the procedure described in DEFRA NAN R277. Measurements to assess compliance with the noise limits shall be undertaken in accordance with the approved assessment protocol unless the Planning Authority agrees in writing to a variation. All noise and operational data used in the complaints investigation is to be made available to the complainant and an independent acoustic consultant commissioned/employed by a complainant at their request at no cost.

d) Where a dwelling to which a complaint is related is not listed in the tables attached to these conditions, the assessment protocol shall include noise limits to be adopted at the complainant's dwelling for compliance checking purposes. The Noise Limits if not those in Tables 1 and 2 shall be assessed using ON/OFF testing in accordance with IoAGP; ~~are to be those selected from Tables 1 and 2,~~

NOTE: the NOISE LIMITS in Tables 1 & 2 are no longer considered to be valid and sound, and are thus inadmissible: reference SS CD017.023

having regard to Table 3, and specified for a listed location which the independent consultant considers appropriate, taking account of whether it is likely to experience the most similar background noise environment to that experienced at the complainant's dwelling and relevant apportionment of the total ETSU-R-97 noise limits. ~~In the event that the consent of the complainant for access to their property to undertake a compliance assessment is withheld, the assessment protocol shall set out details of the proposed alternative representative measurement position.~~

A compliance assessment is required at the complainants property. A compliance assessment need only be completed if access to the property is allowed by the complainant.

e) ~~Where the proposed measurement location is close to the wind turbines, rather than at the complainant's property (e.g. to improve the signal to noise ratio), then the protocol shall include a method to determine compliance at the complainant's property based on the noise levels measured at the agreed location.~~

f) The wind farm operator shall provide to the Planning Authority the independent consultant's assessment of the rating level of noise immissions undertaken in accordance with the assessment protocol within two months of the date of the approval of the protocol unless otherwise agreed in writing by the Planning Authority. Certificates of calibration of the instrumentation used to undertake the measurements shall be submitted to the Planning Authority with the independent consultant's assessment of the rating level of noise immissions.

g) Where a further assessment of the rating level of noise immissions from the wind farm is required pursuant to Guidance Note 5(b) of the attached Guidance Notes, the wind farm operator shall submit a copy of the further assessment within 21 days of submission of the independent consultant's initial assessment unless otherwise agreed in writing by the Planning Authority.

Note: For the purposes of this condition, a "dwelling" ~~is a building in residential use~~ is a noise sensitive receptor reference SAC CD012.016, CD017.005 Hearing Statement - W L Huson & CD 17.17 Conditions Noise Sensitive Receptors (NSR) .. which lawfully exists or had planning permission at the date of this consent and deemed planning permission.

CD17.17

6.1. Mr Huson Suggests:

NOISE SENSITIVE RECEIVERS (NSR)

Dwellings are generally considered to be NSR and the ETSU_R_97 night time noise limit of 43 dBA outside a dwelling assumes significant attenuation from outside a dwelling to inside a bedroom where it is assumed that a target noise limit of 30 dBA, Leq will be achieved to protect sleep (WHO Guidelines).

In the case of a camping ground it is impossible to achieve any significant attenuation of sound from outside a tent to inside where people sleep. The target night time noise limit for camping areas should be set at 30 dBA, Leq, or 28 dBA, L90.

7. Suggested Condition to protect campers.
"Target noise limits outside any camp site area at night are determined as the base noise limit of 28 dBA, L90 or Background plus 5 dB, whichever is the greater, over the operating wind speeds of the chosen wind turbines."
This condition will protect the amenity of campers and prevent any adverse impact on tourism in the area.

Given Concerns over Background measurements Tables 1 & 2 need new background noise measurements Table 1 & 2 Noise Limits now considered to be inadmissible.

Table 1 - Between 07:00 and 23:00 - noise limits expressed in dB LAF90,10-minute as a function of the standardised wind speed (m/s) at ten metre height as determined within the site averaged over ten minute periods

Location	Standardised wind speed at ten metre height (m/s) within the site averaged over ten-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
Table to be completed with content taken from the Statement of Agreed Matters												

Table 2 - Between 07:00 and 23:00 - noise limits expressed in dB LAF90,10-minute as a function of the standardised wind speed (m/s) at ten metre height as determined within the site averaged over ten minute periods.

Location	Standardised wind speed at ten metre height (m/s) within the site averaged over ten-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
Table to be completed with content taken from the Statement of Agreed Matters												

Table 3 - Coordinate locations of the properties listed in Tables 1 and 2.

Location	Easting	Northing
Table to be completed with content taken from the Statement of Agreed Matters		
The geographical coordinate references are provided for the purpose of identifying the general location of dwellings to which a given set of noise limits applies.		

The geographical coordinate references are provided for the purpose of identifying the general location of dwellings to which a given set of noise limits applies.

CD 17.17 Save Straiton Proposed Noise condition:

AMPLITUDE MODULATION

9. SUMMARY

Application of the IoA AM Method significantly underestimates the true amplitude modulation experienced at a dwelling.

See Note 4 below.

Guidance Notes for Noise Condition

These notes are to be read with and form part of the planning condition on noise. The measured data is to be split into wind speed bins as described below. The rating level in each wind speed bin is the arithmetic sum of the wind farm noise level, any tonal penalty applied in accordance with Note 3 and any AM penalty applied in accordance with Note 4. Reference to ETSU-R-97 refers to the publication entitled "The Assessment and Rating of Noise from Wind Farms" (1997) published by the Energy Technology Support unit (ETSU) for the Department of Trade and Industry (DTI). IOAGPG is "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise" and includes Supplementary Guidance Notes 1 to 5 of the IOAGPG, or any updates to these documents current at the time of measurement. The IOA Metric is "A Method for Rating Amplitude Modulation in Wind Turbine Noise" dated 9th August 2016 or any update of that current at the time of measurement.

Note 1 – Data Collection

a) Values of the LAF90,10-minute noise index should be measured in accordance with the IOAGPG. Measurements shall be undertaken in such a manner to enable a tonal penalty to be calculated and to allow an AM penalty to be calculated for selected periods where a tonal or AM assessment is required.

b) To enable compliance with the condition to be evaluated, the wind farm operator shall continuously log during each successive ten-minute period and shall retain those data for a period of not less than 24 months:-

• Arithmetic mean hub height wind speed in metres per second (m/s) measured at or derived from one or more meteorological mast(s) located within the site (if part of the wind farm hereby consented).

• Arithmetic mean hub height wind direction in degrees from north measured at or derived from one or more meteorological mast(s) located within the site (if part of the wind farm herby consented).

• Arithmetic mean nacelle anemometer wind speed for each wind turbine on the wind farm.

• Arithmetic mean nacelle orientation for each wind turbine on the wind farm.

• Arithmetic mean nacelle wind direction for each wind turbine on the wind farm.

• Arithmetic mean, minimum and maximum rotor RPM for each wind turbine on the wind farm.

• Whether each wind turbine is running normally for each wind turbine on the wind farm.

All ten-minute periods shall commence on the hour and in ten-minute increments, thereafter, synchronised with Universal Coordinated Time (UTC). The wind speeds at turbine hub height shall be 'standardised' to a reference height of ten metres as described in ETSU-R-97 at page 120 using a reference roughness length of 0.05 metres. It is these standardised ten metre height wind speed data which are correlated with the noise measurements determined as valid.

Note 2 – Data Analysis

a. The independent consultant shall identify a sub-set of data having had regard to:-

• the conditions (including time of day and corresponding wind directions and speeds) at times in which complaints were recorded;

• the nature/description recorded by the complaints if available;

• information contained in the written request from the local planning authority;

• likely propagation effects (downwind conditions or otherwise);

• the results of the tonality and AM analysis where relevant.

In cases where it is possible to identify patterns of clearly different conditions in which complaints have arisen, additional sub-sets may be considered, provided this does not introduce unreasonable complexity in the analysis and can be justified by the independent consultant.

b. Within each of the sub-set(s) of data identified, data shall be placed into separate 1 m/s wide wind speed bins, centred on whole wind speeds and the arithmetic average LAF90,10-minute sound pressure level within that wind speed bin is the wind farm noise level.

Note 3 – Tonal Penalty

a. Where, in accordance with the assessment protocol, the noise contains or is likely to contain a tonal component, a tonal audibility shall be calculated for each ten-minute period using the following procedure.

b. For each ten-minute period for which a tonal assessment is required this shall be performed on noise immissions during two-minutes of each ten-minute period. The two-minute periods should be spaced at ten-minute intervals provided that uninterrupted uncorrupted data are available.

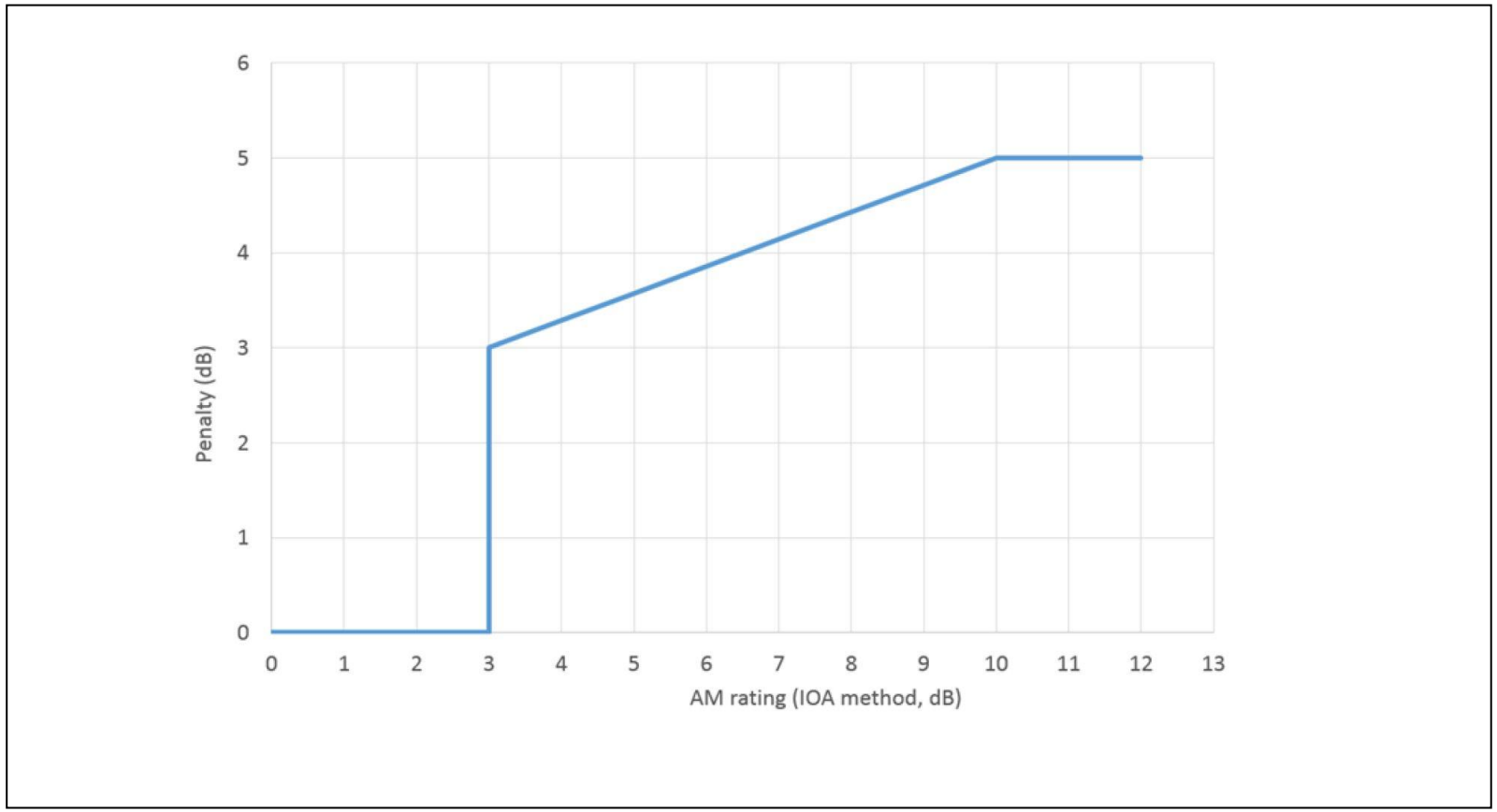
c. For each of the two-minute samples the tone level above audibility shall be calculated by comparison with the audibility criterion given in Section 2.1 on pages 104-109 of ETSU-R-97. Samples for which the tones were below the audibility criterion or no tone was identified, a value of zero audibility shall be substituted. Where data for a ten-minute period are corrupted, that period shall be removed from the tonal analysis.

d. The tone level above audibility for each ten-minute period shall be placed in the appropriate data sub-set and wind speed bin.

Note 4 – AM Penalty

Where, in accordance with the protocol, the noise contains or is likely to contain AM, an AM penalty shall be calculated for each ten-minute period using the following procedure.

b. ~~For each 10-minute interval for which an AM assessment is required this shall be performed in accordance with The IOA Metric. The value of AM for each ten-minute period shall be converted to a penalty in decibels in accordance with the graph below and the penalty shall be placed in the appropriate data sub-set and wind speed bin. Where a penalty is zero it should be placed in the bin in the same way.~~ Not required if Denbrook Condition is used.



This penalty scheme has not been verified in court the Denbrook Condition has.

Replace Note 4 with Impulsiveness.

Impulsiveness shall be determined in accordance with BS4142 using the penalty scheme described therein.

Reference CD17.17.

9. SUMMARY

Application of the IoA AM Method significantly underestimates the true amplitude modulation experienced at a dwelling.

The use of the IoA AM Method is not fit for purpose when assessing AM from more than one wind turbine.

The IoA Method could produce reasonable results if the recorded sound levels were stationary ergodic. This condition may arise when observing close to a single wind turbine in constant wind conditions.

However, multiple wind turbines that may contribute to amplitude modulation in practice produce sound level data that is not stationary ergodic and the IoA AM Method greatly underestimates the true AM that a person will observe at a dwelling in these situations.

NOTE: Not required if Denbrook Condition is applied.

DENBROOK CONDITION

10. Alternative AM Condition

A better analysis method to use is the direct observation of sample sound level charts that does not require manipulations into and out of the frequency domain (FFT to InverseFFT).

Such an analysis method is described in Condition 20 of the development permit for the Den Brook Wind Farm, as follows:

"Condition 20

At the request of the local planning authority following receipt of a complaint the wind farm operator shall, at its expense, employ a consultant approved by the local planning authority, to assess whether noise immissions at the complainant's dwelling are characterised by greater than expected amplitude modulation. Amplitude modulation is the modulation of the level of broadband noise emitted by a turbine at blade passing frequency. These will be deemed greater than expected if the following characteristics apply:

(a) A change in the measured LAeq, 100 milliseconds turbine noise level of more than 3 dB (represented as a rise and fall in sound energy levels each of more than 3 dB) occurring within a 2 second period.

(b) The change identified in (a) above shall not occur less than 5 times in any one minute period providing the LAeq, 1 minute turbine sound energy level for that minute is not below 28 dB.

(c) The changes identified in (a) and (b) above shall not occur for fewer than 6 minutes in any hour.

Noise immissions at the complainant's dwelling shall be measured not further than 35 m from the relevant building, and not closer than within 3.5 m of any reflecting building or surface, or within 1.2 m of the ground. " As stated in the Noise Hearing Session the Denbrook Condition has been tested up to the High Court.

Additional Note: Each of the applicants have removed a proposed AM Condition contrary to **Final Agreed Version 7 2023-03-03**

CD15.035 Craiginmoddie Date 16-06-23.

CD15.037 Titled Knockcronal but refers to Carrick Date 16.03.2023

Applicants need to resubmit conditions that do not contradict each other in respect of AM

Note 5 – Calculation of Rating Level

a. The LAF90 sound pressure level for each data sub-set and wind speed bin is the arithmetic mean of all the ten-minute sound pressure levels within that data sub-set and wind speed bin except where data has been excluded for reasons which should be clearly identified by the independent consultant. The tonal penalty for each wind speed bin is the arithmetic mean of the separate ten-minute tonal audibility levels in the bin converted to a penalty in accordance with Fig 17 on page 104 of ETSU-R-97. The AM penalty for each bin is the arithmetic mean of the AM penalties in the bin. The assessment level in each bin is normally the arithmetic sum of the bin LAF90, the bin tonal penalty and the bin AM penalty except where the AM penalty and the tonal penalty relate to the same characteristic (e.g. amplitude modulated tones) when the sum of both penalties may overly penalise the characteristics of the noise. Such cases should be identified and only the larger of the AM or tonal penalty should be applied.

Ref BS4142 WTN assessment should not be restricted to 2 minute & gathered continuous samples.

b. If the assessment level in every wind speed bin lies at or below the corresponding wind speed limits set out in the Table(s) attached to the condition then no further action is necessary. In the event that the assessment level is above the limits set out in the Table(s) attached to the noise condition in the corresponding wind speed bin, the independent consultant shall undertake a further assessment of the rating level to correct for background noise so that the rating level relates to wind turbine noise immissions only. Correction for background noise need only be undertaken for those wind speed bins where the assessment level is above the corresponding limit.

c. The wind farm operator shall ensure that all the wind turbines in the development are turned off for such periods as the independent consultant requires to undertake the further assessment. The further assessment shall be undertaken in accordance with the following steps:-

i. Repeating the steps in Note 1, with the wind farm switched off, and determining the background noise (L3) in each wind speed bin as required in the protocol. At the discretion of the consultant and provided there is no reason to believe background noise would vary with wind direction, background noise in wind speed bins where there is insufficient data can be assumed to be the same as the same wind speed bin in other wind directions**. (On Off Testing)**

ii. The wind farm noise (L1) in each wind speed bin shall then be calculated as follows, where L2 is the measured level with turbines running but without the addition of any tonal or AM penalty:

$$L1 = 10 \text{ Log10 } [10(L2/10) – 10(L3/10)]$$

iii. The rating level in each wind speed bin shall be calculated by adding the tonal penalty and AM penalty to the derived wind farm noise L1 in that wind speed bin.

iv. If the rating level after adjustment for background noise contribution and adjustment for impulsive tonal or AM penalties in every bin lies at or below the corresponding limits set out in the Table(s) attached to the condition then no further action is necessary. If the rating level at any integer wind speed exceeds the corresponding limits set out in the Table(s) attached to the condition then the development fails to comply with the condition in the circumstances represented by that wind speed bin.