9 Noise and Vibration

9.1 Introduction

This chapter of the Environmental Impact Statement describes the prevailing noise and vibration conditions in the area surrounding the proposed development, predicts the impacts on same arising from the proposed development and, where considered appropriate, mitigation measures have been specified. It is divided into the following sub-sections:

9.1 Introduction

9.2 Methodology

- *Baseline Noise Survey*
- *Assessment Criteria*
- *Construction Noise Prediction Methodology*
- *Noise Propagation Model*

9.3 Existing Noise Environment

- *Noise Sensitive Receptors*
- *Description of the existing noise environment*

9.4 Noise Impacts

- *Construction Phase Impacts*
- *Operational Phase Impacts*

9.5 Noise Mitigation Measures

- *Construction Phase Mitigation*
- *Operational Phase Mitigation*

9.6 Residual Impacts

9.2 Methodology

The assessment undertaken for this chapter of the EIS includes the following elements:

- a baseline noise survey, and description of the existing noise environment;
- development of assessment criteria to set acceptable noise levels at sensitive receptors for both the construction and operation phases;
- prediction of noise levels for construction and operational phases; and
- evaluation of the effects of noise during both construction and operation.

Power plants are not considered as significant sources of operational vibration which could give rise to nuisance or damage to properties. During construction of the facility there could be potential for the generation of vibration from sources such as pile driving and the use of vibrating rollers. However, given the distance from the proposed development location to the closest sensitive receptor, approximately 1,100m, it is considered unlikely that any construction activity could cause an impact at the sensitive receptors. Therefore, vibration will not be a significant issue at this site, and as such has been scoped out of this impact assessment.

9.2.1 Baseline Noise Surveys

An important consideration in assessing the noise impact of the proposed development is the change in ambient noise levels that it produces at noise sensitive receptors (NSR). Baseline noise surveys have been carried out accordingly, close to potentially affected receptors. During the surveys, a series of 15 minute samples of ambient noise were measured in accordance with *British Standard (BS) 7445: Description and measurement of environmental noise, Part 1, Guide to quantities and procedures, BSi, 1991.*

Baseline monitoring was carried out on the 20th and 21st May 2008, at five locations around the site. The noise monitoring locations (NML) are identified in Figure 9.1 *Baseline Noise Monitoring Locations and Noise Sensitive Receptors*. A description of the monitoring locations is given in Table 9.1 *Description of Noise Monitoring Locations,* and a summary of the results of the monitoring is presented in Table 9.2 *Baseline Noise Level Summary dB Free-Field.* Details of this noise survey can be found in Appendix 6A *Baseline Noise Survey Details.*

Noise measurements were carried out using a B&K 2238 Class 1 Sound Level Meter, which was calibrated before, during and after the survey period. Weather conditions for the survey on the 20th and 21st of May were overcast, dry and calm. Measurements were only undertaken during periods of suitable weather conditions.

Table 9.1: Description of Noise Monitoring Locations

Ref.	Location	Receptor Represented by Monitoring Location	Description
NML1	Approx. 1.75km north west of proposed the site	A two storey house located 150 metres to the north west of NML1.	In a lay-by at the side of the R400. A two storey house is located approximately 150 metres to the north west. A field is situated between the monitoring location and the house. Traffic on the road was the dominant noise source. During the day, there was some audible noise from the Roadstone quarry when there was no traffic on the road. Ambient noise levels are considered to be normal for a rural setting. In the absence of traffic there were no other significant noise sources present at night.
NML2	Field at back of BNM site	No residential receptors. BNM site and workshop only.	The BNM site and workshop is situated approximately 100 metres south west of the monitoring location. Noise sources from the BNM workshop and distant traffic sounds from the R400 were the dominant noise sources during the day. Ambient noise levels are considered to be normal for a rural setting. At night there were no significant noise sources and the noise levels were low.
NML3	Approx. 1 km south east of the proposed site	A two storey house 200 m west of NML3.	Located in a track 200 metres west of a two storey house. A field with heavy and thick hedgerows is situated between the monitoring location and the house. Distant noise from the R400 was the dominant noise source during the day. Intermittent dog barking from the nearest property was encountered during all daytime monitoring periods. Ambient noise levels are considered to be normal for a rural setting. At night there were no significant noise sources and the noise levels were low.
NML4	Approx. 1.5 km south west of the proposed site	A two storey house 80 m north west of NML4.	In a lay-by at the side of the R400. A two storey house is located approximately 80 metres to the north west. A field is situated between the monitoring location and the house. Traffic on the road was the dominant noise source. Ambient noise levels are considered to be normal for a rural setting. In the absence of traffic there were no other significant noise sources present at night.
NML5	Approx. 1.5 km south of the proposed site	Commercial unit and office.	The noise location was on an access road to a piggery. A farm building and office are located beside the noise location. A small quarry is located approximately 100 metres west of the noise location and background quarry noise (HGV reversing and heavy machinery working) was the dominant sound during the day. There was also occasional quarry traffic (HGVs) passing on the access road. The road only offers access to the piggery and the quarry. Ambient noise levels are considered to be normal for a rural setting. There was no quarry activity at night and the noise sources at night were low.

Table 9.2: Baseline Noise Level Summary dB Free-field

NML	Lowest Measured Daytime Noise Levels 08:00 – 22:00 (dB)		Lowest Measured Night-time Noise Levels 22:00 – 08:00 (dB)		Measured L_{AFmax} Range (dB)
	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	
1	60	39	34	21	60 – 91
2	45	39	30	23	55 – 65
3	44	36	33	20	63 – 69
4	64	39	31	21	57 – 86
5	46	39	32	20	54 – 85

9.2.2 Assessment Criteria

The proposed power plant will consist of two generating units located on the site at Derrygreenagh. These are a flexible combined cycle gas turbine unit (CCGT) of c. 430 MW and a reserve/peaking open cycle gas turbine unit (OCGT) of c. 170 MW. The evaluation of the potential noise impacts arising from the construction and operation of the proposed development require the determination of criteria against which predicted noise levels are to be assessed. These levels have been derived from recognised national and international guidance. There are no legal noise limits in planning legislation and Offaly County Council have not developed any specific guidance for the county. The relevant guidance is referenced throughout this assessment report. Where noise predictions show a potential for significant impacts, possible mitigation measures are set out. Any residual impacts remaining after mitigation are described. It should be noted that a small or minor exceedance of any assessment criteria does not necessarily indicate that mitigation is required or that the impact is unacceptable. However, the potential for mitigation of significant impacts must be investigated as part of the Environmental Impact Assessment process.

(i) Proposed Construction Noise Assessment Criteria

The construction phase of a development is often the period over which any potential for noise impact is greatest. There are difficulties in applying the same noise control measures to temporary construction activities as are applied to fixed and permanent installations or operations. The reasons for this are as follows:

- for construction work, noise control measures can be restrictive and could unreasonably prolong the site works and construction programme;
- works areas are not fixed and change according to the demands of the construction work;
- work, in the initial stages at least, is conducted out of doors without the noise abatement benefits of fixed plant houses; and
- mobile plant is used which limits the scope for noise control measures.

Advice and guidelines to local planning authorities and developers in the UK can be found in *Planning Policy Guidance Note PPG 24*, *British Standard BS 5228,* and *Department of the Environment (DoE) Advisory Leaflet (AL) 72*. AL 72 is out of print, but remains as a paper giving guidance on acceptable levels of noise. PPG24 refers to the guidance in BS 5228: *Noise and vibration control on construction and open sites - Code of practice for noise and vibration control applicable to piling operations,* in respect of construction noise. These guidelines are considered to be transferable and appropriate for construction projects in the Republic of Ireland. The *National Roads Authority's Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004,* also provide guidance in relation to acceptable noise levels during construction.

DoE Advisory Leaflet (AL) 72 gives advice as to maximum levels of construction site noise at residential locations during daytime hours, 07:00 - 19:00. Since the criterion of speech interference forms the basis for the recommendations, they can be applied to commercial / office buildings. The leaflet states that the noise level outside the nearest occupied room should not exceed:

- 75dB(A) in urban areas, near to main roads in heavy industrial areas; or
- 70dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise.

These levels are generally taken as being at the façade of a building. (AL) 72 also suggests that in the evening period a level of 10 dB (A) below that during the day may be appropriate. Although BS 5228: *Noise and vibration control on construction and open sites - Code of practice for noise and vibration control applicable to piling operations,* does not propose noise criteria for daytime. It suggests that acceptable noise levels in the evening, 19:00 - 23:00, may need to be 10 dB(A) lower than daytime levels. The daytime assessment criteria which are used for evaluating the significance of construction noise are based on criteria set out in the UK *Department of the Environment (DoE) Advisory Leaflet 72*.

The NRA guidance suggests that noise levels of 70 dB(A) L_{Aeq} between daytime hours, 07:00 - 19:00, and 60 dB(A) L_{Aeq} between evening hours, 19:00 - 22:00, are acceptable. The NRA also outlines acceptable levels for weekend and holiday periods, which are noise levels of 65 dB(A) L_{Aeq} between daytime hours, 07:00 - 19:00 on Saturday and 60 dB(A) L_{Aeq} between 08:00 - 16:30 hours on Sunday and Bank holidays.

A summary of the relevant criteria for the assessment of the effects of construction noise is set out in Table 9.3 *Threshold Criteria for Evaluating the Effects of Noise during Construction.* The noise levels set out in Table 9.3 are not aimed at providing noise limits for construction activities, but are the threshold criteria used for the assessment of construction noise effects. A night-time noise criteria level has been included. However, no significant level of night-time construction work is anticipated during the construction phase of the proposed development.

Table 9.3: Threshold Criteria for Evaluating the Effects of Noise during Construction

Period	Building/Location	Criteria for Assessment $L_{Aeq, 1\ hour}$	Purpose
Daytime 07:00 – 19:00	Dwellings/Offices (façade)	70 dB	To maintain speech intelligibility
Daytime 07:00 – 19:00	Schools	65 dB	To maintain speech intelligibility in classrooms
Evening 19:00 – 22:00	Dwellings (façade)	60 dB	To avoid sleep disturbance
Night-time 22:00 – 07:00	Dwellings (façade)	45 dB	To avoid sleep disturbance
Saturday 08:00 - 16:30	Dwellings (façade)	65 dB	To avoid disturbance
Sundays and Bank Holidays 08:00 - 16:30	Dwellings (façade)	60 dB	To avoid disturbance

The approach that has been adopted in the assessment to determine the potential noise effect from construction activities compares predicted noise levels for each period of the construction phase with the noise criteria in Table 9.3 *Threshold Criteria for Evaluating the Effects of Noise during Construction.* In cases where predictions show that these criteria will be exceeded, for at least a few days, a significant potential effect has been reported. Where possible, noise measurements from similar construction activities are used to inform this assessment.

Increases in road traffic noise of 3 dB(A) or more have been considered potentially significant for construction traffic. Changes in noise levels that are just above the criteria set, and that are likely to apply for a short period, have not been considered significant.

(ii) Proposed Operational Noise Assessment Criteria

The operation of a combustion installation, with a rated thermal input equal to or greater than 50MW, requires an IPPC licence from the Environmental Protection Agency (EPA). Noise guidance has been issued by the EPA, *Guidance Note for Noise In Relation To Scheduled Activities, 2nd Edition, 2006*, which suggests that daytime (08:00 – 22:00) and night-time (22:00 – 08:00) noise levels should not exceed the levels indicated below, at noise sensitive locations:

Daytime	$L_{Ar,T}$	55dB(A) free-field
Night-time	$L_{Aeq,T}$	45dB(A) free-field

The average running time for the CCGT unit is *c.* 16.5 hours per day, based on annual running of 6,000 hours per year. However, this unit will operate up to 24 hours a day for certain periods, as dispatched by the Transmission System Operator, (TSO), depending on demand, wind generation and alternative generating capacity available on the grid.

It is expected that the OCGT unit will have a much lower load factor, with annual running of *c.* 500 hours per annum. It will typically operate during the morning rise (06:00 – 09:00) and during the evening peak (17:00 – 19:00). In certain situations, for example where several unit outages coincide or constraints on the transmission network need to be alleviated, it will run at other times during the day or night. As such the night-time period, with its lower noise limits, will be most critical to the assessment of both units. Noise levels from both units have therefore been considered both during the day and night-time periods.

The EPA Guidance Note mentioned above also recommends that in quiet areas, where background levels are 'very low', below approximately 35 dB L_{A90}, lower noise limits may be more appropriate. As described in Table 9.4 *Noise Assessment Criteria* below, background noise levels, L_{A90} at night, at all receptors fall below 35 dB. Night-time noise levels are being used in the assessment as both the CCGT unit and the OCGT unit will occasionally operate together during the night time period (22:00 – 08:00). *BS 4142, Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas, BSi, 1997* is referred to in the EPA guidance for the method of determining the rating level of an industrial noise source. This standard is more appropriate for industrial installations in an urban / industrial context, rather than a rural location. In the absence of an equivalent standard, dealing with industrial noise sources in a rural environment, BS4142 has been used to establish the noise assessment criteria. Further to this, the World Health Organisation guidelines entitled " *Guidelines for Community Noise (WHO, 2000)*" has also been considered. These guidelines specify that 30dB(A) is the level required for the onset of sleep disturbance (30dB(A)

The *BS 4142: Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas* standard recommends comparison of existing environmental noise levels with predicted operational plant noise levels, in terms of the calculated Rating Level. Calculation of the Rating Level includes an additional penalty, in dB, to account for any tonal or impulsive acoustic features of the introduced noise. The comparison supplies a means of forecasting the reaction of the public in exposure to industrial noise.

An exceedance of background (L_{A90}) levels of about 5 dB is considered to be 'marginal' in *BS 4142: Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas*, while complaints are considered likely where the noise rating level exceeds the background by 10 dB or more. As such, it will be preferable to design the plant ($L_{Aeq, T}$) to a level that is no more than 5 dB above the background noise levels, whilst ensuring the plant noise rating level does not exceed the background level by 10 dB or more in order to avoid significant disruption and complaints. This assumes that the plant does not give rise to any acoustic features such as tonal noise or intermittent noise events. The standard requires that daytime assessments are based on the highest L_{Aeq} from the noise source over a period of one hour, while at night an assessment period of five minutes is specified.

The baseline survey revealed that the minimum background (night-time) noise level at all receptors was less than or equal to 30 dB L_{A90}. *BS 4142: Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas* suggests, similarly to the *EPA guidance*, that background noise levels below about 30 dB are considered to be very low, and suggests that a rating level of 35 dB is also considered to be low. For this reason, *BS 4142* can be interpreted as advising that 30 dB is a lower limit of baseline for comparing with plant noise levels. In these cases, if the proposed development is designed so that specific plant noise, i.e. the plant noise without any correction for acoustic features, is equal to or less than 35 dB L_{Aeq} at receptors, then significant noise impacts will be avoided. Since no acoustic features are predicted for the proposed power plant, the Rating Level would also be equal to 35 dB and would be considered to be very low, and therefore not significant. It is noted that significant disturbance may not necessarily occur where threshold levels are exceeded by small amounts and resultant predicted levels are considered to be low.

These impact assessment criteria, and noise limits, for each receptor are listed in Table 9.4 *Noise Assessment Criteria*. The table establishes two sets of assessment criteria, for day time and night time operations. In the case of daytime operations, the impact assessment criterion at each NSR is derived by adding 5 dB to the measured daytime background noise level, as detailed in BS 4142. For night time operations, all the measured background levels at each NSR are below the 30 dB threshold inferred from BS 4142. Therefore, the impact assessment criteria are derived by adding 5 dB to this baseline background noise threshold. An assessment criteria of 35dB(A) at a noise sensitive receptor would be approximately equivalent to 25dB(A) inside a bedroom. This is 5dB(A) lower than the World Health Organisation (WHO) guidance level for the onset of sleep disturbance (30dB(A)) .

.Table 9.4: Noise Assessment Criteria

NSR	Night Operation			Day Operation		
	Night time Background Noise Level	Background Level + 5dB	Impact Assessment Criterion	Day time Background Noise Level	Background Level + 5dB	Impact Assessment Criterion
1	21	26	35	39	44	44
3	20	25	35	36	41	41
4	21	26	35	39	44	44
5	20	25	35	39	44	44

The operation of the plant will result in infrequent venting of steam during any incidents which cause shutdown of plant items. This may cause unexpected increases in noise emissions, but such events will be very infrequent, and therefore the noise impact of such venting operations is not likely to result in significant effects.

Any transport noise effects resulting from the operation of the proposed project would be permanent. Appropriate guidance for prediction and assessment of traffic noise from new road schemes can be found in the *NRA Guidelines – Guidelines for the Treatment of Noise and Vibration in National Road Schemes, October 2004*. Changes in existing traffic noise are also to be reported using these guidelines, and in general, if road traffic noise is increased by at least 3 dB due to transport noise, then the resultant effect has been reported as significant.

Potential noise impacts on ecologically sensitive receptors in an area will be treated qualitatively, where necessary, due to the absence of comprehensive literature or guidance on the topic.

9.2.3 Construction Noise Prediction Methodology

Noise levels are predicted using the methods set out in British Standard 5228: *Noise and vibration control on construction and open sites - Code of practice for noise and vibration control applicable to piling operations.* Predictions are made based on indicative plant teams representing the noisiest phases of the works.

For specific construction activities the exact plant details will be developed during the detailed design. However, an indicative assessment has been undertaken by assuming a general plant team, based upon experience of the activities required and discussions with the design engineers. Construction noise has been predicted for the 'worst-case' situation in each of three phases of construction (where there is significant potential for the generation of noise), as outlined in Table 9.5 *Construction Phases*, and is considered to be a snap-shot of concurrent construction activities, where numerous construction plant items for multiple activities are operating simultaneously. Information on the expected construction schedule and phasing can be found in Chapter 3 *Description of the Development*, which has been used to develop the plant teams used for noise predictions. Construction plant teams associated with relevant activities are summarized in Appendix 6B *Construction Plant Teams and Associated Sound Power Levels.*

Table 9.5: Construction Phases

Construction Phase	Concurrent Activities
1 – Site Clearance	• Site Clearance/ Demolition • Grading
2 – Civil Works	• Excavation • Piling • Pouring Foundations
3 – Plant Installation	• Backfilling • Excavation • Structural Steelwork

Noise predictions have been undertaken using the proprietary modelling software *SoundPlan* ©. Together with associated sound power levels for construction plant equipment, equivalent noise levels at noise sensitive receptors will also depend upon the expected percentage of usage or on-time, distance from the source, air and ground absorption, and any potential screening from buildings or topography. Location of construction equipment, within the site, for the noise assessment is based upon assumption of a typical case, where plants items are located arbitrarily, unless associated with a location-specific activity.

9.2.4 Noise Propagation Model

Noise predictions were made using Soundplan © according to guidelines specified in British Standard 5228, *Noise and Vibration Control on Construction and Open Sites - Code of practice for noise and vibration control applicable to piling operations*, BSI, 1997 and also according to ISO 9613-2 ISO 9613-2: *Attenuation of Sound Propagation Outdoors - General Method of Calculation*, International Organisation for Standardisation, 1996. These methodologies consider the strength and size of the noise source(s), screening effects due to local topography and intervening buildings, dispersion of sound energy over distance, and attenuation due to ground and air absorption.

Topographical data for the area of the proposed development has been included in the modelling exercise, in the form of elevation contours and spot-heights, for an area with a radius of approximately 1 km around the proposed development site. Buildings in the area are also included in this model. Information on the site layout for the proposed power plant development and auxiliary buildings is detailed in Chapter 3 *Description of the Development*.

Noise source strengths arising from individual items of plant used during steady-state operation of the facility are summarised in Appendix 6C *Operational Plant, Noise Source Levels Used in Noise Prediction Model.* In the absence of sound power levels for individual items of plant, noise levels within plant buildings can be assumed not to exceed a spatially averaged sound pressure level of 85 dB(A), for the purposes of maintaining a safe working environment according to the *Directive 2003/10/EC of the European Parliament and of the Council on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise)* An estimate has been made of the acoustic performance of the building shell, assuming it is of single sheet steel construction for the entire area of the building, based upon previous experience and published data. Octave band transmission loss values for this typical building cladding are shown in Table 9.6 *Octave Band Transmission Loss Assumed for Building Cladding* below.

Table 9.6: Octave Band Transmission Loss Assumed for Building Cladding

Freq (Hz)	31	63	125	250	500	1k	2k	4k	8k
Transmission Loss dB(A)	1	4	10	15	19	24	25	30	30

As the area surrounding the development site consists primarily of cutaway peatlands, fields and vegetation, soft ground attenuation has been included for all predictions of noise at noise sensitive receptors.

The *EPA guidelines* and *BS 4142 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas* suggest the addition of a penalty to the predicted plant noise level, to determine the 'rating level', if the introduced noise is thought to exhibit an acoustic feature. Situations where this is warranted include:

- where the noise contains a distinguishable, discrete continuous note, such as a whine, hiss, screech or hum;
- where the noise contains distinct impulses, such as bangs, clicks, clatters, or thumps;
- where the noise is irregular enough to attract attention; and

- where the level in one 1/3rd octave band is 5 dB (or more) higher than the level in the two adjacent bands and the tonal components are clearly audible.

Noise from operation of the proposed power plant is not expected to normally exhibit these characteristics. As such, the noise Rating Level is equivalent to the predicted plant noise, or Specific Noise level in terms of L_{Aeq}.

9.3 Existing Noise Environment

9.3.1 Noise Sensitive Receptors

Noise sensitive receptors (NSR) in the vicinity of the proposed power plant development at Derrygreenagh have been identified. Where suitable, a single receptor location represents a group of locations where similar effects may occur. No specific amenity areas have been identified in the local area (2 km).

The area around the proposed power plant development is primarily cutaway peatland. Beyond the peatlands, the land use is predominately farmland. There are also three quarries situated within 2 km radius of the proposed site. The largest of the three quarries is approximately 1.5 km to the west of the site, and the smaller quarries are approximately 2 km north east and south west of the site.

The R400 road runs along the western boundary of the main site, with the switchyard to be located to the west of the R400, immediately adjacent to the main site. The R400 road connects the towns of Rochfortbridge, Co. Westmeath and Rhode, Co. Offaly, with an intersection with the M6 motorway (Junction 3), *c.* 2.2 km north of the site towards Rochfortbridge. Residential properties comprise scattered residences, farmhouses, and farm buildings, which are at least 1.1 km from the proposed site. The nearest population centre is Rochfortbridge c. 4 km to the northwest of the site and Rhode which is located c. 6 km southeast of the proposed development site.

Four noise sensitive receptors were selected from residences and other buildings, located within approximately 2 km of the proposed site, in order to comprehensively assess the potential noise impacts from the proposed power plant. These receptors are the closest noise sensitive receptors to the proposed plant. The locations of the sensitive receptors are detailed in Figure 9.1 *Baseline Monitoring Locations and Noise Sensitive Receptors*. The identified receptors are listed in Table 9.1 *Description of Noise Monitoring Locations*.

9.3.2 Description of the Existing Noise Environment

The area around the proposed development site is predominantly rural, and ambient noise levels are very low. The largest road through the area is the regional road R400, as discussed above. There are also further minor roads in the area, with the road over Knockdrin Hill being the closest to the site. This road joins with the R400 *c.* 800 m southeast of the site, and continues towards Castlejordan. The majority of noise sensitive receptors closest to the proposed site are located on the Knockdrin road - see Figure 9.1 *Baseline Monitoring Locations and Noise Sensitive Receptors*. The traffic noise from the R400 is currently the dominant noise source in the area, with other less significant noise sources including the three nearby quarries, noise arising from the current Bord na Móna works site, peat harvesting and transportation activities. Of the three quarries, the BnM/Roadstone Quarry is the largest and as such generates the most noise.

The five noise monitoring locations (NML) were chosen to be representative of the area, and are also the closest noise sensitive receptors. It is noted that peat harvesting was not taking place during the baseline noise surveys. However, as the peat resources in close proximity to the proposed development site are mainly exhausted, there is limited such activity occurring in the area. Furthermore, the Bord na Móna works activities that are currently being undertaken at the site will cease, due to the relocation of these activities prior to the construction of the proposed power plant. Introduction of a new industrial noise source could be expected to change the character of ambient noise in the vicinity of the development somewhat. However, due to the existence of industrial activities, such as the quarries and activities on the BNM site, industrial type noise is already present.

A summary of measured noise levels is shown in Table 9.2 *Baseline Noise Level Summary dB Free-field*. As can be seen from the results in Table 9.2, and Appendix 6A *Baseline Noise Survey Details,* noise levels at NML 1 and NML 4, during both day and night monitoring periods, are higher than the levels at the other locations. This is due to the proximity of the monitoring locations to the R400 road and the influence of the traffic on the noise levels. The high L_{AFmax} results, recorded at these locations, and also at NML 5, were as a result of heavy goods vehicles passing the location during monitoring.

9.4 Noise Impacts

9.4.1 Construction Phase Impacts

(i) Predicted Noise Levels during the Construction Phase

Three phases, each considering concurrent construction activities, have been modelled and assessed. A summary of these three phases is shown in Table 9.5 *Construction Phases.*

Noise levels for 'worst-case' scenarios in each of the three phases of construction have been predicted at nearest noise sensitive receptors, and are shown below in Table 9.7 *Predicted Unmitigated Construction Noise Levels*. Normal working hours during the construction period are expected to be Monday to Friday 07:00 – 19:00 and Saturday 08:00 – 16:30. All of this work thus falls into the daytime noise assessment category. Notwithstanding this fact, an assessment of predicted noise levels against evening assessment criteria has also been carried out, as a conservative approach. No night-time work which gives rise to significant noise are anticipated during the construction phase of the proposed development.

Table 9.7: Predicted Unmitigated Construction Noise Levels

NSR	Predicted Noise Level for Construction Scenario ($L_{Aeq, T}$ dB, facade)			Exceedance of Daytime Construction Noise Criterion (dB) 70 dB(A)	Exceedance of Evening Construction Noise Criterion (dB) 60 dB(A)
	1	2	3		
1	44	41	39	0	0
3	48	46	45	0	0
4	51	49	48	0	0
5	46	42	41	0	0

Table 9.7 *Predicted Unmitigated Construction Noise Levels* indicates that no exceedance of the day-time or evening-time construction noise assessment criteria, $L_{Aeq,T}$ 70 dB and 60 dB respectively, is predicted at any receptor, and consequently no impacts are expected.

(ii) Construction Traffic

Prediction of road noise levels due to construction traffic has been undertaken using a methodology found in the NRA guidelines. The construction phase is divided into three main phases, as detailed in Table 9.5 *Construction Phases*. Phase 2 – Civil Works, is expected to introduce the highest number of vehicles onto the R400, and is estimated to last 10 months in total. During this phase, the number of vehicles accessing the site per day is expected to reach a peak of 480 light vehicles and 40 heavy goods vehicles (HGVs), over a ten month period with HGV numbers dropping significantly outside this period.

The majority of vehicles, including all of the 480 light vehicles, are likely to access the site during the morning peak flow traffic period, and leave the site during the evening peak traffic flow period. HGVs are likely to be spread out over the day. To model the worst case scenario, during the morning and evening periods of maximum traffic movement, all light vehicles were assumed to travel to and from the site in one direction. The maximum increase in noise levels during the peak periods was estimated to be 4 dB(A) for the ten month peak HGV period. This increase in noise level during the peak periods refers to noise generated by all HGV's and light vehicles and is considered the worst case scenario.

Additionally, it is estimated that during Phase 2 –Civil Works, there will be 40 HGVs (80 movements) accessing the site on a daily basis. This is estimated to increase noise levels outside peak hours, as a result of traffic on the R400, by less than 3dB over the full day, which is considered insignificant as typically people will not perceive a noise increase below 3dB.

Based upon the duration of the maximum increased traffic levels, estimated at 10 months, and while assuming the worst case scenario the predicted increase of 4dB(A) during this period for all vehicles (HGVs and LCVs), it is not predicted that noise levels ($L_{10,\ 18hr\ and\ 1hr}$ or L_{den}) due to construction traffic will significantly increase on the local roads. As an introduced noise source, construction traffic using the R400 is likely to be audible above the low background noise levels. However, typically people will not perceive a noise increase below 3dB, and as the predicted increase is 4dB, this increase is not considered to be significant as it is temporary and will not lead to a noticeably different effect to a change of 3 dB.

9.4.2 Operational Phase Impacts

Incorporation of the information presented in Section 9.2.4 into a noise model has enabled predictions of operational noise levels at receptors to be made. Additionally, predicted operational noise contours have been produced, to give an indication of the contribution of the proposed power plant development to environmental noise levels. These are detailed in Appendix 6D *Predicted Operational Noise Contours* which shows the predicted noise contours at 4.3m above ground level - See Figure 9.2 *Proposed Derrygreenagh Power plant, Unmitigated CCGT & OCGT Operational Noise Contours at 4.3m above ground level*.

Table 9.8 *Operational Noise Levels at Receptors for Day Time Operations* and Table 9.9 *Operational Noise Levels at Receptors for Night Time Operations* summarise the predicted noise levels at the closest noise sensitive receptors, under selected operational regimes. The regimes selected include a scenario which represents the typical mode of operation at the site, where the larger CCGT unit only is running, and a "worst case" scenario, where both the OCGT and CCGT units are in operation.

Table 9.8: Operational Noise Levels at Receptors for Day Time Operations

NSR	Impact Assessment Criterion	Predicted Level ($L_{Ar,T}$ dB)		Exceedance of Noise Criterion (dB)	
	Day time	CCGT unit only	CCGT and OCGT units	CCGT unit only	CCGT and OCGT units
1	44	26	27	-	-
3	41	30	34	-	-
4	44	34	37	-	-
5	44	28	30	-	-

No exceedance of the daytime noise assessment criteria is predicted, during either the typical mode of operation or the "worst case" scenario.

Table 9.9: Operational Noise Levels at Receptors for Night Time Operations

NSR	Impact Assessment Criterion	Predicted Level (LAr, T dB)		Exceedance of Noise Criterion (dB)	
	Nightime time	CCGT unit only	CCGT and OCGT units	CCGT unit only	CCGT and OCGT units
1	35	26	27	-	-
3	35	30	34	-	-
4	35	34	37	-	+2
5	35	28	30	-	-

In the worst-case scenario where the CCGT unit and OCGT unit were run simultaneously during the night time period, 22:00 to 08:00, it is predicted that the assessment criteria would be exceeded at noise sensitive receptor four by two dB. However, this is considered to be an infrequent situation and will only occur on a limited number of occasions each year, due to the fact that the OCGT unit will typically only operate for *c.* 500 hours per annum. In addition the criterion is only exceeded by 2 dB whereas an increase of 3dB is required for the typical receptor to perceive any difference. For this reason it is not considered that this exceedance results in a significant effect, and it is not necessary to recommend mitigation measures. It should also be noted that the level of night time noise experienced by noise sensitive receptor four is significantly less than the LAeq, T 45dB (A) guidance issued by the EPA. A noise level of 37dB(A) outside a bedroom window is equivalent to approximately 27dB(A) inside the bedroom, which is below the WHO guide level of 30dB(A).

(i) Operational Road Traffic Noise

As previously described, traffic noise is the dominant noise source in the area. Chapter 11 *Roads and Traffic,* details the traffic impact assessment for the proposed development. As can be seen from this section the Annual Average Daily Traffic (AADT) figure for the R400 is 2,112 for 2008.

Prediction of road noise levels due to operational road traffic has been undertaken using methodology found in the National Roads Authority's *Guidelines for the Treatment of noise and vibration in National Road Schemes, 2004*. Once operational, the maximum predicted number of arrivals to and departures from the site are 52 arrivals and 7 departures in the morning and evening. This includes shift workers, day staff and delivery vehicles. On the local roads, this number of vehicles is not predicted to significantly increase the overall noise levels ($L_{10,\ 18hr\ or\ 1hr}$ or L_{den}).

Individual vehicles using the R400 to access the site are likely to be audible above the low background noise levels. Noise sensitive receptor one (NSR 1) and four (NSR 4) face out onto the R400, and are set approximately 20m back from the road edge. The majority of the vehicles that will access the site are likely to use the roads during the peak morning and evening hours. Using worst case assumptions the increased traffic volumes due to the operation of the facility are likely to increase noise levels by less than 1dB at the nearest noise sensitive receptors during the peak traffic hours. Therefore, no significant impacts are predicted, as a result of operational road traffic as an increase of 3dB is typically required before a person would perceive the difference.

9.5 Noise Mitigation

9.5.1 Construction Phase Mitigation

Good practice for construction will be used on site and is predicted to reduce noise levels even further. These practices include ensuring that:

- plant will be managed in an appropriate manner with respect to minimising noise emissions;
- inherently quiet plant will be selected where appropriate;
- noisy plant will be located and orientated as far as possible from sensitive receptors;
- construction contractors will be required to adhere to the codes of practice for construction working given in *British Standard BS 5228*, and the guidance given therein, for minimising noise emissions from the site; and
- construction contractors will be required to comply with the requirements of the European Communities (Construction Plant and Equipment)(Permissible Noise Levels) Regulations, 1988 as amended in 1990 and 1996 (S.I. No. 320 of 1988, S.I. No. 297 of 1990 and S.I. No. 359 of 1996), and the Safety, Health and Welfare at Work (Control of Noise at Work) Regulations, 2006 (S.I. No. 371 of 2006).

9.5.2 Operational Phase Mitigation

As outlined in Section *9.4.2*, predicted noise impacts during the typical mode of operations at the site, i.e. with the CCGT unit only in operation, are not expected to exceed noise assessment criteria. Predicted noise impacts due to the operation of both units running simultaneously during day-time hours are not expected to exceed noise assessment criteria. On the occasional circumstances where this mode of operation occurs during night time periods, predicted noise levels are only expected to result in noise impacts slightly above the criteria, and therefore the effect has not been considered to be significant. The occasional exceedance of the noise criteria at night due to the operation of the OCGT during operation of the peaking plant results in a noise level which is approximately 3dB(A) less than the guidance level given by the WHO, and substantially below (8dB(A)) the level which is normally required by the EPA during the IPPC permitting process.

9.6 Residual Noise Impact

Construction is likely to be audible in the vicinity of the development, as the area has particularly low background noise levels, although due to the temporary and transient nature of works, this will not result in any significant impacts. It is noted that there are quarrying activities in the area and also peat transportation using locomotives and wagons on the light railway that passes through the development site. Therefore, the sound characteristics of construction activities will not be completely out of character for the area. While peat harvesting activities are no longer carried out in the peatland areas adjacent to the site, it is also possible that harvesting activities from further afield may increase the normal background noise levels as outlined in *Section 9.3* and *Section 9.*4. No significant residual impacts are predicted to occur at the noise sensitive receptors.

Predicted noise levels at the noise sensitive receptors during the operation of the CCGT unit alone are below the assessment criteria. Even during the occasional circumstance when the OCGT operates at night, the predicted levels are sufficiently close to the stringent assessment criteria that a significant noise impact is not likely. Predicted noise levels are also lower than the WHO guidance for sleep disturbance, and the normal IPPC licensee noise levels that are set by the EPA. Therefore no mitigation has been recommended beyond the normal mitigation that is inherent in the design, such as enclosing major noise sources within buildings. No significant residual impacts are predicted to occur at the noise sensitive receptors as a result of the proposed development.