11 NOISE AND VIBRATION

Introduction

11.1.1 This chapter presents the assessment of noise and vibration effects that could arise from the construction and operation of the Project. The chapter describes: the assessment methodology; the baseline conditions at the site and surroundings; the likely environmental noise and vibration effects; and the mitigation measures required to reduce and minimise any adverse effects.

11.1.2 The scope of the assessment includes noise from on-site construction works and traffic; and operational noise from the Project.

11.1.3 Due to the distances between the development site and the nearest noise and vibration sensitive receptors (NSRs), vibration effects during both construction and operation of the Project are not expected to be significant and have therefore been scoped out of the assessment.

Assessment Methodology

11.1.4 This section sets out the legislation, planning policy context and guidance that is relevant to the noise and vibration assessment and the assessment methodologies and baseline forecasting methods employed. A summary of the consultation that has been undertaken has also been provided. Further details of the relevant policy and guidance documentation are provided in Appendix 11.1.

Planning Policy Context

11.1.5 The following planning policy have been referred to inform this EIAR Chapter:

- The National Planning Framework (NPF) for Scotland (Scottish Government, 2014a);
- Draft Fourth National Planning Framework (NPF4) (Scottish Government, 2021);
- Scottish Planning Policy (SPP) (Scottish Government, 2014b);
- Planning Advice Note Planning and Noise (PAN 1) (Scottish Government, 2011a);
- Technical Advice Note: Assessment of Noise (TAN) (Scottish Government, 2011b);
- The North Ayrshire Local Development Plan 2 (North Ayrshire, 2019); and
- The Hunterston Parc Development Framework (2021).

Relevant Legislation, Standards and Guidance

11.1.6 The following legislation, standards and guidance have been referred to within the assessment of noise and vibration effects:

- Part III of the Control of Pollution Act 1974 (CoPA);
- The Environmental Protection Act 1990 (EPA);
- British Standard (BS) 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' Part 1: Noise and Part 2: Vibration;
- BS 7445-2 Description and measurement of environmental noise - Part 2: Guide to the acquisition of data pertinent to land use.
- BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'; and

- World Health Organisation Guidelines for Community Noise (WHO GCN) (Berglund et al., 1999).

Study Area

11.1.7 A study area of 1 km from the site has been considered in the assessment. Beyond this area, noise and vibration impacts are considered unlikely. The following NSRs have been identified within this study area.

- Residential properties on Fairlie Moor Road to the east of the site boundary, with the closest, Fencefoot Farm Cottage, at around 150 m and the second closest, Glenside, at around 400 m from the development site.
- South Lodge and Southannan Cottage, both to the east of the development site off the A78 Irvine Road at around 230 m and 420 m respectively.
- Poteathbank Cottage, around 400 m to the south of the development site, with access off Reservoir Road.
- Residential properties in Fairlie, with the closest being the Southannan Estate at 380 m from the development site.

11.1.8 The following additional NSRs have also been considered at the request of North Ayrshire Council, although these lies outside of the 1 km study area:

- Hunterston House, around 1.4 km to the south-west of the development site.
- The Field Studies Council, on the Isle of Cumbrae, around 2.7 km to the west of the main development site and 1.7 km to the west of the jetty.

11.1.9 The above NSRs are indicated on Figure 11.1.

Baseline Methodology

11.1.10 Representative baseline sound levels have been determined through a combination of long-term unattended and short-term attended monitoring of sound levels at locations representative of the closest residential properties to the site, and by applying professional judgement for receptors that were based further afield.

11.1.11 One long-term monitor (LT1) was installed in the garden of Fencefoot Farm Cottage, to the south of the property, and at a similar distance from the façade of the house to the A78 Irvine Road. Measurements were recorded between 12:45 hours on 24th November and 14:15 hours on 10th December 2021. Sound level measurements were carried out using a 'Class 1' Rion NL-52 sound level meter (SLM) in accordance with BS 7445-2:1991, with the microphone mounted on a pole at 1.5 m above local ground level in a free-field location (i.e. at least 3.5 m away from surfaces not including the ground).

11.1.12 A second long-term monitor (LT2) was installed in the garden of The Lodge House on the Southannan Estate, to the west of the property at around 3.5 m from the façade of the property. Measurements were recorded between 13:30 hours on 24th November and 13:45 hours on 10th December 2021. Sound level measurements were carried out using a 'Class 1' Rion NL-52 sound level meter (SLM) in accordance with BS 7445-2:1991, with the microphone mounted on a pole at 1.5 m above local ground level in a free-field location (i.e. at least 3.5 m away from surfaces not including the ground).

11.1.13 For both surveys data were logged of the broadband, A-weighted sound pressure level in 100 millisecond (ms) samples with the required periods extracted in post-processing; in this instance 15-minute periods. The sound level meter was calibrated before use and the calibration checked again after use, and it was observed that no significant drift had occurred during the survey period.

11.1.14 Weather data including wind speed, wind direction and rainfall were obtained for the survey period from a local weather station in Fairlie.

11.1.15 Short-term baseline sound monitoring was carried out at three locations (ST1, ST2 and ST3). For all surveys, 15-minute data samples were recorded over one period during the daytime on 10th December 2021.

11.1.16 ST1 was located in the Southannan Estate on the access road to the south-west of the nearest residential property within the estate to the development site. The microphone was mounted on a tripod in a free-field location at 1.5 m above local ground level.

11.1.17 ST2 was located on Fairlie Moor Road to the north of Glenside. The microphone was mounted on a tripod in a free-field location at 1.5 m above local ground level.

11.1.18 ST3 was located on the junction of Netherton Avenue and Old Road. The microphone was mounted on a tripod in a free-field location at 1.5 m above local ground level.

11.1.19 The baseline sound monitoring locations are provided on the plan in Figure 11.2.

Consultation

11.1.20 A summary of the consultation undertaken to date with stakeholders and consultees is provided in Table 11.1 below. A formal request for a Scoping Opinion was submitted to North Ayrshire Council in November 2021, which included a section regarding the proposed noise and vibration assessment. Scoping responses were received in December 2021. In addition, informal consultation was carried out with the Environmental Health team at North Ayrshire Council.

Table 11.1: Consultation Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed?
Date	Consultee and Issues Raised	How/ Where Addressed?
17 December 2021	North Ayrshire Council – Scoping Opinion" *"6. Noise/Vibration - There will likely be impact from construction noise, operation of the facility, and transportation of product to the jetty. If generators or similar are proposed, this should be included in the operational activity. NAC Environmental Health require that they be consulted to agree a methodology for background/baseline noise levels and noise targets (and it is understood discussions are ongoing)."*	This is addressed in the assessments of Construction and Operational Noise, and the sections below within this table.
07 December 2021	North Ayrshire Council Environmental Health – Scoping Response *"The RPS report "XLCC Cable Factory-Hunterston EIA Screening Report-NP 12180-V6.0 November 2021" submitted as part of the application confirms that a baseline noise survey will be undertaken and the scope of this will be discussed and agreed with the EHO at North Ayrshire Council. I can advise that contact has been made to discuss the baseline noise survey and applicable noise targets that will require to be met during the construction and operational phases of the Project."*	This has been addressed in the assessment of Operational Noise. It is noted that the EHO at North Ayrshire Council requested that surveys were carried out at Hunterston House and the Field Studies Council. However, as surveys had already been deployed when the correspondence was received these locations were not included in the baseline survey. They have been included in the assessment and assumptions have been made regarding baseline conditions.
December 2021	Largs Community Council – Scoping Response *"The reference viewpoints and baseline noise studies and monitoring sites will be chosen in conjunction with SNH and Local Authorities. We suggest that the neighbouring Community Councils should also be consulted."*	Consultation was made with the EHO at North Ayrshire Council regarding the assessment. It is not common practice to consult with community councils for a project of this scale, and

Date	Consultee and Issues Raised	How/ Where Addressed?
	"Table 6.10 proposes to scope out air quality effects relating to operational traffic and noise effects relating to operational traffic. With 24/7 operations, the EIA should address the impacts on the vehicle movements, and change of shifts, will impact on A78 movements through Largs, Fairlie and West Kilbride." *"It is also proposed to scope out operational vibration effects. A baseline should be established for reference as there is likely to be noise and vibration from turntables and conveyors, but also from the loading of cable on to ships and the operations of the ships in port which could be a 24/7 operation."*	therefore consultation with community councils has not been made. The impact of noise from traffic has been considered in both the construction and operational phase. There are no sources that would introduce an operational vibration impact and therefore this has been scoped out of the assessment.
	Fairlie Community Council – Scoping Response *"2 Noise Impact* *(i) from the twin facility* *Fairlie does want to support development at Hunterston, development that will bring sustainable jobs and help retain our young people in the area. If NAC allows XLCC to dictate the hours of operation, we may be subjected to noise at night from the facility`s operations. Assurances are not enough. Neither are assessments carried out by the developers acousticians. We would recommend that Officers and an independent assessor visit similar facilities and gauge for themselves the noise levels.* *(ii) from the vessels including the cable laying ships likely to be at Hunterston Jetty for extended periods. We note, as a positive step, that XLCC is intending to install mains power for its cable laying ship. Does this mean for all cable laying ships or solely for its own? We remind NAC that the last ships of this type, one old, one new, caused noise nuisance at 8kms, so we would hope that mains power is available at the outset for all vessels coming into Hunterston. It is the 21st Century and we are not yet third world ! Peel Ports has always been mean when it comes to financing anything that could alleviate nuisance to its neighbours, such as mains power supply for vessels using the jetty. This should be a condition of any further development in order that our human rights, under the Aarhus Convention, are not breached. Peel Ports will substantially gain financially with this large scale development and positive practise rather than empty words signifies an ethical company, considerate of its close neighbours..* *We would ask that permanent effective noise monitoring be set up and regulations upgraded with regard to low frequency noise in advance of the development at Hunterston Parc.* *(iii) from the extra road traffic to and from the site, whilst it is under construction and operating. Fairlie already has part of the A78 that is so narrow, larger vehicles have to mount the pavement to pass each other safely. The potential bypass route was lost to housing and without additional or alternative road infrastructure, we will be negatively impacted by noise and safetywise. When the coal lorries operated, they could not go through the village until after 7am and before10 pm. We would wish similar restrictions put in place for any heavy traffic to and from the facility."*	It is understood that these comments are primarily directed to the regulatory authority, rather than the Applicant. However, the potential for future noise monitoring under the EIA regulations is discussed in both the construction and operational assessment sections.
25 November 2021	Private Individual, Mr Riddle "*An assessment of the noise likely from movement of the cable along the jetty approach and onto the receiving vessel should be included for residential receptors at different locations in Fairlie*."	The impact of noise from vessels accessing the facility has been scoped out of the assessment of noise and vibration (See Paragraph 11.1.36)

Assessment Criteria and Assignment of Significance

Receptor Sensitivity/Value

11.1.21 Table 11.2 summarises the descriptions of receptor sensitivity used within this assessment. These accord with the descriptors in TAN 11.

Table 11.2: Definitions of Sensitivity or Value

Sensitivity	Description	Examples of NSR
High	Receptors where people or operations are particularly susceptible to noise and vibration	Residential, including private gardens where appropriate. Quiet outdoor areas used for recreation Conference facilities Theatres/Auditoria/Studios Schools during the daytime Hospitals/residential care homes Places of worship
Medium	Receptors moderately sensitive to noise and vibration, where it may cause some distraction or disturbance	Offices Bars/Cafes/Restaurants where external noise may be intrusive. Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls)
Low	Receptors where distraction or disturbance from noise and vibration is minimal	Buildings not occupied during working hours Factories and working environments with existing high noise levels Sports grounds when spectator noise is a normal part of the event Night Clubs

11.1.22 All of the receptors that have been identified for this assessment are residential. Therefore, the sensitivity of all of the receptors considered in this assessment, is high.

Magnitude of Impact

11.1.23 Table 11.3 and Table 11.4 summarise the descriptions of magnitude of impact for the assessment. These accord with the descriptors in TAN 11 for the quantitative and qualitative evaluation of impact, although it is noted that the terminology differs.

Table 11.3: Definitions of Magnitude (for quantitative evaluation)

Sensitivity	Typical Descriptors
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristic, features or elements (Adverse)
	Minor benefit to, or addition of, one (maybe more) key characteristic, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse)

Sensitivity	Typical Descriptors
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Table 11.4: Definitions of Magnitude (for qualitative evaluation)

Perception	Criteria of Descriptor for Residential Dwellings	Descriptor for Qualitative Impact
Noticeable (Very disruptive)	Significant changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm.	High
Noticeable (Disruptive)	Causes an important change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.	Medium
Noticeable (Mildly intrusive)	Noise can be heard and may cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows more often. Potential for non-awakening sleep disturbance. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Low
Just Noticeable (Non intrusive)	Noise can be heard, but does not cause any change in behaviour or attitude, e.g. increasing volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Negligible
Not noticeable	None	No change

Methodologies Adopted for Impact Assessment

Construction Noise (site works)

11.1.24 Noise effects have been assessed with reference to BS 5228-1:2009+A1:2014. The standard provides guidance, information and procedures on the control of noise from construction sites and promotes a 'Best Practicable Means' (BPM) approach to control noise from construction activities.

11.1.25 Adverse effects due to construction noise associated with this type of development tend to be relatively limited. Construction noise has, therefore, been addressed qualitatively on the basis of professional judgement and experience of similar schemes. Potential effects have been determined based on the qualitative descriptions provided in Table 11.4.

Noise from Construction Traffic

11.1.26 The noise changes identified in Table 11.5 below have been used to determine the magnitude of noise effects associated with construction traffic on the local road network and from temporary diversion routes resulting from construction of the Project. These are based on the guidance in DMRB, LA111, Noise and Vibration (Transport Scotland), for the classification of magnitude of noise effects in the long term. It is noted that construction traffic is a short-term effect. However, as this is not for a new highway, it has been considered appropriate to use the criteria for long term effects from road traffic in this context.

Table 11.5: Magnitude of Impact for Construction Traffic Noise in the Long Term

Predicted Change In $L_{Aeq,T}$ or $L_{A10,T}$	Magnitude of Impact
0 dB	No change
Increase of 0.1 to 2.9 dB	Negligible
Increase of 3 to 4.9 dB	Low
Increase of 5 to 9.9 dB	Medium
Increase of more than 10 dB	High

11.1.27 The magnitude of impact is considered to be 'Low' at NSRs if noise levels are sufficiently low such that they do not have the potential to cause or contribute to some harmful or otherwise unwanted effect. Similarly, a small change in noise level where noise levels are already high would result in a greater magnitude of effect than those above. Consequently, the absolute levels of road traffic noise have also been considered in terms of guidance contained within the WHO 'Guidelines for Community Noise' and the Noise Insulation Regulations (NIR).

11.1.28 The NIR provides a $L_{A10,18h}$ level above which insulation should be offered, assuming other factors are satisfied. This level applies to permanent traffic or construction traffic where the road is being altered or built and, therefore, the need to provide noise insulation does not apply here. However, these criteria have been used to evaluate significance. This applies where the combined traffic noise level from the new or altered highway together with other traffic in the vicinity is 68 dB $L_{A10,18hr}$ or greater and the contribution to the increase in the relevant noise level from the new or altered highway is at least 1 dB. This corresponds to a free-field level of 63 dB $L_{Aeq,16h}$. Therefore, a change in traffic noise levels of greater than 3 dB would result in a 'medium' magnitude of effect, and a change of 5 dB would result in a 'high' magnitude of effect if the combined traffic noise level exceeds 63 dB $L_{Aeq,16h}$.

11.1.29 The WHO 'Guidelines for Community Noise' provides guidance on noise levels for typical situations. For daytime external noise levels, it is considered that:

'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces, and outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development.'

11.1.30 Based on this guidance, noise effects from road traffic are only considered to be significant if the traffic noise level exceeds a level of 50 dB $L_{Aeq,16hr}$. Below this level, the magnitude of effect is at most 'very low' from this source alone.

11.1.31 New guidance was issued by the WHO in 2018. The guidelines are intended to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation noise (road traffic, railway and aircraft), wind turbine noise and leisure noise. For traffic noise, the guidelines recommend reducing noise levels produced by road traffic noise to below 53 dB L_{den} and 45 dB L_{night}.

11.1.32 The WHO guidelines utilise the annual average of the L_{den} and L_{night} parameters which exclude the effect of the façade. Averaging variations in traffic flow and meteorological effects over a period of a year the annual average noise level would be lower than the noise level under conditions favourable to sound propagation or during the peak traffic assessed as part of this study.

11.1.33 The use of yearly average parameters is a fundamental aspect of the WHO guidance. The thresholds are based on potential health effects at population level due to long term exposure to noise. It follows that it is unlikely that exposure to higher levels of noise over a shorter period of time would result in the same health impacts. In addition, it cannot be assumed that thresholds

applicable at population level for the purpose of making strategic decisions on long term transportation policy can be applied directly to assessing the potential significance of noise on a single property due to a project of limited duration.

11.1.34 Furthermore, the WHO guideline values give the lowest threshold noise levels below which the occurrence rates of particular effects can be assumed to be negligible. Exceedances of the WHO guideline values do not necessarily imply significant noise impact and, indeed, it may be that significant impacts do not occur until much higher degrees of noise exposure are reached.

Operational Noise (on site)

11.1.35 Sound immissions[1] from the Project have been predicted at the nearest NSRs identified in the section above ('Study Area'). Predictions have been carried out using SoundPLAN Version 8.2 sound modelling software utilising the propagation method contained in ISO 9613-2:1996 'Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation'. The model predicts sound levels under light down-wind conditions based on hemispherical sound propagation with corrections for atmospheric absorption, ground effects, screening and directivity.

11.1.36 For the purposes of this assessment, the following assumptions have been made in relation to the plant to be included as part of the Project:

- Noise levels inside buildings will need to be controlled not to exceed 85 dB $L_{Aeq,T}$, so as to comply with the workplace noise requirements for the site. Therefore a worst-case assumption has been adopted of an internal noise level of 85 dB $L_{Aeq,T}$ in all buildings (with the exception of the storage carousels) for both the daytime and night-time period. The cladding of the buildings has been assumed to have a sound insulation of 32 dB $R_w + C_{tr}$. In practice, some of the buildings would be concrete construction or steel portal framed buildings with a higher sound insulation performance, so this is a worst-case assumption.
- The noise level within the storage carousels has been based upon data provided by the Project team. The storage carousels would be open to the atmosphere on the eastern side. The remaining sides and the roof would be of a material with a sound insulation of 32 dB $R_w + C_{tr}$.
- There would be extract fans mounted on the roof of the degassing chambers, which have been modelled as area sources at 2 m above the building.
- The utilities compound would include chillers, cooling towers and generators, all of which have been modelled as point sources.
- The potential impact of noise from cable laying vessels (CLVs) accessing the facility has been scoped out of the assessment of noise and vibration. This is because CLVs are likely to be a small proportion of the total shipping traffic visiting the jetty and represent an insignificant amount of port-related noise.
- Cables will be loaded onto the vessels via a cable tensioner that would pull the cables along a roller-pathway. The cable tensioners will be powered by mains electricity on the jetty.

11.1.37 Acoustic source data have been obtained from information provided by the Project team and RPS' experience of other similar developments. Sound power levels of modelled sources, and transmission losses for building elements in octave bands are provided in Appendix 11.2.

11.1.38 The following assumptions have been incorporated into the noise model:

[1] the act of immitting, or of sending or thrusting in; injection; -- the correlative of emission

- the topography of the site and the surrounding area has been obtained from site surveyed topographical data and Ordnance Survey (OS) open data (Terrain 50);
- the effect of screening from solid structures (buildings) has been incorporated into the modelling process by importing OS Open Data 'Settlement Area' shape file data into the model; and
- the ground type in the hardstanding areas of the site and areas of water have been set to hard (G = 0), and the surrounding area is set to soft (G=1).

11.1.39 Noise effects due to the operation of the Project have been assessed according to the guidance in BS 4142:2014+A1:2019. This standard primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound' from the Project) at residential NSRs. The specific sound level may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the 'rating level', whether or not a rating penalty is applied. The 'residual sound' is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

11.1.40 BS 4142:2014+A1:2019 requires that the background sound levels adopted for the assessment be representative of the period/s being assessed. The standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated. However, the standard also states that there is no 'single' background sound level that can be derived from such measurements. It is particularly difficult to determine what is 'representative' of the night-time period because it can be subject to a wide variation in background sound levels between the shoulder night periods.

11.1.41 The approach that has been adopted for this assessment is to determine the background sound levels in 15-minute periods and calculate various statistical parameters in the daytime and (07:00 hrs to 23:00 hrs) and night-time (23:00 hrs to 07:00 hrs) periods, which have been used to derive representative background sound levels. Further information regarding the determination of background sound levels is provided under 'Baseline Conditions'.

11.1.42 The specific sound levels have been determined separately in terms of the $L_{Aeq,T}$ index for operations during the daytime (07:00 hrs to 23:00 hrs) and night-time (23:00 hrs to 07:00 hrs) period.

11.1.43 All of the plant may operate continuously and have therefore been included within both the daytime and night-time assessment periods.

11.1.44 At each NSR, the rating level has been determined from the predicted specific sound level. Where RPS has considered it to be appropriate, a rating penalty has been applied for tonality, impulsivity and/or intermittent specific sounds as described in the commentary to paragraph 9.2 of BS 4142:2014+A1:2019. This has been applied with consideration for the main sound sources from the development that contribute to the level and character of the specific sound at each NSR location.

11.1.45 As per the requirements of the standard, an initial estimate of the impact of the specific sound has been obtained by subtracting the measured background sound level from the rating level of the specific sound. Table 11.6 provides the initial evaluation following this method.

Table 11.6: Operational Noise - Initial Evaluation of Noise Impact

Magnitude	Typical Descriptors
High	Difference between Rating Level and Background Level of more than +10 dB.
Medium	Difference between Rating Level and Background Level of +5 to +10 dB.
Low	Difference between Rating Level and Background Level of 0 dB to +5 dB.
Negligible	Difference between Rating Level and Background Level of less than 0 dB.
No change	Difference between Rating Level and Background Level of less than - 10 dB.

11.1.46 Following the initial evaluation of impact, the context of the sound has also been considered, which is a key requirement of the standard. In evaluation of the context, the following factors have been considered:

- the absolute level of the sound;
- the character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

11.1.47 The absolute level of the sound has also been considered in relation to the guidance published by the World Health Organisation (WHO) on the desirable levels of environmental noise in 2000. In this document, Guidelines for Community Noise (GCN). The authors consider that sleep disturbance criteria should be taken as an internal noise level of 30 dB L_{Aeq} or an external level of 45 dB $L_{Aeq,8hr}$, measured at 1 m from the façade (equivalent to a free-field level of 42 dB L_{Aeq}).

11.1.48 The criteria for speech intelligibility and moderate annoyance during the daytime and evening should be taken as an internal noise level of 35 dB L_{Aeq}. For external daytime levels, it is considered that:

'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces, and outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development.'

11.1.49 The major concern in Europe is with respect to noise from transportation systems, and most of the studies on which these guidelines are based relate to this type of noise source. There can be no certainty that the same effects will be observed from noise of an industrial nature, but in the absence of any more detailed information some weight should be attached to the WHO guidance when assessing industrial noise as well.

11.1.50 The evaluation of the magnitude of noise impacts at receptors has been amended following consideration of the above contextual factors, and with reference to the definitions in Table 11.3 and Table 11.4.

Operational Traffic

11.1.51 Noise from operational traffic on the highway has been considered using the same methodology as applied to construction traffic described above.

Significance of Effects

11.1.52 The significance of effects has been determined using the matrix provided in Table 11.7 for the following descriptions for the overall significance:

- **Substantial**: These effects represent key factors in the decision-making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective.
- **Major**: These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a moderate or slight significance.
- **Moderate**: These effects, if adverse, while important, are not likely to be key decision making issues.
- **Minor**: These effects may be raised but are unlikely to be of importance in the decision making process.
- **No change**: No effect, not significant, noise need not be considered as a determining factor in the decision making process.

11.1.53 The above descriptions are based on the descriptions of significance provided in TAN, although the terminology differs.

Table 11.7: Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial

11.1.54 Where the matrix offers more than one significance option, professional judgement has been used to decide which option is most appropriate.

11.1.55 Effects that are moderate, major or substantial are considered to be significant with respect to the EIA Regulations. Negligible and minor effects are not considered significant.

Limitations of the Assessment

11.1.56 As required by the EIA Regulations, this section sets out the limitations of the assessment process and any difficulties encountered.

Baseline Noise Monitoring

11.1.57 For all surveys, there are limitations associated with: the instrumentation itself; and the use of instrumentation, i.e. the measurements. Uncertainty due to instrumentation error has been significantly reduced with the introduction of modern instrumentation and is reduced further by ensuring that all instrumentation is calibrated before and after each measurement period and is within accepted formal calibration intervals. Baseline sound levels have been determined from

measurements carried out over a period of one week, allowing analysis of how representative the baseline data is given the naturally varying noise levels at the site, which reduces the uncertainty.

Noise Modelling and Calculations

11.1.58 For noise modelling and calculations, there are limitations in the source data used and the sound propagation model or calculation method.

11.1.59 Operational sound emissions from the Project have been determined from information provided by the Project team and RPS' experience of other similar sites. Therefore, these data are estimates of realistically achievable sound levels although the final plant installed within the Project site may vary from that which has been modelled.

11.1.60 Sound immissions at NSRs have been calculated using the prediction methodology in ISO 9613-2:1996. ISO 9613-2, which is widely used for the prediction of industrial noise. For source heights up to 30 m and prediction distances between 100 m and 1000 m, ISO 9613-2:1996 claims accuracy of +/-3 dB.

Assessment of Effects

11.1.61 The acoustics standards and guidance adopted for the assessment of effects are based on the subjective response of the majority of the population. This is considered to be the best that can be achieved in a population of varying subjective responses, which are dependent upon a wide range of factors.

11.1.62 On the basis of the above, it is considered that limitations to the assessment have been minimised and that the results provide a robust estimate of the likely noise effects of the Project.

Baseline Environment

11.1.63 The Project site is in a rural location with the surrounding uses being mainly agricultural and woodland. There is a wildlife sanctuary to the north, and a wetlands SSSI to the west. The A78, Irvine Road, a busy main road, runs around 100 m to the east of the site, and a railway line runs parallel to this at around 200 m to the east of the site. The village of Fairlie is around 400 m to the north-east. There are also several individual properties within 400 m to the east of the site. Hunterston House is around 1.4 km to the south-west of the development site. The nearest property on the Isle of Cumbrae is the Field Studies Council near Millport, around 2.7 km to the west of the main development site and 1.7 km to the west of the jetty.

11.1.64 An analysis has been carried out of the measured baseline sound levels at the long-term sound monitoring locations. The data have been extracted and post-processed in 15-minute periods for the daytime (07:00 to 23:00 hrs) and night-time (23:00 to 07:00 hrs) periods. These analyses are provided in Table 11.8 for LT1 and Table 11.9 for LT2. Data are rounded to the nearest whole number. Further survey details and graphical plots of the survey data are provided in Appendix 11.3.

Table 11.8: Summary of Baseline Sound Levels at LT1

Value	Daytime (07:00 to 23:00 hours)		Night-time (23:00 to 07:00 hours)	
	Residual Sound Level $L_{Aeq,T}$	Background Sound Level $L_{A90,T}$	Residual Sound Level $L_{Aeq,T}$	Background Sound Level $L_{A90,T}$
Range	51 - 64	38 - 58	35 - 59	35 - 58
Arithmetic Mean	59	49	53	46
Standard Deviation	2	3	4	5
25th Percentile	58	47	49	42

Value	Daytime (07:00 to 23:00 hours)		Night-time (23:00 to 07:00 hours)	
	Residual Sound Level $L_{Aeq,T}$	Background Sound Level $L_{A90,T}$	Residual Sound Level $L_{Aeq,T}$	Background Sound Level $L_{A90,T}$
50th Percentile / Median	59	50	51	47
75th Percentile	60	52	54	49

Table 11.9: Summary of Baseline Sound Levels at LT2

Value	Daytime (07:00 to 23:00 hours)		Night-time (23:00 to 07:00 hours)	
	Residual Sound Level $L_{Aeq,T}$	Background Sound Level $L_{A90,T}$	Residual Sound Level $L_{Aeq,T}$	Background Sound Level $L_{A90,T}$
Range	49 - 67	33 - 63	34 - 61	32 - 55
Arithmetic Mean	59	46	52	39
Standard Deviation	3	5	5	6
25th Percentile	56	44	46	35
50th Percentile / Median	59	47	50	37
75th Percentile	60	49	53	42

11.1.65 BS 4142:2014+A1:2019 requires that the background sound levels adopted for the assessment are representative of the period being assessed. The Standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated.

11.1.66 However, the Standard states that there is no 'single' background sound level that can be derived from such measurements. It is particularly difficult to determine what is 'representative' of the night-time period because it can be subject to a wide variation in background sound level between the beginning and end of the night period, and the quieter middle part of the night period. The accompanying note states that 'a representative level should account for the range of background sounds levels and should not automatically be assumed to be either the minimum or modal value'.

11.1.67 In this instance, the 25th percentile from the monitoring has been used to characterise the baseline sound environment. This is not the lowest sound level encountered but is lower than that obtained using the arithmetic mean. It therefore considered to represent typical sound levels that are likely to be encountered. Similarly, representative baseline residual levels have been based on the 25th percentile levels.

11.1.68 The results of the short-term sound monitoring surveys are provided in Appendix 11.3.

11.1.69 For Fencefoot Farm Cottage, the data from monitoring at LT1 have been considered the most appropriate to use for the assessment of impact.

11.1.70 ST2 has been considered the most representative location for Glenside and Southannan Cottage, which are at a similar distance from the A78. The measured data at ST2 have been correlated to the data measured at LT1 in the same periods and an appropriate reduction has been applied to derive the ambient and background sound levels.

11.1.71 South Lodge is further from the A78 then Fencefoot Farm Cottage, but not as far as Glenside, so the level has been taken as halfway between those measured at LT1 and those calculated for Glenside and Southannan Cottage.

11.1.72 ST3 has been considered the most representative location for Hunterston House. The measured data at ST3 have been correlated to the data measured at LT1 in the same periods and an appropriate reduction has been applied to derive the ambient and background sound levels.

11.1.73 ST1 has been considered the most representative location for the Southannan Estate and Fairlie. The measured data at ST1 have been correlated to the data measured at LT2 in the same periods and an appropriate reduction has been applied to derive the ambient and background sound levels.

11.1.74 No baseline data have been obtained at a location representative of the Field Studies Council. Therefore, noise levels have been assumed for this location, and are a conservative estimate of the noise levels that would be expected.

11.1.75 A summary of the representative baseline sound levels at each of the NSRs considered in the assessment is provided in Table 11.10 below.

Table 11.10: Representative Baseline Sound Levels for Assessment

NSRs	Daytime (07:00 to 23:00 hours)		Night-time (23:00 to 07:00 hours)	
	Residual Sound Level $L_{Aeq,T}$	Background Sound Level $L_{A90,T}$	Residual Sound Level $L_{Aeq,T}$	Background Sound Level $L_{A90,T}$
Fencefoot Farm Cottage	58	47	49	42
Glenside	48	42	39	37
Hunterston House	52	41	44	35
Poteathbank Cottage	58	47	49	42
Residence at the Field Studies Council	40	35	35	30
South Lodge	53	45	44	39
Sounthannan Cottage	48	42	39	37
Southannan Estate	45	43	35	34

Future Baseline Conditions

11.1.76 The EIA Regulations require consideration of how future changes, such as climate change, would influence future baseline conditions. There is no established relationship between climate change and the noise and/or vibration baseline. No changes to the baseline conditions described above are anticipated.

Mitigation Measures Adopted as Part of the Project

11.1.77 Construction works would follow Best Practicable Means (BPM) outlined in Section 72 of the Control of Pollution Act 1974 (as amended) to minimise noise and vibration effects. Contractors would be required to adopt and implement the BPM measures identified. These would be implemented through the Code of Construction Practice (CoCP).

11.1.78 The following measures will be implemented through the CoCP, based upon the guidance contained in BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014:

- **Communication:** Occupiers of residential and business properties that are likely to be affected by the works will be notified in advance of the works. A Community Relations Manager would be appointed to act as the first point of contact on environmental matters for North Ayrshire Council, other external bodies and the general public. Information regarding the nature and duration of the works and named contact details for key members of staff will be displayed on a noticeboard near to the site.
- **Standard Construction Hours:** Normal working hours would be as specified in the Construction and Environmental Management Plan i.e. 07:00 to 19:00 hours Monday to Friday, and 08:00 to 13:00 hours on Saturday and at no time on Sundays or on public or bank holidays. There are some works required outside of these hours, including the construction of the VCV Tower and works inside the building. Any works likely to generate noise that would be perceptible at the nearest NSRs that is required outside of these hours to permit construction activities, would be agreed with North Ayrshire Council prior to commencement of the activity. In such instances, the contractor would apply to North Ayrshire Council for written consent prior to work commencing by submitting a Section 61 application in line with the Control of Pollution Act.
- **Access Routes:** Access to the site would be from the existing public highway via the unnamed access road (which in turn connects to the A78) on the western boundary of the Project site. A Construction Traffic Management Plan (CTMP) will be agreed with North Ayrshire Council prior to the commencement of any construction works. Full details of construction access routes are provided in Chapter 10 Traffic and Transport.
- **Equipment:** Quieter alternative methods, plant and equipment would be used, where reasonably practicable.
- **Worksite:** Plant, equipment, site offices, storage areas and worksites would be positioned away from existing NSRs, where reasonably practicable.
- **Maintenance:** All vehicles, plant and equipment would be maintained and operated in an appropriate manner, to ensure that extraneous noise from mechanical vibration, creaking and squeaking is kept to a minimum.
- **Piling:** If piling is required, the piling types and methods will be determined by design and will be confirmed by the Contractor and agreed in consultation with North Ayrshire Council prior to work commencing.

Operational Phase Mitigation

11.1.79 As full detailed specifications of plant are unknown at this stage, a scenario has been modelled based upon typical plant, which demonstrates that a reasonable acoustic environment is attainable at the nearest NSRs to the development site. In the event that details of the design alter, suitable mitigation measures to achieve acceptable noise levels at NSRs would be agreed with North Ayrshire Council.

11.1.80 The majority of noise generating plant would be contained within buildings. The buildings would be constructed with insulated cladding to reduce noise breakout and where required, would be ventilated using forced ventilation with a vertical exhaust.

11.1.81 There would be some external plant as necessary. If required, external plant can be fitted with silencers to meet the required noise limits.

Assessment of Construction Effects

Site Construction Works

11.1.82 Details of the construction of the Project are provided in Chapter 2 Project Description. It is anticipated that the construction phase would take approx. 2 years to complete.

11.1.83 Noise emissions are likely to be highest at the early stages of construction works, i.e. enabling works, earthworks, and substructure works, and decrease during the plant and building erection and fit-out stages.

11.1.84 For the majority of the construction period, plant on-site would comprise various diesel mechanised construction plant including excavators (with various tool attachments depending upon the task being undertaken), haulage vehicles, mobile cranes and heavy and light goods vehicles. Breakers would be required to remove existing areas of hardstanding. Construction of new hardstanding areas, roads and building foundations would require concrete mixers and pumps, concrete rollers and poker vibrators. Fit out stages would require various hand tools such as cutting tools, drills and air compressors. Additionally, there would be general plant operating throughout the construction period including generators to power site equipment and lighting, water pumps and a road sweeper.

11.1.85 Piling is likely to be required for foundations of structures on site; this will be dependent on the ground type. The extrusion tower basement will require sheet piles initially. This method could generate high levels of noise, particularly from cutting steel, but this would be a relatively short-term activity. Other techniques may include CFA, impact, driven or vibratory piling. Impact, driven or vibratory methods of piling would generate higher levels of noise and vibration then CFA piling, so would be the preferred method, if viable.

11.1.86 The extrusion tower would be constructed from a slip form method which is a continuous concrete pour. This would require working from 07:00 to 00:00 hours Monday to Saturday for a period of 43-50 weeks within the construction programme.

11.1.87 From the 'Study Area' section of this chapter, the closest NSRs to the site are Fencefoot Farm Cottage and South Lodge, which are around 150 m and 230 m to the east of the site respectively, and the nearest property on the Southannan Estate, which is located at around 380 m to the north-east of the site.

11.1.88 Table 11.8 of this chapter indicates that during the daytime baseline ambient noise levels measured at Fencefoot Farm Cottage are variable, ranging between 51 and 64 dB $L_{Aeq,T}$ in 15-minute periods during daytime hours when the majority of construction works would take place. From Table 11.10, levels are expected to be around 5 dB lower at South Lodge and 13 dB lower at the Southannnan Estate. This indicates that levels are low at times when there is a drop in traffic levels. Therefore, there is potential for noise from construction activities to be audible at the nearest NSRs. There is likely to be some measurable change in the level and character of the sound environment. The noise may cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows more often. However, noise generating works would be intermittent and, therefore, activities within residents' homes and gardens would not be consistently affected.

11.1.89 Table 11.8 of this chapter indicates that during the night-time baseline ambient noise levels measured at Fencefoot Farm Cottage are variable, ranging between 35 and 59 dB $L_{Aeq,T}$ in 15-minute. extrusion tower construction would only take place for one hour of the night-time period between 23:00 and 00:00 hrs. During this period levels are likely be toward the upper end of this range, around the 75th percentile level of 54 dB $L_{Aeq,T}$. From Table 11.10, levels are expected to be around 5 dB lower at South Lodge and 14 dB lower at the Southannnan Estate. This indicates that levels would be low at some locations during the early part of the night-time. Therefore, there is potential for noise from construction of the extrusion tower to be audible at the nearest NSRs

during the night-time period. There is likely to be some measurable change in the level and character of the sound environment. The noise may cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows more often. There is potential for sleep disturbance; however, this would only be during the early night-time period and not throughout the night. Furthermore, noise generating works would be intermittent and not continuous throughout the 43-50 week construction period and, therefore, activities within residents' homes and gardens would not be consistently affected.

11.1.90 There is potential for vibration to be generated by some works including piling (depending on the method used) and use of vibratory equipment such as vibratory rollers and poker vibrators. However, vibration falls off rapidly with distance and therefore is unlikely to be felt at the nearest NSRs.

11.1.91 In summary, it is likely that construction works will generate noise levels at NSRs that are perceptible and may from time to time affect activities commonly occurring in residential areas during the daytime. There is potential for some sleep disturbance; however, this is limited to the early period of the night-time and to the 43-50 weeks required for the extrusion Tower construction. Vibration is unlikely to be perceptible at the nearest NSRs.

11.1.92 With reference to Table 11.3 and Table 11.4, the magnitude of noise impacts, prior to mitigation, would be low. With reference to Table 11.2, the sensitivity of receptors is high. Therefore, with reference to Table 11.6, there is likely to be a direct, temporary, medium-term noise effect on NSRs of minor to moderate adverse significance prior to the implementation of further mitigation measures. Construction activities would take place to a predetermined schedule following the BPM measures stated within the mitigation section above, which would be enforced through the CoCP, and S.61 applications would be carried out where applicable for out of hours works. With consideration of the mitigation to be applied, the effect is considered to be minor adverse. There is likely to be no effect from vibration.

Construction Traffic

11.1.93 Noise effects from traffic on the local road network have been assessed for all road links that are included within the traffic routes provided in Chapter 10 Traffic and Transport.

11.1.94 Baseline traffic data have been provided for the base year (2022); and the average and maximum construction traffic flows have been provided. An evaluation has been made of the noise effect from construction traffic by comparing both the average and maximum construction traffic to the baseline traffic.

11.1.95 A summary of the calculations and assessments are provided in Table 11.11 for the average construction traffic scenario and Table 11.12 for the maximum traffic scenario. Although the predicted $L_{A10,18hr}$ noise levels are rounded to zero decimal places, the change in noise levels is rounded to 1 decimal place to allow for comparison to the levels (Table 11.5).

Table 11.11: Assessment of Noise from Construction Traffic – Average

Survey ID	Location	2022 Baseline 18-hr AAWT (06:00 – 00:00)				2022 Baseline + Construction (Average) 18-hr AAWT (06:00 – 00:00)				Change in Noise Level (dB)
		Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	
10755	A78 South of Largs	13852	5.8%	48.3	70	13901	5.8%	48.3	70	0.0
80358	A78 Site	9290	4.1%	96.6	72	9468	4.5%	96.6	72	0.2
40912	A760 Blairpark	5164	8.7%	96.6	70	5173	8.6%	96.6	70	0.0
50759	A78 West Kilbride	9565	5.0%	48.3	68	9743	5.3%	48.3	68	0.2
811627	A781 West Kilbride	2583	1.2%	32.2	59	2593	1.2%	32.2	59	0.0
996074	A781 Rural (Munnoch)	1319	1.2%	96.6	63	1321	1.2%	96.6	63	0.0
20761	A78 Loup Cottage Caravan Park	13541	3.2%	96.6	73	13709	3.4%	96.6	73	0.1

Survey ID	Location	2022 Baseline 18-hr AAWT (06:00 – 00:00) Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	2022 Baseline + Construction (Average) 18-hr AAWT (06:00 – 00:00) Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	Change in Noise Level (dB)
754	A738 Eglington Road	8124	3.0%	48.3	66	8163	3.0%	48.3	66	0.0
30762	A738 High Street (Saltcoats)	10725	4.7%	48.3	68	10744	4.7%	48.3	68	0.0
80495	A78 Dual (East of Dalry Road)	21428	6.5%	112.7	77	21557	6.7%	112.7	77	0.0
40760	A78 Dual (South of Stevenson Road)	37018	4.7%	112.7	79	37137	4.8%	112.7	79	0.0
80401	A737 Irvine Road (North)	12079	4.0%	64.4	70	12181	4.3%	64.4	70	0.1
80402	A737 Irvine Road (South)	12533	5.2%	64.4	70	12542	5.1%	64.4	70	0.0
74439	A737 Dalgarven	8189	4.8%	96.6	71	8281	5.2%	96.6	72	0.1
10905	A738 Stevenston Road (Kilwinning)	12853	3.5%	64.4	70	12863	3.5%	64.4	70	0.0
811627	A781 West Kilbride	2583	1.2%	32.2	59	2593	1.2%	32.2	59	0.0

Table 11.12: Assessment of Noise from Construction Traffic – Maximum

Survey ID	Location	2022 Baseline 18-hr AAWT (06:00 – 00:00) Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	2022 Baseline + Construction (Maximum) 18-hr AAWT (06:00 – 00:00) Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	Change in Noise Level (dB)
10755	A78 South of Largs	13852	5.8%	48	70	13939	5.8%	48.3	70	0.0
80358	A78 Site	9290	4.1%	97	72	9850	7.1%	96.6	73	0.8
40912	A760 Blairpark	5164	8.7%	97	70	5181	8.6%	96.6	70	0.0
50759	A78 West Kilbride	9565	5.0%	48	68	10125	7.9%	48.3	69	1.0
811627	A781 West Kilbride	2583	1.2%	32	59	2600	1.2%	32.2	59	0.0
996074	A781 Rural (Munnoch)	1319	1.2%	97	63	1323	1.2%	96.6	63	0.0
20761	A78 Loup Cottage Caravan Park	13541	3.2%	97	73	14084	5.3%	96.6	74	0.5
754	A738 Eglington Road	8124	3.0%	48	66	8193	3.0%	48.3	66	0.0
30762	A738 High Street (Saltcoats)	10725	4.7%	48	68	10759	4.7%	48.3	68	0.0
80495	A78 Dual (East of Dalry Road)	21428	6.5%	113	77	21901	7.8%	112.7	78	0.3
40760	A78 Dual (South of Stevenson Road)	37018	4.7%	113	79	37474	5.5%	112.7	80	0.2
80401	A737 Irvine Road (North)	12079	4.0%	64	70	12455	6.0%	64.4	71	0.6
80402	A737 Irvine Road (South)	12533	5.2%	64	70	12550	5.1%	64.4	70	0.0
74439	A737 Dalgarven	8189	4.8%	97	71	8548	7.6%	96.6	72	0.7
10905	A738 Stevenston Road (Kilwinning)	12853	3.5%	64	70	12870	3.5%	64.4	70	0.0
811627	A781 West Kilbride	13852	5.8%	48	70	13939	5.8%	48.3	70	0.0

11.1.96 The assessments in Table 11.11 and Table 11.12 indicate that the change in noise levels due to construction traffic would be less than 1 dB on all traffic links, and therefore with reference to Table 11.5 and the supporting text, the magnitude of impact is negligible. From Table 11.2, the receptors are of high sensitivity. Therefore, with reference to Table 11.6, there is likely to be a direct, temporary, medium-term noise effect on NSRs of minor adverse significance prior to the implementation of further mitigation measures.

Further Mitigation

11.1.97 Reasonable mitigation for noise and vibration from construction effects would be provided as part of the Project and implemented through the CoCP. With this mitigation in place, construction noise

and vibration effects are expected to be minor adverse and of a temporary nature. On this basis, it is not expected that any further mitigation measures are required.

Future Monitoring

11.1.98 Noise and vibration monitoring could be carried out during construction works at the discretion of the Environmental Health Department at North Ayrshire Council. This could either comprise short-term measurements or monitoring over a longer period via a remote access noise monitor with set noise thresholds. Monitoring may also be carried out to address any complaints that may occur. Procedures for noise monitoring would be discussed and agreed with North Ayrshire Council and implemented through the CoCP.

Accidents and/or Disasters

11.1.99 Some accidents and disasters may cause an instantaneous increase in noise levels. However, no unusual construction techniques are proposed and the likelihood of an accident or disaster occurring that would result in a noise or vibration effect is very low.

Assessment of Operational Effects

Operational Noise (on site)

Initial Assessment of Impact

11.1.100 Table 11.13 and Table 11.14 provide the initial estimates of the noise impact at the nearest NSRs due to the operation of the Project in accordance with BS 4142:2014+A1:2019 for the daytime and night-time periods respectively. The predicted specific sound levels are also presented graphically in Figure 11.3 for the daytime and Figure 11.4 for the night-time, both at 4 m above local ground level.

11.1.101 With reference to BS 4142:2014+A1:2019, a character correction may need to be applied to the specific sound level depending on the acoustic characteristics of the sound. In RPS' experience of similar sites, noise from the Project is likely to be of a broadband nature and would not be impulsive or readily distinctive. In addition, the predicted specific sound levels are below or at the background sound levels. Therefore, in this instance, it is not considered appropriate to apply any corrections for the acoustic character of the plant.

Table 11.13: BS 4142 Initial Assessment of Impact – Daytime (07:00 – 23:00 hrs)

Noise Sensitive Receptor	Background Sound Level, $L_{A90,T}$ dB	Specific Sound Level, $L_{Aeq,T}$ dB	Character Correction	Rating Level, $L_{Ar,Tr}$ dB	Rating Level minus Background Sound Level dB
Fencefoot Farm Cottage	47	37	0	37	-10
Glenside	42	34	0	34	-8
Hunterston House	41	24	0	24	-17
Poteathbank Cottage	47	32	0	32	-15
Residence at the Field Studies Council	35	22	0	22	-13
South Lodge	45	38	0	38	-7
Sounthannan Cottage	42	37	0	37	-5
Southannan Estate	43	34	0	34	-9

Table 11.14: BS 4142 Initial Assessment of Impact – Night-time (23:00 – 07:00 hrs)

Noise Sensitive Receptor	Background Sound Level, $L_{A90,T}$ dB	Specific Sound Level, $L_{Aeq,T}$ dB	Character Correction	Rating Level, $L_{Ar,Tr}$ dB	Rating Level minus Background Sound Level dB
Fencefoot Farm Cottage	42	35	0	35	-7
Glenside	37	31	0	31	-6
Hunterston House	35	22	0	22	-13
Poteathbank Cottage	42	30	0	30	-12
Residence at the Field Studies Council	30	18	0	18	-12
South Lodge	39	33	0	33	-6
Sounthannan Cottage	37	32	0	32	-5
Southannan Estate	34	30	0	30	-4

11.1.102 From Table 11.13 the rating levels range from 17 dB to 5 dB below the background sound levels during the daytime, with the highest value of the rating level minus the background level being -5 dB at Southannan Cottage. From Table 11.14 the rating levels range between 13 dB and 4 dB below the background sound level during the night-time, with the highest value of the rating level minus the background level being -4 dB at the Southannan Estate. On this basis, with reference to Table 11.6, it is likely that the noise impact would be low depending on the context.

Consideration of Context

11.1.103 From Table 11.13, the predicted specific sound levels during the daytime range from 22 to 38 dB $L_{Aeq,T}$. These levels are below the levels quoted for annoyance during the daytime provided in the WHO (Berglund *et al.,* 1999).

11.1.104 From Table 11.14, the predicted specific sound levels during the night-time range from 18 to 35 dB $L_{Aeq,T}$. These levels are below the levels quoted for the onset of sleep disturbance during the night-time provided in the WHO (Berglund *et al.,* 1999).

11.1.105 Table 11.15 and Table 11.16 provide an evaluation of the increase in ambient sound levels by combining the residual sound levels from Table 11.10 and the specific sound levels during the daytime and night-time periods respectively.

Table 11.15: Change in Ambient Sound Levels – Daytime (07:00 – 23:00 hrs)

Noise Sensitive Receptor	Residual Sound Level, $L_{Aeq,T}$ dB	Specific Sound Level, $L_{Aeq,T}$ dB	Combined Sound Level, $L_{Aeq,T}$ dB	Change in Sound Level, dB
Fencefoot Farm Cottage	58	37	58	0
Glenside	48	34	48	0
Hunterston House	52	24	52	0
Poteathbank Cottage	58	32	58	0
Residence at the Field Studies Council	40	22	40	0
South Lodge	53	38	53	0
Sounthannan Cottage	48	37	48	0
Southannan Estate	45	34	45	0

Table 11.16: Change in Ambient Sound Levels – Night-time (23:00 – 07:00 hrs)

Noise Sensitive Receptor	Residual Sound Level, $L_{Aeq,T}$ dB	Specific Sound Level, $L_{Aeq,T}$ dB	Combined Sound Level, $L_{Aeq,T}$ dB	Change in Sound Level, dB
Fencefoot Farm Cottage	49	35	49	0
Glenside	39	31	40	1
Hunterston House	44	22	44	0
Poteathbank Cottage	49	30	49	0
Residence at the Field Studies Council	35	18	35	0
South Lodge	44	33	44	0
Sounthannan Cottage	39	32	40	1

11.1.106 From Table 11.15, during the daytime, the predicted specific sound levels are sufficiently below the residual sound levels that there would be no increase in the ambient sound levels.

11.1.107 From Table 11.16, during the night-time, the predicted specific sound levels are sufficiently below the residual sound levels that there would only be a small increase in the ambient sound level of up to 1 dB in some locations. Where an increase of 1 dB would occur, at Glenside, Southannan Cottage and the Southannan Estate, levels would be below the thresholds in the WHO GCN for sleep disturbance, so this increase is not significant.

11.1.108 With consideration of the context, the noise impact of the operational Project is considered to be either negligible or low (depending on location). As the sensitivity of receptors is high, there is likely to be a direct, long term noise effect on NSRs of minor adverse significance.

Operational Traffic

11.1.109 Noise effects from traffic on the local road network have been assessed for all road links that are included within the traffic routes provided in Chapter 10 Traffic and Transport.

11.1.110 Baseline traffic data have been provided for the base year (2022); a future baseline year (2024) and with the operational development. An evaluation has been made of the noise effect from operational traffic by comparing the scenario with the operational traffic to the 2022 baseline scenario which is a worst-case assessment.

11.1.111 A summary of the calculations and assessments are provided in Table 11.17. Although the predicted $L_{A10,18hr}$ noise levels are rounded to zero decimal places, the change in noise levels is rounded to 1 decimal place to allow for comparison to the levels Table 11.5.

Table 11.17: Assessment of Noise from Operational Traffic

Survey ID	Location	2022 Baseline 18-hr AAWT (06:00 – 00:00)				2022 Baseline + Development (Average) 18-hr AAWT (06:00 – 00:00)				Change in Noise Level (dB)
		Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	
10755	A78 South of Largs	13852	5.8%	48	70	14243	5.7%	48.3	70	0.1
80358	A78 Site	9290	4.1%	97	72	10142	4.5%	96.6	72	0.5
40912	A760 Blairpark	5164	8.7%	97	70	5267	8.6%	96.6	70	0.1
50759	A78 West Kilbride	9565	5.0%	48	68	10420	5.3%	48.3	68	0.5
811627	A781 West Kilbride	2583	1.2%	32	59	2659	1.2%	32.2	59	0.1
996074	A781 Rural (Munnoch)	1319	1.2%	97	63	1343	1.2%	96.6	63	0.0

Survey ID	Location	2022 Baseline 18-hr AAWT (06:00 – 00:00) Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	2022 Baseline + Development (Average) 18-hr AAWT (06:00 – 00:00) Flow	% HGV	Speed (km/h)	$L_{A10,18hr}$ (dB)	Change in Noise Level (dB)
20761	A78 Loup Cottage Caravan Park	13541	3.2%	97	73	14390	3.5%	96.6	74	0.3
754	A738 Eglington Road	8124	3.0%	48	66	8405	3.0%	48.3	67	0.1
30762	A738 High Street (Saltcoats)	10725	4.7%	48	68	10936	4.7%	48.3	68	0.1
80495	A78 Dual (East of Dalry Road)	21428	6.5%	113	77	22165	6.7%	112.7	77	0.2
40760	A78 Dual (South of Stevenson Road)	37018	4.7%	113	79	37872	4.9%	112.7	79	0.1
80401	A737 Irvine Road (North)	12079	4.0%	64	70	12606	4.4%	64.4	70	0.3
80402	A737 Irvine Road (South)	12533	5.2%	64	70	12715	5.1%	64.4	70	0.0
74439	A737 Dalgarven	8189	4.8%	97	71	8626	5.3%	96.6	72	0.3
10905	A738 Stevenston Road (Kilwinning)	12853	3.5%	64	70	13039	3.5%	64.4	70	0.0
811627	A781 West Kilbride	13852	5.8%	48	70	14243	5.7%	48.3	70	0.1

11.1.112 The assessment in Table 11.17 indicates that the change in noise levels due to operational traffic would be less than 1 dB on all traffic links, and therefore with reference to Table 11.5 and the supporting text, the magnitude of impact is negligible. From Table 11.2, the receptors are of high sensitivity. Therefore, with reference to Table 11.6, there is likely to be a direct, medium-term noise effect on NSRs of minor adverse significance prior to the implementation of further mitigation measures.

Further Mitigation

11.1.113 As the significance of operational noise effects from the Project would be minor, no specific mitigation measures for noise are expected to be required, although as a matter of best practice, where quieter plant can be selected without limiting the functionality of the Project, these would be agreed in the procurement phase of the Project.

Future Monitoring

11.1.114 Noise and vibration monitoring could be carried out at the discretion of the Environmental Health Department at North Ayrshire Council. This could either comprise short-term measurements or monitoring over a longer period via a remote access noise monitor with set noise thresholds. Procedures for noise monitoring would be discussed and agreed with North Ayrshire Council following consent. Monitoring may also be carried out to address any complaints that may occur. Procedures for noise monitoring would be discussed and agreed with North Ayrshire Council in advance.

Accidents/Disasters

11.1.115 Some operational accidents and disasters may cause an instantaneous increase in noise levels. However, the likelihood of an accident or disaster occurring that would result in a noise or vibration effect is very low.

Potential Changes to the Assessment as a Result of Climate Change

11.1.116 There is no published research into the effects of climate change on noise levels. Furthermore, all noise assessments are based on standardised meteorological conditions, with noise monitoring carried out in specific conditions. On this basis, there would be no changes to the noise and vibration assessment as a result of climate change.

Assessment of Cumulative Effects

11.1.117 Cumulative effects have been considered for all consented developments and live planning applications within 2 km of the Project site that are listed in Appendix 4.4.

Construction Phase

11.1.118 The majority of the potential developments listed in Appendix 4.4 are unlikely to require intensive construction works over an extended period and therefore the effects are likely to be minor when considered in isolation. There are a few with potential to give rise to a significant noise and/or vibration effect; these include:

- The erection of Cassion gates and removal of existing bund (ref: 21/00107/EIA);
- Demolition of existing structures and minor earth works at Hunterston B Nuclear Power Station (ref: 20/00485/LUP); and
- The replacement and enlargement of existing jetty at Hunterston Marine Yard (ref:21/00109/EIA).

11.1.119 Cumulatively there is potential either for an increase in the level of impact at common receptors over a short period, if any of the sites go ahead simultaneously, or for an extension to the time period over which the impact would occur. All of the projects would have their own project specific management plans, which would set out their environmental management controls. With this in mind, it is likely that any cumulative construction effects would be minor and not significant.

Operational Phase

Sites With Noise Assessment Data

11.1.120 The following planning applications have noise assessments that supported the planning applications:

- the approved planning application for the synchronous compensator (ref: 20/00942/PP);
- the pending planning application for the synchronous compensator (ref: 21/01135/PPM); and
- the consented planning application for Hunterston Grid Services Complex.

11.1.121 For all three sites, an assessment was carried out in accordance with BS 4142:2014+A1:2019. Therefore, a cumulative assessment has been carried out below following the methodology within this BS.

11.1.122 Of the above, only the first two have common receptors with the Project. Therefore, only these two sites have been considered in the assessment below. For the third site, the reported rating levels were equal to or below the background sound levels at the closest NSRs, Campbellton Bungalow and Campbellton Cottage, which are around 2 km from the Project site. Therefore, cumulative operational impacts with this development are considered unlikely.

Initial Assessment of Impact

11.1.123 The reported rating levels for these sites at receptors which are common with the Project been provided in Table 11.18 for the daytime and Table 11.19 for the night-time. These have been added to the rating level for the Project and a cumulative assessment of impact has been provided.

Table 11.18: Cumulative BS 4142 Initial Assessment of Impact – Daytime (07:00 – 23:00 hrs)

Noise Sensitive Receptor	Background Sound Level, $L_{A90,T}$ dB	Rating Level, $L_{Ar,Tr}$ dB				Rating Level minus Background Sound Level dB
		Project	Application Ref: 20/00942/PP	21/01135/PPM	Cumulative for all three sites	
Fencefoot Farm Cottage	47	37	n/a	19	37	-10
Glenside	42	34	n/a	19	34	-8
Hunterston House	41	24	22	18	27	-14
Poteathbank Cottage	47	32	31	27	35	-12
Residence at the Field Studies Council	35	22	n/a	6	22	-13
South Lodge	45	38	n/a	8	38	-7
Sounthannan Cottage	42	37	n/a	8	37	-5
Southannan Estate	43	34	n/a	8	34	-9

Table 11.19: Cumulative BS 4142 Initial Assessment of Impact – Night-time (23:00 – 07:00 hrs)

Noise Sensitive Receptor	Background Sound Level, $L_{A90,T}$ dB	Rating Level, $L_{Ar,Tr}$ dB				Rating Level minus Background Sound Level dB
		Project	Application Ref: 20/00942/PP	21/01135/PPM	Cumulative for all three sites	
Fencefoot Farm Cottage	42	35	n/a	18	35	-7
Glenside	37	31	n/a	18	31	-6
Hunterston House	35	22	22	20	26	-9
Poteathbank Cottage	42	30	31	25	34	-8
Residence at the Field Studies Council	30	18	n/a	8	18	-12
South Lodge	39	33	n/a	9	33	-6
Sounthannan Cottage	37	32	n/a	9	32	-5
Southannan Estate	34	30	n/a	9	30	-4

11.1.124 From Table 11.18 the cumulative rating levels range from 14 dB to 5 dB below the background sound levels during the daytime, with the highest value of the rating level minus the background level being -5 dB at Southannan Cottage. From Table 11.19 the cumulative rating levels range between 12 dB and 4 dB below the background sound level during the night-time, with the highest value of the rating level minus the background level being -4 dB at the Southannan Estate. On this

basis, with reference to Table 11.6, it is likely that the cumulative noise impact would be low depending on the context.

Consideration of Context

11.1.125 Table 11.20 and Table 11.21 provide an evaluation of the increase in ambient sound levels by combining the residual sound levels from Table 11.10 and the combined specific sound levels for the three developments during the daytime and night-time periods respectively.

Table 11.20: Cumulative Change in Ambient Sound Levels – Daytime (07:00 – 23:00 hrs)

Noise Sensitive Receptor	Baseline Residual Sound Level, $L_{A90,T}$ dB	Specific Sound Level, $L_{Aeq,T}$ dB			Combined Sound Level (Baseline plus Three Sites), $L_{Aeq,T}$ dB	Change in Sound Level dB
		Project	Application Ref: 20/00942/PP	Application Ref: 21/01135/PPM		
Fencefoot Farm Cottage	58	37	n/a	13	58	0
Glenside	48	34	n/a	13	48	0
Hunterston House	52	24	22	12	52	0
Poteathbank Cottage	58	32	31	21	58	0
Residence at the Field Studies Council	40	22	n/a	0	40	0
South Lodge	53	38	n/a	2	53	0
Sounthannan Cottage	48	37	n/a	2	48	0
Southannan Estate	45	34	n/a	2	45	0

Table 11.21: Cumulative Change in Ambient Sound Levels – Night-time (07:00 – 23:00 hrs)

Noise Sensitive Receptor	Baseline Residual Sound Level, $L_{A90,T}$ dB	Specific Sound Level, $L_{Aeq,T}$ dB			Combined Sound Level (Baseline plus Three Sites), $L_{Aeq,T}$ dB	Change in Sound Level dB
		Project	Application Ref: 20/00942/PP	Application Ref: 21/01135/PPM		
Fencefoot Farm Cottage	49	35	n/a	12	49	0
Glenside	39	31	n/a	12	40	1
Hunterston House	44	22	22	14	44	0
Poteathbank Cottage	49	30	31	19	49	0
Residence at the Field Studies Council	35	18	n/a	0	35	0
South Lodge	44	33	n/a	3	44	0
Sounthannan Cottage	39	32	n/a	3	40	1
Southannan Estate	35	30	n/a	3	36	1

11.1.126 From Table 11.20, during the daytime, the predicted combined specific sound levels are sufficiently below the residual sound levels that there would be no increase in the ambient sound levels.

11.1.127 From Table 11.21, during the night-time, the predicted combined specific sound levels are sufficiently below the residual sound levels that there would only be a small increase in the ambient sound level of up to 1 dB in some locations. Where an increase of 1 dB would occur, at Glenside, Southannan Cottage and the Southannan Estate, levels would be below the thresholds in the WHO GCN for sleep disturbance, so this increase is not significant.

11.1.128 With consideration of the context, the cumulative operational noise impact is considered to be either negligible or low (depending on location). As the sensitivity of receptors is high, there is likely to be a direct, long term noise effect on NSRs of minor adverse significance.

Sites Without Noise Assessment Data

11.1.129 There are several sites at screening stage which have potential for cumulative operational impacts with the Project. These are as follows:

- Proposed synchronous condenser plant (ref: 21/01044/EIA);
- Proposed synchronous compensator (ref: 21/00480/EIA);
- Synchronous compensator and ancillary infrastructure (20/00652/EIA); and
- Proposed 49.9 MW cryogenic energy storage facility (ref: 21/00622/EIA).

11.1.130 It is recommended that cumulative impacts with the Project are considered when more information becomes available for these projects. However, for the purposes of this EIAR it is assumed that suitable controls will be placed upon these developments such that cumulative operational noise effects would be minor.

11.1.131 The remaining projects in Appendix 4.4 are either unlikely to generate high levels of operational noise or are sufficiently far from the Project site that cumulative noise impacts are unlikely.

11.1.132 On the basis of the above, cumulative noise effects with other developments within the vicinity of the Project are likely to be no greater than minor, and therefore not significant.

Inter-relationships

11.1.133 Noise and vibration effects on ecological receptors are considered in Chapter 5 Ecology and Nature Conservation.

11.1.134 There is potential for noise and vibration effects on residential amenity to combine with other effects such as Landscape and Visual Effects (Chapter 7); and Traffic and Transport (Chapter 10). The effects of noise on health are considered in Appendix 2.2.

Summary of Effects

11.1.135 This assessment has considered noise and vibration effects during the construction and operational phases of the Project.

11.1.136 During the construction phase, there is likely to be a direct, temporary, medium term residual noise effect on NSRs of minor adverse significance. There is expected to be no effect from vibration.

11.1.137 During the operational phase, there is likely to be a direct, long term residual noise effect on NSRs of negligible to minor adverse significance. There is expected to be no effect from vibration.

11.1.138 Subject to suitable controls during the construction phase, and the mitigation outlined in this report being applied in the operational phase, the Project would not result in any significant effects and would not, in noise and vibration terms, conflict with national or local policies.

References

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Hunterston Parc (2021) Development Framework.

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Scottish Government (2011a) Planning Advice Note: PAN 1 Planning and Noise. The Scottish Office.

Scottish Government (2011b) Technical Advice Note: Assessment of Noise TAN.

Scottish Government (2014a) Ambition Opportunity Place: Scotland's Third National Planning Framework.

Scottish Government (2014b) Scottish Planning Policy.

Table 11.22: Summary of Likely Environmental Effects for Noise and Vibration

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Construction phase							
Residential Properties within 1 km of the site boundary.	High	Loss of amenity due to noise	Short term	Low	Minor Adverse	Not significant	Direct Temporary and therefore reversible
Residential Properties within 1 km of the site boundary.	High	Loss of amenity due to vibration	Short term	No change	No change	Not significant	
Operational phase							
Residential Properties within 1 km of the site boundary.	High	Loss of amenity due to noise	Long term	Low	Minor Adverse	Not significant	Direct Effects are reversible
Residential Properties within 1 km of the site boundary.	High	Loss of amenity due to vibration	Long term	No change	No change	Not significant	