

SPR EA1N and EA2 PROJECTS



DEADLINE 6 – COMMENTS ON EAST ANGLIA ONE OPERATION PHASE NOISE MONITORING REPORT SUBMITTED AT DEADLINE 5

Interested Party: SASES **IP Reference Nos.** 20024106 and 20024110

Date: 24 February 2020

Issue: 2

SUMMARY

1. The Applicants referred to this report (“EA1 Report” [\[REP5-022\]](#)) during ISH4 although it had not been previously submitted in the examinations. The EA1 Report was submitted at deadline 5 in response to ISH4 action point 6.
2. The Applicants rely upon this report to support their submission that:
 - a. generally there have proven to be no noise issues at Bramford arising from the EA1 substation; and
 - b. the EA1N and EA2 substations will not emit tonal noise.
3. In fact the EA1 report does not provide any support for these assertions given:
 - a. it is based on unverified assumptions;
 - b. the testing process was flawed;
 - c. the EA1 substation is not comparable to the EA1N or EA2 substations either individually or in combination; and
 - d. the Bramford substation site and relevant receptors are not comparable to the Friston substation site.
4. Attached at Appendix 1 is report prepared by Rupert Taylor dated 22 February 2021 in relation to the conclusions of the EA1 Report in relation to tonality etc.

THE EA1 REPORT

Conclusions

5. The EA1 Report concludes (paragraph 77) that *“the specific sound of the EA1 substation is in compliance with the noise limit criteria contained in requirement 24 (2) of the DCO for the EA1 windfarm.* The wording of Requirement 24 is set out in paragraph 10 of the EA1 Report. In the essence the noise limit is 35 dB LAeq, 5min at three specified receptors, referred to below as the “EA1 receptors”.
6. Further, and no doubt it is upon this conclusion which the Applicants rely, it is stated (paragraph 68) that *“Numerical analysis of the results, using the third octave method described*

within BS4142:2019 methods for writing and assessing industrial and commercial sound, confirms that no tones are objectively quantifiable”.

7. However these conclusions are incorrect and inapplicable to the Friston site for the reasons set out in Rupert Taylor’s Report attached at appendix 1 and for the reasons set out below.
8. Further it should be noted that in the ES for the EA1 project it was recognised that “*Noise from electricity infrastructure can contain tonal components (the “mains hum”) - see paragraph 40 of Environmental Statement Volume 3 – Onshore Noise and Vibration. This is also recognised in the operational noise requirement in the DCO which refers to “relevant penalties for tonal or impulsive noise” - see requirement 24 (1).*

<https://webarchive.nationalarchives.gov.uk/20191203074627/https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/EN010025/EN010025-000550-7.4.7%20Volume%203%20Chapter%206%20Noise%20and%20Vibration.pdf>

9. The EA1 Report also recognises the tonal nature of sound emissions from substations – see paragraph 17.

Unverified Assumptions

10. The assessment for the EA1 EA1 Report was purportedly to have been carried out on a worst case basis as that is when the substation would be at its noisiest. However there is no evidence that that is the case. All that is relied upon are “*Conversations between site operatives and the substation Senior Authorised Person indicated that the substation was running at full capacity during the measurements*” and the conclusion drawn was “*and therefore may be assumed to be representative of worst case (noisiest) conditions*”. See paragraph 37.
11. So essentially a worst-case assumption was made based on a conversation. This undermines the reliability of the EA1 Report.

Flawed Testing Methodology

12. Aside from the assumption that the substation was operating at full capacity the noise testing only took place over a very limited period. At each of the chosen three receptors there was approximately a one hour test duration on 5 August 2020. At two receptors (NMP 2 & NMP3) noise was monitored from approximately half past midnight to approximately 01:30 whereas at the third (NMP1) it was measured from 02:22 to 03:22.
13. The testing was carried out on 4 and 5 August before the EA1 substation was commissioned. Paragraph 11 states that “*At the time of writing this report the FON was scheduled for issue to National Grid by 30 September 2020*”. Requirement 24 in the EA1 DCO, which is reproduced at paragraph 10 of the EA1 Report, defines completion of commissioning as meaning “*the date when the circuits have been fully tested and verified that they are able to transmit their rated power capacity to the grid connection point and National Grid has issued an FON (final operation notification) to the generator.*” It is unclear whether it is the generator or National Grid which issues the FON.
14. Also the words “*within three months of completion of commissioning*” as set out in Requirement 24(2) of the EA1 DCO have been curiously interpreted in this context as meaning both three months before completion of commissioning as well as the natural meaning of three

months after commissioning. Why would you test the noise emissions from the EA1 substation before it had completed commissioning?

15. Please note action point 6 from the ISH6 Action Points issued by the Examining Authorities is drafted as follows:

“Justification of anticipated noise levels during operation at the sub-station sites
Submit evidence of noise level measurements from the operation of EA1 substation following its commissioning” [emphasis added]

16. The EA1 Report was not prepared following the commissioning of EA1.
17. Additional noise testing is reported as having taken place at a bridleway location referred to as NMP4/VER1, at which location noise levels of 35dBA L90 were recorded (Table 3.2). However, no one third octave data has been provided for this location, unlike NMP1, 2 and 3, which prevents any objective conclusion being reached as to tonality at this location, which was about 150m from the super-grid transformers in the substation, and therefore more representative of the 250m separation distance proposed for the Friston site.
18. According to para 55 of the EA1 Report *“there was no discernible or audible noise”* at NMP4/VER1 which appears inconsistent with the 35dBA noise measurement taken there. Based on this information, and the extremely low sound levels at NMP1, 2 and 3, it is not possible to reach meaningful conclusions about the lack of tonality of EA1.

EA1 and EA1N & EA2 Substations not Comparable

19. The EA1 substation is not directly comparable with those proposed for EA1N or EA2.
- EA1N and EA2 have a planned maximum capacity of 800 MW and 900 MW respectively. The EA1 substation capacity is approximately 700 MW.
 - The design of the EA1N and EA2 substations will be different; EA1 is a 220kV substation whereas the EA1N and EA2 substations will be 275kV.
 - Harmonic filters which can be a significant emitter of noise are not present in the EA1 substation as built, unlike the proposals for Friston which show six harmonic filters in each substation..
 - There is also the obvious point that two substations are proposed to be built at Friston not one.

Receptors Not Comparable

20. The plan attached to the EA1 Report (reproduced at Appendix 2 below) shows the location of the three receptors. This plan is unhelpful as it does not show the position or layout of the EA1 substation at Bramford. What is more informative is Figure 26.2 from the EA1 Environmental Statement which is reproduced at Appendix 2 below accompanied by the relevant link.
21. These plans show that the monitoring points for EA1 are 600m to 1200m from the EA1 substation whereas those proposed for Friston are approximately 250m from the substations, with the village of Friston in close proximity.

APPENDIX 1

Report prepared by Rupert Taylor dated 22 February 2021

East Anglia One North and East Anglia Two
SASES (Substation Action Save East Suffolk)

**Supplementary submission on applicant's Document "East Anglia ONE
Operation Phase Noise Monitoring Report" 3rd February 2021**

22 February 2021

1. INTRODUCTION

The applicants have produced the document "East Anglia ONE Operation Phase Noise Monitoring Report" 3rd February 2021.

This supplementary report by Rupert Thornely-Taylor addresses a specific issue that arises with respect to the content of that Document, namely audibility and tonal character.

2. APPLICATION OF BS4142 TO TONAL CHARACTER

Paragraph 17 of the document states

The sound emissions (i.e. sound level emitted at source) from transformers and reactors at substations typically contain a significant proportion of their acoustic energy (if not most) at 100 Hz. The commentary to clause 9.2 of BS 4142:2014+A1:2019 suggests the following subjective method for the determination of the rating penalty for tonal specific sounds:

"18. Tonality

19. 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."

The document then proceeds to consider the perceptibility of transformer noise using a method which departs from the method set out in BS4142, and leads to a conclusion based on very specific assumptions. Using more appropriate assumptions a very different conclusion would be reached.

The document contains an attempt to calculate the indoor sound level of tones at 100Hz and 200Hz (notwithstanding the fact that BS4142 requires the noise to

measured and assessed outdoors) and to assess the result against the threshold of audibility from ISO 226. They conclude that "it is considered that a 100 Hz tone in the specific sound from the substation that is no greater than 42 dB $L_{eq,100Hz,outside}$ is unlikely to be perceptible within any nearby dwelling and that a 200 Hz tone in the specific sound from the substation that is around 32 dB $L_{eq,200Hz,outside}$ is also unlikely to be perceptible within any nearby dwelling."

At this point it is necessary to clarify that for detailed calculations such as this the "A-weighting", an adjustment made to measured physical sound levels to approximate the human ear's unequal response to sounds of across the spectrum, has to be taken out of account. The value of the A-weighting curve at 100Hz is -19.1 dB, so a single-frequency sound with an unweighted level of 42 dB measures 22.9 dBA.

It is also necessary, when departing from the standard approach required by BS4142 and carrying out, as the applicants have, an assessment of indoor noise, to make an adjustment for the difference between sound levels out of doors and inside a room in a dwelling.

The applicants have made their outside-inside adjustment based on a Defra Report NANR116. This presents the results of a laboratory tests where the sound source was pink noise (white noise with the same energy content in each frequency band - true white noise increases by 3dB per octave) - appropriate for the transportation noise sources considered. This means that the modal behaviour of the receiving room at a single frequency is hidden by the behaviour of the other frequencies in the band. Room acoustics at low single frequencies is modal, not statistical (i.e. there is not a diffuse field assumed by statistical acoustics). This is recognised in the Northern Powergrid document "NSP/007/020 - Guidance on Substation Design: Transformer Noise".

From the NANR116 report the EA1 report takes the outside-inside correction as a minimum of 19 dB and says that "On this basis, the spectral level of a 100 Hz tone in the specific sound from the substation that is no greater than 42 dB $L_{eq,100Hz,outside}$ may be approximately 19 to 25 dB $L_{eq,100Hz,inside}$ ". The report then compares this with the threshold of hearing from ISO 226 which it takes as 26 dB at 100Hz (for 50% of the population¹). Thus, on this basis, 42 dB (without A-

¹ The report misquotes the definition of audibility from ISO226 which should be "3.7 threshold of hearing level of a sound at which, under specified conditions, a person gives 50 % of correct detection responses on repeated trials"

weighting) outside gives $42-19=23$ dB inside, 3dB below the 50% audibility threshold.

If the DCO Requirements 26 and 27 limit is an A-weighted level of (as now proposed) 31 dBA, and if it should be tonal such that all the spectral content was at 100Hz, this is a physical sound level, after removing the A-weighting, of 50.1 dB. After taking the outside to inside reduction of 19 dB this gives an internal sound level of 31.1 dB for comparison against the audibility threshold of 26 dB. It will therefore be highly perceptible (over 5dB above the 50% audibility threshold).

In that case, the 6dB tonal penalty would apply, and the requirement 26 and 27 limits would be breached.

The outside to inside reduction of 19dB is for a ventilation opening of 0.05m^2 . On a summer night much more than this would be required, reducing the 19dB and increasing the audibility further. For a wide open window the normal assumption is an outside-inside reduction of 10dB. For a room with one of more modes at 100Hz the true figure could be less than 10 dB. It is the impossibility of knowing the specific construction details and dimensions of dwellings being assessed that is the reason why BS4142 provides only for the assessment of noise outdoors.

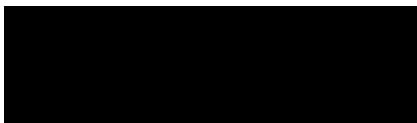
In an outdoor assessment, as the proper application of BS4142 requires, the audibility would be substantial.

It should also be borne in mind when making assessments of noise levels to be measured in the future, that the international standard for sound level meters, BS EN 61672-1:2013 requires an accuracy no better than ± 1 dB at 100Hz for the sound level meter, plus a further ± 0.5 dB for the effect of a windshield, so an actual true level as perceived by the ear, may be as much as 1.5dB higher than indicated in a measurement.

3. CONCLUSIONS

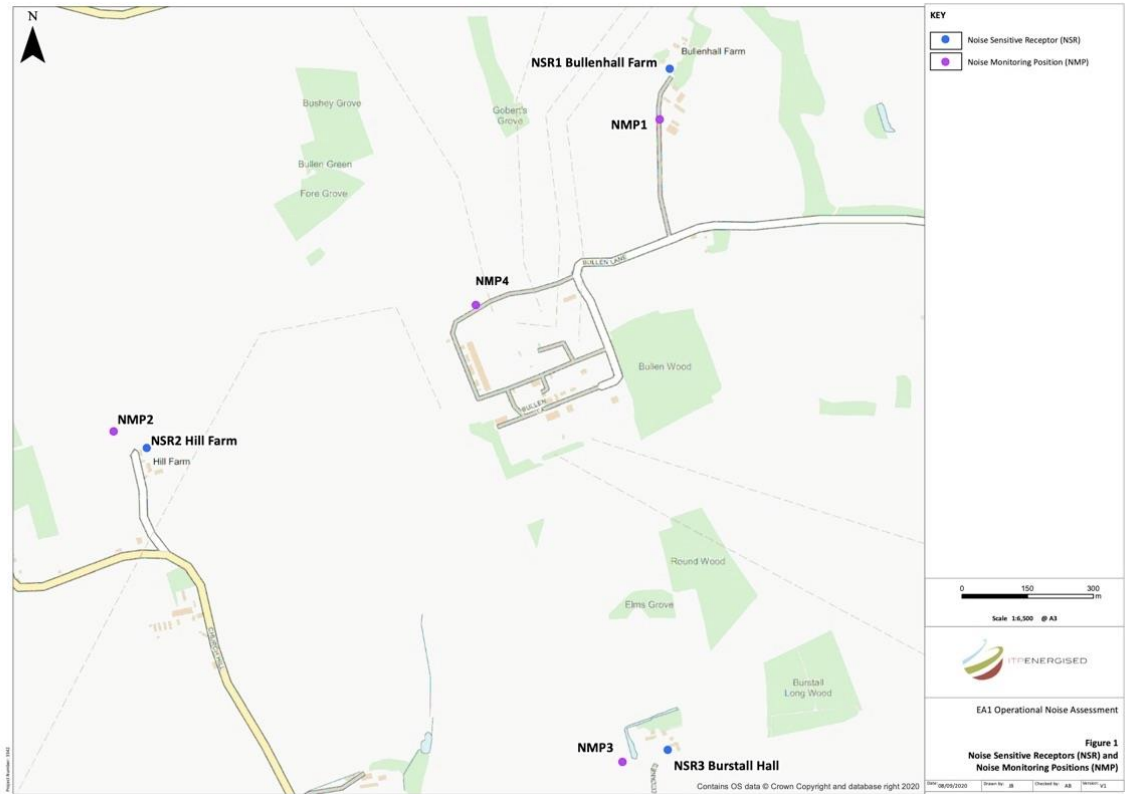
The report submitted by the applicants "East Anglia ONE Operation Phase Noise Monitoring Report" 3rd February 2021, seeks to demonstrate that if the transformer and allied noise is tonal it will not be perceptible at receptors and therefore no penalty for tonality should be applied. The method used does not accord with the provisions of BS4142, and reaches a conclusion based on inappropriate assumptions. If appropriate assumptions are made, the method used by the applicants leads to the reverse conclusion, namely that a tonal noise with a specific sound level just on the limits of Requirements 26 and 27 would be highly perceptible and therefore attract a +6 dB penalty, causing the requirements to be breached.

Signed



Rupert Thornely-Taylor
3 February 2021

APPENDIX 2



APPENDIX 3

[https://webarchive.nationalarchives.gov.uk/20191203074249/https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/EN010025/EN010025-000553-7.4.7a\(3\)%20Volume%203%20Chapter%2026%20Noise%20and%20Vibration%20Figures%20\(Fig%2026.2%20-%2026.3\).pdf](https://webarchive.nationalarchives.gov.uk/20191203074249/https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/EN010025/EN010025-000553-7.4.7a(3)%20Volume%203%20Chapter%2026%20Noise%20and%20Vibration%20Figures%20(Fig%2026.2%20-%2026.3).pdf)

