HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

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6 Noise and vibration

6.1 Introduction

6.1.1 This chapter describes the assessment of potential noise and vibration effects resulting from the construction, operation and decommissioning of the Power Station, other on-site development as described in chapter A1 (introduction) (Application Reference Number: 6.1.1), Marine Works and the Site Campus within the Wylfa Newydd Development Area.

6.1.2 The chapter excludes noise and vibration effects associated with road traffic. These effects are considered in the assessment contained within chapter C5 (noise and vibration effects of traffic) (Application Reference Number 6.3.5), which covers project-wide effects of traffic upon noise and vibration.

6.1.3 Please refer to chapter B6 (noise and vibration) (Application Reference Number: 6.2.6) for the technical basis for the assessment including a summary of legislation, policy and guidance; key points arising in consultation that have guided the noise and vibration assessment; and assessment methodologies and criteria.

6.1.4 The potential indirect effects of noise and vibration on the Welsh language and culture are assessed as part of volume C of the Welsh Language Impact Assessment (Application Reference Number: 8.21). These include potential effects on quality of life and local amenity.

6.2 Study area

6.2.1 This section describes the study areas relevant to the noise and vibration assessment for the Wylfa Newydd Development Area.

Buildings

6.2.2 The study areas include all properties where there is any potential for adverse noise or vibration effects due to the construction, operation or decommissioning within the Wylfa Newydd Development Area. These receptors have been identified through initial calculations of the distance that potential effects may extend, and are grouped for ease of reference. The residential receptor groups are shown on figure D6-1 (Application Reference Number: 6.4.101), and are described in table D6-1.

Table D6-1 Residential receptor groups

Receptor group	Receptor location
A	Outlying residential properties east of the Wylfa Newydd Development Area
B	Residential properties in Cemaes
C	Residential properties on the A5025 between Cemaes and Tregele
D	Outlying residential properties west of the Wylfa Newydd Development Area
E	Outlying residential properties south of the Wylfa Newydd Development Area
F	Residential properties in Tregele
G	Outlying residential property south of the Wylfa Newydd Development Area (linked to development)
H	Any property over 1,000m from the Wylfa Newydd Development Area within study area

6.2.3 The study areas for construction and operational noise differ, due to the different distances over which potential adverse effects may occur.

6.2.4 The study area for the construction noise assessment extends at least 1.5km from the Wylfa Newydd Development Area over land. The groups in table D6-1 are applicable to both the construction and operational noise and vibration assessments; however, group H is only used for the consideration of construction impacts at distances greater than 1,000m from the Wylfa Newydd Development Area.

6.2.5 Other noise sensitive receptors are users of:

- Cemaes Bay Primary School;
- St David's Roman Catholic Church, Cemaes;
- Bethesda Methodist Church, Cemaes;
- Eglwys Sant Padrig Church, Cemaes;
- The Village Hall in Cemaes Village;
- School Lane Football Ground, Cemaes;
- Public Rights of Way (PRoWs);
- other recreational receptors (playing fields, marine leisure activities, Isle of Anglesey Area of Outstanding Natural Beauty and Cestyll Garden);
- offices at the Existing Power Station and those used by the Isle of Anglesey County Council (IACC) in Cemaes;
- buildings used for retail and other commercial premises in and around Cemaes; and

- buildings used for retail and other commercial premises in and around Tregele village.

Site sensitive receptors

6.2.6 The Wylfa Newydd Development Area includes existing utilities and services which are potentially sensitive to vibration. These are termed 'site sensitive receptors' (SSRs) and include:

- underground high-voltage cables;
- overhead high-voltage cables;
- water mains;
- foul water drains; and
- the Existing Power Station.

6.2.7 In preparation for vibration trials of on-site rock fracturing activities conducted in 2013, the SSR owners/operators were consulted on appropriate vibration threshold limits to prevent the risk of damage or disturbance to SSRs [RD1]. The agreed thresholds vary from 5mm/s for oil-filled high-voltage cables up to 50mm/s for buried water utility structures. A threshold of 6mm/s applies at the Existing Power Station boundary.

6.3 Baseline environment

6.3.1 This section provides a summary of the baseline conditions for noise and vibration within the study area described in section 6.2.

Noise

6.3.2 A number of measurement surveys have been undertaken in the vicinity of the Wylfa Newydd Development Area between 2010 and 2015. An initial set of baseline noise measurements were undertaken on behalf of Horizon in 2010. Two sets of subsequent measurements in the area are presented in this report: the first set was taken by the IACC in 2012, and the second set was taken on behalf of Horizon in 2014. An additional location (MP7 Caerdegog Uchaf) was monitored in 2015 in response to a change in the access arrangements at one of the properties south of the Wylfa Newydd Development Area.

6.3.3 The locations of these surveys are presented in figure B6-1 (Application Reference Number: 6.2.22).

2010 Survey

6.3.4 The aim of the 2010 baseline noise survey was to obtain a preliminary indication of the likely range of baseline noise levels, and to identify noise sources that may influence environmental noise levels.

6.3.5 The 2010 baseline noise survey indicated that noise levels were dominated by local and distant road traffic, noise generated by the passage of wind in vegetation and trees and some noise from the Existing Power Station. Noise from the National Grid transformers adjacent to the Existing Power Station

included 'audible tonality' (i.e. transformer hum), which has been the subject of some adverse community response in the past. This transformer is likely to be retained even though the Existing Power Station has ceased electricity generation. The extent of the contribution of each of these noise sources will vary with weather conditions.

6.3.6 A summary of the results of the 2010 baseline noise survey is shown in table D6-2.

Table D6-2 Summary of results from 2010 survey

Time period	Mean daily range of levels (dB)	Monitoring location			
		Felin Cafnan	Tyn Refail, Tregele	Clovelly, A5025	Parc Lodge, Cemaes
Day (07:00-19:00)	L_{Amax}	62–83	78–92	62–85	48–79
	L_{A90}	38–47	38–52	37–47	33–40
	L_{Aeq}	45–62	60–68	44–59	38–52
Evening (19:00-23:00)	L_{Amax}	54–78	75–85	55–73	48–77
	L_{A90}	36–41	35–45	34–43	32–37
	L_{Aeq}	42–56	53–62	42–52	35–49
Night (23:00-07:00)	L_{Amax}	49–70	46–85	44–74	43–68
	L_{A90}	36–44	29–40	31–44	33–40
	L_{Aeq}	39–51	34–61	36–52	36–45

6.3.7 The range of noise levels measured at Tyn Refail were generally higher than those measured at the other three receptors, which is likely to be due to the effect of the nearby A5025 at this location.

2012 survey by the IACC

6.3.8 The daytime results of the 2012 survey are contained in three reports, presented in appendix B6-1 (Baseline Noise Monitoring, Application Reference Number: 6.2.20) and summarised in table D6-3. No observations on audible noise sources are included in these reports, but from the photographs of the monitoring locations, the following can be seen.

- Clovelly – Existing Power Station and pylons visible. Equipment located in garden area with the majority of vegetation not in leaf, and adjacent to agricultural land.
- Douglas Inn, Tregele – Existing Power Station visible along with pylons in the foreground. Equipment located on elevated terrace, overlooking car park with several flags flying and with clear line of sight to A5025. According to the reports in appendix B6-1 (Application Reference Number: 6.2.20), a "…*steam release or trip from the Existing Power Station*" was noted on one occasion by residents during a night-time period.

- Cafnan – Existing Power Station and pylons visible, along with a minor road, hedgerows and agricultural land.

Table D6-3 Summary of results from 2012 survey

Time period	Noise parameter	Range of daily values (dB)		
		Cafnan	Douglas Inn, Tregele	Clovelly, A5025.
Day (07:00–19:00)	L_{A90}	38–57	49–53	41–50
	L_{Aeq}	47–61	52–60	50–56
	L_{A10}	49–64	54–60	51–59
Evening (19:00–23:00)	L_{A90}	26–54	37–47	36–58
	L_{Aeq}	41–58	46–52	40–60
	L_{A10}	44–60	49–55	43–62
Night (23:00–07:00)	L_{A90}	22–52	28–42	24–50
	L_{Aeq}	37–70	41–51	38–61
	L_{A10}	43–60	45–50	42–64

6.3.9 All of the locations have shown a wide range in recorded noise levels, indicating that the noise environment is variable in the area. One contributory factor to this variation is likely to have been the influence of weather conditions. Whilst no recorded weather data for the survey period were presented in the survey reports, the weather forecast data included some periods of high winds and rain. Any periods of adverse weather conditions have not been excluded from the results presented by the IACC reports (summarised in table D6-3).

2014/2015 noise survey

6.3.10 The term ‘noise survey’ in this report refers to the surveys undertaken at the Wylfa Newydd Development Area in 2014 and 2015. These surveys have been selected to represent the baseline noise environment for this assessment as they represent the largest and most robust dataset.

6.3.11 Measurements during the survey were undertaken on a continuous basis to ensure adequate characterisation of noise levels during the daytime and night-time periods. Environmental noise levels are inherently variable, being influenced by man-made and natural factors. The survey periods were therefore selected to ensure that this variability was characterised. Full details of the equipment used and methodology employed during the survey are presented in appendix B6-1 (Application Reference Number: 6.2.20). The locations used during the noise survey are summarised in table D6-4.

Table D6-4 Wylfa Newydd Development Area baseline noise monitoring locations

Location	Receptor group	Approx. British National Grid coordinates (m)		Notes
		Easting	Northing	
MP1 Tre'r-Gof-Isaf	A	236642	393569	Centre of front garden, 15m away from pond. Approximately 6m from garden boundaries adjacent to drive and house. No line of sight to Existing Power Station, but sea and wind turbines visible. Free-field location.
MP2 10 Maes Capel	B	236649	393151	Centre of rear garden, approximately 4m from the conservatory and 7m from southern boundary. Free-field location. Partial line of sight to some vehicles using A5025, but no line of sight to road itself. Existing Power Station not visible.
MP3 Bron Wylfa	C	236070	393073	Centre of rear garden, approximately 7m from the house and 12m from eastern boundary. Free-field location. No line of sight to A5025. Existing Power Station not visible.
MP4 Maen-y-Bugail	D	233878	393086	To west of property on gravelled area. Approximately 6.5m from house and garage. No line of sight to Existing Power Station, but hedges lining local road visible. Free-field location.
MP5 Hafan	E, H	233676	392053	In middle of garden on concrete path. Row of trees approximately 20m to west. Good view of Existing Power Station and Nanner Road. Free-field location.

Location	Receptor group	Approx. British National Grid coordinates (m)		Notes
		Easting	Northing	
MP6 Ysgubor Ddegwm, Tregele	F	235475	392553	Field to west of residential dwelling. North-western corner used (approximately 12m from western boundary and 5m from northern boundary). Hen coop located in south-eastern corner of field, approximately 30m away. Partial line of sight to A5025 and wind turbines (tips only), no clear view of Existing Power Station. Location chosen to maximise screening and distance from A5025. Free-field location.
MP7 Caerdegog Uchaf	G	234131	391813	In garden, approximately equidistant between property façade and greenhouse to south of property façade Scattered vegetation in garden, but location sheltered from breeze due to garden wall. Approximately 470m from A5025. Free-field location.

6.3.12 During equipment set-up, check and retrieval visits for the 2014 survey, the audible noise sources at each monitoring location were noted. These audible noise source observations are summarised in table D6-5.

Table D6-5 Observations on audible noise sources from noise survey

Location	Daytime observations	Night-time observations
MP1 Tre'r-Gof-Isaf	Mechanical equipment. Intermittent aircraft noise. Wind through vegetation. Occasional aircraft in distance. Occasional birdsong.	Audible hum and short alarm from direction of Existing Power Station. Waves on shore. One aircraft in distance.
MP2 10 Maes Capel	Traffic on A5025 dominant. Tractor on adjacent track audible. Sheep noise. Distant dog barking. Wind in trees. Sporadic noise from gulls and crows audible. Occasional aircraft.	Hum from direction of Existing Power Station dominant. Faint noise from wind in vegetation. Owl call.
MP3 Bron Wylfa, Fford Caergybi	Hum from direction of Existing Power Station faintly audible. Wind noise through vegetation. Occasional birdsong. Occasional aircraft.	Hum from direction of Existing Power Station dominant. Distant dog barking. Barely audible reversing alarm. Variable aerodynamic noise from direction of Existing Power Station.
MP4 Maen-y-Bugail	Aircraft, wind through vegetation. Dogs barking distantly audible. Sea noise distantly audible. Cows in adjacent field intermittently audible. Farm machinery. Occasional aircraft.	Noise from sea dominant. No noise from Existing Power Station audible.
MP5 Hafan	Birds intermittently audible. Wind noise through vegetation. Road noise distantly audible. Occasional car passing on adjacent road. Occasional aircraft.	Wind in vegetation. Very faint noise from sea. Dog barking in the distance from the direction of Tregele.
MP6 Ysgubor Ddegwm, Tregele	Traffic on A5025 dominant. Cockerel and other fowl (very audible, sporadic). Occasional aircraft. Mechanical noise in distance. Farm machinery.	Hum from direction of Existing Power Station dominant. Wild fowl calling and livestock noise. Variable aerodynamic noise from direction of Existing Power Station. Wind in vegetation.
MP7 Caerdegog Uchaf	Birdsong audible. Sporadic noise from A5025 barely audible.	Wind in vegetation was audible. Vehicle movements on the A5025.

6.3.13 All measurements which were identified as potentially having been influenced by rainfall or high winds have been removed from the results. In addition, a visual review of time history graphs was undertaken, and periods when noise levels were judged to be atypically elevated were also removed. A full

description of the data analysis process is provided in appendix B6-1 (Application Reference Number: 6.2.20).

6.3.14 Appendix B6-1 (Application Reference Number: 6.2.20) also summarises the baseline data by presenting various statistical noise parameters, in accordance with relevant guidance documents, good industry practice, and by specific request from the IACC. These parameters have been reviewed and, using professional judgement, a suitable typical value has been selected and is presented in table D6-6. Note that where T is used to denote a time interval, a typical value has been selected based on hourly and 15-minute values.

Table D6-6 Summary of results from noise survey

Time period	Typical noise level (decibel)	Monitoring location						
		MP1 Tre'r gof Isaf	MP2 Maes Capel	MP3 Bron Wylfa	MP4 Maen-y-Bugail	MP5 Hafan	MP6 Ysgubor Ddegwm	MP7 Caerdeg og Uchaf
Receptor Group		A	B	C	D	E, H	F	G
Day (07:00–19:00)	$L_{A90, T}$	35	40	38	35	34	39	36
	$L_{Aeq, T}$	42	46	46	40	43	48	44
	$L_{Aeq, 12hr}$	43	46	48	45	46	49	46
Evening (19:00–23:00)	$L_{A90, T}$	34	39	36	35	31	32	32
	$L_{Aeq, T}$	38	41	43	39	37	45	38
	$L_{Aeq, 4hr}$	41	43	45	43	40	46	42
Night (23:00–07:00)	$L_{A90, T}$	33	38	32	34	28	27	19
	$L_{Aeq, T}$	34	40	37	38	33	36	29
	$L_{Aeq, 8hr}$	38	42	40	41	39	41	43

6.3.15 The $L_{Aeq\ T}$ results in table D6-6 have been compared with the World Health Organization's (WHO's) *Guidelines for Community Noise* [RD2], which present guideline noise levels for community noise in specific environments. The daytime baseline noise levels are all well below the guideline value of 55dB $L_{Aeq\ T}$ associated with protecting the majority of people from 'serious annoyance' in outdoor living areas. Furthermore, with the exception of Ysgubor Ddegwm, these baseline noise levels are also well below the guideline value of 50dB $L_{Aeq\ T}$ associated with protecting the majority of people from 'moderate annoyance' in outdoor living areas. At Ysgubor Ddegwm, the weekday daytime noise levels are close to this guideline value at 49dB(A) during the daytime period.

6.3.16 With respect to sleep disturbance guidelines, the WHO's *Guidelines for Community Noise* [RD2] recommends a guideline value of 45dB $L_{Aeq\ T}$ outside bedrooms. The night-time baseline noise levels presented in table D6-6 are lower than this guideline value.

6.3.17 In addition, reference has been made to the more recent *Night Noise Guidelines for Europe* [RD3], which reviews health effects associated with

exposure to night-time noise and recommends night noise guideline values. The guidelines present a night noise level of 40dB L_{night} (outside) and an interim target of 55dB(A) aimed at situations where the 40dB(A) target is not achievable. Furthermore, the guideline value is expressed as a yearly average, and hence occasional exceedances should not necessarily be interpreted as likely to result in harmful effects.

6.3.18 Comparison of the night (between 23:00 and 07:00 hours) baseline results in table D6-6 with the interim target level and night noise guideline indicates that, whilst the interim target level was complied with at all locations, noise levels were equal to or above the precautionary night noise guideline at the following locations:

- Maes Capel – 42dB(A);
- Bron Wylfa – 40dB(A);
- Maen-y-Bugail – 41dB(A);
- Ysgubor Ddegwm – 41dB(A); and
- Caerdergog Uchaf – 43dB(A).

6.3.19 It should be remembered that the night noise guideline is defined as a yearly average noise level; hence, these monitoring results are unable to fully confirm compliance or exceedance of this assessment criterion. Furthermore, it should be remembered that noise levels during periods of adverse weather or atypical conditions have been removed, and noise levels during these periods may be considerably higher.

Vibration

6.3.20 The IACC and Natural Resources Wales have agreed that no particular sources of vibration have been identified as likely to affect sensitive receptors for the existing baseline scenario (as stated in appendix B6-1, Application Reference Number: 6.2.20). A baseline vibration survey was therefore not considered necessary.

Evolution of the baseline

6.3.21 Between the survey and the implementation of the Wylfa Newydd Project, baseline noise levels (i.e. those that occur in the absence of the Wylfa Newydd Project) may have changed, or may be likely to change due to a number of non-project related factors.

- The Existing Power Station stopped generating electricity in December 2015. The noise assessment presented within the Environmental Statement for the decommissioning of the Existing Power Station predicted that ambient noise levels would reduce by approximately 2dB(A) at Tregele and Cafnan, and by less than 1dB(A) at Cemaes during daytime periods. However, the 2014 survey results (measured with the Existing Power Station in operation) indicate that noise levels were lower than those predicted without the Existing Power Station in operation. The Environmental Statement for the decommissioning of the Existing Power

Station also states that previous studies of vibration undertaken at other nuclear sites have confirmed that generation does not give rise to perceptible levels of vibration off-site, and therefore no change in vibration levels is expected as a result of ceasing to generate electricity.

- Two National Grid transformers at the Existing Power Station are likely to remain operational, even though the Existing Power Station has stopped producing electricity.
- Road traffic is likely to increase slightly over time, in common with most areas of the UK, and may also increase due to committed development in the area. However, an increase of 25% in traffic flow in the short term would generally be required before an increase in traffic noise level of 1dB would be observed. An increase of this level is considered to be unlikely to occur between the 2014 baseline survey and commencement of the construction works.

6.3.22 The outcome of the assessments presented in this report would not be affected by changes in background noise described above, as the adopted assessment criteria are related to fixed thresholds rather than background noise levels.

6.4 Design basis and activities

6.4.1 This section sets out the design basis for the assessment of effects. It sets out where any assumptions have been made to enable the assessment to be carried out at this stage in the evolution of the design. This section also identifies the embedded and good practice mitigation that would be adopted to reduce adverse effects as inherent design features or by implementation of standard industry good working practice.

6.4.2 As described in chapter D1 (proposed development) (Application Reference 6.4.1), the application for development consent is based on a parameter approach. The operational noise assessment described within this chapter has taken into consideration the flexibility afforded by the parameters. A worst case scenario has therefore been assessed from a noise and vibration perspective within the parameters described in chapter D1. The construction noise and vibration assessments are based on illustrative Landscape and Habitat Management Strategy (LHMS) (Application Reference Number: 8.16) Reference Points 1 and 3, a construction plant schedule developed to support the noise modelling which is presented in appendix D6-1 (Noise Model Inputs and Outputs, Application Reference Number: 6.4.23), and a plan of the construction zones which defines the areas within which construction plant will operate and which is shown on figure D6-2 (Application Reference Number: 6.4.101).

Construction

Basis of assessment and assumptions

6.4.3 A brief description of the principal construction activities that the assessment considers is presented in table D6-7. The construction activities are expected

to be undertaken on all days of the week, and certain activities (identified below) would occur at night as well as during the daytime.

Table D6-7 Overview of the principal construction activities

Construction activities	Description
Site Preparation and Clearance Works	Vegetation clearance, field boundary and wall removal and building/structures demolition, asbestos removal and treatment within the Remediation Processing Compound. These activities would be the first conducted and would be undertaken during daylight hours only.
Site grading	Topsoil clearance, the construction of site haul routes and roads, formation of contractors' compounds and then the formation of bunds and mounds around the Wylfa Newydd Development Area. Some blasting would be required to remove rock outcrops. Site grading activities would be conducted during daylight hours only.
Deep excavation	Excavation and blasting to form the platforms on which the construction of the Units would be undertaken. These activities would be conducted during daylight hours only.
Rock processing	Rock arising from the deep excavations would be crushed and processed for use in the Marine Works and site grading. Rock processing works will be conducted during daylight hours only.
Marine Works	Permanent Marine Works would comprise the Cooling Water System, Cooling Water System intake and outfall, the Marine Off-Loading Facility (MOLF), breakwater structures, shore protection works, surface water drainage outfalls, fish recovery and return system, fish deterrent system, navigation aids and Dredging. The MOLF would allow shipping vessels to deliver materials to the Wylfa Newydd Development Area. This would reduce the number of construction vehicle movements on the A5025 and other roads. The marine construction activities would employ a semi-dry method and would operate on a 24-hour basis. Construction of the Cooling Water System outfall tunnel would utilise a cut-and-cover

Construction activities	Description
	methodology for the section extending 100m north from the Turbine House. The remainder would be tunnelled (from the seaward end) using a rock wheel cutter and blasting. The outfall tunnel works would be on a 24-hour basis. Temporary Marine Works would comprise temporary cofferdams, a temporary access ramp, navigation aids, temporary outfalls and a temporary barge berth. Generally, these works would be on a 24-hour basis.
Construction of Unit 1 and Unit 2	On completion of the deep excavations, concrete works for the construction of two UK Advanced Boiling Water Reactors (Unit 1 and Unit 2) would begin. The concrete would be poured using concrete pumps and booms, operating on a 24-hour basis. Additionally, supporting facilities, buildings, plant and structures, and radioactive waste and spent fuel storage buildings would be constructed.
Concrete production and transportation	A concrete batching plant located near the MOLF would provide concrete for the construction of the Units and other activities. Concrete production and transportation would be on a 24-hour basis.
Site logistics (24 hour)	Activities such as de-watering areas using pumps, maintaining and fuelling vehicles, transportation of people around the Power Station. The site logistics works would be on a 24-hour basis.
Site Campus construction	On-site temporary workers' accommodation is proposed. The construction of the accommodation would be phased, and each completed phase would be a noise-sensitive receptor. Site Campus construction would be conducted during daytime hours.

Assessment scenarios

Noise

6.4.4 An indicative construction programme has been provided in figure A2-6 of chapter A2 (project overview and introduction to the developments) (Application Reference Number: 6.1.2).

6.4.5 Daytime and night-time noise modelling has been undertaken for four periods in time during the construction of the Wylfa Newydd Project, each representative of a three-month (quarter of a year) period. The quarters selected for noise modelling are those with the highest number of concurrent construction activities in the construction programme, and correspondingly are the periods where the greatest number of plant/machinery would be in use simultaneously. The modelled scenarios are therefore considered to represent a worst case.

6.4.6 For the construction noise assessments, the Wylfa Newydd Development Area has been divided into 16 construction zones, which are shown on figure D6-2 (Application Reference Number: 6.4.101). These zones are not identical to those defined in the Works Plan (Application Reference Number :2.3), but represent the areas that heavy plant will be operating within to deliver Works Nos. 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 2A, 2B, 2C, 2D, 3A, 3B and other associated development within the Wylfa Newydd Development Area.

6.4.7 The construction plant schedule in appendix D6-1 (Application Reference Number: 6.4.23) details the type and number of the construction plant/machinery which are included in each of the noise models, together with an indication of the construction zone(s) in which they would be operating. Within each construction zone, points representing each item of heavy plant has been spatially distributed at random (within certain parameters) using a Geographic Information System; this has the effect of creating a broadly diffuse distribution of plant within each construction area.

6.4.8 The date that the construction activities would begin is not confirmed and therefore the construction programme is expressed relative to the commencement date. Construction would commence in the first year following award of development consent.

6.4.9 The magnitude of change assigned to each noise-sensitive receptor is the greatest that is predicted under any of the modelled scenarios, for either the daytime or night-time condition. The four periods selected for modelling are set out below.

Months 22 to 24

6.4.10 Months 22 to 24 of the construction programme are anticipated to include Site Preparation and Clearance Works, site grading, deep excavations, outfall tunnelling, Marine Works, site logistics and the construction of the Site Campus. The Site Campus accommodation buildings would be constructed from pre-fabricated modular units, delivered to site for rapid assembly. In addition to these activities the movements of dredgers, tugs and other vessels associated with the Wylfa Newydd Project within construction zone 10 are included in the construction noise model. Whilst evolving, early in the programme the landform across the Wylfa Newydd Development Area would still be similar to the baseline condition, and therefore the LHMS Illustrative Reference Point 1 digital terrain model has been used for the construction noise modelling for this period.

Months 31 to 33

6.4.11 Months 31 to 33 of the construction programme are anticipated to include many of the same construction activities as would be undertaken in months 31 to 33 (site grading, deep excavations, outfall tunnelling, Marine Works including vessel movements, site logistics and the construction of the Site Campus), but would also include concrete production, distribution and pouring; the cranage of materials and equipment; and the use of mobile lifts to access structures that have been built. By this stage, a proposed 7m tall earth bund along the south-east boundary of construction zone 9 and the A5025 would be completed, and this would reduce construction noise levels at Tregele. This noise model is therefore based on LHMS Illustrative Reference Point 1, plus the addition of this bund, referred to as Mound B in the LHMS. This scenario has the greatest number of construction plant/equipment of any quarter throughout the whole construction programme.

Months 61 to 63

6.4.12 Months 61 to 63 of the construction programme are anticipated to include site grading; concrete production, distribution and pouring; site logistics; the cranage of materials and equipment; and the use of mobile lifts to access structures that have been built. By this stage of the Wylfa Newydd Project, the Marine Works and deep excavation activities would be completed and some of the plant/equipment would be working in the deep excavations. This scenario is broadly representative of how the works would continue up to month 120. The terrain model for this scenario is based on LHMS Illustrative Reference Point 3, which includes the deep excavations and much of the mounding.

Months 112 to 114

6.4.13 The final re-instatement and landscape formation of construction zones 5 and 9, Mound A and Mound E is anticipated to begin in month 112. Other activities that would still be ongoing, though generally less intensively than earlier in the programme, include site grading; concrete production, distribution and pouring; site logistics; the cranage of materials and equipment; and the use of mobile lifts to access structures that have been built. There would be fewer items of construction plant/equipment operating at this time, but the scenario has been included because the final re-instatement and landscape formation works would bring excavators, compactors, vibratory rollers and tractors close to the boundary of the Wylfa Newydd Development Area. The construction noise model for this scenario is based on LHMS Illustrative Reference Point 3.

Vibration

6.4.14 The assessment of vibration does not relate to any specific points in time, but instead is based on the closest approach of construction equipment that may emit high levels of vibration to sensitive receptors. The following plant/equipment items have been identified from the construction plant list as having the potential to emit high levels of vibration and are considered in the vibration assessment:

- telescopic leader rig with hydraulic vibratory hammer for use in the outfall tunnelling in zone 11;
- vibratory pile hammer used in construction zones 2 and 10;
- Caterpillar CS74B vibratory soil compactor (roller) used in the construction of haul routes/roads and in construction zones 5, 9, A, C and E;
- Caterpillar 825G (32tonne) compactors used in construction zones 5, 9, 12, A, C and E. No vibration data are available for this plant, and therefore they have been assumed to be similar to the Caterpillar CS74B vibratory soil compactors;
- crusher and screen (400tonne/hr mobile jaw powerscreen) used in construction zones 2 and 6. No vibration data are available for this plant; however, it is considered very unlikely that they would cause greater levels of vibration than a vibratory piling rig;
- tracked horizontal vibratory screens used in construction zones 2 and 10. No vibration data are available for this plant; however, it is considered very unlikely that they would cause greater levels of vibration than a vibratory piling rig; and
- Dawson pile hammer (operated from crane) in construction zones 2 and 10.

6.4.15 Vibration from construction plant/equipment attenuates rapidly with distance. Predictions of vibration presented later in this chapter (starting at section 6.5.29) demonstrate that in most cases the vibration levels at distances of over 92m from the source would be negligible. As the dimensions of working areas (and the distances between working areas) are much greater than this, and other emitters are likely to be more than 92m away, the assessment only considers the effect of one vibration emitter at a time at receptors.

Blasting vibration and air- overpressure (blasting noise)

6.4.16 This assessment assumes that all blasting events would be designed by the blasting contractor to meet the blasting vibration limits set out in appendix B6-2 (Noise and Vibration Modelling and Assessment Methodology Report, Application Reference Number: 6.2.21).

6.4.17 As detailed in appendix B6-2 (Application Reference Number: 6.2.21), it is impossible to predict the location of the maximum air overpressure, and it is not accepted practice to set specific limits for air overpressure; instead, the accepted best practical approach set out in British Standard, (BS) 5228-2 [RD5] is to minimise its generation at source. This approach is adopted in *Minerals Technical Advice Note (Wales): 1: Aggregates* (MTAN1) [RD6] which notes that careful blast design should be able to resolve excessive levels of air overpressure, and recommends approval of a scheme by which air overpressure is managed and mitigated through careful design of blasting operations.

6.4.18 The design of blasting operations would reduce the generation of air overpressure (including audible noise from blasting) to a practicable minimum by implementing measures which minimise the Gas Release Pulse and Stemming Release Pulse, which are the are the greatest contributors to air overpressure.

6.4.19 Air overpressure associated with blasting events has not been considered quantitatively in this assessment. However, it is recognised that, without proper management, blasting events (in particular the effects of audible secondary vibrations caused by air overpressure in buildings) have the potential to cause concern to residents. More details are provided within the Main Power Station Site sub-Code of Construction Practice (CoCP) (Application Reference Number: 8.7), which set out the project's blasting strategy.

Site suitability

6.4.20 The site suitability in terms of ambient noise levels at the proposed Site Campus has been assessed in accordance with *Technical Advice Note 11: Noise* [RD7].

6.4.21 There are few existing anthropogenic noise sources which affect the location of the proposed Site Campus (construction zone 12), and so baseline noise levels at this location are expected to be low. However, by the time that the Site Campus would be occupied, construction works across the Wylfa Newydd Development Area would be ongoing.

6.4.22 To establish the site's suitability for the Site Campus, the modelled daytime and night-time noise levels associated with the months 31 to 33 scenario have been used. This is the period in the programme expected to cause the highest construction noise levels at the proposed Campus Site. It is also assumed that parts of the Site Campus will be completed and occupied, but other parts will be under construction; therefore, noise from ongoing Site Campus construction activities within construction zone 12 has been included in the modelled noise levels.

Embedded mitigation

6.4.23 There are embedded measures included in the project design that would reduce the noise and vibration effects from the construction. These are summarised below.

6.4.24 Earth mounds located at the north-east, south and south-west extents of the Wylfa Newydd Development Area (identified as construction zones A, C and E on figure D6-2 (Application Reference Number: 6.4.101)) would provide attenuation of construction noise for receptors, as per the Phasing Strategy (Application Reference Number: 8.29).

6.4.25 An earth bund along the south-east of construction zone 9, referred to as Mound B in the LHMS, (see figure D6-2, Application Reference Number: 6.4.101) along the boundary with the A5025 is incorporated to reduce construction noise levels at properties in Tregele. The proposed haul routes (see figure D6-2, Application Reference Number: 6.4.101) within the Wylfa

Newydd Development Area would be capped with suitable materials and techniques, which would have a lower potential for emitting noise and vibration than unsurfaced haul roads, as per the Main Power Station Site sub-CoCP (Application Reference Number: 8.7). For example, this measure would reduce ground-borne vibration levels caused by dumper trucks impacting on road surface irregularities, such as the edges of holes.

Good practice mitigation

6.4.26 The contractors would work in accordance with the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Main Power Station Site sub-CoCP (Application Reference Number: 8.7), which include topic-specific environmental management strategies. The Noise and Vibration Management Strategies would set out requirements to predict, control and monitor both noise and vibration throughout the entire construction period. Compliance with the Noise and Vibration Management Strategies set out in the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Main Power Station Site sub-CoCP (Application Reference Number: 8.7) would be a requirement of the contract between Horizon and the contractors appointed to undertake the works. The noise and vibration management strategies would require the measures described below to be implemented wherever practicable. These measures are consistent with the guidance in BS 5228-1:2009+A1:2014.

6.4.27 Prior to the commencement of construction activities, the preferred construction methodology and equipment would be reviewed to identify any reasonable opportunities to reduce construction noise and vibration and potential effects on sensitive receptors. Where reasonable opportunities are identified, these would be adopted as part of the construction methodology. There would be a preference for electrically powered equipment rather than diesel or petrol powered equipment, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.28 Heavy plant and equipment would comply with the noise limits quoted in the Outdoor Noise Directive 2000/14/EC, which is enacted in the Noise Emission in the Environment by Equipment for use Outdoors Regulations 2001 (United Kingdom Statutory Instrument 2001/1701). All plant would be maintained on a regular basis to ensure in good working order and compliance with these noise limits, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.29 All heavy plant and equipment which are fitted with noise abatement covers would not be operated with the noise abatement covers open or removed, to ensure that the acoustic insulation they are fitted with remains effective. The effectiveness of acoustic insulation and silencers fitted to plant would be monitored and assessed on a monthly basis. Any plant or equipment identified to have defective or underperforming insulation or silencers would be immediately investigated and repaired, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.30 Heavy plant, equipment and vehicles in intermittent use would be shut down or throttled down to a minimum during waiting periods as far as is practicable, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.31 There would be a preference for fabrication to occur off-site or within purpose-built buildings on site, rather than in open areas, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.32 Consideration will be given to site layout in order to eliminate or reduce emissions received at sensitive locations. Noise or vibration emitting plant will be situated as far as practicable from sensitive areas, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.33 Vehicles and mechanical plant employed for any activity associated with the construction works will be fitted with effective exhaust silencers/suppression equipment, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.34 Plant employed for any activity associated with the construction works will be operated in a manner such that noise and vibration emissions will be controlled and limited as far as reasonably practicable, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.35 Vehicles will not wait or queue on the public highway with engines running (unless the engine was required to power the operation of the vehicle e.g. concrete wagon), as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.36 All materials will be handled in a manner that would reduce noise, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.37 Noise from reversing vehicle alarms would be controlled and limited by designing circulation routes to avoid the need for vehicles to reverse as far as practicable and using banksmen where appropriate. To reduce noise, reversing alarms fitted to all vehicles would incorporate one or more of the following features, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6):

- highly directional sounders;
- broadband or warbling signals;
- self-adjusting output sounders (also known as ‘smart sounders’); and
- flashing lights.

6.4.38 The location of static equipment (such as generators, compressors and pumps would be positioned to reduce noise at sensitive receptors as far as practicable.

6.4.39 Localised noise screens or enclosures would be placed around small-scale and comparatively immobile equipment where practicable.

6.4.40 Vibratory rollers will not be started, stopped, or the direction of travel reversed close to sensitive receptors unless no alternate option is available.

6.4.41 The need for considerate working practices and behaviours would be communicated to the workforce through site inductions, shift briefings and toolbox talks.

6.4.42 Applications for prior consent under Section 61 of the Control of Pollution Act 1974 would be required for all major construction activities. Each application would contain the particulars of the works to be undertaken, the working methods, details of the plant proposed to undertake the works, noise (and vibration if relevant) predictions and the proposed noise-control measures. Applications would be submitted to the IACC for consent. The aim of Section 61 applications would be to establish that the best practicable means have been employed to control noise emissions. The IACC may attach conditions to each consent, where it is considered that additional measures are required. As a minimum, the following information would be set out in each Section 61 application, as per Appendix A of the Wylfa Newydd CoCP (Application Reference Number: 8.6) and summarised below.

- Noise and vibration monitoring procedures, including equipment specification, locations, durations, trigger action levels and reporting requirements.
- Blasting control procedures, designed to reduce the generation of air overpressure at source and ensure that blast vibration does not exceed the limit values set out in appendix B6-2 (Application Reference Number: 6.2.21).
- Contact details (24 hours, seven days a week) for on-site personnel responsible for noise and vibration management.
- Complaint response protocols.
- In the event that works for which Section 61 consent has been applied for, need to be rescheduled or modified (for example, using different plant, working methods or working hours), Horizon will apply for a dispensation or variation from the IACC before commencing those works.

6.4.43 The strategic placement of material when building mounds A and C would create noise barriers that construction plant would work behind. This would require that the mound be built sequentially in layers, with the perimeter of the mound nearest to properties being built first, which would then provide attenuation whilst the remainder of that layer is completed behind, as per the Phasing Strategy (Application Reference Number: 8.29).

6.4.44 To improve efficiencies, some works would be carried out during the more sensitive evening, night-time and weekend periods (as set out in the heading rows of table D6-16). However, key potentially noisy activities would be restricted during these periods. For example, earthworks near receptor locations would not be carried out at night. Blasting events would also not be planned for these more sensitive periods, as per the Main Power Station Site sub-CoCP (Application Reference Number: 8.7). As part of the Section 61 consent, blasting times will be communicated to the local community in advance.

6.4.45 A Community Liaison Group will be established and construction issues will be regularly discussed between Horizon, the contractors, the IACC and representatives from the local community, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6). BS 5228 states (in both Parts 1 [RD4] and 2 [RD5], which relate to noise and vibration respectively):

"*It is well established that people's attitudes to noise (and vibration) can be influenced by their attitudes to the source or activity itself. Noise (and vibration) from a site will tend to be accepted more readily by local residents, if they consider that the contractor is taking all possible measures to avoid unnecessary noise (and vibration).*"

6.4.46 This forum would provide advanced notice to the local community of works taking place, so that residents may plan around them.

6.4.47 All blasting will be designed to comply with the relevant vibration thresholds set out in the Main Power Station Site sub-CoCP (Application Reference Number: 8.7).

Operation

Basis of assessment and assumptions

6.4.48 Noise emissions during the operation of the Power Station would principally be associated with the normal operation of equipment associated with power generation. The operational sources considered in this section include the following:

- transformers;
- emergency generators;
- buildings;
- reactor building stacks;
- pumps and motors;
- cooling and ventilation systems; and
- reserve ultimate heatsink.

6.4.49 Noise during operation of the Power Station associated with marine vessel movements are also considered in this section.

6.4.50 The radioactive waste facilities would be constructed after the commencement of Power Station operations. The noise associated with the construction of these facilities is therefore considered in this section, as it would occur during the operational phase.

6.4.51 The operation of the Power Station would involve various types of balanced rotating equipment, such as steam turbines and diesel generators, which have the potential to be vibration sources. However, as all such equipment would be located within substantial structures, any vibration transmitted into the surrounding ground is likely to be negligible and orders of magnitude lower than would be expected to give rise to nuisance or damage to offsite properties. Therefore, it is not proposed to include a quantitative assessment

of operational vibration in the noise and vibration assessment, as confirmed in appendix A6-1 (Scoping Opinion Tracker, Application Reference Number: 6.1.9).

6.4.52 The design of many operational noise sources has not been finalised, since commercial contracts with suppliers of plant and machinery have yet to be awarded. The control of noise emissions would form a component of the purchasing policy and decision making for key relevant items of plant and machinery, as referred to in the Wylfa Newydd Code of Operational Practice (CoOP) (Application Reference Number: 8.13). This would ensure that the final plant and machinery items installed do not result in greater adverse noise or vibration effects than those assessed in this study.

6.4.53 The operational noise modelling undertaken has represented 'a worst case' through the implementation of the following approach:

- Only the screening associated with the following buildings has been accounted for in the model: Reactor Buildings, Control Buildings, Turbine Buildings, Heat Exchanger Buildings and Service Building. As screening provided by all other buildings is not accounted for in the model, the calculated levels at receptors are higher than those that would be expected in practice.
- The screening associated with the Reactor Buildings, Control Buildings, Heat Exchanger Buildings and Service Buildings has been minimised by using the minimum dimensions from the parameter envelope for each building. This results in a lower degree of screening in the model than would be expected in practice, leading to an overestimate of noise levels at receptors.
- When calculating noise break-out levels for the buildings containing noise sources, the maximum dimensions from the parameter envelope for each building have been used. This results in the highest potential sound value being used to represent the break-out levels for each building.
- The calculated noise levels are based on the assumption that each receptor is simultaneously downwind of all sources, which is a theoretical scenario that would only rarely occur at certain receptors. Therefore, the results represent an overestimate of the noise level that would typically be experienced.

6.4.54 The locations of the key buildings and structures that would radiate noise are presented in figure D6-11 (Application Reference Number: 6.4.101).

Transformers

6.4.55 Environmental noise during normal operations has the potential to arise from a number of different plant items. One of the key operational noise issues is likely to be the operation of the generator transformers and auxiliary transformers. The largest transformers are the generator transformers, which have the greatest potential to cause noise effects at local receptors. In addition, there are smaller sets of auxiliary transformers. Noise associated with transformers could commonly be described as a continuous hum, with

tonal low to middle frequency components. In addition, fan cooling systems have the potential to give rise to additional continuous noise with harmonic components.

6.4.56 The electrical rating of each transformer has been used with the formulae provided in *Handbook of Acoustics* [RD8] to predict the sound rating (as defined by the National Electrical Manufacturers Association). This is then used by the procedure outlined in section C-20 and table C-30 of *Noise and Vibration Control* [RD9], which has been used to predict transformer noise and is considered to represent an appropriately conservative methodology. *Noise and Vibration Control* [RD9] provides a methodology for accounting for degradation of transformers over their lifetime, which can occur when the laminations or tie-bolts become loose and the transformer begins to 'buzz' or 'rattle'. The electrical ratings for the transformers are:

- two generator transformers – each made up of three limbs at 530 Mega Volt Amps (MVA) each;
- four auxiliary normal transformers – each approximately 70 MVA; and
- two auxiliary standby transformers – each approximately 110 MVA.

6.4.57 In addition, provision would be made for:

- eight (four per Unit) feedwater pumps variable speed drive transformers (each approximately 10MVA);
- six (three per Unit) class 1 feeder transformers (each approximately 9MVA); and
- eight (four per Unit) RIP MG set feeder transformers (each approximately 4MVA)

Buildings

6.4.58 There are various other buildings with the potential to give rise to environmental noise during normal operations. The likely internal noise levels have been evaluated based on experiences of other power station projects where similar types, size and ratings of equipment have been used, and have been selected to represent a worst case for each building type. The construction type of the walls and roof for each building are selected to be representative of the design. The buildings, and the assumptions adopted in the noise model are provided in table D6-8.

Table D6-8 Modelling assumptions for normally operational buildings

Building name	Sources within building	Assumed internal noise level	Walls and roof construction type
Back-up Buildings, Emergency Diesel Generator Buildings	Diesel generators	105 dB(A) incident on internal	100mm concrete

Building name	Sources within building	Assumed internal noise level	Walls and roof construction type
		building envelope	
Switchgear Building	Various items of equipment, including chillers	75 dB(A) incident on internal building envelope	Standard steel frame building with profiled steel cladding and no significant penetrations
Auxiliary Standby Generator Building	Diesel generators	85 dB(A) incident on internal building envelope	Standard steel frame building with profiled steel cladding and no significant penetrations
Turbine Building	Steam turbine and generator	85 dB(A) 1m from turbine and generator	Standard steel frame building with profiled steel cladding and no significant penetrations
House (auxiliary) Boiler Building	Boilers, fans and ancillary equipment	80 dB(A) incident on internal building envelope	Standard steel frame building with profiled steel cladding and no significant penetrations
Waste processing buildings, water treatment buildings and temporary storage facilities	Storage vessels, pumps and other mechanical equipment	80 dB(A) incident on internal building envelope	Standard steel frame building with profiled steel cladding and no significant penetrations

6.4.59 Breakout of noise through the walls and roofs of these buildings has been calculated in accordance with BS EN 12354-4 [RD10]. This standard provides a methodology for estimating the noise that passes through the walls of a building to the external environment. The resulting sound power value has been assigned to external building surfaces in the noise model.

6.4.60 The operation of individual air supply and extraction systems for certain buildings has also been considered during normal operations. The sound power levels for all external sources, and building surfaces are shown in appendix D6-1 (Application Reference Number: 6.4.23).

6.4.61 Noise emissions from several potential environmental noise sources have been considered and identified as likely to have a negligible effect at receptors. The sources that have been scoped out from the noise model are described below:

- Operation of plant within the reactor building, control building, heat exchanger building, radioactive waste building and filter vent building. Within these buildings, there are numerous individual noise sources that are expected to give rise to moderate levels of internal noise. However, all façades of these buildings would be constructed with reinforced concrete, able to withstand impact from aircraft. In addition, there would be thick, heavy door sets to all entranceways that would not open during normal operations. These factors mean that breakout from the internal sources through the building façades would be negligible.
- Operation of a centralised air handling system that would supply and extract air for certain buildings, meaning there would be no air exhaust or intake openings external to these buildings.

Reactor building stacks

6.4.62 Air from within the reactor buildings would be emitted via the main vertical stack. Noise at the stack exit is expected to be dominated by noise from the fans used to push air through the stack. The exhaust system is not yet specified, and the source noise levels associated with the fans are not known. It has been assumed that the combined sound power of the fans would be approximately 110dB(A), which is considered to adequately represent a worst case scenario based on professional judgement. After passing through standard splitter attenuators, the sound power is expected to be approximately 90dB(A).

Building platform

6.4.63 The platform height options have been included in the noise model as follows, which reflects the landscape design:

- +18.0mAOD for the power block;
- +21.0mAOD for the surrounding areas; and
- +6.6mAOD for the area around the circulating water intakes and the MOLF.

Reserve ultimate heat sink

6.4.64 The reserve ultimate heat sink facility would be based around forced-draft, wet-cell cooling towers, arranged in two sets. These cooling towers would be used during certain emergency events and during routine testing, and would produce noise emissions.

Pumps and motors

6.4.65 External pumps and motors with the potential to give rise to perceptible levels of environmental noise at receptors have been included in the model. These

include the cooling water pumps (which would be located within pits) and their associated motors (located at the circulating water platform), which would be located within acoustic enclosures. Additionally, the biocide pumps and their associated motors, which would also be located within acoustic enclosures, are included in the model.

6.4.66 The sound power values for these sources have been derived using the relevant formulae contained within *Noise and Vibration Control* [RD9].

Standby emergency generators

6.4.67 There are various diesel generators that would all be located within substantial buildings. The main standby combustion plant consists of:

- Emergency Diesel Generators (EDGs) – there would be a total of six EDGs: one EDG would be located in each of the six EDG Buildings, (three EDGs would be required for each of the two UK Advanced Boiling Water units), each with a stack. Each EDG would be powered by a diesel-fuelled compression ignition engine. Each EDG would be rated at 10.4MW electrical output (MWe).
- Back-up Building Generators (BBGs) – there would be a total of four BBGs: two BBGs would be located in each of the Back-up Buildings (one Back-up Building, containing two BBGs, would be required for each UK Advanced Boiling Water Reactor unit), and each BBG would have a separate stack. The BBG would be powered by a diesel-fuelled compression ignition engine and each BBG would be rated at 4.8MWe.
- Auxiliary Standby Generators (ASGs) – there would be a total of two ASGs. The ASGs would be housed in the ASG Buildings, one located in the north, the other in the south of the installation, each with a stack. The ASGs would be powered by diesel-fuelled compression ignition engines and each ASG would be rated at 3.6MWe.

6.4.68 Although long-term running of these generators does not form part of the normal operations scenario, there would be a requirement to test the generators during the commissioning phase, and then regularly for short periods throughout the operational phase, and during outages. The main sources of environmental noise associated with the operation of these generators are:

- cooling fans, which would be located on the roof of each building;
- air intake apertures, which would be fitted with high-performance acoustic attenuators; and
- exhaust stacks, which would also be fitted with high-performance attenuators.

6.4.69 The sound power levels associated with each of these sources are shown in appendix D6-1 (Application Reference Number: 6.4.23).

6.4.70 In addition to the generators described above, mobile generators would be involved in annual exercises involving the operation of the generators for

approximately one hour. In addition, these mobile generators would be subject to monthly maintenance testing involving their operation for less than five minutes. Given the infrequency of this operation, and the relatively low levels of noise associated with the mobile generators, these are not considered further in the assessment.

Marine vessels

6.4.71 The number of marine vessel movements during the operational phase would be much lower than those that have been assessed during the construction phase. Ship movements inside the harbour would be limited to maintenance dredging activities and very infrequent movements (less than one per year) linked to the delivery of Abnormal Indivisible Loads during operation. An assessment of the marine vessel movements has been undertaken based on the available data, which is based on 24-hour working.

Assessment scenarios

6.4.72 Not all fixed plant items would be routinely used during normal operations, and consideration has been given to noise associated with testing during normal operations and outage periods. The following operational activities are considered in this section:

- normal operations;
- commissioning of standby emergency generators;
- routine testing of standby emergency generators;
- routine testing of the reserve ultimate heatsink;
- LOOP (Loss of Off-site Power)/LOCA (Loss of Coolant Accident);
- testing of emergency alarm systems;
- outage; and
- construction of radioactive waste facilities.

6.4.73 For each scenario, all auxiliary boilers have been modelled as operating at full load. In reality, different combination of boilers would operate in each scenario, and therefore the modelling represents a conservative approach.

Normal operations

6.4.74 During periods where no generators are being tested, the modelled operational sources are shown in table D6-9.

Table D6-9 Modelled operational sources during normal operations

Plant	Number of plant and load
Generators	None operating
Auxiliary boilers	All boilers operating at full load
RUHS, Fire Water Pump House	None operating
All other sources	Operating

Commissioning testing of standby generators

6.4.75 The commissioning of the Units on-site (known as 'Site Acceptance Testing') would be undertaken to confirm that the generators have not been damaged during transit or during installation and the system operates as per the design specification. The Site Acceptance Testing would be carried out over 72 hours, with a diesel generator combination test taking place over 24 hours and individual tests being carried out over the remaining 48 hours.

6.4.76 This commissioning of the standby emergency generators is anticipated to occur once for Unit 1, in 2024 or 2025, and then once for Unit 2, approximately one to two years later. Commissioning of new generators approximately halfway through the 60-year lifespan of the Wylfa Newydd Power Station is expected and would follow a similar pattern. The sources operating for the commissioning scenario are displayed in table D6-10. The combination of sources has been selected to represent the highest levels expected during commissioning. The three highest contributing EDGs have been determined on a per-receptor basis to ensure the approach represents a worst case.

Table D6-10 Modelled operational sources during commissioning

Plant	Number of plant and load
EDGs	Three highest contributing EDGs operating at full load
BBGs	Two BBGs operating at 30% load
ASGs	Not operational
Auxiliary boilers	All boilers operating at full load
RUHS, Fire Water Pump House	None operating
All other sources	Operating

Routine testing of standby emergency generators

6.4.77 Routine maintenance and testing of each standby emergency generator would be conducted at set intervals, in accordance with a defined maintenance and testing programme. Test runs would be conducted routinely to prove operation and also following the completion of routine maintenance to confirm there are no defects. It is anticipated that this would consist of a four-hour test run per month and a 10-hour test after preventative maintenance undertaken during each Scheduled Outage (i.e. once every 18 months). The standby plant would be tested individually and no two units would be tested within the same day.

6.4.78 It is proposed to undertake the routine testing described above during daylight hours. However, there is the possibility that, in exceptional circumstances, testing could be required at night. Therefore, to ensure the assessment scenario represents a worst case, operation during both the day and night is considered. The noise sources included in the model for the routine testing scenarios are displayed in table D6-11.

Table D6-11 Modelled operational sources during routine testing of standby emergency generators

Plant	Number of plant and load
Generators	Highest contributing generator operating at full load
Auxiliary boilers	All boilers operating at full load
RUHS, Fire Water Pump House	None operating
All other sources	Operating

Routine testing of RUHS

6.4.79 Routine maintenance and testing of each of the banks of cooling towers that comprise the RUHS would be conducted at set intervals, in accordance with a defined maintenance and testing programme. Test runs would be conducted routinely to prove operation and also following the completion of routine maintenance to confirm there are no defects.

6.4.80 It is expected that testing of each bank of cooling towers would be tested once per month, and this testing would occur during the daytime.

Table D6-12 Modelled operational sources during routine testing of RUHS

Plant	Number of plant and load
Generators	None operating
Auxiliary boilers	All boilers operating at full load
RUHS	Both banks of cooling towers operating at full load
Fire Water Pump House	Not operating
All other sources	Operating

LOOP/LOCA

6.4.81 A LOOP or LOCA event would not occur with any regularity, and the likelihood of either scenario occurring is low.

6.4.82 The Office for Nuclear Regulation has advised that the following LOOP frequency figures should be used at Generic Design Assessment for the generic site:

- short-term LOOP of up to two hours' duration: 1 in 20 years;
- medium-term LOOP of between two and 24 hours' duration: 1 in 200 years; and
- long-term LOOP of between 24 and 168 hours' duration: 1 in 20,000 years.

6.4.83 It should be noted that the figures provided by the Office for Nuclear Regulation are viewed as conservative. For the purposes of this assessment, Horizon has assumed that the frequency of LOCA events is included in the above estimate of LOOP events.

6.4.84 A LOOP or LOCA scenario would require all EDGs, BBGs and ASGs to operate for a period of at least two hours, with the EDGs subsequently shutting down either after restoration of off-site power or as the electrical demand falls. The initial period prior to the shutdown of the EDGs would be the worst case in terms of noise, and is shown in table D6-13.

Table D6-13 Modelled operational sources during LOOP/LOCA

Plant	Number of plant and load
EDGs	All operating at full load
BBGs	All operating at full load
ASGs	All operating at full load
Auxiliary boilers	All boilers operating at full load
RUHS, Fire Water Pump House	Operating
All other sources	Operating

Testing of emergency alarm systems

6.4.85 The potential noise effects associated with the routine testing of external emergency alarms is considered qualitatively.

Outage

6.4.86 Other than testing of emergency generators, the activities undertaken during routine outages are not anticipated to lead to potentially significant noise or vibration effects, since they would be undertaken within buildings. Therefore, outage has not been considered in the noise modelling scenarios. There would be a higher volume of on-site vehicular activity during outage, and this is considered quantitatively.

Construction of radioactive waste facilities

6.4.87 The plant list and programme for the construction of radioactive waste facilities would be determined around five to 10 years after the commencement of Power Station operations. A qualitative assessment has therefore been carried out, taking into account the distance to the nearest residential receptors and the likely small plant complement when compared to the Main Construction stage. The works are likely to involve a concrete batching plant in addition to typical building construction plant (excavators, cranes, loaders, dozers, etc.).

Embedded mitigation

Transformers

6.4.88 The combined noise level from transformers at the Power Station, including generator transformers, auxiliary transformers and associated cooling systems (hereafter referred to as 'transformer noise') are considered to have significant potential to cause noise effects at local receptors due to a variety of factors, including the following.

- High intrinsic levels of noise – transformer noise is caused by a phenomenon called magnetostriction, which causes oscillatory expansion and contractions in the core of the transformer. It is not

possible to remove this effect from transformer design, and therefore transformers are inherently noisy items of equipment.

- The potential for tonality at low to middle frequencies – magnetostriction causes noise to be radiated at discrete frequencies, which humans perceive as tonality. As humans can detect tonal noise more readily than other types of noise, the likelihood for annoyance is increased. The lowest of these discrete frequencies (called the fundamental frequency) for the proposed generator transformers would be 100Hz. As this is a relatively low frequency, noise at this fundamental frequency can pass around objects and through windows more readily than other types of noise, which also increases the likelihood for annoyance.
- A characteristic noise signature – as well as the fundamental frequency described above, transformer noise is also emitted at multiples of the fundamental frequency (called harmonics). This gives transformer noise a particular characteristic sound that makes it readily distinguishable when compared to other types of noise. This makes it more likely to be perceived by residents and increases the likelihood for annoyance.
- The potential of noise levels to deteriorate over time – over the operational lifetime of a transformer, the laminations or tie-bolts that hold its structure together become loose and transformers can begin to 'buzz' or 'rattle'.
- The location of the transformers – the transformers would be located to the east of each reactor building. The transformer for Unit 2 would be located to the east of the main plant shown on figure A2-1 (Application Reference Number: 6.1.10). It is not technically feasible to relocate the generator transformers without a fundamental redesign of the reactor building.
- A local history of transformer noise issues – the National Grid transformers adjacent to the Existing Power Station have been the subject of some adverse community responses in the past. This may have increased the sensitivity of the local community to transformer noise.

6.4.89 In recognition of these factors, transformer noise shall be subject to appropriate near field limits, selected to achieve a free-field transformer noise level of 25dB $L_{Aeq,T}$ or below at the closest residential receptors.

6.4.90 Near field limits will also be selected such that the unweighted transformer noise level does not exceed a level of 38dB within the 125Hz octave band at the same locations.

6.4.91 These measures are included in the Wylfa Newydd CoOP (Application Reference Number: 8.13).

6.4.92 These values have been discussed with the IACC during consultation, and have been selected to take into account the factors described above, as well as the low background noise environment at local receptors (see table D6-6).

The levels are considered to represent a conservative threshold, below which noise is unlikely to be perceptible for the majority of the time, and where annoyance due to transformer noise is unlikely to occur.

6.4.93 The separate criterion for noise at 125Hz is included to ensure that low frequency noise is reduced to an appropriate level, one that would be unlikely to cause disturbance.

6.4.94 The total source sound power value of the unmitigated generator transformers has been estimated at 115dB(A) per generator transformer, based on the conservative empirical methodology described earlier. This value includes a correction to account for the deterioration of transformer noise over time.

6.4.95 The closest residential receptors to the proposed generator transformers are located east of the development along the A5025, at the north-western edge of Tregele and property south of the Wylfa Newydd Development Area. To meet the criterion of 25dB $L_{Aeq\ T}$ at these receptors, the noise model indicates that the estimated transformer noise levels would need to be reduced by approximately 20dB(A).

6.4.96 There are various ways of achieving this amount of noise reduction, including the construction of purpose-built enclosures from sufficient thicknesses of concrete or steel. For instance, a full enclosure constructed from 100mm concrete, with an acoustically treated ventilation system, would provide a reduction in noise levels (known as 'transmission loss') of at least 40dB. The criteria above relate to the noise output from the transformers in combination with any associated cooling/ventilation systems.

6.4.97 In practice, the degree of noise reduction required by the enclosure would also depend on the sound power radiated by the selected generator transformers, and it may be possible to meet the above criteria without any enclosure if a suitably quiet model is available.

Good practice mitigation

6.4.98 There are a number of embedded mitigation measures that would reduce the noise and vibration effects from the operational Power Station. These measures have been taken into account in forming the worst case scenarios and undertaking their assessment.

6.4.99 The proposed noise sources (e.g. turbines and back-up generators) are located within substantial buildings, as per the Wylfa Newydd CoOP (Application Reference Number: 8.13). In addition, the detailed design of the buildings would reduce the potential for noise leakage through openings and penetrations in the building envelopes. These factors mean that noise from equipment within these buildings would be inaudible at local receptors.

6.4.100 The design of the Power Station will take the design advice provided in the European Commission's Best Available Techniques Reference Document for Large Combustion Plants [RD11] into account. Examples of where the noise reduction techniques recommended in the document are demonstrated in the proposed design are provided in table D6-14, as per the Wylfa Newydd CoOP (Application Reference Number: 8.13).

Table D6-14 Summary of techniques from [RD11]

Technique	Description from [RD11]	Example of technique in proposed design
Appropriate location of equipment and buildings	Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens	• The main sources are located around the central part of the overall Power Station, which means that the distance to local receptors is maximised. • Large buildings (including main reactor buildings) would provide effective screening for certain sources at local receptors.
Operational measures	These include: • improved inspection and maintenance of equipment; • closing of doors and windows of enclosed areas, if possible; • equipment operated by experienced staff; • avoidance of noisy activities at night, if possible; and • provisions for noise control during maintenance activities.	The Wylfa Newydd CoOP (Application Reference Number: 8.13) sets out requirements addressing these types of measures.
Low-noise equipment	This potentially includes compressors, pumps and disks	Low noise versions of equipment would be purchased, where appropriate.
Noise attenuation	Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings	• Landscape features, such as a large earth bund near Tregele, would have the effect of reducing operational noise at the closest receptors. • Large buildings (including main reactor buildings) would provide effective screening for certain sources at local receptors.

Technique	Description from [RD11]	Example of technique in proposed design
Noise-control equipment	This includes: • noise-reducers; • equipment insulation; • vibration or acoustic insulation, or vibration isolation; • enclosure of noisy equipment; and • soundproofing of buildings.	• The majority of the power generation equipment would be housed in substantial buildings. • Acoustic attenuators would be included in the combustion air intake and exhaust systems for all combustion units. • Air handing systems would be fitted with acoustic attenuators where appropriate. • Where appropriate, rotating items of plant would be mounted on appropriately specified anti-vibration mounts.

6.4.101 The 2006 edition of '*Reference Document on Best Available Techniques for Large Combustion Plants*' [RD12] lists relevant additional noise control measures for combustion noise sources that are additional to those presented in [RD11]. These recommendations, and the way in which the proposed design addresses them, are provided in table D6-15.

Table D6-15 Summary of Best Available Technique from [RD12]

Technique	Example of technique in proposed design
Optimum operation of rotating machinery	As part of the equipment maintenance procedures, and to meet plant specifications, items of rotating plant would be properly aligned and balanced.
Use of acoustic machine enclosures	Where appropriate, the generators would be housed within acoustic enclosures, primarily specified for reducing noise exposure to personnel undertaking maintenance work within the generator buildings.
Selection of structures according to their noise isolation effect to envelope the building	The major Power Station noise sources (e.g. turbines, back-up generators), would be located within substantial buildings.
Use of mufflers in intake and exhaust channels	It is confirmed that acoustic attenuators are included in the combustion air intake and exhaust systems for all combustion units.
Use of vibration isolators and flexible connections	Where appropriate, rotating items of plant would be mounted on appropriate anti-vibration mounts. These would reduce the potential for vibration transmission into the building structure and subsequent re-radiation of noise. Note that this vibration within the building structure is different from ground-borne vibration described earlier.
Application of a carefully detailed design, e.g. to prevent possible leakage of noise through openings or to minimise pressure variations in piping.	The detailed design of the buildings would ensure that a high level of attention is paid to ensuring that the potential for noise leakage through openings and penetrations in the building envelopes is minimised.

Decommissioning

Basis of assessment and assumptions

Site Campus

6.4.102 Decommissioning of the Site Campus would be undertaken in phases to meet the reduction in accommodation demand as the Power Station construction works are completed.

6.4.103 The modular construction of the accommodation blocks would enable the units comprising each building to the removed with minimal disruption and would offer the opportunity to re-use the units on other projects. As each accommodation block is removed, the infrastructure associated with that block will also be removed.

6.4.104 The amenity building would be decommissioned internally in phases with the final removal of the complete building when accommodation is no longer needed.

6.4.105 Reinstatement of areas will commence when an area has been cleared of the buildings and the associated infrastructure.

6.4.106 None of the activities undertaken whilst decommissioning the Site Campus are expected to give rise to greater noise levels than will occur during the construction of the Site Campus.

Temporary Marine Works

6.4.107 Temporary cofferdams will be required for the Cooling Water outfall facility, the Cooling Water outfall and the Cooling water intake. A temporary access ramp would be constructed at the southern end of Porth-y-pistyll, and a temporary barge berth is required.

6.4.108 The inner harbour temporary cofferdam and the southern causeway would be temporary structures. These structures would be removed following completion of the works in the inner harbour and western breakwater respectively. Each of these activities would be expected to extend over a period of 12 months.

6.4.109 Decommissioning the above temporary structures will involve removing rock fill, and then removing the retaining piles or pile walls. Steel piles will be cut off at sea bed level by divers.

6.4.110 None of the activities undertaken whilst decommissioning the temporary Marine Works are expected to give rise to greater noise levels than will occur during the construction of the Marine Works.

Power Station

6.4.111 Before decommissioning of the Power Station starts, Horizon would need to obtain consent from the Office for Nuclear Regulation and undertake a separate impact assessment under the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999. This would require a period of consultation relating to the submission of a decommissioning proposal and supporting Environmental Statement. Horizon expects that this process would begin in the final few years prior to generation ceasing, so that the specific environmental characteristics of the environmental baseline could be fully evaluated and understood.

6.4.112 At this stage, no plant list or detailed methodologies are available for decommissioning works, and therefore a quantitative assessment of decommissioning is not possible. However, Horizon has developed a strategy for the decommissioning of the Power Station, which is used to inform a

qualitative assessment. The decommissioning strategy includes the following activities:

- The shutdown of reactors, followed by the reduction and eventual cessation of abstraction and discharge of cooling water.
- All plant and equipment would be removed prior to demolition and all structures down to 1m below ground level would be removed.
- Civil structures greater than 1m depth would be left in situ and punctured to allow drainage; all voids below 1m would be backfilled or grout filled, including the discharge water channel and the discharge water tunnels.
- The intake, outfall and MOLF structures will be removed, but not the breakwaters.
- Hardstanding areas would be removed (except those associated with the Intermediate Level Waste and spent fuels store which would remain until those facilities were removed).
- The landscaped mounds, including pasture and planting, would remain in-situ and the landscape drainage system would remain in place.
- No new impermeable areas would be developed as part of the decommissioning works, and any new compounds or buildings would be sited on existing hardstanding or permeable areas.

6.4.113 It can be assumed that the removal of structures during decommissioning works will be carried out using similar equipment as for construction.

6.4.114 Furthermore, the decommissioning strategy indicates that the earth mounds in construction zones A, C and E, or the bund in construction zone 9 beside the A5025 will be retained. These mitigation measures will attenuate decommissioning noise associated with the removal of the structures in construction zones 4 and 8.

6.4.115 The decommissioning strategy indicates a target 20-year timeframe from the end of power generation for completion of main decommissioning activities. As such, decommissioning would occur over a much greater time period than construction, and would involve fewer activities. Therefore, demolition activity will be less intense than the construction activities, and there may be substantial periods of time during which relatively little demolition activity occurs between the various phases of decommissioning activities.

Embedded mitigation

6.4.116 The embedded mitigation measures detailed for construction would be applicable to the decommissioning works.

Good practice mitigation

6.4.117 Good practice measures to be implemented during decommissioning will be similar to those identified for construction and relevant standards such as BS 5228-1 [RD4] or its successor, applicable at the time of decommissioning will be followed.

6.5 Assessment of effects

6.5.1 This section presents the findings of the assessment of effects associated with the construction, operation and decommissioning of the Power Station, Marine Works, other on-site development and the Site Campus.

Construction

Assessment criteria

6.5.2 Construction noise modelling and assessment has been undertaken in accordance with guidelines contained within the British Standard BS 5228-1 [RD4]. A technical overview of the modelling and assessment methodology is provided within appendix B6-2 (Application Reference Number: 6.2.21), whilst model input data are contained within appendix D6-1 (Application Reference Number: 6.4.23). As per section 4.5 of appendix B6-2 (Application Reference Number: 6.2.21) these are the adopted magnitude scales for the long-term and short-term construction operations.

Table D6-16 Adopted magnitude scale for long-term construction plant and machinery noise, dB $L_{Aeq,1hr}$ free-field

Magnitude of Change	Day of week/time period							
	Monday to Friday			Saturday			Sunday and Public Holidays	
	07.00 - 19.00	19.00 - 22.00	22.00 - 07.00	07.00 - 13.00	13.00 - 22.00	22.00 - 07.00	07.00 - 22.00	22.00 - 07.00
Large	≥72.0	≥67.0	≥62.0	≥72.0	≥67.0	≥62.0	≥67.0	≥62.0
Medium	62.0 – 71.9	57.0 – 66.9	52.0 – 61.9	62.0 – 71.9	57.0 – 66.9	52.0 – 61.9	57.0 – 66.9	52.0 – 61.9
Small	55.0 – 61.9	47.0 – 56.9	42.0 – 51.9	55.0 – 61.9	47.0 – 56.9	42.0 – 51.9	47.0 – 56.9	42.0 – 51.9
Negligible	<55.0	<47.0	<42.0	<55.0	<47.0	<42.0	<47.0	<42.0
	or less than a 3dB increase in the pre-existing ambient noise level							

Table D6-17 Adopted magnitude scale for short-term construction plant and machinery noise, dB $L_{Aeq,1hr}$ free-field

Magnitude of effect	Day of week/time period							
	Monday to Friday			Saturday			Sunday and Public Holidays	
	07.00 - 19.00	19.00 - 22.00	22.00 - 07.00	07.00 - 13.00	13.00 - 22.00	22.00 - 07.00	07.00 - 22.00	22.00 - 07.00
Large	≥72.0	≥67.0	≥62.0	≥72.0	≥67.0	≥62.0	≥67.0	≥62.0
Medium	70.0 – 71.9	57.0 – 66.9	52.0 – 61.9	70.0 – 71.9	57.0 – 66.9	52.0 – 61.9	57.0 – 66.9	52.0 – 61.9
Small	67.0 – 69.9	52.0 – 56.9	42.0 – 51.9	67.0 – 69.9	52.0 – 56.9	42.0 – 51.9	52.0 – 56.9	42.0 – 51.9
Negligible	<67.0	<52.0	<42.0	<67.0	<52.0	<42.0	<52.0	<42.0
	or less than a 3dB increase in the pre-existing ambient noise level							

6.5.3 Magnitude of change and the sensitivity of the receptor, as defined in section 6.2, have been used to establish significance of effects in the accordance with chapter B1 (introduction to the assessment process) (Application Reference Number: 6.2.1).

Noise

6.5.4 Free-field construction noise levels have been calculated for each elevation and for each floor of each building within the study area, for all modelling scenarios. This has enabled the magnitude of change to be established at all noise-sensitive receptors potentially affected by construction within the Wylfa Newydd Development Area, in accordance with the criteria set out in appendix B6-2 (Application Reference Number: 6.2.21). An indication of the number of residential properties falling into each magnitude of change category has also been provided in the sections below.

Residential receptors

6.5.5 As indicated in appendix B6-2 (Application Reference Number: 6.2.21), all residential properties are considered to have high sensitivity to construction noise.

6.5.6 Table D6-18 below provides the numbers of residential receptors (which are high-sensitivity) within each change in magnitude category when assessed against the long-term Sunday daytime and Sunday night-time criteria (which are also applicable for public holidays), arranged by groups. Receptors are categorised based on the highest change in magnitude to which they would be subjected in any of the modelled scenarios.

6.5.7 The Sunday criteria are used to establish the highest number of potential effects. The reason for this is that the Sunday criteria are the most stringent

of the presented criteria, and the intensity of construction activities will be the same on Sundays as for other days of the week.

6.5.8 For high sensitivity receptors, negligible changes in magnitude occur when none of the guidance thresholds set out in appendix B6-2 (Application Reference Number: 6.2.21) are exceeded, or when the change in noise level is unlikely to be perceptible. As such, negligible changes are not considered to be significant. Minor, medium and large changes imply that one or more guideline value(s) is or may be exceeded, and are considered significant.

Table D6-18 Predicted significance of effect at residential receptors

Magnitude of change	Significance of effect (adverse)	Receptor group (numbers of dwellings)							
		A	B	C	D	E	F	G	H
Large	Major significance	1	0	8	3	0	9	1	0
Medium	Major significance	26	213	12	10	10	59	0	11
Small	Moderate significance	4	376	0	1	16	2	0	416
Negligible	Minor (not significant)	0	7	0	0	0	0	0	36

6.5.9 Detailed breakdowns of the significance of effect for different days of the week and periods of the day (e.g. weekday, weekday night, Saturday morning, Saturday afternoon and evening, Sunday and public holiday daytime, Sunday and public holiday night-time) are contained in appendix D6-1 (Application Reference Number: 6.4.23).

6.5.10 It is clear from table D6-18 that the majority of the properties that fall within the large and medium magnitude of effect categories are within receptor groups B and F, which are the residential properties of Cemaes (south of construction zone A), and the residential properties in Tregele (to the south-east of construction zone 9). These properties are likely to experience a major adverse effect, which is considered significant.

6.5.11 The majority of the properties that will experience a medium magnitudes of change are also predicted for the residential and hotel properties in Cemaes and Tregele, and outlying residential properties east of the Power Station. These would result in a major adverse effect, which is considered significant and are predominantly associated with noise from the construction of the mounds in zones A and C, and the proximity of the bulk earthworks haul routes.

6.5.12 When considering all the residential groups, there are at total of 1177 properties likely to experience a significant adverse effect, of which:

- 814 are due to a small magnitude of change,
- 341 are due to a medium magnitude of change, and,

- 22 are due to a large magnitude of change.

6.5.13 The small magnitudes of change are largely associated with residential properties within the valley at Cemaes, and properties over 1,000m from the Power Station. These properties would experience a moderate adverse effect, which is considered significant.

6.5.14 As such, the construction noise assessment will consider additional mitigation for these construction zones to reduce residual noise effects, focusing mainly on measures that would help reduce noise levels for properties in Tregele and Cemaes, where the greatest improvements might be made.

6.5.15 There are 44 residences for which a negligible magnitude of change is predicted. As such these properties would experience a minor adverse effect, which is considered not significant.

Other high-sensitivity receptors

6.5.16 Other receptors which are considered highly sensitive to construction noise are hotels and schools. For the assessment of construction noise at schools, only weekday daytime noise levels are considered.

Table D6-19 Predicted significance of effect at other high-sensitivity receptors

Magnitude of change	Significance of effect	Nº Hotels	Nº Schools
Large	Major significance	0	0
Medium	Major significance	1	0
Small	Moderate significance	4	1
Negligible	Minor significance	0	1

6.5.17 No large magnitudes of change are predicted at any schools or hotels. A medium magnitude of change would occur at one hotel, leading to a major adverse effect, which is considered significant.

6.5.18 Small magnitudes of change are predicted at one school and four hotels. As such, these receptors will experience a moderate adverse effect, which is considered significant.

6.5.19 A negligible magnitude of change would occur at one school. As such this receptor would experience a minor adverse effect, which is not considered significant.

Medium-sensitivity receptors

6.5.20 Community buildings and places of worship are considered to be medium-sensitivity receptors. Table D6-20 below summarises the magnitudes of change and significance of effects at medium-sensitivity receptors.

6.5.21 No large magnitudes of change are predicted at any community buildings or places of worship, but medium magnitudes of change, would occur at two places of worship. As such, these receptors would experience a moderate adverse effect, which is considered significant.

6.5.22 Small magnitudes of change are predicted at four community buildings and five places of worship. As such, these receptors will experience a minor adverse effect, which is considered not significant.

Table D6-20 Predicted significance of effect at medium-sensitivity receptors

Magnitude of change	Significance of effect	Nº Community buildings	Nº Places of worship
Large	Major significance	0	0
Medium	Moderate significance	0	2
Small	Minor significance	4	5
Negligible	Negligible significance	0	0

6.5.23 Paragraphs 31-42 of Minerals Planning Guidance 11 (MPG11) [RD15] have been cancelled and superseded by MTAN1 [RD6], however paragraph 43 which is extant states that "*footpaths and bridleways should not normally be regarded as noise sensitive*". Conversely, the Institute of Environmental Management and Assessment Guidelines [RD14], state that where nationally recognised, footpaths are potential noise-sensitive receptors. In view of this conflicting advice on whether footpaths are considered sensitive receptors, a conservative approach has been taken and effects have been assessed for nationally recognised PRoWs. However, the sensitivity of a PRoW is considered to be lower than that of residential properties, as users are mobile and would experience the noise effects for a matter of minutes rather than several hours or days.

6.5.24 Although occasional sections of PRoWs, such as the Wales Coast Path and Copper Trail, could be subject to noise levels above 65dB $L_{Aeq,1\text{-hour}}$, users would experience noise levels below 65dB $L_{Aeq,1\text{-hour}}$ for the majority of the time, and the average noise levels experienced would generally be below 65dB $L_{Aeq,1\text{-hour}}$. A magnitude of small has therefore been assigned. This is supported by paragraph 43 of MPG11 [RD15] which states that a noise level of 65dB(A) represents an appropriate limit for "*open spaces which the public uses for relaxation*". Effects at PRoWs are assessed as minor and are therefore not significant.

Low-sensitivity receptors

6.5.25 Receptors with a low sensitivity to noise include commercial premises and offices. Table D6-21 summarises the magnitudes of change and significance of effects at low-sensitivity receptors.

Table D6-21 Predicted significance of effect at low-sensitivity receptors

Magnitude of change	Significance of effect	Nº Commercial	Nº Offices
Large	Moderate significance	2	5
Medium	Minor significance	4	0
Small	Minor significance	23	3
Negligible	Negligible significance	3	0

6.5.26 Large magnitudes of change are predicted at two commercial buildings and five office buildings. As such, these receptors would experience a moderate adverse effect, which is considered significant.

6.5.27 Medium magnitudes of change are predicted at four commercial buildings. As such, this receptor would experience a minor adverse effect, which is considered not significant.

6.5.28 Small magnitudes of change are predicted at twenty-three commercial buildings and three office buildings. As such, these receptors would experience a minor adverse effect, which is considered not significant.

Vibration

Properties

6.5.29 Predictions of free-field vibration levels arising from the use of vibratory plant and equipment during the construction works have been undertaken using the calculation methodologies set out in BS 5228-2 [RD5]. The horizontal distances from equipment at which the vibration levels are likely to be equal to the thresholds between the magnitude of change categories set out in appendix B6-2 (Application Reference Number: 6.2.21) are presented in table D6-22 below. The predicted vibration levels are presented in terms of the peak particle velocity (mm/s), which is commonly abbreviated PPV.

Table D6-22 Horizontal distances of vibration threshold, m

Equipment	Used in construction zones	Distances that trigger magnitude of change*			
		Large (10mm/s PPV)	Medium (5mm/s PPV)	Small (1mm/s PPV)	Negligible (≤1mm/s PPV)
Telescopic leader rig w/hydraulic vibratory hammer	11	Less than 13	13 to 21	22 to 73	Greater than 73
Vibratory pile hammer (all operations)	2, 10	Less than 13	13 to 21	22 to 73	Greater than 73
Caterpillar CS74B vibratory soil compactor (roller)	5, 9, 12, A, C, E	Less than 18	18 to 29	30 to 92	Greater than 92
Caterpillar 825G (32tonne) compactors	5,9, A, C, E	Less than 18	18 to 29	30 to 92	Greater than 92
Crusher and screen (400tonne/hr mobile jaw power-screen)	2, 6	Less than 13	13 to 21	22 to 73	Greater than 73
Tracked horizontal vibratory screens	2, 10	Less than 13	13 to 21	22 to 73	Greater than 73
Dawson pile hammer (model HPH6500)	2, 10	Less than 42	42 to 71	72 to 245	Greater than 245

* For buildings without any known or suspected structural weaknesses.

Telescopic leader rig with hydraulic vibratory hammer

6.5.30 One of the Site Campus buildings would be within 2m of zone 11, where the telescopic leader rig with hydraulic vibratory hammer would be used. If the hydraulic vibratory hammer were to be used within 13m of the building there could be a large magnitude of change, which would be considered a major adverse effect which is significant.

6.5.31 In many cases, however, the hydraulic vibratory hammer would be used at greater distances from the Site Campus buildings, leading to medium or small magnitudes of change, causing major or moderate adverse effects respectively (both of which are considered significant). Similar significant effects could occur at the closest buildings associated with the Existing Power Station.

Vibratory pile hammer, crusher and screen, and tracked screen

6.5.32 There is potential for the vibratory pile hammer to be used in construction zone 10 within 15m of buildings associated with the Existing Power Station, resulting in a vibration level of up to 7.9mm/s. This would be a medium magnitude of change at a low sensitivity receptor, resulting in a minor adverse effect, which is not considered to be significant.

6.5.33 There is potential for the vibratory pile hammer to be used in construction zone 2 within 66m of the historic building Felin Gafnan Mill. This would result in a vibration level of up to 1.1mm/s PPV at Felin Gafnan Mill, which would be a small magnitude of change resulting in a moderate adverse effect, which is considered significant.

6.5.34 One residence is located just over 160m from both construction zones 2 and 10, and therefore is sufficiently distant that the vibration caused by the vibratory pile hammer would be a negligible magnitude of change, resulting in a minor significance of effect that is not considered to be significant.

6.5.35 These conclusions are also valid for the crusher and screen, and the tracked horizontal vibratory screen that would be used in zone 2, which are all assumed to generate similar levels of vibration.

6.5.36 When the crusher and screen is operated in zone 6, the closest residential properties are over 120m away, and therefore the predicted magnitude of change is negligible, leading to a minor adverse effect, which is not considered significant.

Dawson pile hammer (model HPH6500)

6.5.37 The use of the Dawson pile hammer near the western extent of zones 2 or 10 would result in a small magnitude of change at one residence, which would result in a minor significant effect. When considering Felin Gafnan Mill a conservative approach has been taken, and the vibration magnitude criteria have been reduced by 50% due to the potential for structural weakness of this building. Based on this a large magnitude of change would be expected at the historic building Felin Gafnan Mill, which would result in a major adverse effect that would be considered significant.

6.5.38 If used close to the eastern extent of zone 10, at say 15m from the closest buildings associated with the Existing Power Station, a vibration level of 37.7mm/s PPV is predicted. This would be a large magnitude of change and would result in a major adverse effect, which would be considered significant.

Soil compactors

6.5.39 There are five residential properties within 18m of the construction zones where the Caterpillar CS74B vibratory soil compactors and Caterpillar 825G (32t) compactors would operate. If the compactors are operated right up to the edge of the construction zones, then these properties would experience a large magnitude of change, resulting in a major adverse effect, which is considered significant.

6.5.40 There are seven residential properties located between 18m and 29m from the construction zones where the soil compactors would operate. The predicted magnitude of change at these properties is medium, resulting in a major adverse effect, which is considered significant.

6.5.41 There are 75 residential properties at distances between 30m and 92m, for which small changes in magnitude are predicted, which would result in moderate adverse effects which are considered significant.

Site sensitive receptors

6.5.42 Threshold values associated with SSRs have been agreed with the owners/operators of the SSRs to prevent the risk of damage or disturbance to assets [RD1]. These thresholds are part of the noise and vibration strategy of the Main Power Station Site sub-CoCP (Application Reference Number: 8.7), and appropriate separation distances (or lower vibration emitting plant) would be maintained between the source of vibration and the SSR to ensure that vibration levels from construction works would comply with the threshold limits at SSRs at all times.

6.5.43 The magnitude of change would therefore be negligible, which would result in a minor adverse effect which is not significant.

PRoWs

6.5.44 Users of PRoWs within 20m of the use of vibratory rollers are expected to experience medium-magnitude effects at most. The zones of working for the use of vibratory rollers would be restricted as part of the Section 61 process as set out in the Wylfa Newydd CoCP (Application Reference Number: 8.6). This would lead to minor-magnitude effects at most, which would not be considered significant for the medium-sensitivity receptors

Blasting vibration and air overpressure

6.5.45 All blasting events would be designed to meet the blasting vibration limits set out in appendix B6-2 (Application Reference Number: 6.2.21), and the Main Power Station Site sub-CoCP (Application Reference Number: 8.7). Compliance with the Main Power Station Site sub-CoCP (Application Reference Number: 8.7) requirements would result in a negligible magnitude of change for both blasting vibration, and air overpressure and blasting noise. For receptors with a high sensitivity this would result in a minor effect which is not significant. Similarly, compliance with the proposed vibration criteria for the protection of the SSR (including the Existing Power Station, National Grid transformers and other infrastructure maintained by service providers) would ensure vibration levels do not exceed the operators' recommended limit

values. On this basis, the magnitude of change at these receptors is likely to be negligible, which for receptors with a high sensitivity would result in a minor adverse effect (not significant).

6.5.46 Horizon has established a detailed and comprehensive strategy for managing air overpressure from blasting in the Main Power Station Site sub-CoCP (Application Reference Number: 8.7). Therefore, based on professional judgement, the likely effects are anticipated to be of minor adverse significance.

Shipping vessel movements

6.5.47 There are currently 2,646 movements of Roll-on Roll-off and bulk vessels which pass within 1.7 nautical miles of the Wylfa Newydd Development Area per year. It is forecast that the Project will result in 552 additional annual movements, which represents an increase of 21% above the baseline.

6.5.48 A 21% increase in annual Roll-on Roll-off and bulk vessel movements would be expected to increase shipping noise by less than 3dB. This is considered a negligible change in magnitude. For receptors of a high sensitivity this would result in a minor adverse effect, which is not considered significant. This assessment is based on a 24-hour working period, as the available data on vessel movements is not broken down into specific daytime and night time periods.

Noise effects at the Site Campus

6.5.49 The predicted construction noise levels at the most exposed facades of the Site Campus are expected to be in the range of between 54dB and 70dB $L_{Aeq,16\text{-hours}}$ during the daytime and between 43dB and 54dB $L_{Aeq,8\text{-hours}}$ at night, corresponding to a large magnitude of change. As such it is considered that the Site Campus would experience a major adverse effect, which is considered to be significant.

6.5.50 Furthermore, the predicted noise levels would classify the Site Campus in the Technical Advice Note 11 [RD7] noise exposure category (NEC) B during the day and NEC C at night.

6.5.51 The NEC category C states that:

"Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise."

6.5.52 Chapter D2 (alternatives and design evolution) (Application Reference Number: 6.4.2) of this Environmental Statement considers alternative sites for the Temporary Workers Accommodation. The site selection process, which is documented in the Site Selection Report – Volume 1 – Introduction and Context (Application Reference Number 8.24.1) considered a range of planning and environmental criteria. A four-stage site identification, screening and assessment process was undertaken to identify potentially suitable sites; this culminated with a detailed assessment of 15 short listed sites in the final stage of the process. It was concluded that the Site Campus location to the

north east of the Existing Power Station was the most suitable of these sites; the main advantages of the Site Campus location are that it offers better opportunities for social cohesion due to its closer proximity to settlements, and it is located on-site within the Wylfa Newydd Development Area. An on-site location would reduce travel times (a positive for worker welfare) and thus daily traffic flows and emissions and transport costs. It also offers a high level of flexibility in terms of its size.

6.5.53 Whilst the Site Campus is located away from the MOLF, concrete batching plant, deep excavations and landscaping mounds, it is close to construction zone 11 and additional mitigation measures would be required in the design of Site Campus to achieve suitable internal noise levels and ensure that there will be only minor adverse effects at these dwellings. Further details on potential noise mitigation measures are provided in table D6-31.

Operation

Assessment criteria

6.5.54 The details of the operational assessment methodology and derivation of the criteria for all receptor types are set out in chapter B6 (Application Reference Number: 6.2.6).

6.5.55 Operational noise effects at residential properties have been assessed based upon the principles set out in in BS 4142 [RD13]. This standard uses a comparison of the 'rating level' (i.e. noise from the Power Station, plus any adjustment for the characteristic features of the sound) with background sound level, to derive an initial estimate of the impact. The magnitude scale used to derive the initial estimate of the impact is shown on table D6-23.

6.5.56 The standard describes the assessment outcome in terms of 'impact', and this term has therefore been adopted in the assessment of operational effects presented in this chapter. Its meaning is equivalent to the term 'adverse effect' used elsewhere in this Environmental Statement.

Table D6-23 Magnitude of operational noise effects at residential receptors

Magnitude of change	Difference between rating and background noise levels	Description of impact from BS 4142 [RD13]
Large	≥15dB	A difference of around +10dB or more is likely to be an indication of a 'Significant Adverse' impact, depending on the context.
Medium	10-14dB	
Small	5-9dB	A difference of around +5dB is likely to be an indication of an 'Adverse' impact, depending on the context.
Negligible	0-4dB	No description in BS 4142 [RD13], but described as 'Between Low and Adverse' impact for this assessment.
	<0dB	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 on the context.

6.5.57 BS 4142 [RD13] then requires the initial estimate of the impact to be modified based on context, and the contextual factors that have been considered are discussed in chapter B6 (Application Reference Number: 6.2.6). The overall significance has been determined after taking these factors into account.

6.5.58 A key factor is the absolute level of sound. The values presented in table D6-24 have been used when putting absolute sound levels in context.

Table D6-24 Guideline values used to inform the context of operational noise levels at residential receptors

Free-field noise level	Description of effect
<50dB $L_{Aeq,16h}$ (07:00 – 23:00)	Moderate annoyance for community noise in outdoor living areas, from *Guidelines for Community Noise* [RD2].
<45dB $L_{Aeq,8h}$ (23:00 – 07:00)	Sleep disturbance with a window open, when measured outside, from *Guidelines for Community Noise* [RD2].
Annual average of 40dB L_{night}	Lowest observed adverse effect level for night noise. A health-based limit value for protection of the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise, from *Night Noise Guidelines* [RD3].

6.5.59 The magnitude criteria for operational noise at non-residential receptors is summarised in table D6-25 below. The derivation of these criteria is fully explained in appendix B6-2 (Application Reference Number: 6.2.21).

Table D6-25 Operational noise magnitude criteria (non-residential receptors)

Receptor Type	External free-field noise level that relates to an onset of a small magnitude of change	Relevant guidance	Description of level in guidance document
Educational	45dB(A)	BB93 [RD16]	Level below which no special measures are likely to be necessary to protect buildings or playing fields from external noise.
Places of worship	47dB(A)	BS 8233 [RD17]	Internal acoustic design criteria for new places of worship of 35dB(A).
Commercial	52dB(A)	BS 8233 [RD17]	Internal acoustic design criteria for offices in new buildings of 40dB(A).
Industrial	52dB(A)	BS 8233 [RD17]	Internal acoustic design criteria for offices in new buildings of 40dB(A).

Modelling results

6.5.60 Contour plots have been produced for the assessment scenarios whose definition is based on a fixed combination of noise sources in operation. These scenarios are the normal operations and the LOOP/LOCA scenarios described in section 6.4. Figures D6-12 and D6-13 (Application Reference Number: 6.4.101) provide an illustrative example of likely noise levels during these scenarios.

6.5.61 Other scenarios involve a more complicated 'receptor-specific' combination of sources. For instance, three of the six EDGs would operate in the 'commissioning' scenario. An assessment of a worst case at any particular receptor has been undertaken by combining noise contributions from the three EDGs with the highest potential noise contributions at the receptor in question. In this way, many permutations of source combinations have been considered, which noise contour plots cannot reflect.

Normal operations

6.5.62 In order to provide an assessment against BS 4142 [RD13] of noise during normal operations, it is necessary to derive the 'rating level', which is the specific sound level plus any adjustment for the characteristic features of the sound.

6.5.63 During normal operations, the sources with the potential to emit tonal noise are the transformers, for the reasons described earlier. As transformer noise would be limited to 25dB(A) or less at all local properties, it is likely to be wholly or partially masked by the existing noise environment (or 'residual sound'). It is not therefore considered likely that tonality at receptors would be described as 'highly perceptible'.

6.5.64 In recognition of some potential for tonal characteristics to be audible at receptors, and to ensure a conservative approach to the BS 4142 [RD13] assessment, a correction has been made for potential tonality at receptors.

6.5.65 Therefore, in accordance with the 'subjective method' described in section 9.2 of BS 4142 [RD13], a correction of +4dB for tonality has been applied to the specific sound levels when deriving the rating levels. This is a conservative approach, as tonality is unlikely to be considered as 'clearly perceptible'.

6.5.66 Table D6-26 presents the initial estimated level of impact according BS 4142 [RD13] during normal operations for the most affected property within each residential receptor group.

Table D6-26 Initial estimate of impact due to normal operations

Group	Typical measured background sound level ($L_{A90\ T}$, dB)		Highest specific sound level ($L_{Aeq\ T}$, dB)	Highest rating level ($L_{Ar\ T}$, dB)	Rating level minus background sound level		Initial estimate of impact according to BS 4142	
	Day	Night			Day	Night	Day	Night
A	35	33	28	32	-3	-1	Low	Low
B	40	38	24	28	-12	-10	Low	Low
C	38	32	31	35	-3	3	Low	Between Low and Adverse
D	35	34	36	40	5	6	Adverse	Adverse
E	34	28	28	32	-2	4	Low	Adverse
F	39	27	32	36	-3	9	Low	Adverse
G	36	19	34	38	2	19	Between Low and Adverse	Significant Adverse

6.5.67 As table D6-26 demonstrates, the initial estimate of noise impact during the day with normal operations is 'Adverse' at receptor group D (west of the Wylfa Newydd Development Area).

6.5.68 The initial estimate of noise impact during the night with normal operations is 'Significant Adverse' at receptor G (property south of the Wylfa Newydd Development Area linked to development) and 'Adverse' at groups D (west of

the Wylfa Newydd Development Area), E (south of the Wylfa Newydd Development Area) and F (Tregele village).

6.5.69 At other receptor groups the initial estimate of noise impact is 'Low' or 'Between Low and Adverse'.

6.5.70 BS 4142 [RD13] requires that these initial estimates should be modified for relevant contextual factors. Relevant contextual factors in this instance are considered to include the following:

- the characteristics of the existing local noise environment;
- the potential for higher local sensitivity to transformer noise; and
- a comparison of the total ambient sound level (i.e. a combination of the specific sound level and the existing ambient noise level) against relevant absolute criteria.

6.5.71 As described previously, transformer hum is currently a feature of the local noise environment caused by the existing transformers operated by National Grid at the Existing Power Station. During the previous surveys, transformer hum was audible at properties along the A5025 between Tregele and Cemaes. However, transformer hum was not audible during the 2015 survey at properties in Tregele itself and may not be a feature of the existing noise climate at these properties. Therefore, it is neither assumed for the purpose of this assessment that transformer noise is a feature of the existing noise environment at all local properties, nor that the local population is habituated to transformer noise.

6.5.72 As previously identified, the National Grid transformers adjacent to the Existing Power Station have been a noticeable feature of the local noise climate and the subject of some adverse community response in the past. This is considered a relevant contextual factor with the potential to increase the initial outcome of the BS 4142 [RD13] assessment for receptors that have a higher sensitivity to transformer noise due to a history of exposure to transformer noise. However, as the transformer noise from the Power Station would be limited to 25dB(A) or less at all local properties, it is likely to be wholly or partially masked by a combination of the existing noise environment and other Power Station noise sources. Therefore, an adverse community response is not considered likely.

6.5.73 In relation to absolute criteria, BS 4142 [RD13] states, "*Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night*".

6.5.74 As detailed in chapter B6 (Application Reference Number: 6.2.6), it was agreed with the IACC that the most relevant absolute criterion during the night is the guideline level for the avoidance of sleep disturbance of 45dB(A) recommended by the WHO [RD2]. The specific sound levels in table D6-26, when combined with the night time ambient (i.e. L_{Aeq}) levels in table D6-6, are significantly below this level (up to 40dB(A)), and therefore normal operations at night are considered unlikely to cause sleep disturbance.

6.5.75 Similarly, the specific sound levels combined with the daytime ambient levels are below the level of 50dB(A) recommended by the WHO [RD2] for the avoidance of moderate annoyance in outdoor living areas.

6.5.76 These factors taken together indicate that, with the proposed specification of transformer noise levels, noise effects associated with the normal operation of the Power Station would be of negligible magnitude at all residential receptors, and therefore not significant.

6.5.77 Effects at commercial and industrial receptors, which are considered of Lower sensitivity, would also be classified as negligible and not significant, as noise levels would be lower than at the closest residential receptors.

6.5.78 Effects at churches and schools are expected to be negligible and not significant, due to their distance from the operational noise sources and the screening provided by intervening buildings.

6.5.79 Effects at PRoWs, such as the Wales Coast Path and Copper Trail, are expected to be negligible and not significant.

Commissioning testing of standby emergency generators

6.5.80 Table D6-27 presents the initial estimated level of impact during commissioning according to BS 4142 [RD13].

Table D6-27 Initial estimate of impact due to commissioning testing of standby emergency generators

Group	Typical measured background sound level ($L_{A90\ T}$, dB)		Highest specific sound level ($L_{Aeq\ T}$ (dB)	Highest rating level $L_{Ar\ T}$, dB)	Rating level minus background sound level (dB)		Initial estimate of impact according to BS 4142	
	Day	Night			Day	Night	Day	Night
A	35	33	32	36	1	3	Between Low and Adverse	Between Low and Adverse
B	40	38	27	31	-9	-7	Low	Low
C	38	32	36	40	2	8	Between Low and Adverse	Adverse
D	35	34	40	44	9	10	Adverse	Significant Adverse
E	34	28	32	36	2	8	Between Low and Adverse	Adverse
F	39	27	35	39	0	12	Low	Significant Adverse
G	36	19	40	44	8	25	Adverse	Significant Adverse

6.5.81 As table D6-27 demonstrates, the initial estimate of noise impact during daytime commissioning tests 'Adverse' at receptor groups D (west of the Wylfa Newydd Development Area) and G (property south of the Wylfa Newydd Development Area linked to development).

6.5.82 The initial estimates of noise impact during night time commissioning tests is 'Significant Adverse' at receptor groups D (west of the Wylfa Newydd Development Area), F (Tregele village) and G (property south of the Wylfa Newydd Development Area linked to development). At receptor groups C (on the A5025 between Cemaes and Tregele) and E (south of the Wylfa Newydd Development Area) the initial estimate of noise impact is 'Adverse'.

6.5.83 At other receptor groups the initial estimate of noise impact is 'Low' or 'Between Low and Adverse'.

6.5.84 As before, BS 4142 [RD13] requires that this initial estimate should be modified for relevant contextual factors. Relevant contextual factors in this instance are considered to include the following:

- a comparison of the total ambient sound level (i.e. a combination of the specific sound level and the existing ambient noise level) against relevant absolute criteria; and

- a consideration of the duration of effects.

6.5.85 As detailed in chapter B6 (Application Reference Number: 6.2.6), it is agreed with the IACC that the most relevant absolute criterion during the night is the guideline level for the avoidance of sleep disturbance of 45dB(A) recommended by the WHO [RD2]. The specific sound levels in table D6-27, when combined with the ambient (i.e. L_{Aeq}) levels in table D6-6, are at least 3dB below this level, and therefore generator testing at night is considered unlikely to cause sleep disturbance.

6.5.86 The initial estimates of impact detailed in table D6-27 could apply if the equipment would be continuously operational. However, commissioning of standby emergency generators would be very infrequent (e.g. four brief periods of commissioning are anticipated over the 60-year life of the Power Station), and a worst case operation would occur during the 24-hour combination test. This is an important contextual factor that means there is no potential for long-term impacts during the day or night associated with commissioning testing.

6.5.87 Taking these contextual factors into account, it is considered that the noise impact at residential receptors from generator testing during commissioning would be negligible and not significant.

6.5.88 Taking into account predicted levels and similar contextual factors, impacts at all other receptor types (i.e. commercial and industrial receptors, churches and schools and PRoWs) are expected to be negligible and not significant.

Routine testing of standby emergency generators

6.5.89 Table D6-28 presents the initial estimated level of impact according to BS 4142 [RD13] during the routine testing of standby emergency generators. Note that this reflects a worst case testing scenario at each property.

Table D6-28 Initial estimate of impact due to routine testing of standby emergency generators

Group	Typical measured background sound level ($L_{A90\ T}$, dB)		Highest specific sound level ($L_{Aeq\ T}$, dB)	Highest rating level ($L_{Ar\ T}$, dB)	Rating level minus background sound level (dB)		Initial estimate of impact according to BS 4142	
	Day	Night			Day	Night	Day	Night
A	35	33	27	31	-4	-2	Low	Low
B	40	38	23	27	-13	-11	Low	Low
C	38	32	32	36	-2	4	Low	Adverse
D	35	34	38	42	7	8	Adverse	Adverse
E	34	28	28	32	-2	4	Low	Adverse
F	39	27	31	35	-4	8	Low	Adverse
G	36	19	39	43	7	24	Adverse	Significant Adverse

6.5.90 As table D6-28 demonstrates, the initial estimate of noise impact during daytime testing is ‘Adverse’ at receptor groups D (west of the Wylfa Newydd Development Area) and G (property south of the Wylfa Newydd Development Area linked to development).

6.5.91 The initial estimates of noise impact during night time testing is ‘Significant Adverse’ at receptor G (residential property south of the Wylfa Newydd Development Area linked to development), and ‘Adverse’ at receptor groups C (on the A5025 between Cemaes and Tregele), D (west of the Wylfa Newydd Development Area), E (south of the Wylfa Newydd Development Area) and F (Tregele village).

6.5.92 At other receptor groups the initial estimate of noise impact is ‘Low’.

6.5.93 As in the preceding assessments, this initial estimate of impact is modified due to contextual factors. The specific sound levels shown in table D6-28, when combined with the ambient (i.e. L_{Aeq}) levels in table D6-6, are below the guideline level for the avoidance of sleep disturbance recommended by the WHO [RD2], and therefore generator testing is unlikely to cause sleep disturbance during the day or night.

6.5.94 In addition, as discussed in section 6.4, it is proposed to undertake the routine testing during the day, and testing during the night would only be undertaken in exceptional circumstances. This further reduces the potential for long-term impacts at night.

6.5.95 The specific sound levels combined with the daytime ambient levels are below the level of 50dB(A) recommended by the WHO [RD2] for the avoidance of moderate annoyance in outdoor living areas.

6.5.96 The initial estimates of impact detailed in table D6-28 reflect noise levels during testing of the loudest generator for each receptor, and are therefore a worst case that would only be expected to occur on one day per month. On the other 11 test runs that would occur on other days in each month, noise levels during testing would on average be 5dB lower. Based on this monthly average, the initial impact estimate would be 'Low' or 'Between Low and Adverse' for receptors.

6.5.97 Taking these contextual factors into account, it is considered that the noise from routine generator testing would result in a minor impact at residential receptor groups D and G during the day. At all other receptors there would be a negligible impact during the day and night.

Routine testing of RUHS

6.5.98 Table D6-29 presents the initial estimated level of impact according to BS 4142 [RD13] during the routine testing of the RUHS, which would only occur during the day.

Table D6-29 Initial estimate of impact due to routine testing of RUHS

Group	Typical measured background sound level ($L_{A90\ T}$, dB)		Highest specific sound level ($L_{Aeq\ T}$, dB)	Highest rating level ($L_{Ar\ T}$, dB)	Rating level minus background sound level		Initial estimate of impact according to BS 4142	
	Day	Night			Day	Night	Day	Night
A	35	33	34	38	3	-	Between Low and Adverse	-
B	40	38	30	34	-6	-	Low	-
C	38	32	40	44	6	-	Adverse	-
D	35	34	42	46	11	-	Significant Adverse	-
E	34	28	31	35	1	-	Between Low and Adverse	-
F	39	27	36	40	1	-	Between Low and Adverse	-
G	36	19	35	39	3	-	Between Low and Adverse	-

6.5.99 As table D6-29 demonstrates, the initial estimate of noise impact during daytime testing is 'Significant Adverse' at receptor group D (west of the Wylfa Newydd Development Area). At receptor group C (on the A5025 between Cemaes and Tregele) the initial estimate of noise impact is 'Adverse'. At other receptor groups the initial estimate of noise impact is 'Low' or 'Between Low and Adverse'.

6.5.100 As in the preceding assessments, this initial estimate of impact is modified due to contextual factors.

6.5.101 The specific sound level combined with the daytime ambient levels is below the level of 50dB(A) recommended by the WHO [RD2] for the avoidance of moderate annoyance in outdoor living areas.

6.5.102 As discussed in section 6.4, it is proposed to undertake the routine testing of each bank of cooling towers on a monthly basis, and therefore any impacts could occur for a maximum of a few hours per month. This limits the potential for long-term impacts.

6.5.103 Taking these contextual factors into account, it is considered that the noise from routine testing of the reserve ultimate heatsink would result in a negligible impact at residential receptors.

LOOP/LOCA

6.5.104 Table D6-30 presents the initial estimated level of impact according to BS 4142 [RD13] during LOOP/LOCA events.

Table D6-30 Initial estimate of impact due to LOOP/LOCA

Group	Typical measured background sound level ($L_{A90\ T}$, dB)		Highest specific sound level ($L_{Aeq\ T}$, dB)	Highest rating level ($L_{Ar\ T}$, dB)	Rating level minus background sound level		Initial estimate of impact according to BS4142	
	Day	Night			Day	Night	Day	Night
A	35	33	38	42	7	9	Adverse	Adverse
B	40	38	33	37	-3	-1	Low	Low
C	38	32	44	48	10	16	Significant Adverse	Significant Adverse
D	35	34	47	51	16	17	Significant Adverse	Significant Adverse
E	34	28	38	42	8	14	Adverse	Significant Adverse
F	39	27	40	44	5	17	Adverse	Significant Adverse
G	36	19	47	51	15	32	Significant Adverse	Significant Adverse

6.5.105 The specific sound levels in table D6-30, when combined with the ambient (i.e. L_{Aeq}) levels in table D6-6, marginally exceed the guideline level for the avoidance of sleep disturbance recommended by the WHO [RD2] at four properties; therefore, if a LOOP/LOCA event were to occur at night, the noise could cause some sleep disturbance at these four properties.

6.5.106 The initial estimates of impact detailed in table D6-30 assume that the equipment would be regularly operational. However, LOOP/LOCA events are expected to be extremely rare – particularly those that last longer than 24 hours (i.e. one event in 200 years). This is an important contextual factor that removes the potential for long-term impacts.

6.5.107 Taking these contextual factors into account, it is considered that the noise from LOOP/LOCA events would result in a negligible impact at residential receptors, during both daytime and night-time periods.

Testing of emergency alarms

6.5.108 The emergency alarm system would include alarms aimed at providing audible coverage at all external areas of the site and would undergo routine testing. The testing procedure for these systems, which would detail the frequency and duration of alarm tests, has not yet been determined. However, it is

expected that testing would be required infrequently for short periods and is only likely to be necessary during the day.

6.5.109 The design and location of the alarm sources is not currently known, and it is not yet possible to accurately predict noise levels associated with the alarms. However, it would be expected that tonal alarms would be used, and it is likely that they would be audible at several local properties during tests and emergencies.

6.5.110 Details of planned routine alarm tests would be made available to the public.

6.5.111 The potential for annoyance due to safety alarm testing for local residents may depend to some extent on their overall attitude towards the site. Testing of alarms at the Existing Power Station is considered likely to be heard at receptors within the local community; therefore, the testing of the Wylfa Newydd Power Station alarms would not represent the introduction of a new type of noise source into the acoustic environment. Given the role of such alarms, it is considered that infrequent and short testing of the alarms would not be likely to give rise to significant noise effects.

Construction of radioactive waste facilities

6.5.112 The plant list and programme for the construction of the spent fuel store have not yet been compiled, and therefore no noise or vibration modelling has been undertaken. These construction activities would be much reduced in scale and duration when compared to the Main Construction stage, and would be undertaken in accordance with BS 5228 Parts 1 & 2 [RD4]; [RD5] or other relevant good practice guidelines in force at the time. A similar type of foundation works is expected as for the other ancillary buildings, and there is the potential for piled foundations to be required. It is envisaged that these activities would be focused during daytime hours, but short-term activities may extend into evening or night-time hours for operational reasons (e.g. concrete pours).

6.5.113 A magnitude of negligible has been assigned to these activities on the following basis. Firstly, the works will be of limited duration, and therefore the thresholds for standard construction works set out in BS 5228 Parts 1 & 2 [RD4]; [RD5] would be applicable, which are considerably higher than those for long term works set out in table D6-16.

6.5.114 Secondly an application for prior consent under Section 61 of the Control of Pollution Act 1974 would be required for the works, the aim of which would be to establish that the best practicable means have been employed to control noise emissions. The IACC may attach conditions to the consent, where it is considered that additional measures are required.

6.5.115 These potential effects are therefore determined as likely to be not significant. This assessment applies to both proposed locations for this facility. The location on Nuclear Decommissioning Authority-owned land to the north of the Power Station, which is currently occupied by the Existing Power Station, is further away from residential receptors. Construction activities at this location would therefore be expected to cause less noise at noise sensitive receptors.

Marine vessel movements

6.5.116 As discussed in section 6.4, marine vessel movements inside the harbour would be limited to maintenance dredging activities and very infrequent movements (less than one per year) linked to the delivery of Abnormal Indivisible Loads during operation.

6.5.117 Maintenance dredging activities would be required infrequently, and would only occur during the day. Based on the typical sound power of 110dB(A) for harbour dredging activities taken from BS 5228-1 [RD4], noise levels would be below 50dB $L_{Aeq,T}$ at 400m, which is the likely minimum distance to the closest residential noise sensitive receptor. As 50dB $L_{Aeq,T}$ is the daytime criteria recommended for the avoidance of annoyance outdoors by the WHO [RD2], adverse effects would not be associated with dredging during the day.

6.5.118 In addition, the infrequency of such noise events further limits the potential for long-term impacts.

6.5.119 For these reasons, the potential effects associated with marine vessel movements are not considered to be significant.

On-site vehicular activity

6.5.120 The effects of operational vehicles on public highways are considered in the assessment contained within chapter C5 (Application Reference Number: 6.3.5).

6.5.121 In addition, the potential for noise effects associated with the on-site movement and parking of vehicles during the operation of the Power Station is considered here.

6.5.122 Heavy vehicles visiting the Power Station are expected to average approximately 35 inbound and outbound heavy vehicles per day, which is equivalent to the numbers at the Existing Power Station. As the majority of such vehicles would be expected to visit the site between 07:00 and 19:00, this corresponds to an average of approximately six heavy vehicle movements per hour.

6.5.123 Car movements would be predominantly associated with inbound and outbound personnel. The hour with the greatest potential for noise effects at local receptors due to car movements is expected to be between 06:00 to 07:00, when approximately 95 inbound movements would be expected. During outages (whose occurrence is discussed in chapter D1 (Application Reference 6.4.1), this number would increase to approximately 565 inbound movements.

6.5.124 Car parks have the potential to give rise to noise effects due to the operation of car engines, and the slamming of car doors. The proposed cark parking facilities are described in chapter D1 (Application Reference 6.4.1). The car park with the greatest potential to cause operational noise effects is the 700 capacity southern cark park, which is in relatively close proximity to receptor group G (property south of the Wylfa Newydd Development Area linked to development).

6.5.125 During normal operations the combined noise from vehicular movements and parking outlined above, together with noise from the plant and equipment discussed earlier, is not expected to cause the guideline level for the avoidance of sleep disturbance recommended by the WHO [RD2] to be exceeded at receptor group G (property south of the Wylfa Newydd Development Area linked to development) between 06:00 to 07:00. At all other receptors, the noise levels from vehicular activity on site would be significantly lower. Therefore, noise from on-site vehicular activity during normal operations is not considered significant.

6.5.126 During outage, there is the potential for the combined vehicular and plant noise levels to be equivalent to the guideline level for the avoidance of sleep disturbance recommended by the WHO [RD2] between 06:00 to 07:00 at receptor group G (property south of the Wylfa Newydd Development Area linked to development). This is based on a worst case assumption that all personnel arriving on site during outage use the southern car park.

6.5.127 At all other times of the night, the combined noise values would be below the guideline level. Similarly, at all other receptors, combined noise levels would be below the guideline value.

6.5.128 Therefore, the likely effects of combined vehicular and plant noise levels during outages are anticipated to be of minor adverse significance.

Assessment of low frequency noise

6.5.129 The assessment of low frequency noise has been considered by comparing the predicted noise levels at 63Hz and 125Hz to the adopted thresholds for low frequency noise set out in table D6-31.

6.5.130 The rationale for the adoption is detailed in appendix B6-2 (Application Reference Number: 6.2.21).

Table D6-31 Low frequency noise assessment criteria

Octave band centre frequency, Hz	Octave band NANR45 reference curve, L_{eq}	Adopted threshold of significance (Night)	Adopted threshold of significance (Day)
63Hz	47dB	44dB	49dB
125Hz	41dB	38dB	43dB

6.5.131 During normal operations, the low frequency noise levels at the closest receptors would be equivalent to or lower than the adopted night thresholds, and therefore no adverse impacts due to low frequency noise would be expected.

6.5.132 During the routine testing of the diesel generators, the low frequency noise levels at the closest receptors would exceed the adopted night thresholds by between 0dB and 7dB, depending on the receptor locations and the operational scenario. However, testing of diesel generators would only occur at night in exceptional circumstances, and the 10-hour EDG tests would be restricted to the hours of 07:00 to 19:00.

6.5.133 During routine testing, the low frequency noise levels at the closest receptors would be equivalent to or lower than the daytime thresholds, and therefore no significant adverse impacts due to low frequency noise would be expected.

6.5.134 During LOCA/LOOP events and commissioning tests, low frequency noise levels could exceed the adopted thresholds by up to 13dB. However, commissioning testing would be very infrequent (e.g. four periods of commissioning over the 60-year life of the Power Station) and LOCA/LOOP events would be exceptionally rare. In addition, by not taking account of the potential level difference between the outdoor and indoor environments, the adopted thresholds are considered to be conservative.

6.5.135 Taking these factors into account, it is considered that the overall potential for low frequency noise impacts is not significant.

Decommissioning

Noise

6.5.136 The scale of the decommissioning works would be smaller than those assessed for construction, and the earth mounds and bunds in construction zones 9, A, C, and E (shown on figure D6-2 (Application Reference Number: 6.4.101)) would remain in place, reducing noise from decommissioning activities within the Wylfa Newydd Development Area at many noise sensitive receptors. As such, the decommissioning works are unlikely to increase the number of significant adverse effects at noise sensitive receptors which are already established by the construction noise assessment.

6.5.137 Notwithstanding this it is considered that there would still be the potential for medium and small magnitudes of change for long durations at many of the nearby residences, resulting in a major and moderate adverse effects respectively, which are both considered significant.

6.5.138 It is likely that a small number of dwellings may experience higher decommissioning noise levels, exceeding 62dB $L_{Aeq,1\text{-hour}}$ whilst plant is operating nearby, but such effects would only be expected be for limited short periods of time. Nonetheless, noise levels above 62dB $L_{Aeq,,1\text{-hour}}$ for a limited short duration would be judged as a medium magnitude of change, resulting in a major effect which is considered significant.

Vibration

6.5.139 The scale of the decommissioning works would be smaller than those assessed for construction, and there will be little decommissioning activity in construction zones 9, A, C and E as the landscape mounds and bunds in these zones are being retained. These zones are on the perimeter of the Wylfa Newydd Development Area and are the closest to residential receptors.

6.5.140 It is therefore considered unlikely that there would be any perceptible levels of vibration at properties due to the decommissioning works. This is because the distances between works and the nearest receptors would only trigger negligible magnitude of change, leading to a minor effect which is not considered significant.

Transboundary effects

6.5.141 No transboundary effects associated with the construction or operation have been identified.

6.6 Additional mitigation

6.6.1 In accordance with chapter B1 (Application Reference Number 6.2.1), embedded and good practice mitigation measures relevant to noise and vibration were taken into account when determining the 'pre-mitigation' significance of effects. These are detailed in the design basis and activities section of this chapter.

6.6.2 Additional mitigation measures would be implemented to address potential significant effects identified in the assessment of effects section. These additional mitigation measures are summarised in table D6-32, table D6-33 and table D6-34 for construction, operation and decommissioning respectively.

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Construction

Table D6-32 Additional mitigation measures - construction

Additional mitigation measures	Objective	Achievement criteria and reporting requirements
Strategic placement of early earthworks material around the southern perimeter of Mound A, adjacent to residential properties on the A5025 between Cemaes and Tregele, early in the programme, as per the Phasing Strategy (Application Reference Number: 8.29). This would form a bund to screen noise from bulk material haulage to Mound A. The construction of the bund, which would eventually form part of Mound A, would be built in such a way as to ensure noise levels at adjacent properties do not exceed 62dB $L_{Aeq\ 1hr}$ for more than eight weeks in a year, as defined in the long term magnitude scale presented in table D6-17. Appropriate and regular noise monitoring (which will be detailed by the Section 61 applications) will be carried out at the dwellings closest to the bund, to ensure compliance with these thresholds, as per the Main Power Station Site sub-CoCP (Application Reference Number: 8.7).	Reduce construction noise at the receptors on the A5025 between Cemaes and Tregele.	By creating a bund along the haul route (which would later form part of Mound A), and constraining the duration of these works, there would be a reduction in the number of properties that fall within the major significance category. Continuous internet accessible noise monitoring would be carried out at locations agreed with IACC which are representative of the closest receptor(s) to determine the success of these measures. Further information on noise monitoring is provided in row five of this table.
The strategic placement of material when building Mounds A and C, as described below, would create noise barriers that construction plant would work behind, as per the Main Power Station Site sub-CoCP (Application Reference Number: 8.7). This would require that the mound be built sequentially in layers, with the perimeter of the mound nearest to properties being built first, which would then provide attenuation whilst the remainder of that layer is completed behind, as per the Phasing Strategy	To build the outer faces of these mounds early in the programme, and in such a way that none of the dwellings in Cemaes are regularly subject to noise levels above 67dB $L_{Aeq\ 1hr}$ for more than eight weeks in each year.	By creating the outer faces of Mounds A and C, and constraining the works so that the short-term threshold which is provided in MTAN1 [RD6] applies, there would be a reduction in the number of properties that would experience

Additional mitigation measures	Objective	Achievement criteria and reporting requirements
(Application Reference Number: 8.29). The outer perimeter of the mound would be constructed in such a way that construction noise levels do not exceed 62dB $L_{Aeq\ 1hr}$ for more than eight weeks in a year, as defined in the long term magnitude scale presented in table D6-17.		effects of major adverse significance. The Wylfa Newydd CoCP (Application Reference Number: 8.6) and Main Power Station Site sub-CoCP (Application Reference Number: 8.7) would require noise monitoring to be carried out at locations agreed with IACC which are representative of the closest receptor(s) to determine the success of these measures, and will provide an escalation strategy in the case that the threshold noise levels are exceeded. Further information on noise monitoring is provided in row five of this table.
Mound B is proposed along the east boundary of construction Zone 9, which is adjacent to the A5025, this feature forms part of the embedded mitigation. To reduce construction noise effects from the haul route to Mound C and earthworks in Zone 9 this will be constructed early in the programme, as per the Phasing Strategy (Application Reference Number: 8.29), and in such a way that none of the dwellings in Tregele are regularly subject to noise levels over 62dB $L_{Aeq,1\text{-}hour}$ for more than eight weeks in a year, as defined in the long term magnitude scale presented in table D6-17. Appropriate and regular noise	To reduce construction noise effects from the haul route between Mound C and earthworks in Zone 9.	Appropriate and regular noise monitoring will be carried out at the dwellings closest to the bund, to ensure compliance with these thresholds. The Main Power Station Site sub-CoCP (Application Reference Number: 8.7) sets out monitoring requirements and provides an escalation strategy in the case

Additional mitigation measures	Objective	Achievement criteria and reporting requirements
monitoring (which would be detailed by the Section 61 applications) would be carried out at the dwellings closest to the bund, to ensure compliance with these thresholds, as per the Main Power Station Site sub-CoCP (Application Reference Number: 8.7).		that the threshold noise levels are exceeded.
Horizon is committed to a voluntary Local Noise Mitigation Strategy (LNMS) which offers secondary glazing to properties within the LNMS boundary area for the main site and along the A5025, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6). Horizon are also committed to ongoing monitoring of noise effects and considering potentially additional eligibility of affected properties during construction as part of the Section 61 process. Night workers, those needing a particularly quiet home environment to work in, or those that have a medical condition which will be seriously aggravated by construction noise, will also be considered on a case by case basis. The LNMS is described in the Wylfa Newydd CoCP (Application Reference Number: 8.6).	Provide noise insulation to qualifying residences, guest houses, Bed and Breakfasts, and hotels. Horizon will ensure that assessments of eligibility are undertaken with sufficient time to procure and install glazing to properties prior to critical works commencing. The assessments will be based on when detailed construction information is available and reviewed every six to nine months during the Project, in accordance with the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Main Power Station Site sub-CoCP (Application Reference Number: 8.7).	Noise insulation and temporary rehousing are regularly deployed during the construction of major infrastructure schemes and would reduce the effects of construction noise to residents whilst the construction works are progressed. However, at this stage of the Project, impacts are still considered to be significant for properties that qualify for the measures outlined in the LNMS, for the following reasons. There may be cases where internal noise levels are still above desirable levels, even after noise insulation has been installed. Offers for noise insulation would not necessarily be taken up by all the eligible parties.

Additional mitigation measures	Objective	Achievement criteria and reporting requirements
		It's not technically feasible to install noise insulation in all properties. The property would not benefit from the noise insulation if windows were opened, although the provision of acoustically treated ventilation is intended to reduce the need to open windows. Gardens and other outside spaces would not be protected from construction noise effects.
Horizon would install a web-based continuous noise monitoring scheme to be deployed throughout the construction works at the Wylfa Newydd Development Area. IACC would have shared access to the monitoring data, with the opportunity for public access to relevant information such as average noise levels. Installation of monitoring equipment would be undertaken at up to six residential locations at any time, representative of the locations where the greatest noise levels are expected. The precise locations would be discussed with the IACC, and be confirmed by the Section 61 application, once initial site suitability visits have been undertaken and access arrangements to the locations have been agreed. It is intended that monitoring equipment will be installed at Felin Gafnan, subject to access arrangements and site suitability survey. It is intended that these continuous monitoring stations will be installed for the duration of the construction programme,	To monitor construction noise levels against the relevant thresholds and trigger escalation actions in the case that they exceed (or are considered likely to exceed) the thresholds.	The reporting requirements for noise monitoring will be set out in the Main Power Station Site sub-CoCP (Application Reference Number: 8.7).

Additional mitigation measures	Objective	Achievement criteria and reporting requirements
although they would be moved at the request of the resident, landowner or IACC. Additional short term measurements at key locations (ranging from hours to weeks) would be identified as required, and would take into account the characteristics of the works described by the specific Section 61 application.		
Horizon would undertake a vibration risk assessment as part of the Section 61 application for any construction activity involving vibratory or impact equipment to be used on the Main Site. This assessment would establish safe working distances for receptors in relation to construction vibration. This would ensure that any equipment that is identified as having potentially adverse vibration effects can be located sufficiently away from any sensitive receptors, so that any effects on such receptors can be reduced to negligible. Where works are required within the safe working distances, alternative equipment or working methods would be investigated and vibration levels would be reduced to the greatest extent practicable. The Section 61 applications would also describe appropriate vibration monitoring to be carried out at the closest receptors to determine the success of these requirements, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6).	Ensure that vibration from construction does not exceed a small magnitude of impact at dwellings and other receptors.	Vibration monitoring would be carried out at the closest receptors in accordance with the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Main Power Station Site sub-CoCP (Application Reference Number: 8.7). If the vibration monitoring indicates that the threshold levels are likely to be breached then the escalation procedure set out in the Wylfa Newydd CoCP (Application Reference Number: 8.6).
Acoustic mitigation measures would be provided as part of the building design of the Site Campus to achieve the requirements and guidance provided in BS 8233:2014 [RD17], World Health Organisation Guidelines [RD2] (for $L_{AF,max}$ levels), Approved Document E of the Building Regulations [RD18] and CIBSE Guide B4 [RD19]. Preliminary information indicates that for some bedrooms, mechanical ventilation would be required to	The Site Campus will be designed such that internal living spaces will meet the relevant noise guidelines.	A building acoustic design statement would be produced and shared with the relevant council officers, to demonstrate that the design of the Site Campus building complies with the relevant guidelines set out in

Additional mitigation measures	Objective	Achievement criteria and reporting requirements
provide ventilation without the need for opening windows, and that windows would need to be double glazed with units of appropriate acoustic performance, as per the Design and Access Statement volume 3, appendix 1-2 (Associated Developments and Off-Site Power Facilities) (Application Reference Number: 8.2.3).		the Royal Institute of British Architects Stage 2 report for the Site Campus.
Potential significant adverse residual noise effects due to construction noise from the WNDA Development have been identified for Cemaes Primary School. Horizon is committed to liaising with the primary school to identify practical mitigation measures to reduce or manage these residual effects. These measures could include the installation of noise insulation measures to reduce noise levels within teaching spaces and/or the provision of additional teaching resources. Funding would be made available through the Community Impact Fund to implement agreed mitigation measures, as per Section 106 Draft Heads of Terms for Planning Obligations (Application Reference Number: 3.4).	Reduce or manage the potential adverse effects of construction noise due to the WNDA Development at Cemaes Primary School.	Achievement criteria will be linked to the provision of funding for practical mitigation measures.
Potential significant adverse residual noise effects due to construction noise from the WNDA Development have been identified for Eglwys Sant Padrig Church in Cemaes. Horizon is committed to identify practical mitigation measures to reduce or manage these adverse effects. These measures could include installation of noise insulation measures to reduce noise levels within the church, however the cultural heritage effects of any noise insulation measures must be considered. Alternative measures, such as provision of a speech amplification system, would also be considered. Funding would be made available	Reduce or manage the potential adverse effects of construction noise due to the WNDA Development at Eglwys Sant Padrig Church in Cemaes.	Achievement criteria will be linked to the provision of funding for practical mitigation measures.

Additional mitigation measures	Objective	Achievement criteria and reporting requirements
through the Community Impact Fund to implement the agreed mitigation measures, as per Section 106 Draft Heads of Terms for Planning Obligations (Application Reference Number: 3.4).		

Operation

Table D6-33 Additional mitigation measures – operation

Additional mitigation measures	Objective	Achievement criteria and reporting requirements
None		

Decommissioning

Table D6-34 Additional mitigation measures – decommissioning

Additional mitigation measures	Objective	Achievement criteria and reporting requirements
It is not possible to determine additional mitigation measures for decommissioning at this time.		

6.7 Residual effects

6.7.1 This section describes the residual effects for noise and vibration having taken into account the embedded, good practice and additional mitigation described above. Table D6-35 below provides a summary of significant residual effects identified either prior to or post application of additional mitigation for the construction phase.

6.7.2 No significant residual effects were identified for the operational or decommissioning phases.

6.7.3 Additionally, all effects of minor significance or greater identified in the assessment of effects section are summarised in appendix I3-1 (master residual effects table) (Application Reference Number: 6.9.8).

6.7.4 Residual effects are predicted during the construction phase. Figures D6-3 to D6-10 (Application Reference Number: 6.4.101) show the predicted residual noise levels, and a description of the significant effects arising at properties is shown in table D6-35 below.

6.7.5 The potential indirect effects of noise and vibration on the Welsh language and culture in the Wylfa Newydd Development Area are assessed as part of volume C of the Welsh Language Impact Assessment (Application Reference Number: 8.21). These include potential effects on quality of life and local amenity.

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Table D6-35 Summary of residual effects

Receptor (or group of receptors)	Sensitivity of receptor(s)	Description of potential effect	Nature of effect	Potential magnitude of change	Potential significance of effect	Additional mitigation	Post-mitigation magnitude of change	Significance of residual effect
Construction								
Residential properties (mainly in receptor groups B and H).	High	Long-term exposure to construction noise has the potential to cause annoyance, sleep disturbance and other adverse health outcomes.	Exposure to construction noise	Large at 22 properties. Medium at 341 properties. Small at 814 properties.	Major adverse at 363* properties (22 + 341) *Both the large and medium magnitude of change lead to a major adverse effect for residential receptors. Moderate at 814 properties.	Noise barriers in the form of bunds and working behind outer faces of Mounds A and C. Eligible properties will be offered noise insulation under the LNMS. Continuous noise monitoring will be undertaken and escalation actions	Large at 11 properties. Medium at 310 properties. Small at 850 properties.	Major adverse at 321 properties (11 + 310) which is significant. The number of properties that are likely to experience major adverse effects is reduced from 363 to 321 due to additional mitigation). The number of moderate adverse effects will

Receptor (or group of receptors)	Sensitivity of receptor(s)	Description of potential effect	Nature of effect	Potential magnitude of change	Potential significance of effect	Additional mitigation	Post-mitigation magnitude of change	Significance of residual effect
						undertaken in the case that they exceed threshold levels.		increase from 814 to 850. This increase is due to the reduction in the number of properties at which major effects are identified with additional mitigation.
Schools and hotels	High	High noise levels in schools can affect learning, language development and retention.	Exposure to construction noise	Small at one school, and negligible at one school. Medium at one hotel and small at four hotels.	Moderate at one school, and minor at one school. Major at one hotels and moderate at four hotels.	Noise barriers in the form of bunds and working behind outer faces of Mounds A and C	Small at one school, and negligible at one school. Medium at one hotel and small at four hotels.	Moderate adverse at one school which is significant. Minor adverse at one school which is not significant.

Receptor (or group of receptors)	Sensitivity of receptor(s)	Description of potential effect	Nature of effect	Potential magnitude of change	Potential significance of effect	Additional mitigation	Post-mitigation magnitude of change	Significance of residual effect
								Major adverse effect, which is significant at one hotel. Moderate adverse effect at four hotels, which is significant.
Community buildings and places of worship	Medium	High noise levels can cause annoyance and could potentially affect speech intelligibility.	Exposure to construction noise.	Medium at two places of worship Small at four community buildings and five places of worship.	Moderate at two places of worship. Minor at four community buildings and five places of worship.	Noise barriers in the form of bunds and working behind outer faces of Mounds A and C.	Medium at one place of worship. Small at four community buildings and six places of worship.	Moderate adverse effect, which is significant, at one place of worship. Minor adverse effect, not significant, at four community buildings and six

Receptor (or group of receptors)	Sensitivity of receptor(s)	Description of potential effect	Nature of effect	Potential magnitude of change	Potential significance of effect	Additional mitigation	Post-mitigation magnitude of change	Significance of residual effect
								places of worship.
Commercial properties and offices	Low	High noise levels can cause annoyance and could potentially affect speech intelligibility.	Exposure to construction noise	Large at two commercial properties and five offices, Medium at four commercial properties, Small at 23 commercial properties and three offices.	Moderate at two commercial properties and five offices, Minor at 27 commercial properties and three offices.	Noise barriers in the form of bunds and working behind outer faces of Mounds A and C.	Large at one commercial property and five offices. Medium at two commercial properties. Small at 26 commercial properties and three offices.	Moderate adverse effect, which is significant at one commercial property and five offices. Minor adverse effect, not significant at 28 commercial properties, and three offices.

Receptor (or group of receptors)	Sensitivity of receptor(s)	Description of potential effect	Nature of effect	Potential magnitude of change	Potential significance of effect	Additional mitigation	Post-mitigation magnitude of change	Significance of residual effect
Residential properties and other buildings discussed in section 6.5.29 onwards which are in close proximity to the Wylfa Newydd Development Area	High	Vibration can cause annoyance, feelings of alarm and, in the most severe cases, can cause damage to structures.	Exposure to construction vibration.	Large	Major	Vibration safe working distances, the use of alternate working methods and vibration monitoring.	Small	Moderate adverse effect which is significant.
Operation								
No residual effects.								
Decommissioning								
Residential properties, schools and hotels.	High	Long-term exposure to construction noise has the potential to cause annoyance,	Exposure to decommissioning noise.	Medium magnitude of change.	Major effect which is considered significant.	None	Medium magnitude of change.	Major effect which is significant.

Receptor (or group of receptors)	Sensitivity of receptor(s)	Description of potential effect	Nature of effect	Potential magnitude of change	Potential significance of effect	Additional mitigation	Post-mitigation magnitude of change	Significance of residual effect
		sleep disturbance and other adverse health outcomes. High noise levels can cause annoyance and could potentially affect speech intelligibility.						

6.8 References

Table D6-36 Schedule of references

ID	Reference
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[RD2]	Berglund, B., Lindvall, T., Schwela, D.H. (eds.) 1999. *Guidelines for Community Noise*. Geneva: World Health Organization.
[RD3]	World Health Organization Regional Office for Europe. 2009. *Night Noise Guidelines for Europe*. Copenhagen: World Health Organization Regional Office for Europe.
[RD4]	British Standards Institution. 2014. *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise*. London: British Standards Institution.
[RD5]	British Standards Institution. 2009. *BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Vibration*. London: British Standards Institution.
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[RD7]	Welsh Assembly Government. 1997. *Technical Advice Note 11: Noise*. [Online]. [Accessed 3 January 2018]. Available from: http://gov.wales/desh/publications/planning/technicaladvicenotes/tan11/tan11e.doc?lang=en.
[RD8]	Crocker, M. J. 1998. *Handbook of Acoustics*. Hoboken, New Jersey, USA: John Wiley and Sons.
[RD9]	United States Department of Defense. 2003. Unified Facilities Criteria (UFC) *Noise And Vibration Control*, UFC 3-450-01. [Online]. [Accessed: 3 January 2018]. https://www.wbdg.org/FFC/DOD/UFC/ufc_3_450_01_2003.pdf.
[RD10]	British Standards Institution. 2000. *BS EN 12354-4:2000 Building acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 4: Transmission of indoor sound to the outside*. London: British Standards Institution.
[RD11]	Commission Implementing Decision (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of

ID	Reference
	the Council, for large combustion plants (notified under document C (2017) 5225.
[RD12]	European Commission. 2006. *Integrated Pollution Prevention and Control: Reference Document on Best Available Techniques for Large Combustion Plants*. [Online]. [Accessed: 13 May 2017]. Available from: http://eippcb.jrc.ec.europa.eu/reference/BREF/lcp_bref_0706.pdf
[RD13]	British Standards Institution. 2014. *BS 4142:2014 Methods for rating and assessing industrial and commercial sound*. London: British Standards Institution.
[RD14]	Institute of Environmental Management and Assessment. 2014. *Guidelines for Environmental Noise Impact Assessment*. Lincoln: Institute of Environmental Management and Assessment
[RD15]	Welsh Assembly Government. 1993. *Mineral Planning Guidance 11: The Control of Noise at Surface Mineral Workings*. Cardiff: Welsh Assembly Government. [Online]. [Accessed 3 January 2018]. Available from http://gov.wales/topics/planning/policy/mpgnotes/mpg11/
[RD16]	Department for Education, Education Funding Agency. 2015. *Building Bulletin 93: Acoustic design of schools: performance standards*. [Online]. [Accessed: 13 May 2017]. Available from: https://www.gov.uk/government/publications/bb93-acoustic-design-of-schools-performance-standards.
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[RD18]	Ministry of Housing, Communities & Local Government, Resistance to sound: Approved Document E. Newcastle Upon Tyne, United Kingdom: NBS, part of RIBA Enterprises Ltd. [Online}. [Accessed: 13 May 2017]. Available from: https://www.gov.uk/government/publications/resistance-to-sound-approved-document-e
[RD19]	Chartered Institution of Building Services Engineers. 2016. *CIBSE Guide B4: Noise and Vibration Control for Building Services Systems*. [Online]. [Accessed: 13 May 2017]. Available from: https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q20000008Jr5RAAS