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## 8. NOISE AND VIBRATION

### 8.1 Introduction

8.1.1 This chapter of the Preliminary Environmental Information (PEI) Report addresses the potential noise and vibration effects of the proposed Open Cycle Gas Turbine (OCGT) power station (hereafter referred to as the 'Proposed Development').

8.1.2 Impacts during the construction, operation and decommissioning phases of the Proposed Development are assessed. In particular, the chapter considers the potential impacts on identified receptors in terms of:

- Predicted noise and vibration levels during the site clearance and construction works associated with the Proposed Development;
- Predicted changes in road traffic noise levels on the local road network during the construction and operational phases; and
- Predicted noise and vibration resulting from operation of the Proposed Development.

8.1.3 This chapter is supported by the Figures 8.1 and 8.2 which show the identified receptor locations and the worst case predicted operational sound levels provided in PEI Report Volume II and Appendices 8A and 8B in PEI Report Volume III.

### 8.2 Legislation and Planning Policy Context

#### Legislative Background

8.2.1 The following legislation and planning context have been considered in the preparation of this chapter

#### *Environmental Protection Act 1990*

8.2.2 The Environmental Protection Act 1990 (EPA) Part 3 prescribes noise (and vibration) emitted from premises (including land) so as to be prejudicial to health or a nuisance as a statutory nuisance.

8.2.3 Local Authorities are required to investigate any public complaints of noise and if they are satisfied that a statutory nuisance exists, or is likely to occur or recur, they shall serve a noise abatement notice. A notice is served on the person responsible for the nuisance. It requires either the abatement of the nuisance or works to abate the nuisance to be carried out, or it prohibits or restricts the activity. Contravention of a notice without reasonable excuse is an offence. Right of appeal to the Magistrates Court exists within 21 days of the service of a noise abatement notice.

8.2.4 In determining if a noise complaint amounts to a statutory nuisance the Local Authority can take account of various guidance documents and existing case law; no statutory noise limits exist. Demonstrating the use of 'Best Practicable Means' (BPM) to minimise noise levels is an accepted defence against a noise abatement notice.

***Control of Pollution Act 1974***

- 8.2.5 Sections 60 and 61 of the Control of Pollution Act 1974 (CoPA) provide the main legislation regarding demolition and construction site noise and vibration. If noise complaints are received, a Section 60 notice may be issued by the local planning authority with instructions to cease work until specific conditions to reduce noise have been adopted.
- 8.2.6 Section 61 of the CoPA provides a means for applying for prior consent to carry out noise generating activities during construction. Once prior consent has been agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained on-site.
- 8.2.7 The CoPA requires that BPM (as defined in Section 72 of CoPA) be adopted for construction noise on any given site. CoPA makes reference to British Standard (BS) 5228 (British Standards Institute (BSI) (Ref 8-1) as BPM.

***Environmental Permitting Regulations 2010***

- 8.2.8 The Environmental Permitting Regulations 2010 require the application of Best Available Techniques (BAT) to activities performed within installations regulated by the legislation in order to manage the impact of these operations on the surrounding environment. This therefore just applies to the operational period, not construction.
- 8.2.9 In terms of noise specifically, the selection of BAT will have to be considered and balanced with releases to different environmental media (air, land and water) and to give due consideration to issues such as usage of energy and raw materials. Noise, therefore, cannot be considered in isolation from other impacts on the environment.
- 8.2.10 The definition of pollution within the Regulations 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 BPM to prevent or minimise noise nuisance. In the case of noise, “*offence of any human senses*” may be judged by the likelihood of complaints.
- 8.2.11 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. Consequently, the aim of BAT should be to ensure that there is no reasonable cause for annoyance to persons beyond the installation boundary.
- 8.2.12 Guidance regarding Environmental Permitting and noise is available in the Environment Agency’s Integrated Pollution Prevention and Control (IPPC) H3 document ‘Horizontal Guidance for Noise Part 2 - Noise assessment and Control’ (Ref 8-2). However, ‘Horizontal Guidance for Noise Part 1 – Regulation and Permitting’, which provided useful guidance relating to noise limits from industrial installations in terms of absolute rating levels and rating levels relative to background noise levels (as defined in BS 4142:2014 (Ref 8-3) (now superseded)) was withdrawn in February 2016. Therefore industry wide noise limits no longer apply.

## **Planning Policy Context**

### **National Planning Policy**

- 8.2.13 Section 5.11 of the Overarching National Policy Statement (NPS) for Energy (EN-1) (Ref 8-4) refers to the Government's policy on noise within the Noise Policy Statement for England (discussed further below) and sets out requirements for noise and vibration assessment for Nationally Significant Infrastructure Projects such as the Proposed Development.
- 8.2.14 At paragraph 5.11.8, with regards decision making, NPS EN-1 states; "*The project should demonstrate good design through selection of the quietest cost-effective plant available; containment of noise within buildings wherever possible; optimisation of plant layout to minimise noise emissions; and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission.*" Section 8.5 of this chapter describes the noise impact avoidance measures identified relevant to the Proposed Development.
- 8.2.15 The NPS for Fossil Fuel Electricity Generating Infrastructure (EN-2) (Ref 8-5) sets out policy specific to fossil fuel power stations. At paragraph 2.7.1, specific sources of noise identified that are relevant to the Proposed Development include; "*the gas and steam turbines that operate continuously during normal operation*". It reiterates at paragraph 2.7.5 the point made in NPS EN-1 that; "*the primary mitigation for noise from fossil fuel generating stations is through good design, including enclosure of plant and machinery in noise-reducing buildings wherever possible and to minimise the potential for operations to create noise*" and goes on to state that; "*Noise from gas turbines should be mitigated by attenuation of exhausts to reduce any risk of low-frequency noise transmission.*"
- 8.2.16 The NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (Ref 8-6) states at paragraph 2.20.4 that; "*A new gas pipeline may require an above ground installation such as a gas compression station on the route of the pipeline to boost transmission line pressure... These may be located in quiet rural areas, and therefore the control of noise from these facilities is likely to be an important consideration.*"

### **National Planning Policy Framework**

- 8.2.17 The National Planning Policy Framework (NPPF) was updated in July 2018 (Ref 8-7). The document sets out the Government's planning policies for England and how these are expected to be applied. The Framework supersedes the previous guidance document PPG 24 'Planning and Noise' (Ref 8-8).
- 8.2.18 The NPPF is a matter which the Secretary of State is likely to consider "relevant and important" in determining an application for a Development Consent Order (DCO).
- 8.2.19 The planning system is required to contribute to and enhance the natural and local environment. Consequently, the aim is to prevent both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution.

8.2.20 The NPPF states that planning policies and decisions should aim to:

- *“avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established [subject to the provisions of the Environmental Protection Act 1990 and other relevant law]; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.”*

8.2.21 With regards to ‘adverse effects’ and ‘significant adverse effects’ the NPPF refers to the Noise Policy Statement for England Explanatory Note (NPSE) (Ref 8-9), which is described below.

#### **Noise Policy Statement for England**

8.2.22 The NPSE seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. The NPSE applies to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise.

8.2.23 The statement sets out the long term vision of the government’s noise policy, which is to:

*“promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development”.*

8.2.24 This long term vision is supported by three aims:

- *“avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvements of health and quality of life”.*

8.2.25 The long term policy vision and aims are designed to enable decisions to be made regarding what is an acceptable noise burden to place on society.

8.2.26 The ‘Explanatory Note’ within the NPSE provides further guidance on defining ‘significant adverse effects’ and ‘adverse effects’ using the concepts:

- No Observed Effect Level (NOEL) - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observable Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

8.2.27 The three aims can therefore be interpreted as follows:

- The first aim is to avoid noise levels above the SOAEL;
- The second aim considers situations where noise levels are between the LOAEL and SOAEL. In such circumstances, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur; and
- The third aim seeks, where possible, to positively improve the health and quality of life through the pro-active management of noise whilst also taking account of the guiding principles of sustainable development. It is considered that the protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

8.2.28 The NPSE recognises that it is not possible to have single objective noise-based measures that define the SOAEL, LOAEL and NOEL that are applicable to all sources of noise in all situations. The levels are likely to be different for different noise sources, receptors and at different times of the day.

#### **Planning Practice Guidance**

8.2.29 In March 2014, DCLG released its Planning Practice Guidance (PPG) (Ref 8-10) web-based resource to support the NPPF. The guidance advises that local planning authorities' should consider:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and
- Whether or not a good standard of amenity can be achieved.

8.2.30 This guidance introduced the additional concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). Full details of the PPG on effects are provided in Table 8.1.

8.2.31 Factors to be considered in determining if noise is a concern are identified including the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative impacts.

8.2.32 With particular regard to mitigating noise impacts on residential development the guidance highlights that impacts may be partially off-set if residents have access to a relatively quiet façade as part of their dwelling or a relatively quiet amenity space (private, shared or public).

**Table 8.1: Planning Practice Guidance**

Perception	Examples of outcomes	Increasing effect level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
<b>Lowest Observed Adverse Effect Level</b>			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
<b>Significant Observed Adverse Effect Level</b>			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

**Local Planning Policy**

8.2.33 North Lincolnshire Council (NLC) does not have a published policy or guidance document on noise. However, direct contact was made with the Environmental Protection function of NLC during the preparation of the noise assessment for the proposed Gas Engine power plant, which is subject to an application under the

Town and Country Planning Act 1990 (TCPA, as amended) and is adjacent to the proposed development. The assessment methodology and approach was agreed and the same methodology that was used for the Gas Engine Site has been applied here. The feedback from NLC is summarised in the Consultation section of this Chapter below.

### ***Other Guidance***

#### **British Standard 7445-1:2003 and 7445-2:1991**

- 8.2.34 BS 7445 'Description and measurement of environmental noise' (Ref 8-11) defines parameters, procedures and instrumentation required for noise measurement and analysis.

#### **British Standard 5228:2009+A1:2014**

- 8.2.35 BS 5228-1 'Code of practice for noise and vibration control on construction and open sites. Noise' (Ref 8-12) provides a 'best practice' guide for noise control, and includes Sound Power Level ( $L_w$ ) data for individual plant as well as a calculation method for noise from construction activities. BS 5228-2 'Code of practice for noise and vibration control on construction and open sites. Vibration' (Ref 8-13) provides comparable 'best practice' for vibration control, including guidance on the human response to vibration.

#### **British Standard 6472:2008**

- 8.2.36 BS 6472-1 'Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting' (Ref 8-14) presents recommended frequency weighted vibration spectra (for continuous vibration) and vibration dose values (VDV) (for intermittent vibration) above which adverse comment is likely to occur in residential properties.

#### **British Standard 7385:1993**

- 8.2.37 BS 7385-2 'Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration' (Ref 8-15) presents guide values for transient and continuous vibration, above which there is a likelihood of cosmetic damage. The standard establishes the basic principles for carrying out vibration measurements and processing the data, with regard to evaluating vibration effects on buildings.

#### **British Standard 4142:2014**

- 8.2.38 BS 4142 'Methods for rating and assessing industrial and commercial sound' (Ref 8-16) can be used for assessing the effect of noise of an industrial nature, including mechanical services plant noise. The method compares the difference between 'rating level' of the industrial noise, with the 'background level' at the receptor position.

### **World Health Organisation**

- 8.2.39 The World Health Organisation's (WHO) 'Guidelines for Community Noise' (Ref 8-17) recommend external daytime and evening environmental noise limits, and internal night-time limits to avoid sleep disturbance.

- 8.2.40 The WHO 'Night Noise Guidelines for Europe' (Ref 8-18) recommend updated guidelines on night-time noise limits to avoid sleep disturbance.

#### **Calculation of Road Traffic Noise**

- 8.2.39 Department of Transport (DfT)/ Welsh Office Memorandum 'Calculation of Road Traffic Noise' (CRTN)' (Ref 8-19) describes procedures for traffic noise calculation, and is suitable for environmental assessments of schemes where road traffic noise may have an effect.

#### **Design Manual for Roads and Bridges**

- 8.2.41 The Highways England '*Design Manual for Road and Bridges Volume 11 Section 3 Part 7 HD213/11 (Revision 1) Traffic Noise and Vibration*' (DMRB) (Ref 8-20) provides guidance on the appropriate level of assessment to be used when assessing the noise and vibration effects arising from all road projects, including new construction, improvements and maintenance. The guidance can also be used for assessing changes in traffic noise levels as a result of non-road projects such as this.

### **8.3 Assessment Methodology and Significance Criteria**

#### **Elements scoped out of the assessment**

- 8.3.1 Operational traffic flows associated with the development are likely to be very minimal and predicted to be limited to private cars and occasional van deliveries. Chapter 7: Traffic and Transport conservatively assumes 30 additional vehicle movements per day, a negligible increase in vehicle movements. Therefore detailed assessment is not required and further assessment of operational traffic noise has been scoped out of this assessment.
- 8.3.2 No causes of significant vibration associated with operational generating plant are anticipated. The primary rotating equipment within the generator set will be balanced to a high degree and constantly monitored for any changes in the vibration levels it produces. The function of this monitoring will be to identify maintenance issues to allow rectification before potential damage can ensue. Therefore, further assessment of operational vibration has been scoped out of this assessment.

#### **Determining Baseline Conditions and Noise Sensitive Receptors**

##### **Noise Monitoring Locations and Protocol**

- 8.3.3 The location of potential noise sensitive receptors (NSRs) in proximity to the Site has been considered when assessing the effects associated with noise and vibration levels from the demolition, construction, operational and decommissioning phases of the Proposed Development.
- 8.3.4 It has been agreed in consultation with NLC that there is only one NSR with the potential to be significantly impacted by the Proposed Development. This is given the following definition:
- NSR 1: Hazeldene on Marsh Road, a residential property approximately 650 m east of the Proposed Development Site.

- 8.3.5 The distance quoted above is the approximate distance from the receptor to the location of the likely nearest noise generating item of the Proposed Power Plant Site (Fin Fan Coolers). This distance was used to determine the sound propagation attenuation during the construction noise assessment.
- 8.3.6 The existing Immingham CHP plant has been required to undertake regular (annual) noise monitoring at three locations around the site including Hazeldene. Noise monitoring has been undertaken on behalf of VPI since 2005 and, as result, there is now a dataset of background and ambient sound levels at the receptor measured over a period of 13 years. These measurements have been made in a variety of wind directions and show that in similar conditions the background and ambient levels at each monitoring location have been fairly consistent over the monitoring period.
- 8.3.7 The third party monitoring reports on these surveys show that appropriate instrumentation and methodologies have been used. It is therefore considered that these results represent a robust and representative record of the background sound levels in the area. It was agreed in consultation with NLC that this data would be used to derive the background sound levels for the assessment of noise from the Gas Engine site, which is subject to a separate TCPA application. The same data has been used for the Proposed Development.
- 8.3.8 Noise and vibration from construction have the potential to impact on non-residential receptors, such as the buildings and structures associated with the existing CHP site and the adjacent Lindsey Oil Refinery. However, due to the nature of the plant associated with the construction and given the significant distances to residential receptors, no significant vibration is expected and therefore detailed analysis is not required.

#### **Impact Assessment and Significance Criteria**

- 8.3.9 Effects are classified based on the magnitude of the impact and the sensitivity or value of the affected receptor. The criteria for assigning the magnitude of impacts are outlined below for the various potential impacts during construction, operation and demolition, and these are followed by a scale of receptor sensitivity in Table 8.9 and overall classification of effects matrix in Table 8.10.

#### **Assessment of Construction Noise Effects**

- 8.3.10 As a construction contractor has not yet been appointed, specific details on the construction activities, programme and number or type of construction plant are not yet available. Therefore, detailed construction noise predictions at specific NSRs have not been undertaken. Nevertheless, indicative demolition and construction noise predictions have been undertaken using the calculation methods set out in BS 5228:2009+A1:2014 (Ref 8-12), based upon construction information from other power stations and pipeline construction projects.
- 8.3.11 The calculation method provided in BS 5228 takes account of factors including the number and types of equipment operating, their associated Sound Power Levels (SWLs), their modes of operation (% on-times within the working period), the distance to NSRs, and the effects of any intervening ground cover or barrier/topographical screening. This allows prediction of the magnitude of impact.

- 8.3.12 The subsequent assessment of construction noise ‘effects’ at residential NSRs considers the guidance in ‘example method 1 – the ABC method’ as defined in BS 5228-1:2009+A1:2014. Table 8.2 (reproduced from BS 5228) provides guidance in terms of appropriate threshold values for residential NSRs, based upon existing ambient noise levels.

**Table 8.2: Construction noise thresholds at residential dwellings**

Assessment category and threshold value period	Threshold Value $L_{Aeq,T}$ dB(A) – free-field		
	Category A (a)	Category B (b)	Category C (c)
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends (d)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

NOTE 1: A potential significant effect is indicated if the  $L_{Aeq,T}$  noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total  $L_{Aeq,T}$  noise level for the period increases by more than 3 dB due to site noise.

NOTE 3: Applies to residential receptors only.

(a) Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

(b) Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.

(c) Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.

(d) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 – 23:00 Sundays.

- 8.3.13 For the appropriate period (day, evening, night, weekend etc.), the ambient noise level is determined and rounded to the nearest 5 dB and the appropriate Threshold Value is then derived. The predicted construction noise level is then compared with this Threshold Value. Based upon this BS 5228 ABC method, the criterion adopted in this assessment for the determination of potentially significant effects is the exceedance of the  $L_{Aeq,T}$  threshold level for the category appropriate to the ambient noise level at each NSR.
- 8.3.14 This is considered to be potentially equivalent to the SOAEL, although as stated in BS 5228, other project-specific factors, such as the number of NSRs affected and the duration and character of the impact should also be considered by the assessor when determining if there is a potentially significant effect. Similarly, the criterion for the LOAEL for this assessment is a predicted construction noise level equal to the existing ambient noise level at each NSR, i.e. resulting in a 3 dB increase in noise level when combined with the ambient noise level. Note that these criteria relate to residential NSRs only, in line with the ABC method.
- 8.3.15 In accordance with the NPPF and NPSE, it is important to identify NSRs that exceed the LOAEL and ensure adverse effects are mitigated and minimised. The assessment focuses on the impact at existing residential NSRs.

- 8.3.16 Based upon the above, the magnitude of the impact of construction noise is classified in accordance with the descriptors in Table 8.3.

**Table 8.3: Magnitude of construction noise impacts**

Magnitude of Impact	$L_{Aeq,T}$ dB (façade)
High	Exceedance of ABC Threshold Value by $\geq +5$ dB
Medium	Exceedance of ABC Threshold Value by up to +5dB
Low	Equal to or below the ABC Threshold Value by up to -5dB
Very low	Below the ABC Threshold Value by $\geq -5$ dB

#### Assessment of Daytime Construction Works Traffic on the Public Highway

- 8.3.17 The Proposed Development will affect traffic flows on existing roads in the area surrounding the Site during construction. The assessment focuses on the impact at existing residential properties located alongside the local road network.
- 8.3.18 Construction traffic noise has been assessed by considering the increase in traffic flows during the construction works, following the guidance of CRTN (Ref 8-19) and DMRB (Ref 8-20).
- 8.3.19 18-hour (06:00 – 24:00) Annual Average Weekday Traffic (AAWT) data have been obtained for the year 2020 ‘with’ and ‘without’ construction traffic during the peak construction period, in order to determine if any existing roads are predicted to be subject to a potentially significant change in 18-hour traffic flows. Basic Noise Level (BNL) calculations have been undertaken to predict the change in noise level between the ‘with’ and ‘without’ scenarios.
- 8.3.20 The criteria for the assessment of traffic noise changes arising from construction works have been taken from Table 3.1 of DMRB and are provided in Table 8.4 below.

**Table 8.4: Traffic noise criteria**

Magnitude of impact	Change in traffic noise level $L_{A10,18h}$ dB
High	$\geq 5$
Medium	3 to <5
Low	1 to <3
Very low	<1

- 8.3.21 DMRB advises that an increase in road traffic flows of 25% (where the traffic speed and composition remain consistent) equates to an increase in road traffic noise of 1 dB  $L_A$ . A doubling in traffic flow would be required for an increase in 3 dB  $L_A$ .
- 8.3.22 It is generally accepted that changes in noise levels of 1 dB  $L_A$  or less are imperceptible, and changes of 1 to 3 dB  $L_A$  are not widely perceptible. Consequently, at the selected road traffic noise receptors the magnitude of the predicted change in noise levels uses the scale shown in Table 8.6 above with

respect to construction traffic. The criteria are based on the current guidance on short-term changes in traffic noise levels in DMRB. The SOAEL is set at a change in traffic noise of +3 dB and the LOAEL at +1 dB.

### Assessment of Demolition and Construction Vibration Effects

#### *Effects on Humans – Annoyance*

- 8.3.23 Vibration due to construction activities has the potential to result in adverse impacts at nearby NSRs. The transmission of ground-borne vibration is highly dependent on the nature of the intervening ground between the source and receiver and the activities being undertaken. BS 5228-2: 2009+A1: 2014 provides data on measured levels of vibration for various construction works, with particular emphasis on piling. Impacts are considered for both damage to buildings and annoyance to occupiers.
- 8.3.24 Table 8.5 details Peak Particle Velocity (PPV) vibration levels and provides a semantic scale for the description of demolition and construction vibration effects on human receptors, based on guidance contained in BS 5228-2.

**Table 8.5: Construction vibration threshold at residential dwellings**

Peak Particle Velocity (PPV) level	Description	Magnitude of impact
>= 10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	High
1.0 to < 10 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.	Medium
0.3 to < 1 mm/s	Vibration might be just perceptible in residential environments.	Low
0.14 to < 0.3 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Very low

- 8.3.25 For residential receptors and other high sensitivity receptors, the LOAEL is defined as a PPV of 0.3 mm/s (millimetres per second), this being the point at which construction vibration is likely to become perceptible. The SOAEL is defined as a PPV of 1.0 mm/s, this being the level at which construction vibration can be tolerated with prior warning.
- 8.3.26 At receptors above the SOAEL, further consideration of whether an effect is significant is undertaken using professional judgement, taking account of the duration and frequency of the effect, as well as the time of evening/ night that the effect would be experienced.

#### *Effects on Buildings*

- 8.3.27 In addition to human annoyance, building structures may be damaged by high levels of vibration. The levels of vibration that may cause building damage are far in excess of those that may cause annoyance. Consequently, if vibration levels are

controlled by reference to those relating to annoyance (i.e. 1.0 mm/s), then it is highly unlikely that buildings will be structurally damaged by demolition and construction vibration levels.

- 8.3.28 The criteria used in this assessment relate to the potential for cosmetic damage, not structural damage. The principal concern is generally transient vibration, for example due to piling.
- 8.3.29 BS 7385-2: 1993 (Ref 8-15) provides guidance on vibration levels likely to result in cosmetic damage and is referenced in BS 5228-2: 2009+A1:2014. Guide values for transient vibration, above which cosmetic damage could occur, are given in Table 8.6.

**Table 8.6: Transient vibration guide values for cosmetic damage**

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mms <sup>-1</sup> at 4 Hz and above	
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

NOTE 1: Values referred to are at the base of the building.

NOTE 2: For un-reinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded

- 8.3.30 BS 7385-2:1993 states that the probability of building damage tends to zero for transient vibration levels less than 12.5 mm/s PPV. For continuous vibration, such as from vibratory rollers, the threshold is around half this value.
- 8.3.31 It is also noted that these values refer to the likelihood of cosmetic damage. ISO 4866:2010 (Ref 8-21) defines three different categories of building damage:
- Cosmetic: Formation of hairline cracks in plaster or drywall surfaces and in mortar joints of brick/concrete block constructions;
  - Minor: Formation of large cracks or loosening and falling of plaster or drywall surfaces or cracks through brick/block; and
  - Major: Damage to structural elements, cracks in support columns, loosening of joints, splaying of masonry cracks.
- 8.3.32 BS 7385-2:1993 defines that minor damage occurs at a vibration level twice that of cosmetic damage and major damage occurs at a vibration twice that of minor

damage. Therefore, this guidance can be used to define the magnitude of impact identified in Table 8.7 below.

**Table 8.7: Magnitude of impact – construction vibration building damage**

Magnitude of impact	Damage risk	Continuous vibration level PPV mm/s
High	Major	30
Medium	Minor	15
Low	Cosmetic	6
Very low	Negligible	<6

8.3.33 In the absence of specific information on likely construction and demolition activities and plant, a qualitative assessment based upon professional judgement has been undertaken. Again given the significant distance to residential receptors, and the adjacent refinery and CHP plant; no significant vibration is expected to result from the proposed construction or demolition activities and therefore further assessment of the effects of vibration on buildings is scoped out.

**Assessment of Operational Noise**

8.3.34 A noise propagation model was developed using CadnaA noise modelling software to assess the worst case supplier option for the Proposed Development. CadnaA implements the noise prediction method ISO 9613-2: 1996 ‘Attenuation of sound during propagation outdoors’ (Ref 8-22), which has been employed to calculate noise levels at surrounding NSRs due to noise breakout from the proposed buildings and plant at the Proposed Power Plant Site. The AGI does not contain any significant noise emitting plant/ sources and has therefore not been included within the noise model.

8.3.35 The noise model consists of a detailed three-dimensional representation of the Proposed Power Plant Site and surroundings. Representative noise level data for the key noise emitting plant/ buildings within the Proposed Development was derived based on calculations using noise level data provided by the Original Equipment Manufacturers (OEMs) based on the indicative concept designs for the Proposed Power Plant Site. The key sources considered were:

- Gas Turbine buildings;
- Exhaust Stacks, Coolers;
- Gas Turbine Air Inlet Housing; and
- Generator Transformers.

8.3.36 Topographical details and other building structures have not been included in the noise model due to the flat terrain of the surrounding area and the absence of any

significant screening between the proposed development and the NSR. The model has therefore been built on a flat plane with hard ground in the locations of the proposed plant, existing plant and roads and grass covered ground for all other areas. The model assumes that the prevailing wind direction is always from source to receiver. Both of these factors will produce a worst case, which is likely to overestimate the noise effect associated with the Proposed Development.

8.3.37 Based upon the predicted noise levels from the noise model, an assessment of potential noise impact at the nearby NSR has been undertaken using the guidance in BS 4142: 2014 (Ref 8-3).

8.3.38 A key aspect of the BS 4142 assessment procedure is a comparison between the Background Sound Level in the vicinity of residential locations and the Rating Level of the sound source under consideration. The relevant parameters in this instance are as follows:

- Background Sound Level – LA90,T – defined in the Standard as the “A-weighted sound pressure level that is exceeded by the residual sound for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels”;
- Specific Sound Level – L<sub>s</sub> (LA<sub>eq</sub>,Tr) – the “equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr”; and
- Rating Level – L<sub>A</sub>,Tr – the “specific sound level plus any adjustment made for the characteristic features of the sound”.

8.3.39 Whereas the previous version of BS 4142:1997 allowed for a single correction of +5 dB to be made to the Specific Noise Level if one or more of the distinguishable, impulsive or irregular features were considered to be present, BS 4142: 2014 (Ref 8-18) allows for corrections to be applied based upon the presence or expected presence of the following:

- Tonality: up to +6 dB penalty;
- Impulsivity: up to +9 dB penalty (this can be summed with tonality penalty); and
- Other sound characteristics (neither tonal nor impulsive but still distinctive): + 3 dB penalty.

8.3.40 Once any adjustments have been made, the background sound level and the rating level are compared. The standard states that:

- *“Typically, the greater the difference, the greater the magnitude of impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context.*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending upon the context.*

- *The lower the rating level is to the measured background sound level, the less likely it is that the specific sound 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, depending upon the context.”*

- 8.3.41 Importantly, as suggested above, BS 4142:2014 requires that the rating level of the noise source under assessment be considered in the context of the environment when defining the overall significance of the impact.
- 8.3.42 BS 4142:2014 suggests that a one hour assessment period is considered during the day and a 15-minute assessment period at night.
- 8.3.43 Table 8.8 below illustrates the adopted magnitude of impact scale used in this assessment based upon the numerical level difference. For BS 4142 assessment purposes the SOAEL is set at a rating level above the background sound level of +10 dB, and the LOAEL at +5 dB, although it should be remembered that the context assessment (including the absolute level of the sound under consideration) can vary the overall classification of effects. The table reflects the lack of hard boundaries within the assessment methodology of BS 4142 and the importance of context in the interpretation of its outputs.

**Table 8.8: Magnitude of impact for industrial noise**

Magnitude of impact	Effect on Residential NSR	Rating level – background sound level (dB)
High	Major depending on context	+14/ ≥+15
Medium/High	Major depending on context	+12/+13
Medium	Moderate depending on context (SOAEL = +10)	+9/+10/+11
Low/Medium	Moderate/Minor depending on context	+7/+8
Low	Boundary of BS 4142 adverse impact but Minor depending on context (LOAEL = +5)	+4/+5/+6
Very Low/Low	Minor	+2/+3
Very low	Negligible	≤0/+1

### ***Significance Criteria***

- 8.3.44 Effects are classified based on the magnitude of the impact and the sensitivity or value of the affected receptor. The criteria for assigning the magnitude of impacts are outlined for the various potential impacts during construction, operation and decommissioning, and these are followed by a scale of receptor sensitivity in Table 8.9 and overall classification of effects matrix in Table 8.10.

### ***Receptor Sensitivity***

- 8.3.45 In accordance with the principles of environmental impact assessment, the sensitivity of existing receptors to noise (or vibration) impacts during either construction, operational or decommissioning phases has been defined in Table 8.9.

**Table 8.9: Sensitivity/ value of receptors**

Sensitivity/ value of resource/ receptor	Description	Examples of receptor usage
Very high	Receptors where noise or vibration will significantly affect the function of a receptor	Auditoria/studios Specialist medical/teaching centres, or laboratories with highly sensitive equipment
High	Receptors where people or operations are particularly susceptible to noise or vibration. Sensitive ecological receptors known to be vulnerable to the effects of noise or vibration.	Residential Quiet outdoor areas used for recreation Conference facilities Schools/educational facilities in the daytime Hospitals/residential care homes Libraries Ecologically sensitive areas for example Special Protection Areas (SPAs)
Medium	Receptors moderately sensitive to noise or vibration where it may cause some distraction or disturbance	Offices Restaurants/retail Sports grounds when spectator or noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf)
Low	Receptors where distraction or disturbance of people from noise or vibration is minimal	Residences and other buildings not occupied during working hours Factories and working environments with existing high noise levels Sports grounds when spectator or noise is a normal part of the event

### ***Significance of Effects***

8.3.46 The following terminology has been used to define effects:

- Adverse: Detrimental or negative effects to an environmental resource or receptor;
- Neutral: Effects to an environmental resource or receptor that are neither adverse nor beneficial; or
- Beneficial: Advantageous or positive effect to an environmental resource or receptor.

8.3.47 The effect resulting from each individual potential impact type above is classified according to the magnitude of the impact and the sensitivity or value of the affected receptor using the matrix presented in Table 8.10 below, but where necessary also considering the context of the acoustic environment.

8.3.48 Where adverse or beneficial effects have been identified, these have been assessed against the following significance scale, derived using the matrix presented in Table 8.10:

- Negligible: Imperceptible effect of no significant consequence;

- Minor: Slight, very short or highly localised effect of no significant consequence;
- Moderate: Limited effect (by extent, duration or magnitude), which may be considered significant; or
- Major: Considerable effect (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards.

For the purposes of this assessment, negligible and minor effects are considered to be not significant, whereas moderate and major effects are considered to be significant.

**Table 8.10: Classification of effects**

Sensitivity/ value of resource/ receptor	Magnitude of impact			
	High	Medium	Low	Very low
Very high	Major	Major	Moderate	Minor
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible

### Extent of Study Area

- 8.3.49 The extent of the study area has been defined to include the nearest receptor to the site, Hazeldene to the east of the site. All other sensitive receptors are located significantly further away with some much closer to existing background sound sources. To the northwest, west, southwest and south of the site the land is in use by existing industrial facilities and there are no exposed sensitive receptors.
- 8.3.50 There are no further NSRs along the route accessing the proposed development along the A160, Humber Road and Rosper Road. The current road traffic flows along the route are very heavy due to traffic accessing the Car import/export site from the Ferry Terminal and the existing industrial facilities. Therefore, any noise associated with construction traffic is not expected to be significant. A detailed assessment of construction traffic is therefore scoped out.

### Sources of Information/ Data

- 8.3.51 The following sources of information had been reviewed and forms the basis of the assessment of likely significant effects of noise and vibration associated with the Proposed Development:
- Construction plant and equipment from similar power station and pipeline construction projects;
  - Construction noise data referenced from BS 5228 (Ref 8-1);

- Indicative concept layout plans for the Proposed Power Plant Site;
- Schedule of buildings and plant for the Proposed Power Plant Site, including Sound Power Levels (SWLs) and internal reverberant sound pressure levels, provided by OEMs;
- AAWT traffic data from the for the Proposed Development (see Chapter 7: Traffic and Transport);
- Ordnance Survey mapping of the Site and surrounding area; and
- Aerial photography.

## **8.4 Consultation**

- 8.4.1 Consultation undertaken during the preparation of this Chapter is presented in Table 8.11 below.

**Table 8.11: Consultation summary table**

Consultee	Date (method of consultation)	Summary of consultee comments	Summary of response/ how comments have been addressed
Annie Ward, Environmental Protection Officer, NLC	27th -29th March 2018 (telecom and follow up email)	<p>North Lincolnshire Council was contacted to discuss and agree the assessment methodology for the Gas engine site. The proposed methodology was:</p> <ul style="list-style-type: none"> <li>• Comparison of the predicted plant sound levels with the background sound level using the method set out in BS4142:2014.</li> <li>• Derivation of noise limits for the detailed design of the plant based on achieving noise levels below the Lowest Observed Adverse Effect Level (LOAEL).</li> <li>• Use of a single assessment location (Hazeldene)</li> <li>• Use of data from the routine CHP site noise monitoring for determination of the representative background sound levels.</li> </ul> <p>Annie Ward confirmed her department's agreement with this approach by email.</p>	The procedure agreed for the Gas Engine site to be adopted for the Proposed Development
Secretary of State (SoS)	July 2018	<ul style="list-style-type: none"> <li>• Baseline and Study Area: A concise description of the methods used to obtain the baseline data, and the location of where the baseline data has been collected from should be included within the ES. Paragraph 6.4.2 of the Scoping Report states that baseline data is currently collected annually; the baseline data should be sufficiently detailed to inform the assessment and appropriately represent baseline conditions. The baseline should also include the ambient noise level during night time.</li> </ul>	Included as part of this assessment

SoS	July 2018	<ul style="list-style-type: none"> <li> <b>Sensitive Receptors:</b>            The Applicant should ensure that sensitive receptors are listed within the ES and to increase clarity, the ES should also include a figure depicting sensitive receptors. The ES should include a thorough description of the criteria and methodology used to determine the sensitive receptors taking into account relevant standards and guidance. Impacts to nearby residential dwellings such as the lone dwelling on Marsh Lane should be assessed. The assessment should also include consideration of impacts to ecological receptors such as the designated and non-designated sites presented within Figure 3 of the Scoping Report.         </li> </ul>	Included as part of this assessment
		<ul style="list-style-type: none"> <li> <b>Noise Limits LOAEL and SOAEL:</b>            The ES should state the noise limit values and how they were determined. To be consistent with the Noise Policy Statement for England (NPSE) the LOAEL and SOAEL should be stated within the ES, and the methodology used for determining them should be included.         </li> </ul>	Included as part of this assessment
		<ul style="list-style-type: none"> <li> <b>Impacts from road traffic:</b>            No study area for the assessment of noise and vibration caused by road traffic (during both construction and operation) has been included within the Scoping Report. The ES should include a study area(s) that is robustly justified and is sufficient to ensure that the anticipated likely significant effects are assessed.         </li> </ul>	The study area is justified as part of this assessment
		<ul style="list-style-type: none"> <li> <b>Construction Noise and vibration:</b>            The Inspectorate considers that insufficient justification has been provided to support a decision to not undertake a quantitative assessment of construction and decommissioning noise and vibration impacts. The ES should include a thorough assessment describing the significant effects of construction noise. The assessment should be undertaken in accordance with relevant standards and guidance e.g. BS 5228 or equivalent.         </li> </ul>	Included as part of this assessment

SoS	July 2018	<ul style="list-style-type: none"> <li>• <b>Plant Layout:</b> The ES should specify the parameters relevant to the noise model and ensure that, where uncertainty exists and flexibility is sought, that the assessment reflects the worst case scenario with respect to noise impacts.</li> <li>• <b>Operational Effects:</b> If any assumptions have been made that are applicable to the noise model then these assumptions should be stated within the ES. Furthermore the noise model should present the residual noise level occurring post mitigation measures.</li> <li>• <b>Effects of transport and traffic:</b> The Applicant should ensure that there is a consistent description of the significant effects of the Proposed Development throughout the ES and provide an assessment where significant effects are likely.</li> <li>• <b>Monitoring:</b> The need for scope and approach to monitoring during construction and operation should be agreed with the relevant consultation bodies and included with the ES. The ES should outline the method that will be used to monitor and record noise complaints during the construction and operational phases of the Proposed Development.</li> <li>• <b>Decommissioning:</b> The ES should include an assessment of noise and vibration effects during the decommissioning where significant effects are likely to occur.</li> </ul>	<p>Included as part of the acoustic noise modelling, as part of this assessment</p> <p>Included as part of the acoustic noise modelling, as part of this assessment</p> <p>Included as part of this assessment</p> <p>Included as part of this assessment</p> <p>Included as part of this assessment</p>
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## 8.5 Baseline Conditions

### Existing Baseline

#### Noise Survey Results

8.5.1 As agreed with NLC during the TCPA application for the gas engine power plant the baseline conditions have been taken from the routine noise monitoring undertaken for the Immingham CHP site.

8.5.2 The routine monitoring only occurs at night when the sources of ambient and background sound are at their lowest level. Therefore the assessment will be based on the night time background sound levels. During the day the background sound levels will be higher so the impact of the Proposed Development will be lower than predicted based on the night time levels.

### Representative Background Sound Levels

- 8.5.3 The full results of the routine site noise monitoring at Hazeldene are given in Appendix 8A (PEI Report Volume III).
- 8.5.4 Section 8.1.1 of BS 4142 states that background sound level should be determined in; *“weather conditions that are representative or comparable to the weather conditions when the specific sound occurs”*. The propagation of sound from outdoor sources is significantly influenced by the weather. In particular the propagation down wind of a source can be 10 to 15 dB greater than that upwind. The prediction methodology used to derive the specific sound level for the generators (based on ISO 9613 (Ref 8-22)) assumes downwind conditions to the receptor. Therefore the predicted specific sound levels will only occur when the receptor is downwind of the source. Representative background sound levels must therefore be measured in similar conditions. Therefore, the data set was filtered so that only measurements sessions where the average wind direction was within a 120° arc (60°s each side) of the downwind condition were included for further analysis.
- 8.5.5 Section 8.1.4 of BS 4142 states that to obtain a representative value the dataset should be analysed statistically and then a judgment made. It clearly states that the lowest measured level should not be taken as representative. Therefore, after filtering for wind direction as described above the remaining levels were analysed and a representative value based on lowest 10th percentile of values was selected.

**Table 8.12: Summary of Representative Background and Ambient Sound Levels at the NSR**

Measurement Position	Representative baseline sound levels (night time)	
	Background sound level $L_{AF90}$	Ambient sound level $L_{Aeq}$
Location 1 – Hazeldene	49	53

- 8.5.6 The monitoring report states that the ambient and background sound at Hazeldene is dominated by existing industrial sources with additional contributions from distant roads and Motorways.

### Future Baseline

- 8.5.7 In the absence of the Proposed Development, future baseline noise levels at the NSR will depend largely on traffic flows on surrounding road/ rail networks and the future operations at other industrial and commercial premises. It is anticipated that the potential effects of the adjacent Gas Engine site will have a negligible effect on the future background sound levels due to the short and intermittent nature of their operation.

## **8.6 Development Design and Impact Avoidance**

### **Construction Noise**

- 8.6.1 Construction activities will typically be undertaken during weekday daytime and Saturday mornings, although some works during peak construction may take place outside of normal working hours, provided that they do not give rise to unacceptable noise impacts. Measures to mitigate noise will be implemented during the construction phase of the Proposed Development in order to minimise impacts at local residential receptors, particularly with respect to activities required outside of normal working hours.
- 8.6.2 The appointed contractor(s) will produce a Construction Environmental Management Plan (CEMP) that would provide details of proposed environmental control measures, including measures related to noise. The CEMP would include the impact avoidance measures as outlined in this section. A framework CEMP will be included in the ES to support the Application and the commitment to prepare a detailed CEMP will be secured through Requirement of the DCO.
- 8.6.3 Mitigation measures for inclusion within the CEMP include, but not be limited to:
- Abiding by construction noise limits at the identified NSR and monitoring of baseline and ongoing noise levels during construction;
  - Ensuring that all processes are in place to minimise noise before works begin and ensuring that BPM are being achieved throughout the construction programme, including the use of localised screening around significant noise producing plant and activities where appropriate;
  - Ensuring that modern plant is used, complying with the latest European noise emission requirements. Selection of inherently quiet plant where possible;
  - Hydraulic techniques for breaking to be used in preference to percussive techniques where practical;
  - Use of lower noise piling (such as rotary bored or hydraulic jacking) rather than driven piling techniques (if required), where possible;
  - All plant and equipment being used for the works to be properly maintained, silenced where appropriate, operated to prevent excessive noise and switched off when not in use;
  - Ensuring contractors to be made familiar with current legislation and the guidance in BS 5228 (Parts 1 and 2), which should form a prerequisite of their appointment;
  - Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around the Site to be conducted in such a manner as to minimise noise generation;
  - Consultation with NLC and local residents to advise of potential noisy works that are due to take place; and

- Monitoring of plant noise levels, noise complaints, and reporting to the contractor for immediate investigation.
- 8.6.4 Method statements regarding construction management, traffic management, and overall site management will be prepared in accordance with best practice and relevant British Standards, to help to minimise impacts of construction works. One of the key aims of such method statements will be to minimise noise disruption to local residents during the construction phase.
- 8.6.5 Consultation and communication with the local community throughout the construction period will also serve to publicise the works schedule, giving notification to residents regarding periods when higher levels of noise may occur during specific operations, and providing lines of communication where complaints can be addressed.
- 8.6.6 A detailed noise assessment will be carried out once the contractor is appointed and further details of construction methods are known, in order to identify specific mitigation measures for the Proposed Development (including construction traffic). A Requirement for the control of noise during construction would be included within the DCO, to ensure that noise impacts relating to construction activities are minimised through appropriate mitigation.
- 8.6.7 In addition, it is recommended that the contractor should be a member of the 'Considerate Constructors Scheme' which is an initiative open to all contractors undertaking building work.

### **Operational Noise**

- 8.6.8 The selection of the Proposed Power Plant Site and development of the indicative concept layout have included consideration of potential noise effects and proximity to the NSR. During the detailed design stage, potential significant residual noise effects will be mitigated by design (see Section 8.7 (Mitigation and Enhancement)). The generating station will be operated in accordance with an Environmental Permit, issued and regulated by the Environment Agency. This will require operational noise from the generating station to be controlled through the use of BAT, which will be determined through the Environmental Permit application.

## **8.7 Likely Impacts and Effects**

- 8.7.1 This section presents the findings of the noise and vibration assessment for the construction phase, the operational phase and the decommissioning phase of the Project.
- 8.7.2 This section identifies any likely significant effects that are predicted to occur and Section 8.7 highlights the additional mitigation and monitoring measures that are proposed to reduce or eliminate the identified significant effects if required.

### **Construction Noise and Vibration**

- 8.7.3 The duration of construction effects will be as during the construction process set out in Chapter 4. Noise levels experienced by local receptors during such works depend upon a number of variables, the most significant of which are:

- The noise generated by plant or equipment used on site, generally expressed as Sound Power Levels ( $L_w$ ) or the vibration generated by the plant;
- The periods of use of the plant on site, known as its on-time;
- The distance between the noise/ vibration source and the receptor;
- The noise attenuation due to ground absorption, air absorption and barrier effects;
- In some instances, the reflection of noise due to the presence of hard surfaces such as the sides of buildings; and
- The time of day or night the works are undertaken.

8.7.4 At this stage, the final construction methods are not confirmed, therefore the worst case indicative construction noise levels have been used based on information from other technically similar projects provided by the client and taken from published standards and AECOM archives.

8.7.5 The predicted construction sound level at NSR Hazeldene is given in Table 8.13 below.

**Table 8.13: Predicted Construction Sound Levels  $L_{Aeq,T}$**

NSR – Hazeldene, Distance to site centre	Construction Phase	Predicted Construction Sound Level, $L_{Aeq,T}$
650 m	Construction of the Power Generation Plant and Transformers	47

8.7.6 The ABC Threshold Value falls under Category C (55 dB) due to an Ambient sound level of 53  $L_{Aeq}$ . The predicted construction sound level for the power generation plant is below the Category C level in Table 8.2 by -8 dB. The magnitude of impact is predicted to be **Very Low** at the NSR, so considered to have a negligible effect and therefore not significant.

8.7.7 The level of impact due to vibration associated with construction activities at the NSR will be dependent upon a number of factors including distance between the works and receptor, ground conditions, the nature and method of works required close to the receptor and the specific activities being undertaken at any given time.

8.7.8 However, the NSR is not in close enough proximity to the Site to be significantly affected by construction vibration. However, there is the potential for some vibration impacts upon buildings on the adjacent CHP plant site. It is considered unlikely that most typical construction working routines would generate levels of vibration above which building damage would be expected to be sustained.

8.7.9 Where piling, heavy earthworks, vibratory rollers or other significant vibration producing operations are proposed in close proximity to any existing sensitive buildings, further consideration would be given to potential impacts, once the

contractor is appointed and the construction methods requirements are developed. It is not possible at this stage to evaluate what the vibration levels produced might be. The vibration limits set out in this Chapter would be included as part of the CEMP. As the construction of the Proposed Development is within the control of the Applicant, any identified issues can be effectively managed by the Applicant and their contractor(s). Potential measures to ensure that appropriate mitigation is in place during the works are described in later in this Chapter.

### **Operational Noise**

- 8.7.10 Operational noise modelling has been undertaken for the worst-case indicative concept layout (see Figure 8.2 in PEI Report Volume II). Certain assumptions have been made about the exact location of some source components. These will be adjusted if information becomes available through more detailed design. The assessment described below sets out the impacts and effects associated with long-term operation of the Proposed Development.
- 8.7.11 The following assumptions have been made when undertaking the operational noise modelling for the worst-case layout scenario:
- The Proposed Development will operate continually at full load, 24 hours a day (note this is an absolute 'worst case' assumption for the purposes of the noise assessment and is highly unlikely to occur in practice. The nature of the Proposed Development is such that it is intended for intermittent operation);
  - The model of the proposed development is based on indicative plan layouts and noise levels provided by OEMs for all principal noise emitting buildings/elements (Gas Turbine buildings, Exhaust Stacks, Coolers, Gas Turbine Air Inlet Housing and Generator Transformers) and are understood to be external radiated Sound Power Levels (SWLs);
  - The noise data provided by OEMs for the Proposed Development includes two designs - a standard and a low noise design. For the purposes of modelling the standard design was used for worst-case, with the low noise options available if levels were not to be met at the NSR;
  - For the Gas Turbine building where items of particularly noisy equipment will be housed, a reverberant room method was used to calculate the sound power level being radiated by each façade of the building. These facades were then modelled as area and vertical area sources using the sound power per facade calculation method in CadnaA;
  - The reverberant room calculations assumed typical areas and absorption coefficients for each of the elements within the space and typical build constructions and sound reduction indices for the different elements of the facades (walls, solid doors, louvre doors and open louvres);
  - All other elements have been modelled as individual point sources, either located 1 m above the top of the corresponding building, or 1 – 3m above ground level;

- Corrections for tonality, impulsivity, and intermittency have not been applied in the model on the assumption that these potential features will be designed out of the Proposed Development during the detailed design phase by the selection of appropriate plant, building cladding louvres and silencers/attenuators. However, for the purposes of the BS 4142 Assessment (Table 8.16) a 3 dB penalty correction will be applied due to the intermittent nature of operation of the site.

8.7.12 Details of the noise source SWL data, the settings used in the noise modelling software and the list of assumptions used are presented in Appendix 8B (ES Volume III).

8.7.13 The predicted free-field operational specific sound level at the NSR nearest to the Proposed Power Plant Site is presented below in Table 8.14. The result presented is the highest predicted at the NSR within the vicinity of the monitoring location. Assuming continual 24-hr operation, the predicted noise level could apply to 1-hour daytime or 15-minute night-time BS 4142 assessment periods.

**Table 8.14: Predicted Operational Sound Levels – Proposed Power Plant Site Scenario**

Receptor	Predicted operational specific sound level $L_{Aeq,1h}$ dB
NSR 1 – Hazeldene	47

8.7.14 The operational noise assessment has identified absolute sound level criteria that have to be achieved at the identified NSR. Using representative background sound levels presented in Table 8.12 and following the approach agreed with NLC’s Environmental Protection officer, the acceptable rating Levels at the NSR are defined as being no more than +5 dB above background Sound Level as shown in Table 8.15.

**Table 8.15: Operational Noise Criteria – (Representative Existing Background + 5 dB)**

Receptor	Night-time LAF90 dB (23:00-07:00 hrs)
NSR 1 – Hazeldene	54

8.7.15 The night-time BS 4142 assessment for receptor NSR1 is presented in Table 8.16. An acoustic character correction of +3 dB has been applied due to the intermittent operation of the site. In addition, the magnitude of impact and effect classification has been included based upon the BS 4142 assessment outcomes, with reference to the semantic scales in Tables 8.8, 8.9 and 8.10. The representative background sound levels used are those presented in Table 8.12, to present an assessment against existing baseline conditions.

**Table 8.16: Night-time BS 4142 Assessment at NSR1 Hazeldene**

Receptor: NSR 1 – Hazeldene	Proposed Power Plant Site Scenario
Specific Sound Level, $L_s (L_{Aeq,Tr})$ , dB	47

Receptor: NSR 1 – Hazeldene	Proposed Power Plant Site Scenario
Acoustic feature correction, dB	+3
Rating Level ( $L_{Ar,Tr}$ ), dB	50
Representative Background Sound Level, ( $L_{A90,T}$ ), dB	49
Excess of rating level over background sound level, ( $L_{Ar,Tr} - L_{A90,T}$ ), dB	+1
Magnitude of impact (assigned from Table 8.8)	Very low
Classification of effect (assigned from Table 8.10)	Negligible

Uncertainty: Various statistical analysis methods may have been used to determine 'representative' background sound level values at the NSR for 2017 (the most recent survey undertaken) and other sources of noise may have changed in the intervening period. However, these monitoring reports have been examined and it is felt measurements have been undertaken competently and result in a robust representative background sound level.

- 8.7.16 The assessment predicts very low impact and negligible effects at the NSR. This assessment is based upon night time background sound levels; the daytime background sound levels will be higher so the impacts and effects will be even lower. These predicted effects are below the local authority agreed criterion for minor adverse (not significant) effects (+5 dB).
- 8.7.17 Given that operation of the Proposed Development will be 24 hours, provided that noise levels are acceptable during night-time hours, they will automatically be acceptable during the daytime period when existing ambient noise levels are higher.

### Decommissioning and Demolition

- 8.7.18 The predicted noise effects of eventual decommissioning and demolition of the Proposed Development are considered to be comparable to – or less than as the operations are generally similar.– those assessed for construction activities. They would be managed through the use of a Demolition Environmental Management Plan in a similar way to the use of a CEMP as proposed during construction, secured by a requirement in the DCO.

## 8.8 Mitigation and Enhancement Measures

### Construction

- 8.8.1 The assessment predicted that there is the potential for no more than negligible adverse noise effects at residential NSRs during construction works. Therefore, no further specific mitigation or monitoring measures have been identified at this stage. If work is required outside normal working hours, additional management, controls and mitigation may be required as controlled through the CEMP.

### Operational Noise

8.8.2 Assessment of the Proposed Development, in particular the scenario derived from the Example Layouts described as part of the Rochdale Envelope has resulted in negligible noise and vibration effects predicted. The necessary noise controls will be built in to the detailed design as described in Section 8.5. As such no additional mitigation is required.

### Cumulative Effects

8.8.3 Adjacent to the Proposed Development is the VPI Immingham Energy Park A Gas Engine site, which is intended to run intermittently and occasionally in response to peak load demand. There have been two scenarios put forward for the Gas Engine site and planning permission has already been granted. It is possible that both the OCGT and Gas Engine sites will at times operate simultaneously as a worst case situation.

8.8.4 There is potential for the NSR to experience cumulative effects generated by the operational phase of the Proposed Development Project in combination with the Gas Engine scheme. A cumulative BS 4142 assessment has been carried out in Table 8.17 using the scenario from the Gas Engine Site development with the highest operational sound level in order to assess a worst case cumulative scenario. The magnitude of impact and effect classification has been included based upon the BS 4142 assessment outcomes, with reference to the semantic scales in Tables 8.8, 8.9 and 8.10.

8.8.5 In the original BS 4142 Assessment of the Gas Engine site, a conservative character correction of +5 dB was applied, on the assumption that the engine exhausts may include some residual tonal characteristics, though the intention was for these potential features to be designed out of the Proposed Development during the detailed design phase. In the BS 4142 Assessment for the OCGT site (see Table 8.16) an acoustic character correction of +3 dB was applied due to the intermittent operation of the site as residual tonal components are not anticipated.

8.8.6 The combined noise of the two plants may still contain some tonal components from the Gas Engine Site. Therefore +5 dB correction will be applied to the cumulative specific sound level.

**Table 8.17: Cumulative BS 4142 Assessment at NSR1 Hazeldene with both sites operating**

Receptor: NSR 1 – Hazeldene	Simultaneous Operation of OCGT and Gas Engine Site
OCGT Site 'worst case' Specific Sound Level, $L_s (L_{Aeq,Tr})$ , dB (OCGT Option 1)	47
Gas Engine Site 'worst case' Specific Sound Level, $L_s (L_{Aeq,Tr})$ , dB (Gas Engine Scenario 1)	44
Cumulative Specific Sound Level, $L_s (L_{Aeq,Tr})$ , dB	49
Acoustic feature correction, dB	+5

Receptor: NSR 1 – Hazeldene	Simultaneous Operation of OCGT and Gas Engine Site
Rating Level ( $L_{Ar,Tr}$ ), dB	54
Representative Background Sound Level, ( $L_{A90,T}$ ), dB	49
Excess of rating level over background sound level, ( $L_{Ar,Tr} - L_{A90,T}$ ), dB	+5
Magnitude of impact (assigned from Table 8.8)	Low
Classification of effect (assigned from Table 8.10)	Minor

Uncertainty: See Table 8.16

- 8.8.7 BS 4142 states that a difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context. However, the prevailing noise environment in the area is dominated by existing industrial sources. In addition, the predicted effects are equal to the local authority agreed criterion for minor adverse (not significant) effects (+5 dB).

## 8.9 Limitations or Difficulties

### Construction

- 8.9.1 Detailed construction information is not yet available (because the contractor not yet been appointed) and therefore this assessment is purely qualitative based upon experience of similar projects. However the assessment is considered to be robust due to the nature of the area around the site and the scale of the construction which is expected to take place. However, construction noise thresholds (limit values) have been provided in Table 8.2, and further assessment has been identified to ensure that appropriate mitigation is developed to achieve the values below the Category C threshold once the contractor is appointed. This and other mitigation measures detailed above, which are likely to be secured by planning condition if necessary, will help to ensure that construction noise and vibration is minimised.

### Operation

- 8.9.2 As outlined previously, the operational noise is assessed against the background sound levels obtained during the night time surveys undertaken from 2005 to 2017 as part of the ongoing noise monitoring for the existing CHP plant. There are uncertainties involved with the use of this data as there would be with any background sound measurement; other sources of noise may have changed in the intervening period. However in view of the nature of the area these uncertainties are no greater than those which would be associated with a single occasion survey undertaken specifically for this assessment. The full set of third party noise monitoring reports have been examined and demonstrate that the measurements have been undertaken competently and result in a robust representative background sound level.

- 8.9.3 It is considered that the assumptions made during the noise modelling and assessment of the Proposed Development will have led to a conservative ('worst case') assessment.

## **8.10 Residual Effects and Conclusions**

- 8.10.1 As the proposed development meets the limits for all noise generating activities arising from the construction, operational and decommissioning phases of the development, residual impacts will be the same as the predicted impacts.
- 8.10.2 A summary of the residual effects, assuming the implementation of all appropriate mitigation to reduce noise and vibration during demolition/ construction and operational phases, is presented in Table 8.18 below.

**Table 8.18: Summary of Significant Effects**

Development stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation
Construction	Noise effects during construction of the Proposed Development	Expected negligible at nearest residential NSR during daytime.	Further detailed assessment and CEMP once principal contractor appointed, particularly regarding working outside of daytime working hours	Negligible at nearest residential NSR
Operation – night time	Operation of the generators	Negligible	N/A	Negligible
Operation – daytime	Operation of the generators	Negligible	N/A	Negligible
Decommissioning and demolition	Noise effects during decommissioning of the Proposed Development	Expected negligible at nearest residential NSR during daytime.	Further detailed assessment and CEMP once principal contractor appointed, particularly regarding working outside of daytime working hours	Negligible at nearest residential NSR

## **8.11 References**

- Ref 8-1 British Standards Institute (2014) *BS 5228-1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites.*
- Ref 8-2 Environment Agency (2002) *Integrated Pollution Prevention and Control (IPPC) H3 document Horizontal Guidance for Noise Part 2 - Noise assessment and Control*
- Ref 8-3 British Standards Institute (2014) *BS 4142 – Methods for rating and assessing industrial and commercial sound*
- Ref 8-4 Department of Energy and Climate Change (2011) *Overarching National Policy Statement for Energy EN-1*
- Ref 8-5 Department of Energy and Climate Change (2011) *National Policy Statement for Fossil Fuel Generating Infrastructure (EN-2)*
- Ref 8-6 Department of Energy and Climate Change (2011) *National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)*
- Ref 8-7 Ministry of Housing, Communities and Local Government (2018) *National Planning Policy Framework*
- Ref 8-8 Department for Communities and Local Government (1994) *Planning Policy Guidance 24: Planning and Noise*
- Ref 8-9 Department for Environment, Food and Rural Affairs (2010) *Noise Policy Statement for England (NPSE)*
- Ref 8-10 Department for Communities and Local Government (2014) *Planning Practice Guidance*
- Ref 8-11 British Standards Institute (1991) *BS 7445-2 – Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use*
- Ref 8-12 British Standards Institute (2014) *BS 5228-1:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites. Part 1: Noise.*
- Ref 8-13 British Standards Institute (2014) *BS 5228-2:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites. Part 2:Vibration*
- Ref 8-14 British Standards Institute (2008) *BS 6472-1 – Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*
- Ref 8-15 British Standards Institute (1993) *BS 7385-2 – Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration*
- Ref 8-16 British Standards Institute (2014) *BS 4142 – Methods for rating and assessing industrial and commercial sound*
- Ref 8-17 World Health Organisation (WHO) (1999) *Guidelines for Community Noise*
- Ref 8-18 World Health Organisation (WHO) (2009) *Night Noise Guidelines for Europe*
- Ref 8-19 Department of Transport/ Welsh Office (1998) *Calculation of Road Traffic Noise (CRTN)*

- Ref 8-20 Highways Agency (2011) *Design Manual for Road and Bridges Volume 11 Section 3 Part 7 HD213/11 (Revision 1) Traffic Noise and Vibration*
- Ref 8-21 International Standards Organisation (2010) *ISO 4866:2010 Mechanical vibration and shock – vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures.*
- Ref 8-22 International Standards Organisation (1996) *ISO 9613 Acoustics - Attenuation of sound during propagation outdoors.*