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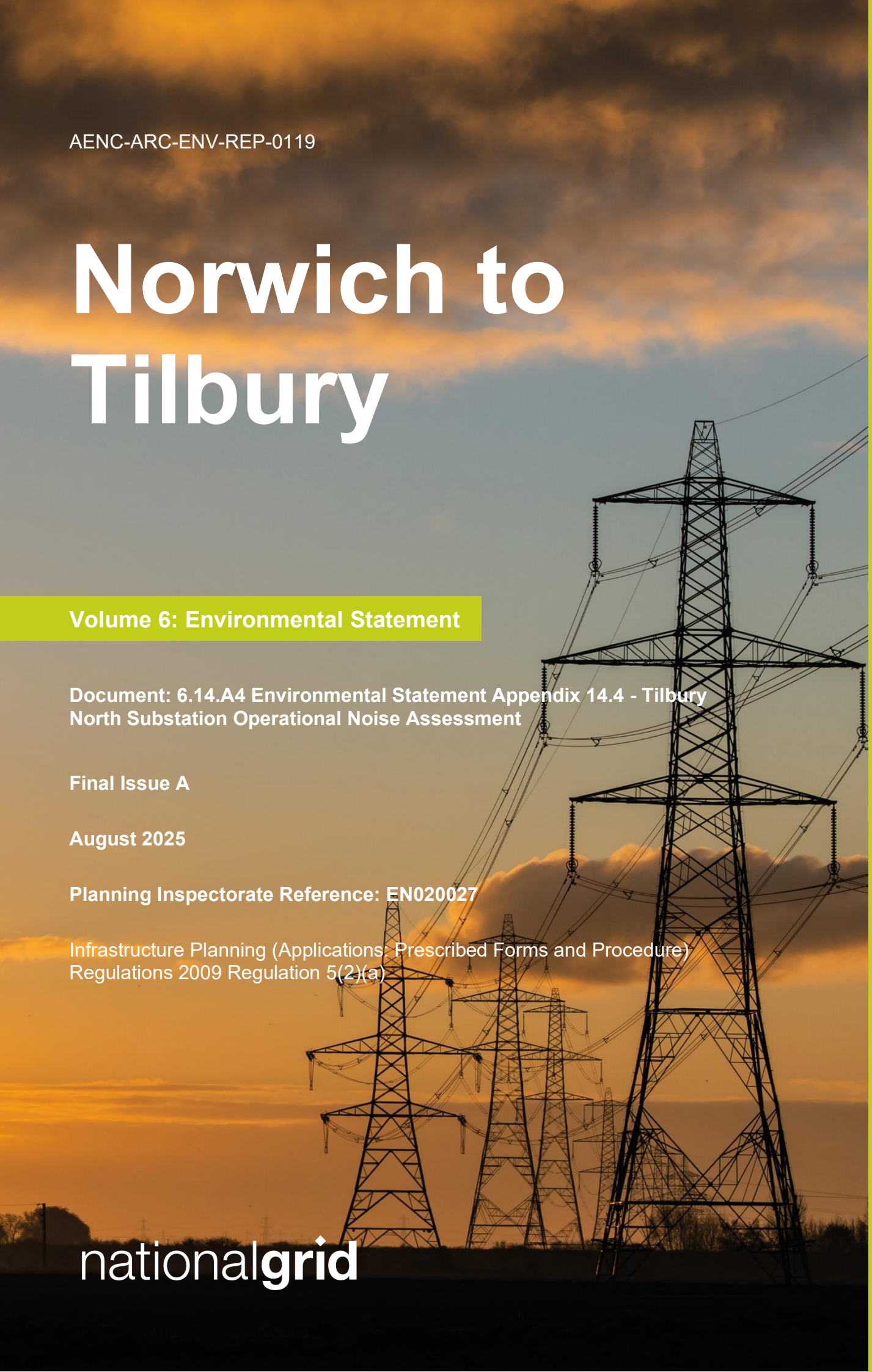

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Contents

14. Tilbury North Substation Operational Noise Assessment

14.1 Introduction

14.1.1 This appendix has been produced to support Chapter 14: Noise and Vibration (document reference 6.14) of the Environmental Statement (ES) (Volume 6 of the Development Consent Order (DCO) application) for Norwich to Tilbury (the 'Project'). It sets out the assessment of operational noise from the proposed Tilbury North Substation. This appendix includes:

- Assessment Methodology – Description of the assessment methodology used in the assessment of operational noise from the proposed Tilbury North Substation
- Baseline Data – Description of the acoustic environment and associated data sources
- Operational Noise Assessment – Description of the potential effects from operational noise from the proposed Tilbury North Substation, without mitigation
- Operational Noise Mitigation – Description of potential mitigation options to reduce noise level from the proposed Tilbury North Substation.

14.2 Assessment Methodology

Assessment Methodology Introduction

14.2.1 The assessment of operational noise has been conducted in accordance with British Standard (BS) 4142:2014+A1:2019. Methods for rating and assessing industrial and commercial sound (BS 4142).

BS 4142 Methodology

14.2.2 BS 4142 is used to assess the potential significance of effects by comparing the 'rating sound level' of an industrial source to the typically representative 'background sound level' at the location of nearby Noise Sensitive Receptors (NSR). Certain acoustic features can increase the potential for a sound to attract attention, and therefore increase its relative significance than that expected from a simple comparison between the specific sound level and the background sound level. BS 4142 identifies noise that contains audible tonality, impulsivity and/or intermittency and recommends that a correction be added to the specific sound level. The specific sound level along with any applicable correction is referred to as the 'rating level'. It should be noted that the penalties can be additive (i.e., if they have a combination of tonal, impulsive, and intermittent acoustic characters).

14.2.3 Where tonality is audible at a receptor a penalty of between 0 and 6 decibels (dB) may be applied. Subjectively, a 2 dB penalty may be applied where a tone is just perceptible, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

14.2.4 The greater the difference between the rating level and the background sound level; the greater the likelihood of complaints. The assessment criteria given by BS 4142 are as follows:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse effect, depending on the context
- A difference of around +5 dB could be an indication of an adverse effect, depending on the context.

14.2.5 The lower the rating level is relative to the measured background sound level, the less likely it is that there would be an adverse effect. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low effect (in BS 4142 terminology), depending on the context.

14.2.6 The assessment should also consider the context of the sound. Where the initial estimate of the effect needs to be modified due to the context, all pertinent factors should be considered, including:

- The absolute level of the sound
- The character and level of the residual sound compared to the character and level of the specific sound
- The sensitivity of the receptor, including whether dwellings already incorporate design measures that secure good internal and/or outdoor conditions, such as: façade insulation treatment, ventilation and/or cooling that would reduce the need to have windows open to provide rapid or purge ventilation and acoustic screening.

14.2.7 With regards to the absolute level of the sound, BS 4142 states that 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, particularly at night. Guidance in this matter is provided by the Association of Noise Consultants (ANC) BS 4142:2014+A1:2019 Technical Note (ANC, 2020) and BS 8233:2014 Guidance on sound insulation and noise reduction for buildings (BS 8233).

14.2.8 The noise rating level will be compared to the background sound level to determine the magnitude of effect. The magnitude of effect of operational noise is determined against the criteria detailed in Table A14.4.1.

Table A14.4.1 – Magnitude of Effect of operational noise

Magnitude	Comparison of Sound Rating Level and Background Sound Level
Large	Rating level ≥ 10 dB above the background sound level (Significant Observed Adverse Effect Levels (SOAEL))
Medium	Rating level between 5 and 9 dB above background sound level (Lowest Observed Adverse Effect Level (LOAEL))
Small	Rating level between 0 and 4 dB above background sound level
Negligible	Rating level below background sound level

14.2.9 Although the above criteria will be used to assess the magnitude of effect, it is standard practice to aim for a sound rating level not to exceed the background sound level, such

that the effect is ‘low’ (as defined in BS 4142), or negligible in terms of the effect magnitude definition defined in Table A14.4.1.

14.2.10 Consideration will also be taken of context, as defined in BS 4142, for the final determination of significance; in particular, absolute noise levels.

14.2.11 Taking account of the guidance provided by BS 4142, the ANC Technical Note, BS 8233, and Planning Practice Guidance for Noise (PPGN), where background sound levels are ‘low’ (less than about 30 dB L_{A90}), the SOAEL is defined as follows:

- SOAEL: rating level ≥35 dB $L_{Ar,Tr}$ or ≥10 dB above the background sound level, whichever is higher.

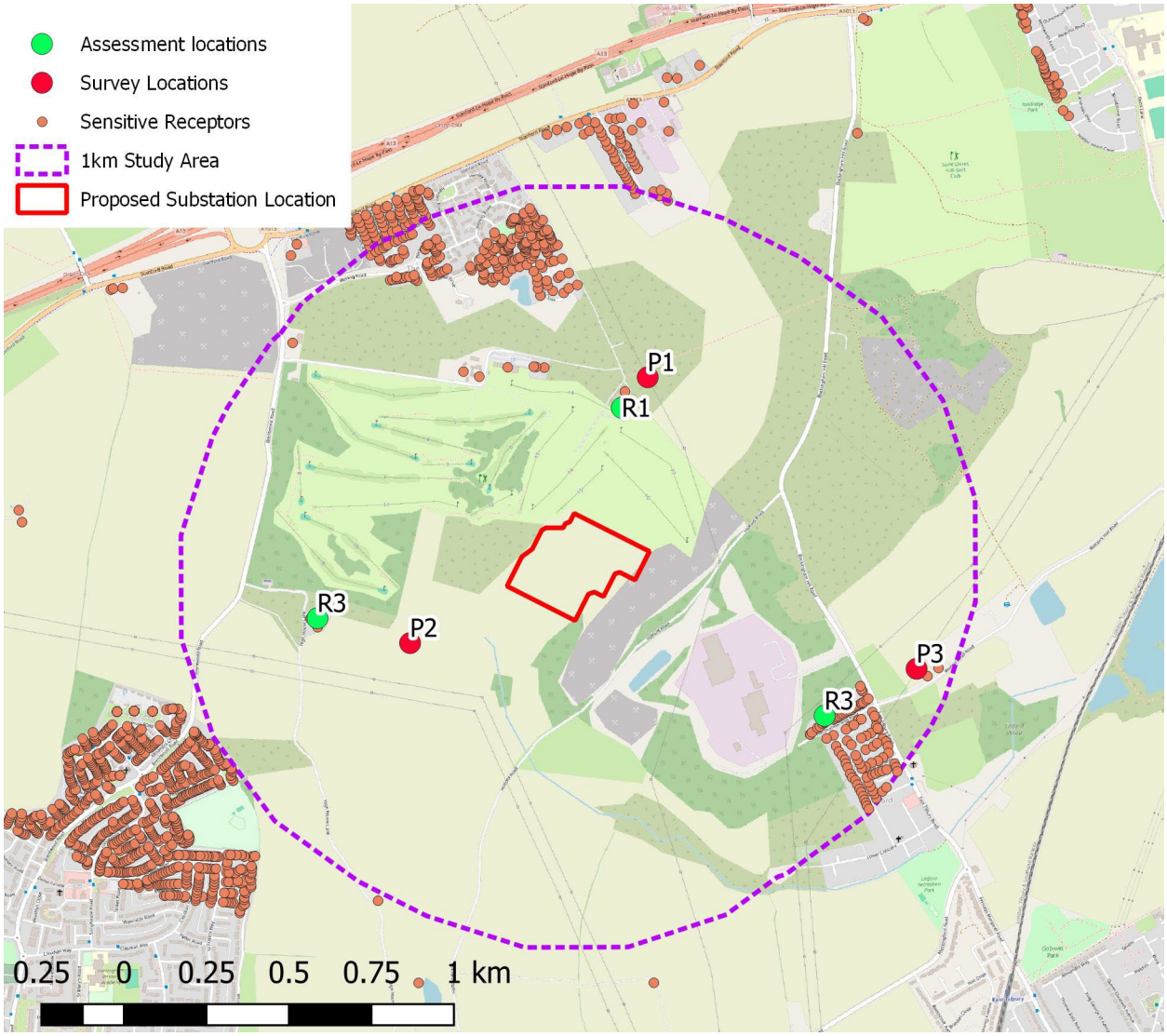
14.3 Baseline Data

Baseline Data Introduction

14.3.1 This section details the baseline information used within the preliminary operation noise assessment.

14.3.2 The proposed Tilbury North Substation location, Study Area, NSR locations, assessment locations, and noise survey locations, are shown in Image A14.4.1 and Figure 14.1: Baseline Noise Data (document reference 6.14.F1).

Image A14.4.1 Operational Noise Baseline Information



14.3.3 The proposed Tilbury North Substation is in a semi-rural area, comprising flat arable farmland. The site is bounded to the north-east and north-west by the Orsett Golf Course, to the south-east by Rainbow Shaw Quarry and to the south-west by arable farmland. There are a small number of small settlements and isolated dwellings approximately 350 m to the north and 580 m to the west of the site, with built up residential areas of Orsett approximately 650 m to the north, Linford approximately 700 m to the south-east, and Chadwell St Mary approximately 1 km to the west.

14.4 Study Area

14.4.1 The Study Area for operational noise effects from the proposed Tilbury North Substation, based on guidance from ISO 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors (International Organisation for Standardisation (ISO) 9613-2), would include NSR within 1 km of the Tilbury North Substation, with a particular focus on the nearest NSR.

14.5 Noise Sensitive Receptors

14.5.1 The nearest NSR are residential dwellings located approximately:

- 350 m to the north of the proposed substation location off Brentwood Road, Orsett (R1);
- 580 m to the west off High House Lane, Chadwell St Mary (R2); and
- 700 m to the southeast off Buckingham Hill Road (R2)

14.6 Measured Noise Levels

14.6.1 The operational noise assessment has been informed by noise survey data obtained from locations representative of nearby NSR.

14.6.2 Background noise level surveys were conducted at three locations representative of the nearby NSR, as detailed in Image A14.4.1. The surveys were conducted for a period of eight days in February 2025.

14.6.3 Table A14.4.2 presents a summary of measured sound levels during daytime (07:00 to 23:00) and night-time (23:00 to 07:00) periods at the survey locations for use in the operational noise assessment.

Table A14.4.2 Summary of Representative Background Sound Levels

Monitoring Location	Description	Easting	Northing	Representative Average Noise Level, dB $L_{Aeq,T}$		Representative Background Noise Level, dB L_{A90}	
				Daytime	Night-time	Daytime	Night-time
P1	Brentwood Road, Orsett	566528	180790	50	47	46	40
P2	High House Lane, Chadwell St Mary	565808	179983	46	42	36	33
P3	Walton's Hall Road, Linford	567342	179908	50	44	41	34

14.7 Operational Noise Assessment

Indicative Plant Data

14.7.1 Table A14.4.3 presents indicative operational source sound power levels from proposed Tilbury North Substation plant.

Table A14.4.3 Indicative Substation Plant Sound Data

Plant Item	Number of Items	Sound Power Level per Unit dBA
Super Grid Transformer	2	95
Super Grid Transformer Cooling	2	93

14.7.2 During normal operation cooling plant would not operate. Cooling plant is only likely to operate during periods of increased load. This would typically only occur during an outage of transformer (e.g., during maintenance or fault) leading to increase in load on its paired transformer. However, for the purposes of this initial assessment it is assumed that cooling plant is operational.

Operational Sound Propagation Modelling (Without Mitigation)

14.7.3 Specific sound levels at nearby NSR due to the proposed Tilbury North Substation plant have been predicted via computer noise modelling using SoundPlan software (version 9.0). The model calculates noise levels in accordance with the methodology described in ISO 9613-2. The resultant noise levels at nearby NSR are presented in Table A14.4.4. The specific sound levels are compared against the background sound levels to determine the worst-case affected NSR.

Table A14.4.4 Resultant Specific Noise Levels at NSR (Without Mitigation)

NSR location	Corresponding Background Measurement Location	Resultant specific sound level, dB L_{Aeq}	Excess over background, dB	
			Daytime	Night-time
R1 - Brentwood Road, Orsett	P1	41	-5	+1
R2 - High House Lane, Chadwell St Mary	P2	37	+1	+4
R3 - Buckingham Hill Road	P3	35	-6	+1

14.7.4 The results indicate that the worst-case affected NSR, without mitigation is R2 High House Lane, Chadwell St Mary, which is not the closest NSR to the proposed Tilbury North Substation, but does have a lower existing typical background noise level than the closest NSR, R1. The specific sound level at this NSR is predicted to exceed the night-time background sound level by +4 dB, without mitigation. Without the cooling plant operating (i.e. during normal operation), noise levels are expected to be approximately 2dB lower.

BS 4142 Assessment (Without Mitigation)

14.7.5 The results of an initial BS 4142 assessment at the worst affected receptor, R2 High House Lane, Chadwell St Mary, without mitigation are presented in Table A14.4.5.

Table A14.4.5 Indicative BS 4142 Assessment (Without Mitigation)

Parameter	Value		BS 4142 Clause	Commentary
	Daytime	Night-time		
Background sound level, dB L_{A90}	36	33	8.1	Representative background sound level at receptor based on measured noise data (Location P2).
Specific sound level, dB $L_{Aeq,T}$	37	37	7.3	Calculated via noise model based on indicative plant data.
Acoustic feature correction, dB	6	6	9.2	Assumed potential tonal audibility at receptor as worst-case. In practice likely to be less.
Sound rating level, dB $L_{Ar,T}$	43	43	9	Sum of specific sound level and acoustic corrections.
Difference in rating noise level relative to background sound level, dB	+7	+10	11	
Assessment Outcome	Medium magnitude, depending on context.	Large magnitude, depending on context.	11	Context The context is a relatively low specific noise level in a semi-rural area, below existing average levels of ambient noise during night-time periods (42 dB $L_{Aeq,16h}$). Likely be a medium magnitude impact considering context Outcome – Likely **Significant Effect**
Uncertainty			10	Uncertainty has been minimised using noise survey data over a suitable representative period. Main uncertainty from the use of indicative plant noise data, although this is based on plant at similar sites.

Parameter	Value		BS 4142 Clause	Commentary
	Daytime	Night-time		
				Likely worst-case acoustic character correction applied for tonality. In practice likely to be lower. Uncertainty unlikely to affect the outcome of the assessment. However, this assessment is indicative based on available plant noise data and further studies would be conducted as the design progresses.

Notes:

BS 4142 Clause refers to the corresponding clause in BS 4142 relating to that aspect of the assessment.

14.7.6 The assessment indicates that without mitigation there is potential for significant adverse effect from noise at nearby NSR due to the operation of the proposed Tilbury North Substation.

14.8 Operational Noise Mitigation

Introduction

14.8.1 The assessment of operational noise is based on currently available design information specification data. Further noise assessment would be undertaken based on detailed design information to inform the specific noise mitigation measures. Further detailed assessment is secured in the Outline CoCP (document reference 7.2) measure NV21.

14.8.2 The outcome of the initial assessment indicates that there is the potential for significant adverse effects without mitigation. Indicative plant data, based on plant used on similar projects, has been used in the assessment. The ongoing design must therefore follow the mitigation hierarchy to reduce noise levels. This section details the noise mitigation options that may be considered as part of the ongoing design.

14.8.3 To avoid significant adverse effects, a reduction in noise levels of at least 8 dB would be required to achieve a sound rating level of less than 35 dB $L_{Ar,T}$ at the worst-case NSR. However, in accordance with planning policy, noise levels should be mitigated and reduced to a minimum below this level as far as reasonably practicable using best available techniques. Where feasible, a sound level below background would be considered as an aim, which would require a reduction in noise levels of at least 10 dB.

Source Contribution

14.8.4 Table A14.4.6 details the contribution of noise from each type of plant item type at the worst affected NSR. The specific sound levels are compared against the background sound levels to determine the worst-case affected NSR.

Table A14.4.6 Plant Sound Level Contribution

Plant Item	Contribution to Resultant Noise Level at NSR, dB L_{Aeq}	Description
Transformers	35	Main Source
Transformer Cooling	33	Main Source

14.8.5 The results indicate all sources are generally similar in their contribution to the specific sound level.

Mitigation Hierarchy

14.8.6 The mitigation of operational noise effects from the proposed Tilbury North Substation would follow the mitigation hierarchy, as follows:

- Mitigation of source
- Reducing propagation of noise
- Administrative controls.

Mitigation of Source

14.8.7 Reducing noise at source is the first consideration in the noise mitigation hierarchy. Consideration should be given to the following for reducing the noise at source:

- Eliminating equipment – (e.g., determining if the equipment is required or whether other processes can perform the same operation)
- Equipment selection – selecting quieter equipment where feasible
- Fitting of manufacturer noise attenuation to equipment.

14.8.8 Additionally, consideration should be given to the siting of the equipment and where it can:

- Be located further away from NSR, and/or
- Take advantage of natural screening provided by non-sensitive buildings and/or topography.

Reducing propagation of noise

14.8.9 Where adequate control of noise cannot be achieved by mitigation of the source alone, consideration should be given to reducing the propagation of noise between the source and NSR. This can typically be achieved with:

- Screening
- Enclosures.

14.8.10 Screening with noise barriers can typically achieve a reduction in noise levels of up 10 dB.

14.8.11 Enclosures (four sided and roof) can be specified to a high level of attenuation and would, acoustically, be a viable option to attenuate noise at this site. Standard

transformer enclosures used by National Grid can reduce noise levels by 20 dB, although higher levels of attenuation are possible through bespoke design. However, consideration should be given to:

- The ventilation requirements of the plant, and the noise that the ventilation plant may generate
- Potential Noise at Work (NaW) implications within the enclosure (e.g., hearing protection zones), which are outside the scope of this assessment.

Administrative Controls

14.8.12 Due to the nature of proposed operation of the proposed Tilbury North Substation, administrative controls, such as limiting hours of operation are unlikely to be viable. As such, the focus would be on the mitigation of source and reducing the propagation of noise, as detailed above.

Indicative Mitigation Options

14.8.13 This section describes indicative mitigation options that may be taken forward as the design progresses to reduce level of noise from the proposed Tilbury North Substation. Table A14.4.7 provides indicative mitigation options for each plant item type, together with an estimate of the level of attenuation that may be achievable.

Table A14.4.7 Indicative Mitigation Options

Plant Item	Potential Mitigation Option	Indicative level of reduction achievable, dB
Transformers	Plant selection	10
	Screening	5
	Acoustic enclosure	20
Cooling systems	Plant selection and manufacturers attenuation	14

Residual Assessment

Operational Sound Propagation Modelling (With Mitigation)

14.8.14 The resultant noise levels at NSR with indicative attenuation, as described in Table A14.4 7, are presented in Table A14.4.8. The specific sound levels are compared against the background sound levels to determine the worst-case affected NSR.

14.8.15 For the purposes of the assessment, it is assumed that noise levels from transformers are attenuated by 20 dB and cooling systems are attenuated by 14 dB, compared to the indicative data.

Table A14.4.8 Resultant Specific Noise Levels at NSR (With Mitigation)

NSR location	Corresponding Background Measurement Location	Resultant specific sound level, dB L_{Aeq}	Excess over background, dB	
			Daytime	Night-time
R1 - Brentwood Road, Orsett	P1	25	-21	-15
R2 - High House Lane, Chadwell St Mary	P2	20	-16	-13
R3 Walton's Hall Road, Linford	P3	19	-22	-15

14.8.16 The results indicate that the worst-case affected NSR, with mitigation, is R2 High House Lane, Chadwell St Mary. The specific sound level at this NSR is predicted to be 13 dB below the night-time background, with mitigation. Without the cooling plant operating (i.e. during normal operation), noise levels are expected to be approximately 5dB lower.

BS 4142 Assessment (With Mitigation)

14.8.17 The results of the initial BS 4142 assessment at the worst affected receptor, R2, with mitigation are presented in Table A14.4.9.

Table A14.4.9 Indicative BS 4142 Assessment (With Mitigation)

Parameter	Value		BS 4142 Clause	Commentary
	Daytime	Night-time		
Background sound level, dB L_{A90}	36	33	8.1	Representative background sound level at receptor based on measured noise data (Location P2).
Specific sound level, dB $L_{Aeq,T}$	20	20	7.3	Calculated via noise model based on indicative plant data.
Acoustic feature correction, dB	6	6	9.2	Assumed potential tonal audibility at receptor as worst-case. In practice likely to be less.
Sound rating level, dB $L_{Ar,T}$	26	26	9	Sum of specific sound level and acoustic corrections.
Difference in rating	-10	-7	11	

Parameter	Value		BS 4142 Clause	Commentary
	Daytime	Night-time		
noise level relative to background sound level, dB				
Assessment Outcome	Negligible magnitude, depending on context.	Negligible magnitude, depending on context.	11	Context The context is a low specific noise level in a semi-rural area, below existing average levels of ambient noise during night-time periods (42 dB $L_{Aeq,16h}$). Additionally, the specific noise level is below the LOAEL during daytime and night-time periods. Outcome – Likely **Not Significant**
Uncertainty			10	Uncertainty has been minimised using noise survey data over a suitable representative period. Main uncertainty from the use of indicative plant noise data, although this is based on plant at similar sites. Likely worst-case acoustic character correction applied for tonality. In practice likely to be lower. Uncertainty unlikely to affect the outcome of the assessment. However, this assessment is indicative based on available plant noise data and further studies would be conducted as the design progresses.
Notes: BS 4142 Clause refers to the corresponding clause in BS 4142 relating to that aspect of the assessment.				

14.8.18 The assessment shows that with indicative mitigation, significant adverse effects from noise at nearby NSR due to the operation of the proposed Tilbury North Substation, including cooling, can be avoided.

14.8.19 Operational noise from the proposed Tilbury North Substation with the inclusion of appropriate mitigation would therefore likely be **not significant** during operation, including cooling. Without cooling (i.e. during normal operation), noise levels would be even lower.

14.9 Conclusions

14.9.1 This appendix presents results of the operational noise assessment of the proposed Tilbury North Substation at nearby NSR.

14.9.2 The assessment has been conducted in accordance with current guidance and good practice. The assessment draws on noise survey data, and indicative operational plant noise data.

14.9.3 The assessment indicates that without mitigation and based on the indicative plant data, there are potential significant adverse effects at nearby NSR due to operational noise from the proposed Tilbury North Substation.

14.9.4 Outline mitigation proposals have been highlighted, including plant selection, manufacturer attenuation, screening, and transformer noise enclosures. Based on the inclusion of these indicative mitigation measures, the impact of operational noise from the proposed Tilbury North Substation at nearby NSR would be **negligible** during daytime periods and night-time periods. The effect of operational noise would therefore be **not significant**.

14.9.5 The assessment is based on indicative plant noise data, and it is anticipated that further assessment would be conducted as the design progresses and included within the ES. The design would seek to reduce noise levels due to the operation of the proposed Tilbury North Substation as far as reasonably practicable. Further detailed assessment is secured in the Outline CoCP (document reference 7.2) measure NV21.

Abbreviations

Abbreviation	Full Reference
ANC	Association of Noise Consultants
BS	British Standard
dB	Decibels
DCO	Development Consent Order
EIA	Environmental Impact Assessment
ES	Environmental Statement
ISO	International Organisation for Standardisation
LOAEL	Lowest Observed Adverse Effect Level
NaW	Noise at Work
NSR	Noise Sensitive Receptors
PPGN	Planning Practice Guidance for Noise
SOAEL	Significant Observed Adverse Effect Levels

Glossary

Term	Definition
A-Weighted	The A Weighting corrects the variation in the ear's ability to hear different frequencies and provides a good representation of how sound is perceived by the human ear.
Decibel (dB)	Unit for measuring sound levels.
Embedded design measures	Measures for the protection of the environment that are embedded (intrinsic) with the design.
Equivalent Continuous Sound Level (Leq)	Equivalent continuous sound level is a notional steady sound level that causes the same A-weighted sound energy to be received as that due to the actual and possibly fluctuating sound over a period of time T. It can also be used to relate periods of exposure and noise level. For example, halving or doubling the period of exposure is equivalent in sound energy to a decrease or increase of 3dB(A) in the sound level for the original period.
Frequency Weighting Networks	Frequency weighting networks, which are generally built into sound level meters, attenuate the signal at some frequencies and amplify it at others. The A-weighting network approximately corresponds to human frequency response to sound. Sound levels measured with the A-weighting network are expressed in dB(A). Other weighting networks also exist, such as C-weighting which is nearly linear (i.e. unweighted) and other more specialised weighting networks. Variables such as Lp and Leq that can be measured using such weightings are expressed as LpA / LpC, LAeq / LCeq etc.
Impact Magnitude	This is the scale of change which a given impact may cause. This is compared to the baseline state and consideration is given to how the change relates to accepted thresholds and standards.
Impact Significance	The level of significance is defined by the magnitude of impact in relation to the sensitivity/value of the environmental receptor.
$L_{A90,T}$	$L_{A90,T}$ index represents the noise level exceeded for 90 percent of the measurement period, T, and is used to indicate quieter times during the measurement period. It is usually referred to as the background noise level.
$L_{Aeq,T}$	The A-weighted L_{eq} sound level measured over a specified period of time, T.
Lowest Observed Adverse Effect Level	This is the level of noise above which adverse effects on health and quality of life can be detected.
L_W (Sound power levels)	These are used to describe the noise output of a noise source.

Term	Definition
Magnitude of change	A term that combines judgements about the size and scale off the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short or long term in duration.
Mitigation	The action of reducing the severity and magnitude of change (impact) to the environment. Measures to avoid, reduce, remedy or compensate for significant adverse effects.
No Observed Effect Level	This is the noise level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
Noise	Unwanted sound.
Noise and vibration sensitive receptor (NSR)	A location that is sensitive to noise and/or vibration. The sensitivity of a receptor to noise and vibration varies depending on the receptor type.
Percentile or Statistical Levels	Calculation of the noise level which is exceeded for a certain percent of a total period. Background noise is often defined as the A-weighted sound pressure level exceeded for 90% of the specified period T, expressed $L_{90,T}$. Road traffic noise is often characterised in terms of $L_{A10,18h}$.
Rating Level	The A-weighted, L_{eq}, sound pressure level of the sound in question at the assessment location over time period T, adjusted for any tonal character and impulsiveness.
Receptor	The physical resource or user group that would respond to an effect e.g. somebody or something adversely affected by a pollutant.
Residual Effects	The consequence of an ‘impact’ of construction, operation and decommissioning of the Proposed Development after mitigation measures have been applied.
Significance	A measure of the importance or gravity of the environmental effect, defined by significance criteria specific to the environmental topic.
Significant observed adverse effect level (SOAEL)	This is the level of noise above which significant adverse effects on health and quality of life occur.
Sound	Sound is vibrations travelling through a medium (usually air) that the can be perceived by the hearing organs.
Substation	Substations are used to control the flow of power through the electricity system. They are also used to change (or transform) the voltage from a higher to lower voltage to allow it to be transmitted to local homes and businesses.

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