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Noise Assessment Review
For Environmental Permit
For Proposed
Energy from Waste (EfW) Facility

At

North Beck Energy Centre
Immingham

For

North Beck Energy Limited

Consultant: D.R. Kettlewell MSc MIOA MAE I.Eng
Report No.: R18.1108/DRK

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APPENDICES

1.0 INTRODUCTION:

1.1 Noise & Vibration Consultants Ltd ("NVC") have been instructed by North Beck Energy Limited (NBEL, the Applicant) to review the site layout, construction and plant locations and advise on predicted noise levels with the assumed noise mitigation measures for the proposed North Beck Energy Centre (NBEC, the Facility) at Immingham.

1.2 We have been asked to carry out a noise impact assessment using empirical data taken from measurements made at other EfW plant operating in the UK, based on information provided by Technology Providers, to determine the resultant noise contribution at identified sensitive receptors.

1.3 The main areas of plant and buildings relevant to the assessment include the following (as shown on Figure 2 attached):

Energy from Waste (EfW) Facility Plant:

Plant Enclosed Within Buildings

(i) Waste Reception
(ii) Waste Bunker
(iii) Turbine Hall
(iv) Boiler Hall
(v) Flue Gas Treatment System
(vi) Draught plant including induced draught fans
(vii) Electrical Rooms
(viii) Ash Storage Building
(ix) Control Room
(x) Offices and Staff Welfare

External Plant

(i) Main Stack
(ii) Air Cooled Condenser
(iii) Substation
(iv) Water Treatment
(v) Transformers
(vi) Grid Connection Compound
(vii) Weighbridge
(viii) Fire Water Pumps & Tanks
(ix) Oil and Ammonia Tanks
(xi) HGV's

1.5 The EfW applicable to this assessment would operate 24 hours a day and 7 days a week. Deliveries to the facility would occur during daytime periods typically over a 12-hour period.

1.6 Information used in this review has been obtained from the following sources:

- ordnance Survey maps of the local area;

- layout and elevation drawings of the Proposed Development (HPW Architecture 3077-10-03 P11, 3077-10-05 P5, 3077-10-06 P5, 3077-10-07 P4, 3077-20-02 P5 & 3077-20-03 P5);
- National Planning Policy Framework – July 2018
- Noise Policy Statement for England (NPSE) – March 2010;
- Planning Practice Guidance – 6th March 2014 Department for Communities and Local Government (Ref ID: 30-001-20140306)
- IPPC - Technical Guidance Note IPPC H3 Part 2 – Noise Assessment & Control;
- BS4142: 2014 'Methods for rating and assessing industrial and commercial sound'
- BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings'
- World Health Organisation: 'Guidelines for Community Noise' - April 1999;
- World Health Organisation 'Night Noise Guidelines for Europe' – 2009;
- Department of Transport 'Calculation of Road Traffic Noise': 1988;
- ISO 9613-2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors;
- North East Lincolnshire Council Planning Permission (DM/0026/18/FUL) dated 12th October 2018;
- Noise & Vibration Chapter 7 of the Environmental Statement;
- Environmental Statement Appendix 7;
- BS4142: 2014 'Methods for rating and assessing industrial and commercial sound'
- BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings'

2.0 RECEPTORS & BASELINE LEVELS

2.1 The Environmental Statement Noise Chapter and Appendices for review include the following details:

- Location of the nearest noise sensitive receptors (NSRs)
- Baseline daytime and night-time noise levels at NSRs
- Predicted noise levels from proposed plant at the site

Receptors

2.2 The Environmental Statement Noise & Vibration Chapter submitted in December 2017 details the nearest sensitive receptors with the following residential receptors identified in the area around the Site (see Figure 1 attached for ease of reference). The baseline monitoring positions are described in the ES as follows:

"Position A (Queens Road) - Northwest from site

This monitoring position is representative of the closest existing receptor northwest of the Site which is located adjacent to Queens Road. Noise levels at this location are dominated by local road traffic noise. The noise meter was positioned towards the rear boundary of the garden away from any buildings.

Position B (Rear of Kendal Road) – West from site

Position B was chosen as a suitable monitoring position to represent typical baseline levels in the vicinity of properties further west of Site at the main residential area of Immingham. Noise levels at this location are dominated by distant road traffic noise. The monitoring position was chosen in the field adjacent to the residential properties."

2.3 Nearest receptors along Queens Road are located at a distance of circa 450m to the proposed EfW facility and receptors off Kendal Road and Somerton Road at a distance of approximately 1.4km.

2.4 Nearest ecological receptors relative to the EfW include the following designated sites (non-statutory):

a) Immingham Dock Reedbeds (circa 640m)
b) Laporte Road Brownfield Site (circa 710m)
c) North Moss Lane Meadow (circa 1.56km)

In terms of the Humber Estuary this is circa 940m from the site boundary.

Baseline Noise Levels

2.5 The Noise & Vibration Chapter provides details of baseline sound monitoring undertaken at the nearest sensitive receptors during daytime and night-time periods. Table 7.12 and 7.13 of the chapter provides details of the baseline residual and representative background sound levels.

2.6 The baseline sound survey was undertaken over a weekend period during November 2017 at two fixed locations (in vicinity of NSRs) under suitable monitoring weather conditions and is therefore considered to provide representative baseline sound levels during the quietest likely period of the week.

2.7 It is understood that there have not been any additional developments in the local area. Therefore, these are considered to be representative of the current baseline sound levels, which are provided below in Table 2.1:

Table 2.1: Assumed baseline sound levels

Receptor	Time Period	Average Residual Sound Level LAeq,T (dB)	Average Background Sound Level LA90 (dB)	Representative Background Sound Level LA90 (dB)	LAmax dB
R1. Queens Road	Daytime	60	48	44	73-85
	Night-time	58	44	40	71-82
R2. Kendal Road	Daytime	52	47	45	52-82
	Night-time	47	43	42	49-67

Note: Representative background sound level is based on the mode value or average whichever is the lowest.

3.0 REVIEW OF NOISE GUIDANCE AND STANDARDS

3.1 Introduction

3.1.1 The ambient environmental noise at any location will vary according to the activities occurring around the location. In the vicinity of a busy motorway, for example, the noise level will remain fairly constant due to the relatively steady noise input from road traffic, whereas the noise level close to a source of high noise over short periods, such as an airport, will vary over a much wider range. It is therefore necessary to consider how to quantify the existing noise levels in an area in order to accurately assess the acceptability of the introduction of a new noise source.

3.1.2 The background sound level, defined as the L_{A90} parameter, represents the sound level exceeded for 90% of a measurement period, or the ninety percentile level. It generally reflects the quieter sound level between peak events and generally ignores the effects of short term higher sound level events. Another way of describing the L_{A90} level is that it represents the `troughs' of the sound climate and the lower 10% of the fluctuating ambient sound.

3.1.3 The ten percentile level L_{A10}, represent the level that is exceeded for 10% of the measurement period and is therefore an indication of the higher levels of sound. This is commonly used to describe and quantify noise from road traffic as it reflects the higher levels of noise and the upper 10% of the fluctuating ambient noise.

3.1.4 The equivalent continuous sound pressure level or L_{Aeq} parameter, is a measure of the average sound energy over a given time period. It will include noise from all contributing sources. This is commonly used to describe and quantify noise from specific industrial noise sources.

Noise Criteria

3.1.5 The noise and vibration chapter relating to the Environmental Statement (Appendix 7.0 of ES) sets out the relevant guidance and standards for noise for industrial development. This provides detail of the most relevant noise criteria upon which the site should be assessed, this includes:

1. BS4142: 2014 `Methods for rating and assessing industrial and commercial sound'
2. BS8233: 2014 `Guidance on sound insulation and noise reduction for buildings'
3. Noise Policy Statement for England (March 2010)
4. National Planning Policy Framework (NPPF) 2018
5. Planning Practice Guidance (March 2014)
6. World Health Organisation (WHO) Night Noise Guidelines for Europe: 2009

3.1.6 In terms of defining a suitable noise limit, achieving a low impact in accordance with ~~reference to~~ BS4142:2014 ~~would be most relevant~~would provide suitable protection for amenity of NSR. ~~and as such t~~The Standard

is based on the measurement of background sound using L_{A90} noise measurements, compared to source noise levels measured in L_{Aeq} units. Once any corrections have been applied for source noise tonality, distinct impulses etc., the difference between these two measurements (i.e. known as the `rating' level) determines the impact magnitude.

- Typically, the greater the difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact (although this can be dependent on the context).
- A difference of around +5 dB 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 (although this can be dependent on the context).

3.1.7 In defining noise limits and the significance of the impact from the site BS4142 indicates that a low impact occurs where the `rating' level from site (which includes a noise character) **does not exceed** the representative baseline sound level and an adverse impact where the `rating' level is around +5dB above baseline sound levels (depending on the context i.e. if residual sound levels significantly increase).

3.1.8 Based on the requirements set out in BS4142: 2014 to achieve a **low impact**, the following noise limits would apply:

Table 4.1: Noise Limits Daytime

NSR	Survey Location	Day (0700-2300 hours)			
		Representative Background Sound Level LA90 dB	Minimum Background Sound Level LA90 dB	Residual Sound Level LAeq dB	Rating Level * Limit $LAeq_{1hr}$ dB
R1	Queens Road	44	41	60	44
R2	Kendal Road	45	41	52	45

*Note: Noise character correction is to be included where applicable in accordance with BS4142: 2014 and representative background sound level is most relevant to the assessment.

Table 4.2: Noise Limits Night-time

NSR	Survey Location	Night (2300-0700 hours)			
		Representative Background Sound Level LA90 dB	Minimum Background Sound Level LA90 dB	Residual Sound Level LAeq dB	Rating Level * Limit LAeq dB
R1	Queens Road	40	40	58	40
R2	Kendal Road	42	35	47	42

*Note: Noise character correction is to be included where applicable in accordance with BS4142: 2014 and representative background sound level is most relevant to the assessment.

3.1.9 NBEL will specify in the EPC Contract that all noise sources will be designed by the EPC Contractor such that the noise character does not contain any tonal, impulse or intermittent character that is perceptible at NSRs.

Other Relevant Guidance and Standards

BS8233: 2014 `Guidance on sound insulation and noise reduction for buildings'

3.1.10 The British Standard BS8233 provides additional guidance on noise levels within buildings. These are based on the WHO recommendations and the criteria given in BS8233 for unoccupied spaces within residential properties.

3.1.11 The guidance provided in section 7.7 of BS8233 provides recommended internal ambient noise levels for resting, dining and sleeping within residential dwellings. Table 4.3 provides detail of the levels given in the standard.

Table 4.3: BS8233: 2014 Indoor ambient noise levels for dwellings

Activity	***Location***	***07:00 to 23:00***	***23:00 to 07:00***
Resting	Living Room	35 dB $L_{Aeq,16hours}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hours}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hours}$	30 dB $L_{Aeq,8hours}$
Study & work requiring concentration	Office	35-45dB $L_{Aeq,16hours}$	-

3.1.12 For a partially open window the standard refers to a reduction of approximately 15dB. This would therefore indicate a noise level outside the window of approximately 50-55dB $L_{Aeq,16hours}$ for living rooms during daytime and 45dB $L_{Aeq,8\ hours}$ during night-time outside bedrooms. For office environments the external noise level would be in the region of 50-60dB $L_{Aeq,16hours}$ on the assumption that the office window is open.

World Health Organisation (WHO) Night Noise Guidelines for Europe: 2009

3.1.13 In 2009, the World Health Organisation published `*Night Noise Guidelines for Europe'*, which it describes as an extension to the WHO `*Guidelines for community noise'* (1999). It concludes that *"Considering the scientific evidence on the thresholds of night noise exposure indicated by Lnight,outside as defined in the Environmental Noise Directive (2002/48/EC), an Lnight,outside of 40dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. Lnight,outside value of 55dB is recommended as an interim target for those countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach."* The target of 40dB(A) outside would relate to an internal noise level within bedrooms of 25-30dB(A) Leq8hours.

IPPC - Technical Guidance Note IPPC H3 Part 2 – Noise Assessment & Control

3.1.14 Integrated Pollution Prevention and Control (IPPC) is a regulatory system that employs an integrated approach to control the environmental impacts of certain industrial activities. It involves determining the appropriate controls for industry to protect the environment through a single permitting process. To gain a Permit, Operators have to show that they have systematically developed proposals to apply the 'Best Available Techniques' (BAT) and meet certain other requirements, taking account of relevant local factors.

3.1.15 In terms of noise specifically, the use of BAT has to be considered and balanced within the wider context of other releases to different media (air, land and water) and taking issues such as usage of energy and raw materials into account. Noise cannot therefore be considered in isolation from other impacts on the environment.

3.1.16 The definition of pollution includes "*emissions which may be harmful to human health or the quality of the environment, cause offence to human senses or impair or interfere with amenities and other legitimate uses of the environment*". BAT is therefore likely to be similar, in practice, to the requirements of the Statutory Nuisance legislation which requires the use of "best practicable means" to prevent or minimise noise nuisance. In the case of noise, "offence to human senses" may be judged by the likelihood of complaints. However, the lack of complaint should not necessarily imply the absence of a noise problem. In some cases it may be possible, and desirable, to reduce noise emissions still further at reasonable costs and this may therefore be BAT for noise emissions.

3.1.17 Consequently, the aim of BAT should be to ensure that there is no reasonable cause for annoyance to persons beyond the installation boundary.

3.1.18 In summary, the aim of BAT should be to achieve the following:

- Underpinning of good practice, a basic level of which the operator should employ for the control of noise including adequate maintenance of any parts of plant or equipment whose deterioration may give rise to increases in noise. For example, this would include bearings, air handling plant, the building fabric as well as specific noise attenuation measures associated with plant, equipment or machinery.
- Noise levels should not be loud enough to give reasonable cause for annoyance for persons in the vicinity, which is a more appropriate environmental standard than that of Statutory Nuisance and is normally the aim of most planning or other conditions applied by Local Authorities.
- Prevention of '*creeping background*' (creeping ambient), which is the gradual increase in sound levels as industry expands and areas develop.

3.1.19 The indicative requirements apply to both new and existing activities but it is more difficult to justify departures from them in the case of new activities. Indeed, because the requirements for noise are likely to be strongly influenced by the local environmental conditions, new installations are expected to meet BAT from the outset and to demonstrate that noise reduction or prevention has been built in to the process design. For most

existing plant, especially where there are no existing noise limits, the focus is on good practice (BAT) and the need to ensure that there is no reasonable cause for annoyance. In assessing any noise impact it is more normal to monitor existing levels and apply corrections and calculations, rather than rely on predictions.

3.1.20 The guidance makes reference to BS4142:1997, BS8233:1999 and WHO guidance for absolute levels for protection of community annoyance. The two British Standards have been updated since the guidance was published and the latest versions have been considered in this assessment.

4.0 NOISE PREDICTIONS

4.1 Mitigation Strategy

4.1.1 The predicted noise levels from the Proposed Development have been calculated using the noise levels provided within Appendix 2. The noise levels are based on plant noise data provided by Technology Providers on other similar projects in the UK. The noise mitigation strategy includes the following mitigation measures:

(i) Sound power levels or reverberant sound pressure levels of plant as detailed in Appendix 2.

(ii) Fan stack designed to a sound power level of 87dB (76dB LAeq @ 1m/90deg at end of stack).

(iii) All buildings fitted with cladding to minimum Rw 24dB (e.g. Kingspan composite panels).

(iv) Turbine Building fitted with Acoustic Doors to minimum Rw 29dB.

(v) Ventilation openings formed by double bank acoustic louvres to minimum Rw 24dB

(vi) Doors closed except for access to vehicles for offloading and collection unless for maintenance or emergency.

(vii) Traffic arrangements on Site would be arranged so that reversing in outside areas is minimised.

(viii) Mobile plant on site would be fitted with broadband type noise reversing alarms.

(ix) Impulse noise not perceptible at NSRs by control at source (e.g. noise from any pressure relief valves e.g. bag filters or valves that produces regular impulse noise to be fitted with silencers to control noise character).

(x) Any external plant to be designed to prevent any perceptible tonal noise character as part of the procurement specification of plant.

(xi) Safety valve fitted with silencer to reduce noise to approximately 85dB $LAeq_{1hr}$ @ 1m (96dB(A) sound power level).

4.1.2 For the purpose of the noise model we have referred to the layout plans and elevations of the EfW provided by NBEL.

4.1.3 In terms of assumed sound reduction index for associated cladding and doors relative to the EfW buildings we have assumed the following acoustic performance, which is detailed below in Table 4.1.

Table 4.1: Assumed SRI values for the cladding, louvres and doors into the buildings

Noise Control	ID	Octave Band Spectra (Hz)										Source
		31.5	63	125	250	500	1000	2000	4000	8000	Rw	
Acoustic Louvres 600mm	AC600	3	6	8	11	20	29	31	28	28	24	Library
Acoustic Door	ACD	5	10	15	20	25	30	35	35	40	29	CNIM
Longspan Composite Wall Panel	AWP60	0	15	16	19	23	26	22	39	47	24	Kingspan
Roller Shutter Door	RSD	0	2	3	5	8	10	11	13	12	10	Millerhill
Kingspan KS1000-TD	KS1000T	14	15	18	18	17	23	30	40	40	23	Kingspan

4.1.4 The information assumed for noise emission levels for the plant provides us with noise data for input into the noise model and is provided in Appendix 2 and below for ease of reference.

Table 4.2: Noise Source Input Data

Name	ID	Type	Oktave Spectrum (dB)											Source
			Weight.	31.5	63	125	250	500	1000	2000	4000	8000	A	lin	
Stack Outlet Silenced	ST	Lw		91.0	91.0	93.0	88.0	85.0	81.0	77.0	72.0	61.0	87.0	97.5	Library
Air cooled condensers	ACC	Lw		99.0	99.0	96.0	94.0	92.0	89.0	85.0	78.0	69.0	94.0	104.0	Air cooled condensers
Turbine Air Cooler	TAC	Lw		91.0	91.0	91.0	86.0	85.0	88.0	79.0	70.0	60.0	90.0	97.2	Turbine Cooler fans
Transformers	TRAN	Lw		76.0	82.0	76.0	73.0	70.0	68.0	65.0	61.0	62.0	73.5	84.5	Transformers
HGV movement	HGV	Lw		97.0	110.0	106.0	102.0	101.0	97.0	95.0	90.0	86.0	103.0	112.6	HGV movement
Flue Gas Treatment	FGT	Li		86.0	86.0	83.0	83.0	82.0	78.0	78.0	77.0	71.0	85.2	91.9	FGT
Furnace & Boiler Hall	FB	Li		86.0	86.0	83.0	83.0	82.0	78.0	78.0	77.0	71.0	85.2	91.9	Furnace
Turbine	TUR	Li		87.5	84.5	89.5	87.5	89.0	90.0	89.9	84.5	79.0	95.0	97.3	Turbine
Waste Bunker & Tip	WASTE1	Li		105.8	103.8	98.1	87.5	74.4	60.9	60.9	64.8	55.6	85.0	108.4	AE&E
Workshop	W	Li		87.0	86.0	87.0	84.0	78.0	74.0	72.0	75.0	74.0	82.6	92.6	Workshop night

4.1.5 For daytime periods the site is assumed to have HGVs moving around the site and doors into the buildings would be closed. For calculation purposes the number of HGVs over the daytime period on an hourly basis is assumed to be 9 (i.e. 18 movements per hour) for worst case scenario.

4.2 Noise Prediction Modelling

4.2.1 Noise prediction modelling of the site is based on the information detailed in Table 4.1 and 4.2 using CadnaA noise prediction modelling software. The results of the noise mapping are shown below and Appendix 3 (noise maps 1 to 2).

4.2.2 The model utilises ISO9613-2 as the method of calculation for propagation from the building to the receptor. Settings for the noise model include the following, which is based on industry accepted standards:

Ground effect (Agr) = 0.5 (mixed ground absorption due to surrounding topography)
Temperature = 10degC
Humidity = 70%
Height above ground for receiver = 4m
Maximum order of reflection = 1

4.2.3 Drawings of the site layout and building elevations have been provided and the main building assumed heights, ACC, air coolers and fan stack within the noise model would indicate the following:

(i) Tipping Hall: 17m to 26.6m

(ii) Waste Bunker: 41m to 47m
(iii) Boiler Hall: 45m to 48m
(iv) FGT: 34m to 45m
(v) Turbine Hall: 24m
(vi) ACC Fans: 12m above ground (20m with wind screen)
(vii) Stack: 90m
(viii) Turbine Air Coolers: 26m above ground

4.2.4 The results of the noise predictions are provided below in Table 4.3, which include the assumed building cladding and insulation specification for doors and louvres provided in Table 4.1.

Table 4.3: Noise Prediction Results at Residential Receptors with noise mitigation

Noise Receptor	Predicted Rating Noise Level LAeq dB with mitigation	Background Sound Level LA90 dB	Level Difference [predicted with LA90] dB
Daytime (0700-2300 hours) LAeq $dB_{1\ hour}$			
R1 Queens Road	41	44	-3
R2 Kendal Road	31	45	-14
Night-time (2300-0700 hours) LAeq dB_{15mins}			
R1 Queens Road	40	40	0
R2 Kendal Road	30	42	-12

4.2.5 The above table shows the impact relative to the likely noise condition and shows that the noise contribution is between 3dB and 14dB **lower** than the representative daytime background sound levels.

4.2.6 The night-time table of results shows that the site noise rating noise level predicted is either equal to or up to 12dB **lower** than the representative background sound levels.

4.2.7 With the proposed mitigation strategy, the site is not expected to produce any noise character at NSRs.

4.2.8 The results show that the daytime and night-time predicted noise levels (according to BS4142: 2014) are likely to show a **low** impact magnitude.

Ecological Receptors

4.2.9 Ecological receptors included in the ES Chapter include the following

R3a. Immingham Dock Reedbeds (circa 640m)
R3b. Laporte Road Brownfield Site (circa 710m)
R3c. North Moss Lane Meadow (circa 1.56km)
R4. Humber Estuary this is circa 940m from the site boundary.

4.2.10 Predicted noise levels at the above ecological receptors are provided below in Table 4.4.

Table 4.4: Noise Prediction Results at Non-residential Receptors with noise mitigation

Noise Receptor	Predicted Noise Level $LAeq_{1hr}$ dB	Baseline Sound Level $LAeq_{1hr}$ dB	Noise Change LAeq dB
Daytime			
R3a. Immingham Dock Reedbeds	39	52-60	0
R3b. Laporte Road Brownfield Site	39	52-60	0
R3c. North Moss Lane Meadow	31	52-60	0
R4. Humber Estuary	33	52	0
Night-time			
R3a. Immingham Dock Reedbeds	38	47-58	0 to +1
R3b. Laporte Road Brownfield Site	38	47-58	0 to +1
R3c. North Moss Lane Meadow	31	47-58	0
R4. Humber Estuary	31	47	0

4.2.11 The above resultant noise levels at the ecological receptors show no significant change in residual sound levels.

Noise Limits

4.2.12 For noise limits, we would expect that given the residual and background sound levels in the area that the design should aim to achieve a noise contribution that is no higher than the background sound level during daytime and night-time periods. Additionally, in consideration of the Technical Guidance Note IPPC H3 Part 2 – Noise Assessment & Control, absolute levels should aim to be no higher than 50dB $LAeq_{1hr}$ daytime at residential NSRs, 45dB $LAeq_{15mins}$ and 60dB LAmax at NSRs during night-time periods.

LAmax Levels

4.2.13 LAmax levels predicted for the operation of the EfW are provided below in Table 4.5.

Table 4.5: Noise Prediction Results LAmax (night-time)

Location	Night-time Predicted Operational Noise Level LAmax dB	WHO night noise guidelines external limits (bedroom window) LAmax dB
R1 Queens Road	45-51	**57**
R2 Kendal Road	35-41	**57**

4.2.14 The LAmax levels are predicted to be below the WHO guidelines for sleep disturbance.

Safety Valve

4.2.15 The operation of safety valves will only occur during emergency situations or during a planned safety test. The noise levels will be very high due to the

release of high-pressure steam and as such will be controlled by a steam vent silencer, however this will have limited effect due to the nature of the source and we would expect sound power levels to be controlled as far as is reasonably practicable by the silencing. We would expect that the noise level excluding silencing to produce a sound power level of approximately 126dB. The silencer is expected to reduce this to a sound power level of approximately 96dB.

5.0 CONCLUSIONS

Noise Limits

5.1 In terms of noise limits at NSRs the indicative background noise levels enable us to establish reasonable noise limits based on satisfying appropriate and relevant standards and guidance. The residential receptors are located at a relatively large distance from the site and therefore the noise contribution from site is relatively low.

5.2 By applying BS4142 methodology, we have assumed that reasonable noise limits at each NSR for daytime and night-time operational periods would achieve a `rating' level that does not exceed background sound levels and night-time operating periods would also not exceed sleep disturbance criteria (i.e. <40dB $LAeq_{1hr}$ and <57dB LAmax) as a contribution at NSRs.

Noise Predictions

5.3 A noise prediction model has been developed based on information from EfW plant library data from similar facilities and information concerning the proposed development. The prediction model used includes the use of ISO9613-2 which is a nationally recognised calculation method to provide good accuracy.

5.4 Within BS4142: 2014 section 10.3 deals with `uncertainty in calculation' and states:

"Uncertainty in calculating sound levels can arise from:

a) uncertainty in any measured sound levels used in the calculations;

b) uncertainty in the operation or sound emission characteristics of the specific sound source and any assumed sound power levels;

c) uncertainty in the calculation method;

d) simplifying the real situation to "fit" the model (user influence on modelling); and

e) error in the calculation process.

Where the sound power level is used for calculating sound pressure levels, it ought to be representative of the source and the conditions under which the source is expected to operate.

Where possible, use recognized standards to establish the sound power level and the uncertainty (e.g. BS EN ISO 3740 and BS EN ISO 3747). Where it is not possible to use appropriate standards, describe the method of establishing the sound power level, report the uncertainty and state the reasons for using this method.

Use a validated method of calculating sound levels, e.g. ISO 9613-2 or similar. If an alternative calculation method is used, fully describe the method and state the reasons for using this method.

Check the implementation of the calculation method for errors.

For simple cases, e.g. where the level of variability in sound propagation resulting from changes in meteorological conditions is likely to be small, simple calculation methods might be sufficient."

5.5 In terms of the prediction calculations undertaken, the following points are noted:

(i) A recognised standard for calculation has been used with appropriate settings to give an accurate prediction.
(ii) Input data for the EfW is based on typical measured plant noise levels within a reverberant environment.
(iii) Input data for the EfW plant and associated equipment has been based on library data from Technology Providers based on other similar sites operating in the UK.
(iv) Detailed layout of the site and elevations for the proposed EfW buildings have been used to inform the noise model.
(v) Typical manufacturers' data on building cladding has been provided for input into the noise model.
(vi) Baseline levels recorded by URS have been referred to which includes the lowest background sound levels as a means of assessing impact.

5.6 The only potential variation in predicted noise levels is likely to be as a result of sound propagation resulting from changes in meteorological conditions. This is difficult to predict and in the situation where there is a positive wind vector in the direction of nearest sensitive receptors the actual background noise level could, in any case, be higher than when measured under ideal conditions. We therefore would not consider this to be a significant factor due to the fact that when assessing the site for compliance this would be carried out in suitable meteorological conditions.

Assessment Results

5.7 The results show no exceedance above relevant noise limits determined from standards and guidance for daytime and night-time periods at nearest sensitive receptor locations.

5.8 Predicted noise levels using typical plant operating noise levels with appropriate noise mitigation would produce levels which would be well within sleep disturbance criteria, guidance levels within BS8233: 2014, WHO guidelines for community noise and amenity and produce a low impact magnitude in accordance with BS4142: 2014.

5.9 Noise levels are expected to be below LOAEL levels according to national policy guidelines.

5.10 The detailed design in conjunction with the appointed EPC Contractor and Technology Providers would enable the noise mitigation strategy to be further developed including choice of plant.

REFERENCES

1. ISO 9613-2: 1996 Acoustics – 'Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation'

2. British Standards BS4142: 2014 `Methods for rating and assessing industrial and commercial sound'

3. BS8233: 2014 `Guidance on sound insulation and noise reduction for buildings'

4. Guidelines for Community Noise – World Health Organisation: April 1999

5. World Health Organisation 'Night Noise Guidelines for Europe' – 2009;

6. BS7445: 2003 - Description and measurement of environmental noise.

7. National Planning Policy Framework – July 2018

8. Noise Policy Statement for England (NPSE) – March 2010

9. Planning Practice Guidance – 6th March 2014 Department for Communities and Local Government (Ref ID: 30-001-20140306)

10. IPPC - Technical Guidance Note IPPC H3 Part 2 – Noise Assessment & Control

11. North East Lincolnshire Council Planning Permission (DM/0026/18/FUL) dated 12th October 2018

12. Noise & Vibration Chapter 7 of the Environmental Statement;

13. Environmental Statement Appendix 7;

FIGURES

Figure 1: Site location and Noise Sensitive Receptors

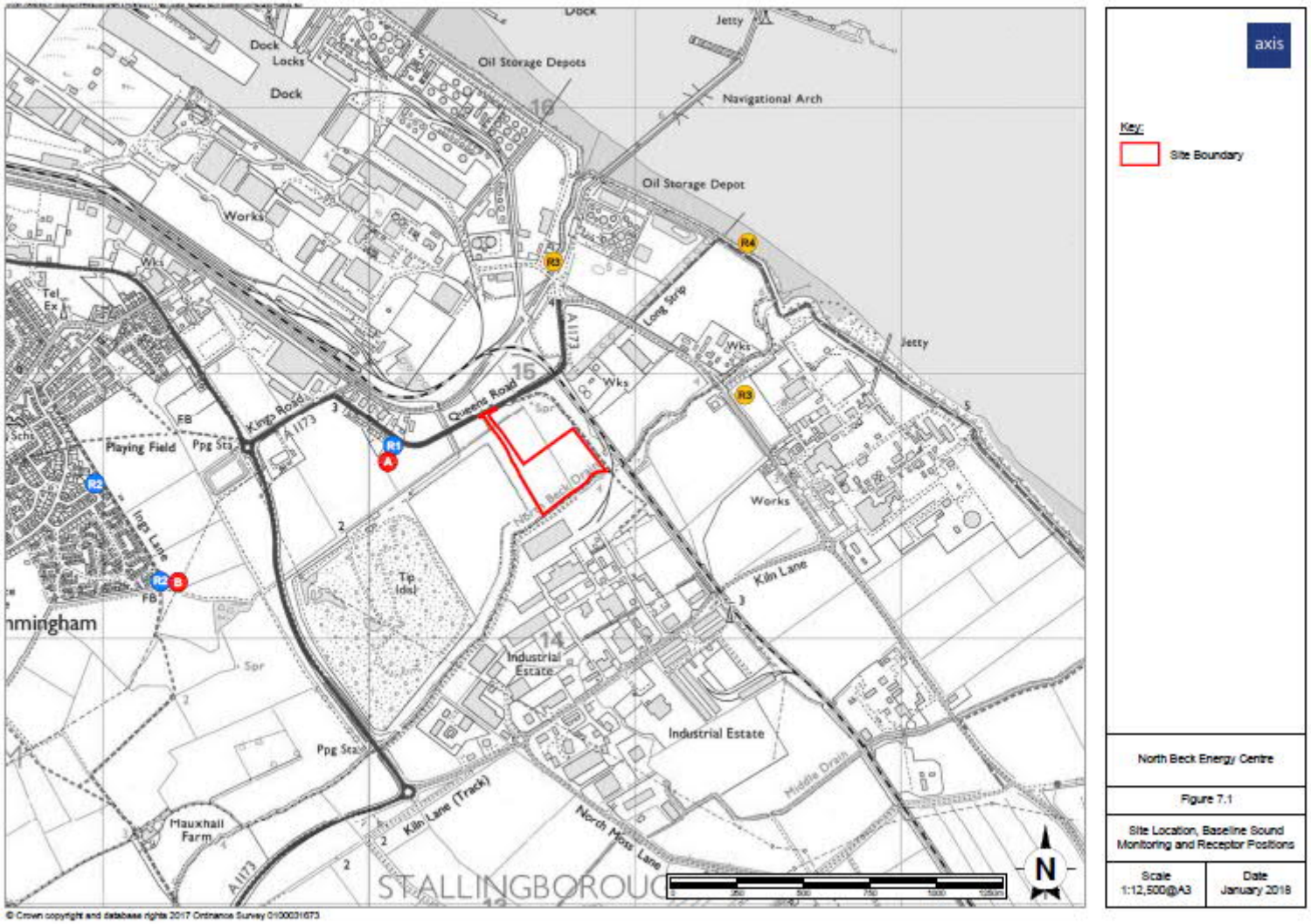

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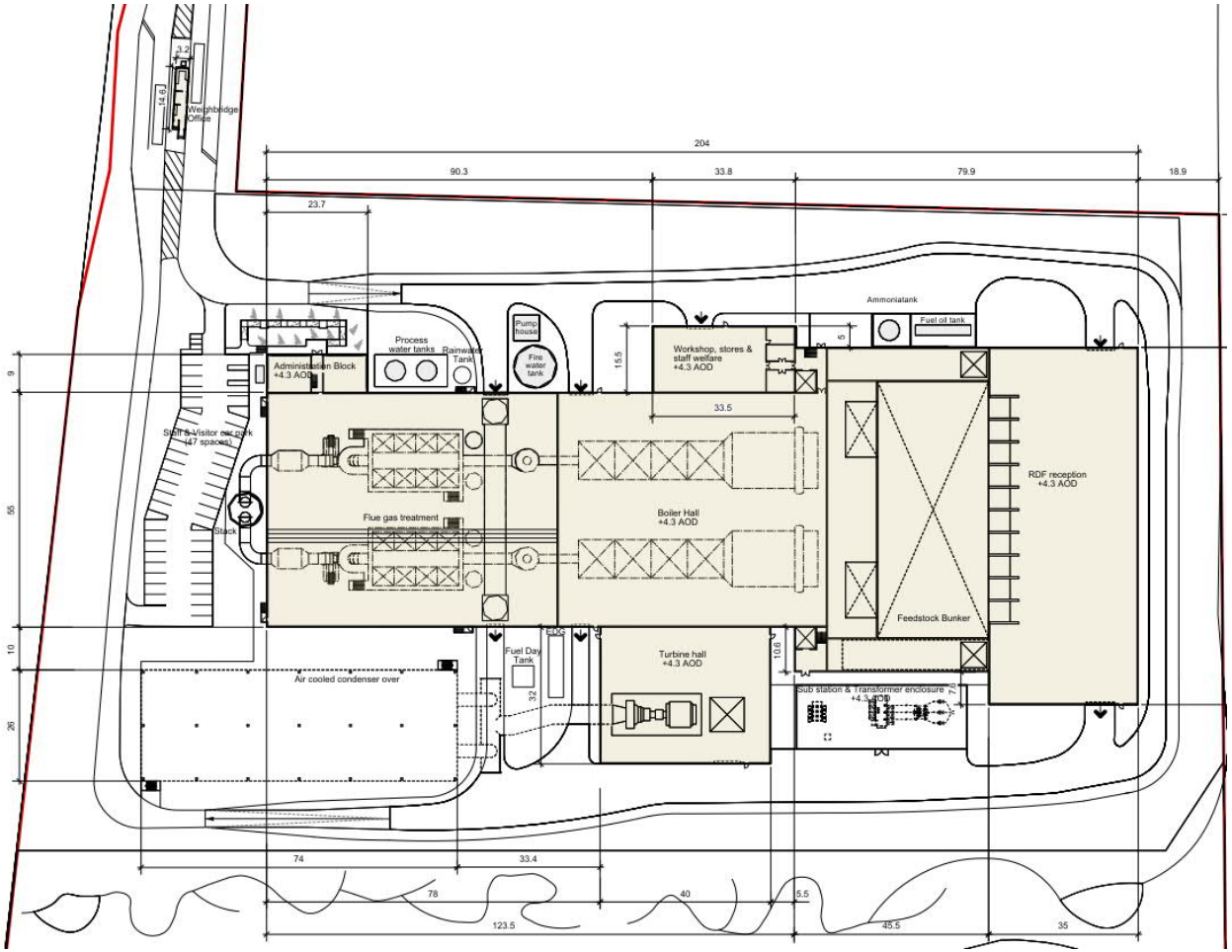
Figure 2: Plan of Site Showing Layout



APPENDIX 1

BASIC ACOUSTIC TERMINOLOGY

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

Sound Pressure Level is a measurement of the size of these pressure fluctuations. It is expressed in decibels (dB) on a logarithmic scale. Each 3 dB increase in sound pressure level represents a doubling of the sound energy. An increase of around 10dB is said to subjectively double the sound level. The threshold of hearing is approximately 0 dB.

The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hz to 20,000 Hz. Although sound can be of one discrete frequency - a 'pure tone' - most noises are made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same 'subjective' way. This is the basis of the A-weighted sound level dB(A), normally used to assess the effect of noise on people. The dB(A) weighting emphasises or reduces the importance of certain frequencies within the audible range.

Noise Measurement

The measurement of sound pressure level is only really meaningful where the level of noise is constant. In the typical industrial environment noise levels can vary widely and sometimes short duration high levels of noise are interspersed with periods of relative quiet. The most widely used means of 'averaging' the noise over a period of time is the Equivalent Continuous Sound Level. Normally written as L_{Aeq} this value takes into account both the level of noise and the length of time over which it occurs. There are many meters available which are capable of measuring L_{Aeq} by electronic integration over the measurement period.

The L_{Aeq} or A-weighted equivalent continuous noise level is a measure of the total noise energy over a stated time period and includes all the varying noise levels and re-expresses as an 'average', allowing for the length of time for which each noise level was presented.

The L_{An} parameters are defined as the noise levels which are exceeded for n% of the monitoring period, thus, for example, the L_{A90} parameter is the noise level exceeded for 90% of the 15-minute period, i.e. 13.5 minutes. The L_{A50} parameter is the noise level exceeded for 50% of the hourly period, i.e. 30 minutes, etc. The L_{max} parameter is the maximum RMS A-weighted noise level occurring during the measurement period.

The definition in layman's terms is given below for terminology used in the measurement and results obtained during the survey work.

A-weighting: Normal hearing covers the frequency (pitch) range from about 20Hz to 20,000 Hz but sensitivity of the ear is greatest between about 500Hz and 5000Hz. The "A-weighting" is an electrical circuit built into noise meters to mimic this characteristic of the human ear.

Ambient noise: The totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Attenuation: Noise reduction

Background noise: The general quiet periods of ambient noise when the noise source under investigation is not there.

Decibel (dB): The unit of measurement for sound based on a logarithmic scale. 0dB is the threshold of normal hearing; 140dB is the threshold of pain. A change of 1dB is only detectable under controlled laboratory conditions.

dB(A) [decibel A weighted]: Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) serves to distinguish sounds of different frequency (or pitch) in a similar way to how the human ear responds. Measurements in dB(A) broadly agrees with an individual's assessment of loudness. A change of 3dB(A) is the minimum perceptible under normal everyday conditions, and a change of 10dB(A) corresponds roughly to doubling or halving the loudness of sound.

dB(C): [decibel C weighted]: Frequency weighting which does not alter low frequency octave band levels by very much compared to `A' weighting. Similar to linear reading (i.e. linear does not alter frequency spectra at all)

Frequency (Hz): The number of sound waves to pass a point in one second.

L_{Aeq}: This is a noise index used to describe the "average" level of a noise that varies with time (T). It allows for the different sensitivities of the human ear to different frequencies (pitch), and averages fluctuating noise levels in a manner, which correlates well with human perceptions of loudness.

$L_{A10,T}$: This noise index gives an indication of the upper limit or peak levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 10 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A10} reading was say 60dB, then this means that for 1 hour out of 10 the level went above 60dB.

$L_{A90,T}$: This noise index gives an indication of the lower limit or levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 90 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A90} reading was say 50dB, then this means that for 9 hours out of 10 the level went above 50dB.

L_{Amax}: This is the highest `A' weighted noise level recorded during a noise measurement period.

Residual noise: The ambient noise remaining at a given position in a given situation when the noise source under investigation is not there.

Specific noise: The noise source under investigation for assessing the likelihood of complaints

Examples of typical noise levels

Source/Activity	**Indicative noise level [dB(A)]**
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/h at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/h at 100m	65
City Traffic at 5m	75-85
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

APPENDIX 2

SITE OPERATIONAL NOISE LEVELS

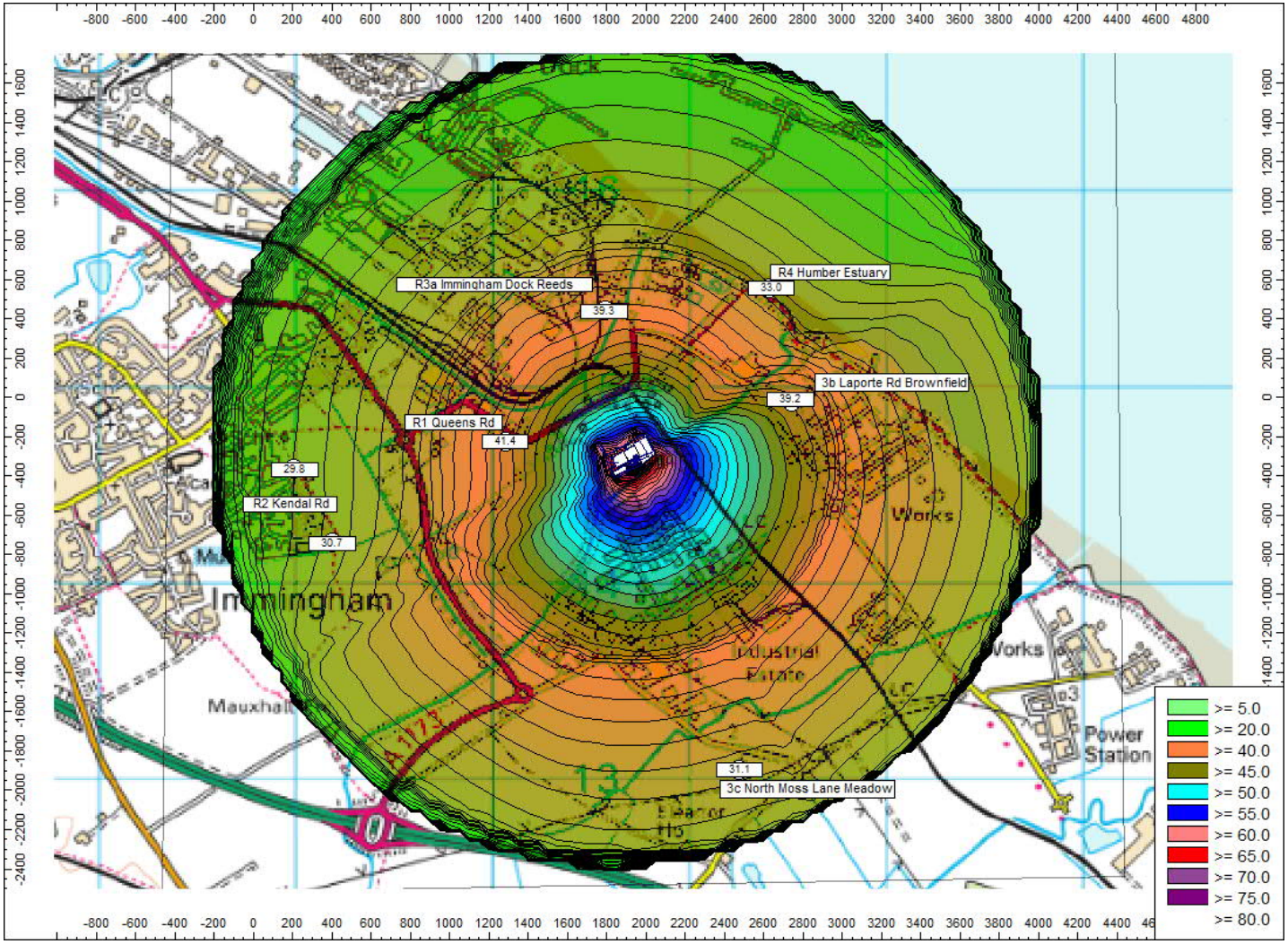
Assumed Noise Levels for Site Plant & Cladding Performance (with noise mitigation measures)

Plant Type	Treatment (Cladding Performance Rw) dB	Sound Power (SWL) Sound Pressure Level (SPL) at roof/walls dB(A)	Assumed % Operating Time	Period of Operation
Boiler Room (walls/roof)	24	85 (SPL)	100	Daytime/Night-time
Tipping Hall (walls/roof)	24	85 (SPL) 80 (SPL)	100 100	Daytime/Night-time
Bunker	24	85 (SPL)	100	Daytime/Night-time
Fan Stack (top)	Silencer	87 (SWL)	100	Daytime/Night-time
Flue Gas (walls/roof)	24	85 (SPL)	100	Daytime/Night-time
Turbine Hall (walls) Turbine Hall (doors)	24 29	95 (SPL) 95 (SPL)	100 100	Daytime/Night-time Daytime/Night-time
Turbine Hall (roof)	24	95 (SPL)	100	Daytime/Night-time
Ash Handling (walls/roof)	24	75 (SPL)	100	Daytime/Night-time
Workshop/Electrical Rooms	24	83 (SPL)	100	Daytime/Night-time
Transformer	-	74 (SWL)	100	Daytime/Night-time
Turbine Air Coolers	-	90 each fan (SWL)	100	Daytime/Night-time
Air Cooled Condenser	Wind screen above fans	94 each fan (SWL) maximum 4 fans	100	Daytime/Night-time
Ventilation openings	24	80-95	100	Daytime/Night-time
HGV	-	103 (SWL)	11 per hour	Daytime

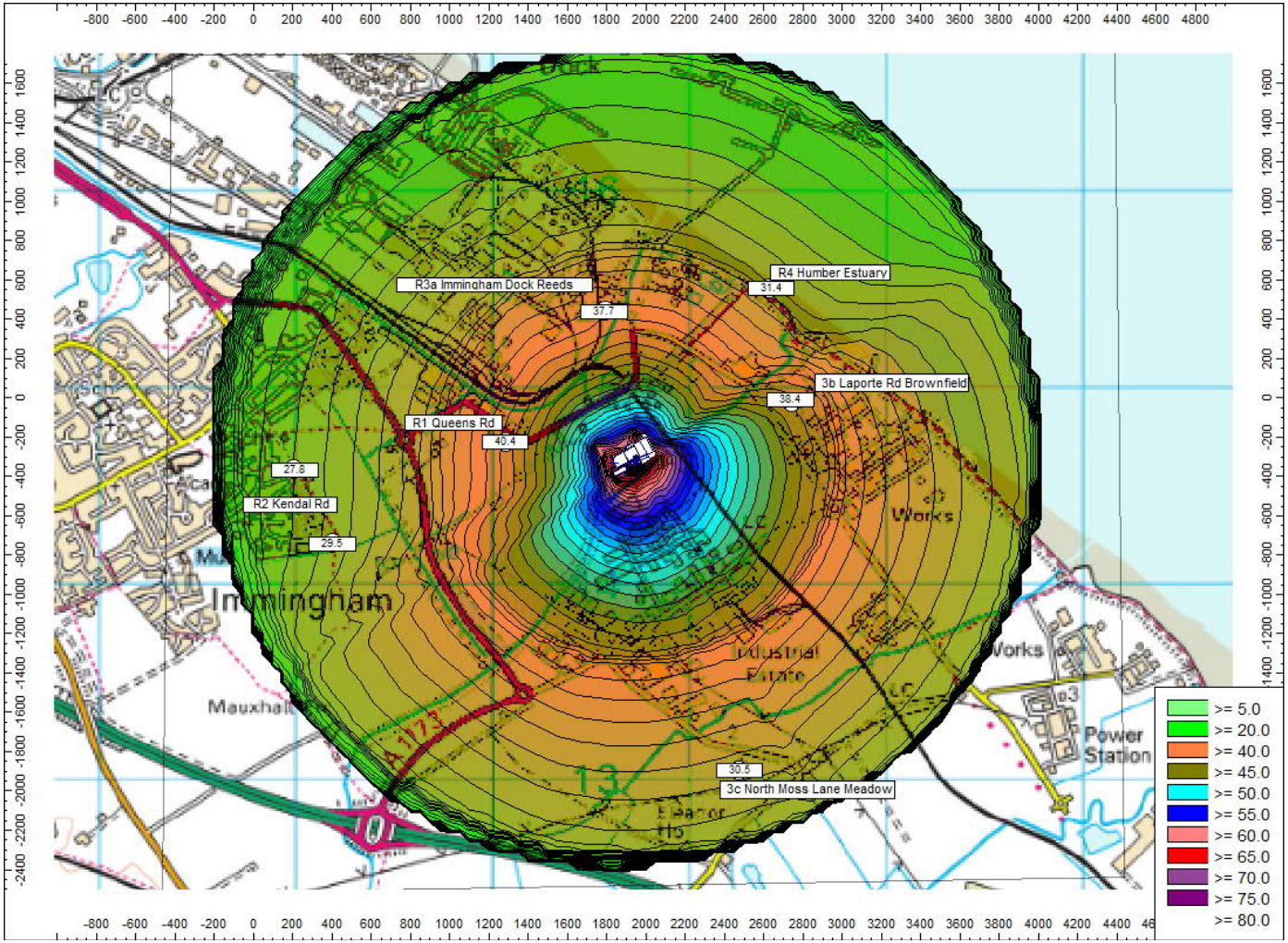
APPENDIX 3

NOISE PREDICTION MAPPING RESULTS

NOISE MAP 1: DAYTIME SITE OPERATIONAL NOISE LEVELS



NOISE MAP 2: NIGHT-TIME SITE OPERATIONAL NOISE



APPENDIX 4

CONSULTANT'S EXPERIENCE & QUALIFICATIONS

Principal Consultant: Dean Robert Kettlewell - MSc MIOA MAE I.Eng (Director & Principal Acoustic Consultant)

Précis

As Director and Principle Acoustic Consultant with Noise & Vibration Consultants Ltd, Dean has over 35 years background experience in a wide range of issues relating to environmental, industrial and commercial noise and vibration assessment. He currently manages corporate and unit specific contracts for:

- Environmental Noise Impact Assessments
- Industrial Noise Assessment and Control
- Planning Issues for Residential and Commercial Development
- Noise at Work Regulations Assessments
- Building Acoustics and Sound Insulation Tests
- Expert Witness representation for Deafness and `Vibration White Finger' Claims
- Integrated Pollution Prevention and Control (IPPC) Applications
- Wind Farm Noise Impact Assessments
- Entertainment Noise Assessment and Control
- Architectural Acoustics
- Specialist knowledge in the Design of Noise Control Systems
- Ground borne vibration measurement and assessment
- Assessment of Environmental & Industrial Noise Nuisance
- Project Management of Noise Control Systems
- Hand-arm Vibration Assessments

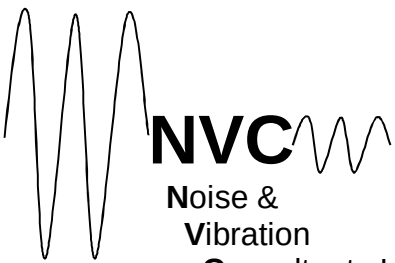
Relevant Work Experience

Director & Principal Consultant - Noise & Vibration Consultants Ltd	2001- to date
Senior Acoustic Consultant - Vibrock Limited	1998 - 2001
Associate & Principal Acoustic Consultant - John Savidge & Associates	1994 - 1998
Technical Manager – LBJ Limited (Noise Control Division)	1990 - 1994
Technical Engineer/ Technical Manager (1988) - Vibac (Noise Control) Ltd	1982 - 1990

Qualifications and Education

M.Sc. Applied Acoustics (Derby University – Distinction)
HNC Electrical & Electronic Engineering
IOA Diploma in Acoustics & Noise Control
IOA Certificate in Law and Administration
Certificate of Competence in Workplace Noise Assessment
Certificate of Competence in Ground Vibration Monitoring

Affiliations:
Member of Institute of Acoustics (MIOA)
Member of Academy of Experts (MAE)
Member of Association of Noise Consultants (ANC)
Incorporated Engineer (I.Eng)


NVC
Noise &
Vibration
Consultants Ltd