10 Noise and Vibration

10.1 Introduction

This chapter presents an assessment of the likely effects of the proposed Site Sustainability Project on noise and vibration. **Chapter 4** ***Description of the Proposed Development*** provides a detailed description of the proposal under consideration here.

10.2 Assessment Methodology

The following methodology is based on the requirements of the EPA document, Draft '*Guidelines on the Information to be Contained in the Environmental Impact Assessment Reports*' (2017) and AWN experience of preparing the noise & vibration chapters for similar developments.

- Compliance noise monitoring data undertaken as part of the facilities annual noise monitoring has been reviewed to summarise the existing noise environment at the nearest noise sensitive locations;
- Additional noise monitoring has been undertaken adjacent to the closest noise sensitive location to supplement the annual noise monitoring results;
- A review of the facilities waste licence operational noise limits has been undertaken to determine the appropriate limit values applicable to the existing facility and any amendments proposed;
- Predictive calculations have been performed to assess the potential impacts associated with the construction and operation of the development at the most sensitive locations surrounding the development site; and
- A schedule of mitigation measures has been proposed to reduce, where necessary, the identified potential impacts relating to noise and vibration from the proposed development.

10.3 Receiving Environment

The Indaver Carranstown Waste to Energy (WtE) facility is located off the R152 Road within the townland of Carranstown, Co. Meath. Lands surrounding the facility are a mix of agricultural farmland, industrial and residential. There are nine residential locations within 200m of the site boundary. The majority of these residences are located to the south west and south east of the site boundary along the R152. Lands to the west of the site are predominantly agricultural farmland with isolated private residences beyond. Lands to the north of the site are a mixture of agricultural farmland and industrial (Platin Cement works and quarry). The closest noise sensitive property being approximately 20m to the south east of the site boundary.

Activities at the Indaver facility are largely contained within the WtE building and ancillary structures with the exception of a small number of external plant items which are positioned along the northern site boundary, away from noise sensitive properties. The facility operates on a 24/7 basis with site traffic permitted to enter the facility between the 07:00 and 18:30hrs Monday to Friday and between 08:00 and 14:00hrs on Saturday.

The noise contribution from the existing site is relatively low. The key activities associated with the existing operations involves site traffic, external plant items to the north of the main building and the main stack.

10.3.1 Noise Emission Limits

The following noise emission limits form part of the facilities existing Industrial Emissions (IE) Licence (W0167-03) as set out in Schedule B.4 of the licence.

Table 10.1: Noise Emission Limits

Daytime dB L_{Aeq} (30 minutes)	**Evening dB L_{Aeq} (30 minutes)**	**Night-time dB L_{Aeq} (30 minutes)**
55	50	45

The daytime period is between 07:00 to 19:00hrs, evening period between 19:00 to 23:00hrs and night-time period between 23:00 and 07:00hrs.

Condition 5.4 of the IE licence states that there shall be no clearly audible tonal or impulsive noise from activities on site.

Any amendments to the facilities operation will therefore be required to operate within the limit values set out in the licence. This applies to the proposed development.

10.3.2 Annual Noise Monitoring

A review of the two most recent annual noise monitoring surveys for 2018 and 2019 has been undertaken to establish current noise levels associated with the current facility in operation. The surveys were undertaken by KD Environmental and were surveyed in accordance with the monitoring methodology outlined in the EPA's document *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (2016)* (NG4).

The 2018 survey was undertaken on 27th and 28th August 2018, the 2019 survey was undertaken on 15 and 16th August.

10.3.2.1 Noise Monitoring Locations

Noise monitoring is undertaken on an annual basis at four monitoring positions around the site boundary as part of the facilities IE Licence (W0167-03). These are described in **Table 10.2** below and indicated in **Figure 10.1**.

Table 10.2: Annual Noise Monitoring Locations

Location	Description
AN1-1	South east site boundary bottom of berm. Approximately 18m from nearest property to south east boundary off the R152 Road
AN1-2	Mid southern site boundary. Approximately 80m from nearest properties to southern boundary off the R152 Road
AN1-3	Monitoring position along south western site boundary. Approximately 45m from nearest property to south west boundary off the R152 Road
AN1-4	Monitoring position along north western site boundary. Monitoring location is not in proximity to any noise sensitive locations.

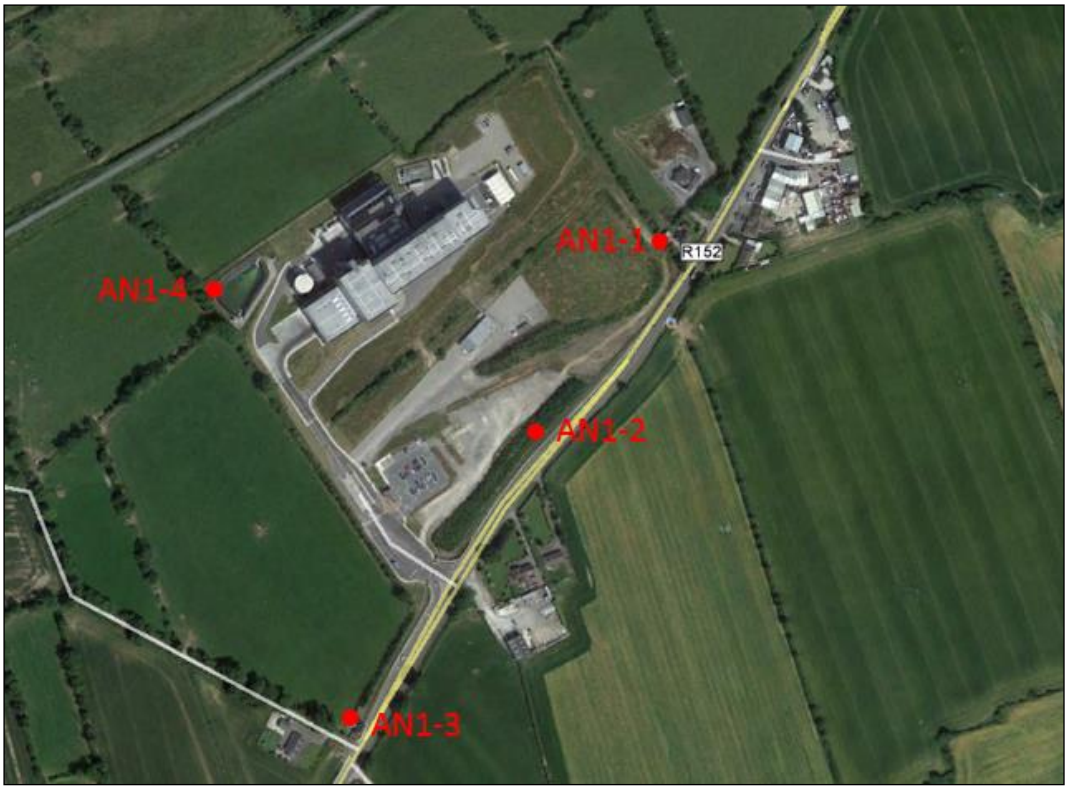

Figure 10.1 Annual Noise Monitoring Survey Locations (Image Source: Google Earth).

10.3.2.2 Noise Monitoring Parameters

The noise survey results are presented in terms of the following three parameters:

- L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.

- L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.
- L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise. This parameter is commonly used to describe plant noise emissions where the L_{Aeq} is influenced by other external noise sources.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

10.3.2.3 Noise Monitoring Results

The results of the 2019 annual noise survey are summarised in **Table 10.3**.

Table 10.3: Annual Noise Monitoring Results – 2019

Monitoring Point	2018 Noise Monitoring Results			
	Period	$L_{Aeq,30mins}$	$L_{A10,30mins}$	$L_{A90,30mins}$
AN1-1	Daytime	59	62 – 63	48 – 49
	Evening	57	62	43
	Night-time	55	60 – 61	39 – 41
AN1-2	Daytime	63	66	53 – 54
	Evening	55	58	48
	Night-time	51 – 52	54	44 – 45
AN1-3	Daytime	57 – 58	59 – 60	52 – 53
	Evening	54	57	45
	Night-time	52 – 53	56 – 57	43 – 44
AN1-4	Daytime	50 – 52	51 - 53	47 – 48
	Evening	49	50	47
	Night-time	48	50	45 – 47

The results of the 2018 annual noise survey are summarised in **Table 10.4**.

Table 10.4: Annual Noise Monitoring Results - 2018

Monitoring Point	2018 Noise Monitoring Results			
	Period	$L_{Aeq,30mins}$	$L_{A10,30mins}$	$L_{A90,30mins}$
AN1-1	Daytime	55 - 56	58 - 59	46
	Evening	51	56	41
	Night-time	47 - 50	49 - 50	39 -40
AN1-2	Daytime	67 - 68	71 - 72	53 – 55
	Evening	61	65	45
	Night-time	56 - 58	38 - 54	33 – 34
AN1-3	Daytime	61 - 62	65	53 – 54
	Evening	55	59	37
	Night-time	51 - 52	48 - 54	32
AN1-4	Daytime	59 - 52	51 - 52	46 – 47
	Evening	45	46	43
	Night-time	44 - 46	46 - 51	43

The noise monitoring reports note the following with respect to the monitored results:

- Noise levels recorded at AN1-1 to AN1-3 are dominated by road traffic on the R152 Road.
- It is not possible to measure noise levels from the facility in isolation due to the frequent traffic along the R152 Road, particularly during daytime periods.
- Low level plant noise emissions are just audible from the facility during evening and night-time periods when road traffic is less frequent.
- Noise levels recorded at AN1-4 are predominantly within the L_{Aeq} day, evening or night-time limit values. Noise levels at this location are influenced by plant noise and on-site activities.
- The L_{A90} parameter which is recorded over 90% of the monitoring duration is less influenced by intermittent noise such as passing road traffic and hence, presents a better description of continual operations associated with the Indaver facility.
- At all monitoring positions, the L_{A90} value is within the relevant noise limit values set for the facility.
- No tonal or impulsive noise characteristics were detected or measured at the monitoring positions.

In summary, the operation of the Indaver facility does not contribute any significant noise levels to the surrounding environment. During daytime periods, noise from the facility is intermittently audible and is predominately associated with vehicles entering and exiting the site and occasional on-site vehicle movements. The on-site sources are, however, in line with noise characteristics from the surrounding environment, predominately from passing road traffic on the R152. During night-time and evening periods noise from operational plant is faintly audible during traffic lulls.

10.3.3 Supplementary Noise Monitoring

An unattended noise monitoring station was installed along the south-eastern boundary of the Indaver facility at approximate location of AN1-1 in order to gain additional noise monitoring data over day, evening and night-time periods. The survey was undertaken between 11th and 16th October 2019.

The results of the surveys are graphed in **Figure 10.2** for the L_{Aeq} and L_{A90} parameters. The graphed results illustrate the cyclical noise levels measured over day, evening and night-time periods which are dominated by road traffic movements along the R152 and the M1 Motorway beyond.

Given that the process and building service plant at the Indaver facility operates on a continual basis, the L_{A90} parameter measured during the quieter night-time periods are considered to reflect more accurately the specific noise contribution from the facility at this location, once surrounding external sources have reduced.

The monitoring position for this location was extended to first floor height (3.5m above ground) to gain a profile of noise levels at upper floor levels at the nearest noise sensitive location. For security, this monitoring location was secured to the boundary fence between the WtE facility and the adjacent property. Due to its position, an element of leaf rustle influenced the background noise levels from adjacent trees.

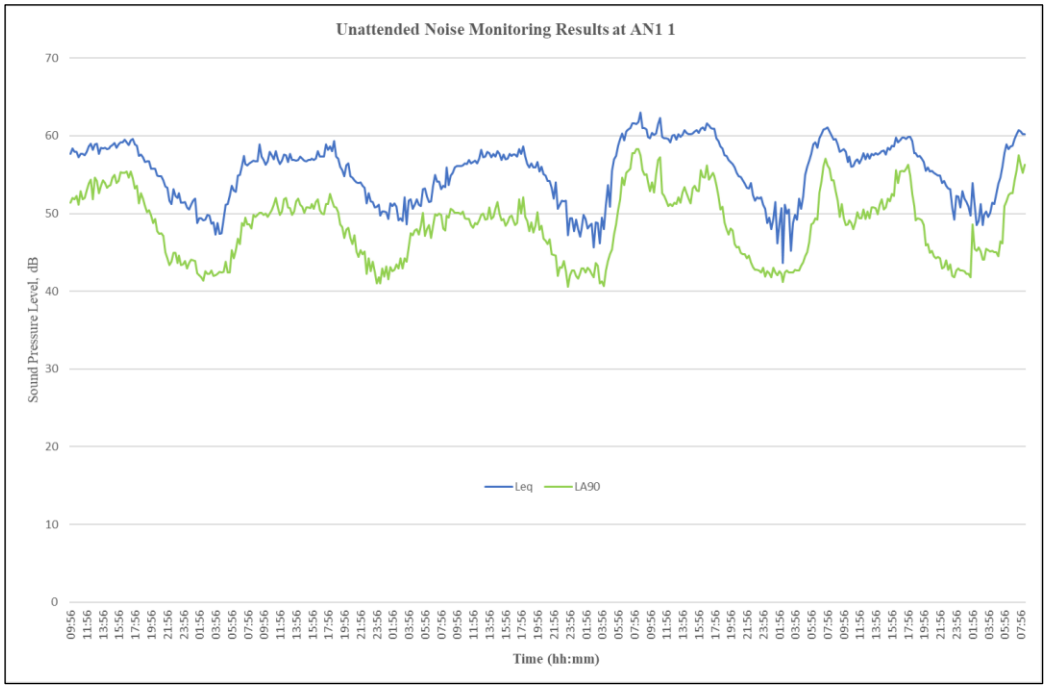

Figure 10.2 Graphed Noise Monitoring Results for AN1-1.

The average noise levels for each day (07:00 to 19:00hrs), evening (19:00 to 23:00hrs) and night-time periods (23:00:07:00) over the 5-day period are summarised in **Table 10.5** below.

Table 10.5: Unattended Noise Monitoring Results AN1-1

Period	Date	Average Measured Noise Levels, per period, dB		
		L_{Aeq}	L_{A10}	L_{AF90}
Daytime	Friday 11/10/2019	59	53	53
	Saturday 12/10/2019	57	50	50
	Sunday 13/03/2019	57	50	50
	Monday 14/10/19	61	54	54
	Tuesday 15/10/19	59	52	52
Evening	Friday 11/10/2019	55	58	47
	Saturday 12/10/2019	55	59	46
	Sunday 13/03/2019	55	58	46
	Monday 14/10/19	55	59	46
	Tuesday 15/10/19	56	59	46
Night-time	Saturday 12/10/2019	51	53	43
	Sunday 13/03/2019	51	54	45
	Monday 14/10/19	54	53	45
	Tuesday 15/10/19	54	54	44
	Tuesday 16/10/19	54	55	45

During daytime periods, average ambient noise levels were measured in the range of 57 and 61dB L_{Aeq}. Average daytime background noise levels were measured in the range of 50 to 54dB L_{A90}. Road traffic was noted to be the dominant source of noise during set up and collection during the daytime period at the monitoring location.

During the evening periods, the average ambient noise levels were measured in the range of 55 to 56dB L_{Aeq}. The average background noise level was measured in the range of 46 to 47dB L_{A90}. Road traffic and low level site activities are expected to be the main contributors to measured noise levels during this period.

During night-time periods, the average ambient noise levels were measured in the range of 51 to 54dB L_{Aeq}. The average background noise levels were measured in the range of 43 to 45dB L_{A90}. Highest ambient and background noise levels during the night-time period are measured between 23:00 and 00:00hrs and the early morning period of 05:30 and 07:00hrs when road traffic flows are higher. During quieter night-time periods, background noise levels are of the order of 41 to 43dB L_{A90}.

The overall results of the unattended noise survey measured noise levels higher than those recorded during the attended surveys at AN1-1.

This was noted to be as a result of some influence from wind generated noise/leaf rustle in adjacent foliage and the height difference between the two locations. Notwithstanding the above, background noise levels are all within the facilities licence limits at this monitoring position.

During night-time periods during traffic lulls and reduction in surrounding extraneous sources typically between 01:00 and 05:00hrs, the background noise level measured at the unattended location is comparable to those measured during the attended annual compliance studies (i.e. between 41 to 43dB L_{A90} as illustrated in **Figure 10.2**)

Operational plant at the WtE facility operates on a continual basis, therefore, in the absence of surrounding traffic and other extraneous sources, the contribution from the WtE facility is best described by the night-time L_{A90} parameter which captures the steady background noise level.

10.3.4 Baseline Summary

The results of the annual compliance noise monitoring surveys in addition to the supplementary noise survey indicate that road traffic dominates the prevailing noise environment at noise sensitive locations surrounding the facility. Activities from the Indaver facility are audible at low level during quieter night-time and evening periods during lulls in surrounding noise sources, predominately road traffic. The range of noise levels measured in terms of the L_{A90} parameter representing the steady background noise levels confirms the facility is operating within its licence limits at present for all periods at all survey locations.

10.4 Characteristics of the Proposed Development

A detailed description of the proposed development is included in **Chapter 4** ***Description of the Proposed Development*** of this EIAR. In relation to potential noise and vibration impacts associated with the proposed development, the potential impacts are considered for both the construction and operational phases.

The construction phase will involve site clearance, demolition of existing structures, excavation, foundations, construction of new structures, connections to on-site utility services and new car parking areas. The various items of construction plant required to undertake these works have the potential to generate high levels of noise at the nearest noise sensitive locations in addition to

construction traffic to and from the site. Vibration impacts during this phase will be limited to ground excavation and building foundations.

The primary sources of outward noise in the operational context are deemed to be long term in nature and will involve:

- External equipment used to serve the tank farm area;
- Mechanical and electrical equipment serving new buildings;
- Vehicle movements on site and at parking areas; and
- additional vehicular traffic to and from the site.

The potential noise impacts associated with both phases area assessed in the following sections.

10.5 Likely Significant Effects

10.5.1 Criteria for Rating of Impacts

The significance of noise and vibration impacts has been assessed in accordance with the Environmental Protection Agency (EPA) Draft '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*' (2017) (see **Tables 10.6 to 10.8**). With regard to the quality of the impact, ratings may have positive, neutral or negative applications in line with the definitions included in **Table 10.6**.

Table 10.6: Quality of Potential Effects

Quality of Impact	Definition
Negative	A change which reduces the quality of the environment (e.g. by causing a nuisance).
Neutral	No effects or effects that are imperceptible, within the normal bounds of variation or within the margin of forecasting error.
Positive	A change that improves the quality of the environment (e.g. by removing a nuisance).

The significance of an impact on the receiving environment are described in **Table 10.7.**

Table 10.7: Significance of Effects

Significance of Impact on the Receiving Environment	Description of Potential Impact
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment.

The duration of impacts as described in the EPA Guidelines are listed in **Table 10.8**.

Table 10.8: Duration of Effects

Duration of Impact	Definition
Momentary	Effects lasting from seconds to minutes
Brief	Effects lasting less than a day
Temporary	Effects lasting one year or less
Short-term	Effects lasting one to seven years
Medium-term	Effects lasting seven to fifteen years
Long-term	Effects lasting fifteen to sixty years
Permanent	Effects lasting over sixty years
Reversible	Effects that can be undone, for example through remediation or restoration

As these guidelines do not quantify the impacts in decibel terms further reference has been made to the '***Guidelines for Environmental Noise Impact Assessment'***[1] produced by the Institute of Acoustics/Institute of Environmental Management

1 IEMA Guidelines for Environmental Noise Impact Assessment 2014

and Assessment Working Party and the Design Manual for Roads and Bridges (DMRB)[2] as discussed in the following sections.

10.5.2 Relevant Guidance

10.5.2.1 Construction Phase

Noise Criteria

Construction works on-site are not licensed under the facilities noise licence limits as these relate to ongoing continual sources. The EPA's document NG4 (2016) notes that construction related issues are typically covered in other guidance documents and best practice standards. Section 11 of NG4 notes "*There are numerous standards and guidance documents that may be of use in the assessment of noise in situations that do not fall under the remit of the Agency*".

For construction noise, the document recommends the use of BS 5228-1: 2009 +A1: 2014 *Code of practice for noise and vibration control on construction and open sites*. In this instance, appropriate criteria relating to permissible construction noise levels are taken from Part 1 – Noise of the British Standard.

This document suggests an absolute construction noise limit depending on the receiving environment. The documents states:

"Noise from construction and demolition sites should not exceed the level at which conversations in the nearest building would be difficult with windows shut […]. *Noise levels between 07:00 and 19:00hrs, outside the nearest window of the occupied room closest to the site boundary should not exceed:*

70dB in rural, suburban and urban areas away from main road traffic and industrial noise;

75dB in urban areas near main roads in heavy industrial areas".

Given the suburban location of the facility, a limit value of 70dB $L_{Aeq,T}$ for construction is considered to be reasonable.

This limit value is also in compliance with those set by Transport Infrastructure Ireland (TII) for construction projects. Their 2004 document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* recommends the following construction noise limit values.

Table 10.9: Recommended Construction Noise Limits (TII 2014)

Days and Times	L_{Aeq}	L_{Asmax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00 to 16:30hrs	65	75

[2] Design Manual for Roads and Bridges (DMRB), LA111 *Noise and Vibration*, Rev 0, Nov 2019.

Sundays & Bank Holidays 08:00 to 16:30hrs	60*	65*

Note * Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the local authority.

Construction Traffic

In order to assist with interpretation of construction traffic noise, **Table 10.10** offers guidance as to the likely impact associated with changes in traffic noise levels. For construction traffic, due to the short-term period over which this impact occurs, the magnitude of impacts is assessed against the 'short term' period as described in the DMRB. The corresponding significance of impact presented in the '*EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EIAR), Draft, August 2017 is included in **Table 10.10** for consistency in wording and terminology for the assessment of impact significance.

Table 10.10: Likely impact associated with change in traffic noise level during the Short-Term Period

Change in Sound Level (dB L_{A10})	Magnitude of Impact (Short Term)	Impact Guidelines on the Information to be contained in EIAR (EPA)
0.1 – 0.9	Negligible	Imperceptible - Not Significant
1 – 2.9	Minor	Slight
3 – 4.9	Moderate	Moderate
5+	Major	Significant - Very Significant

Vibration Criteria

Vibration standards come in two varieties: those dealing with human comfort, and those dealing with cosmetic or structural damage to buildings. For the surface construction works proposed here, vibration is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Building Response Criteria

British Standard 7385-2 (1993) *Evaluation and measurement for vibration in buildings*, gives guidance regarding acceptable vibration in order to avoid damage to buildings. British Standard BS 5228-2 (2009) reproduces these guidance values.

These standards differentiate between transient and continuous vibration. Surface construction activities are transient because they occur for a limited period of time at a given location. Risk of cosmetic damage to residential buildings starts at a PPV of 15mm/s at 4Hz. Below 12.5 mm/s PPV, the risk of damage tends to be zero. Important buildings that are difficult to repair might require special consideration on a case by case basis, but buildings of historical importance should not (unless it they are structurally unsound) be assumed to be more

sensitive. If a building is in a very unstable state, then it will tend to be more vulnerable to the possibility of damage arising from vibration or any other groundborne disturbance.

Table 10.11 summarises the vibration levels below which there is no risk of damage to buildings. These limits apply to vibration frequencies below 15Hz where the most conservative limits are required. For protected or potentially vulnerable buildings, the recommended construction vibration limit is reduced by 50%.

Table 10.11 – Transient Vibration Impact Criteria for Buildings (conservative criteria below which there is no risk of cosmetic damage).

Category of Building	Threshold of potential significant effect (Peak Particle Velocity - PPV - at building foundation) for Transient Vibration
Structurally sound and non-protected buildings	12 mm/s
Protected and / or potentially vulnerable buildings	6 mm/s

Human Perception

Humans are sensitive to vibration stimuli, and perception of vibration at high magnitudes may cause concern. Vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. During surface construction works (e.g. piling) the vibration limits set within **Table 10.11** would be perceptible to building occupants and would have the potential to cause subjective effects.

However, higher levels of vibration are typically tolerated for single events or events of short-term duration, particularly during construction projects and when the origin of vibration is known. For example, piling can typically be tolerated at vibration levels up to 2.5mm/s during the daytime and the evening if those affected are aware of the time-frame and origin of the vibration, and if they have been informed about the limit values relating to the structural integrity of neighbouring properties.

10.5.2.2 Operational Phase

Noise

As noted in **Section 10.3.1**, the existing facility is licensed under an Industrial Emissions Licence which includes the relevant noise emission limits, as presented in **Table 10.1**.

The '*Guidelines for Environmental Noise Impact Assessment*' produced by the Institute of Environmental Management and Assessment (IEMA) (2014) have

been referenced in order to categorise the potential effect of changes in the ambient noise levels during the operational phases of the proposed development.

The guidelines state that for any assessment, the potential significance should be determined by the assessor, based upon the specific evidence and likely subjective response to noise. Due to varying factors which effect human response to environmental noise (prevailing environment, noise characteristics, time periods, duration and level etc.) assigning a subjective response must take account of these factors.

The scale adopted in this assessment is shown in **Table 10.12** below and is based on an example scale within the IEMA guidelines. The corresponding significance of impact presented in the Draft '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*' (EPA, 2017) is also presented.

Table 10.12: Noise Impact Scale – Operational Noise Sources

Noise Level Change dB(A)	**Subjective Response**	**Long Term Impact Classification (IEMA, 2014)**	**Impact Guidelines on the Information to be contained in EIAR's (EPA)**
≥ 0	No change	Negligible	Imperceptible
≥ 0 and < 3	Barely perceptible		Not Significant
≥ 3 and < 5	Noticeable	Minor	Slight - Moderate
≥ 5 and < 10	Up to a doubling of loudness	Moderate	Moderate - Significant
≥10	More than a doubling of loudness	Major	Significant - Profound

The significance table reflects the key benchmarks that relate to human perception of sound. A change of 3dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

It is considered that the ratings specified in the above table provide a good indication as to the likely significance of changes on noise levels in this case and have been used to assess the impact of operational noise.

Road Traffic Noise Assessment Criteria

Given that traffic from the development uses public roads outside the facility boundary, it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements, is associated with the proposed development.

In order to assist with the interpretation of the noise associated with vehicular traffic on public roads, **Table 10.13** offers guidance as to the likely impact

associated with any particular change in traffic noise level, in accordance with the DMRB, LA111 2019 document.

Table 10.13 : Likely impact associated with change in traffic noise level during the Long-Term Operational Phase

Change in Sound Level (dB A)	DMRB Magnitude of Impact	Impact Guidelines on the Information to be contained in EIAR (EPA)
0	No Impact	Imperceptible
0.1 – 2.9	Negligible	Not Significant
3 – 4.9	Minor	Slight - moderate
5 – 9.9	Moderate	Moderate – Significant
10+	Major	Very Significant - Profound

Vibration

There are no operational vibration limits set within the existing licence. There are no expected sources of vibration associated with the existing or the proposed operations, given the type of activity associated with the development and the distances to the nearest sensitive buildings. In this instance, operational vibration limits are not deemed necessary.

10.5.3 "Do Nothing" Scenario

In the absence of the proposed development proceeding, the noise and vibration environment in its current form is expected to remain nominally unchanged. The results of the noise surveys undertaken would remain similar under a Do-Nothing scenario and hence the Do-Nothing Impact of the proposed development is long term, neutral.

There are a number of additional developments proposed within the area however, which have the potential to alter the existing noise environment including developments within the Irish Cement Ltd adjacent facility and other proposed electrical power developments in the surrounding area. The noise environment resulting from these proposed developments have the potential to introduce new sources to the surrounding environment. For these potential future developments, they will be subject to individual noise and vibration impact assessments and will be required to satisfy all planning conditions relating to noise and vibration control. Further comment relating to potential changes in the noise environment is discussed in **Section 10.7** Cumulative Effects.

10.5.4 Operational Phase

Once operational, the potential noise sources associated with the proposed development will be from:

- Mechanical and electrical equipment;
- vehicle movements / activities on site, and;

- additional vehicular traffic to and from the site.

In order to assess the potential impacts from this phase, a 3D noise model of the facility was developed to include for the proposed development, using information provided by the design team including site drawings and topographical information.

The model was developed using a proprietary noise calculation package Brüel & Kjær Type *Predictor.* This is an acoustic modelling package for computing noise levels in the vicinity of different types of noise sources. The calculation standard used in the model for fixed plant and industrial type sources is *ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation.*

The model takes account of the various factors affecting the propagation of sound in accordance with the standard, including:

- the magnitude of the noise source in terms of sound power;
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- attenuation due to atmospheric absorption, and;
- meteorological effects such as wind gradient, temperature gradient and humidity.

Each of the main sources is discussed in turn in the following sections.

10.5.4.1 Mechanical and Electrical Equipment

Tanker Unloading Area

The proposed tanker unloading area is located adjacent to the east of the existing process building and will include an unloading pump. In line with equipment noise limit values applied at the site, the maximum allowable noise level associated with each pump item is 82dB at 1m.

The operational hours of this area are between 07:00 and 18:30hrs Monday to Friday. This source has been included in the model and is assumed to operate continually over the daytime period.

Tank Farm

The proposed tank farm is located along the north-western boundary of the site. This area will include a feeding centrifugal pump, a circulation pump and a mechanical agitator. In line with equipment noise limit values applied at the site, the maximum allowable noise level associated with each pump item is 82dB at 1m.

The operational hours of this area are 24hrs/day, 7 days a week, however the operational periods of the equipment listed above will be intermittent depending on required use. In order to include for a robust assessment, however, all sources are calculated to operate continually over day, evening and night-time periods.

Bottom Ash Storage Building

The proposed ash storage building is located along the north-eastern boundary of the site. Activities are predominately fully enclosed within the building (e.g. front loader within building). External noise sources include an extract fan located to the south west of the building to remove dust and moisture through a filter which will also be located at ground level external to the building. In line with equipment noise limit values applied at the site, the maximum allowable noise level associated with the fan is 82dB at 1m.

The operational hours of this building will be 24hrs/day, 7 days a week. The extract fan is modelled therefore to operate on a continual 24/7 basis.

Hydrogen Building

The proposed hydrogen building is located south of the existing process building and the 110kV exclusion zone. This area includes a compressor building which will house the compressor units internally. Operational noise levels from the compressors will be required to comply with the maximum noise level of 82dB at 1m from the unit. This activity will operate intermittently but a worst case operation of 24hrs/day, 7 days a week has been assumed and hence has been modelled on this basis.

Additional sources from this area include venting of oxygen and hydrogen to the atmosphere from the two vents. This activity is undertaken at atmospheric pressure (i.e. no overpressure venting). Noise levels associated with this activity will be negligible and hence are not included in the model

Above Ground Installation Store

An above ground installation (AGI) is located along the south eastern site boundary. This will include pressure regulation equipment and a metering station. There is no mechanical equipment associated with this installation, potential sources of noise relate to the pressure control area, however this is not expected to generate audible levels of noise beyond the AGI store area. In the absence of any operational noise level data from this potential source, a worst-case operational noise levels of 70dB at 1m from the unit has been modelled assuming a high frequency spectrum. This source is modelled on a continual 24/7 basis to account for its potential operation during day, evening or night-time periods. Operational noise levels from this area will, however, not be continual. This is a worst-case scenario, as noise from this area of the site is expected to be negligible.

10.5.4.2 Vehicle Movements on Site

The tanker unloading area, tank farm, bottom ash storage building and tank/truck/container area in the proposed concrete yard will involve manoeuvring of vehicles into and out of these areas, unloading of tankers/ HGV’s.

For the purpose of assessing noise from on-site vehicle activities, the following has been included in the noise model:

- 2 No. HGV's being unloaded at the tanker unloading area with a sound pressure value of 72dB at 10m using source data from BS5228 Part 1 Ref Table C4.15 'Fuel Tanker Pumping'. The calculations assume that each source operates for 50% of the daytime period and 20% of the evening period.
- 2 No. HGV's per hour accessing / egressing the bottom ash storage building and the hydrogen building with a sound pressure value of 78dB at 10m using source data from BS5228 Part 1 Ref Table C4.1 'Articulated Truck – Maximum drive by'.
- Tanker vehicles driving within the site (16 No. additional per day) with a sound pressure value of 76dB at 10m using source data from BS5228 Part 1 Ref Table C4.15 'Fuel Tanker Lorry – Maximum drive by'.

10.5.4.3 Modelled Results

Noise levels have been modelled at a total of 5 No. off-site noise sensitive locations surrounding the development site, representing the closest noise sensitive locations to the proposed facility. These locations are illustrated in **Figure 10.3**.

Figure 10.3: Noise Modelled Locations.

Table 10.14 presents the calculated noise levels at each of the assessment locations taking account of the operational noise sources associated with the proposed development and assumptions outlined in the previous sections. Results are calculated for the daytime (07:00 to 19:00hrs), evening (19:00 to 23:00hrs) and night-time period (23:00 to 07:00hrs).

Table 10.14: Modelled Operational Noise Levels – New Sources

Modelled Location	Calculated Noise Level, dB $L_{Aeq,T}$		
	Daytime	Evening	Night-time
NSL-1	29	27	27
NSL-2	24	22	22
NSL-3	30	27	26
NSL-4	31	24	23
NSL-5	26	25	25

During the daytime period, calculated noise levels are between 24and 31dB L_{Aeq}. During evening periods noise, calculated noise levels are between 22 and 27dB L_{Aeq}. During night-time periods noise, calculated noise levels are between 23 and 27dB L_{Aeq}.

Noise sources associated with the proposed development are significantly screened from the nearest noise sensitive locations by the site perimeter berms and on-site buildings resulting in low noise levels external to the site.

The specific noise levels noted above relate to sources associated with the new development only. The combined noise levels associated with the existing facility in addition to any new noise sources associated with the proposed development must comply with the facilities noise emission limits.

In order to assess the cumulative noise from both, noise levels measured as part of compliance surveys and additional monitoring has been reviewed. The background measured noise level (L_{A90} parameter), representing as close as possible the steady background operational noise from the facility, has been added to the predicted noise level associated with the proposed development in order to determine the cumulative noise from the facility. **Tables 10.15** to **10.17** present the assessment for day, evening and night-time periods respectively.

Table 10.15: Combined Noise Levels – Daytime

Assessment Location	Nearest Baseline location	Baseline L_{A90} Daytime	Predicted Noise Level dB (Proposed Development)	Cumulative Noise Level, dB(A)	Within daytime limit value? (55dB L_{Aeq})
NSL1	AN1-4	46	29	46	Yes
NSL2	AN1-1	50	24	50	Yes
NSL3	AN1-2	53	30	53	Yes
NSL4	AN1-2	53	31	53	Yes

Assessment Location	Nearest Baseline location	Baseline L_{A90} Daytime	Predicted Noise Level dB (Proposed Development)	Cumulative Noise Level, dB(A)	Within daytime limit value? (55dB L_{Aeq})
NSL5	AN1-1	50	26	50	Yes

Table 10.16: Combined Noise Levels – Evening

Assessment Loc.	Nearest Baseline location	Baseline L_{A90} Evening -	New sources Predicted Level dB (Proposed Development)	Cumulative Noise Level dB(A)	Within evening limit value? (50dB L_{Aeq})
NSL1	AN1-4	43	27	43	Yes
NSL2	AN1-1	46	22	46	Yes
NSL3	AN1-2	45	27	45	Yes
NSL4	AN1-2	45	24	45	Yes
NSL5	AN1-1	46	25	46	Yes

Table 10.17: Combined Noise Levels – Night-time

Assessment Loc.	Nearest Baseline location	Baseline Night-time - L_{A90}	New sources Predicted Level dB (Proposed Development)	Cumulative Noise Level dB(A)	Within night-time limit value? (45dB L_{Aeq})
NSL1	AN1-4	43	27	43	Yes
NSL2	AN1-1	45[3]	22	45	Yes
NSL3	AN1-2	34	26	35	Yes
NSL4	AN1-2	34	23	34	Yes
NSL5	AN1-1	45	25	45	Yes

The result of the assessment outlined in **Tables 10.15** to **10.17** confirms that cumulative noise levels associated with existing and proposed operational noise sources are within the noise emission limits for the facility during day, evening and night-time periods.

[3] The higher background level of 45dB L_{A90} measured over the full night-time period at the supplementary unattended noise monitoring position has been used. This is a worst-case assessment as it includes contribution from road traffic flows during early morning periods.

The baseline noise levels included in the assessment tables above include noise sources from the existing facility combined with surrounding noise sources and hence reflect a worst-case assessment.

10.5.4.4 Additional Traffic Along Surrounding Road Network

Chapter 7 ***Traffic and Transportation*** details the operational phase traffic impacts on the surrounding road network.

Traffic associated with operational Phases 1 and 2 combined (i.e. post construction works) are calculated for the future years of 2027 (Opening year + 5) and design year of 2037 (Operational year + 15).

The assessment has concluded that the proposed development will result in an additional 35 Heavy Vehicle (HGV) trips and 40 Light Vehicle (LV's) trips, which will be spread throughout the day. This equates to a daily total of 70 HGV two-way movements and 80 Light Vehicle movements to and from the site.

Tables 10.18 and **10.19** present the calculated change in noise levels associated with additional traffic along the local road network for the operational years of 2027 and 2037. The traffic flows used in the assessment are the Annual Average Daily Traffic (AADT) flows for two-way traffic, divided into both light and heavy vehicles.

Table 10.18: Change in Traffic Noise Level, Operational Phase 2027

Junction R152/R150	**2027 Opening Year +5**				**Increase in noise level, dB**
	Without Development		**With Development (Phase 1 and Phase 2 Operational)**		
	AADT (Two-Way Flows)		**AADT (Two-Way flows)**		
Arm	**LV**	**HV**	**LV**	**HV**	
R152 (North)	16,439	1,883	16,479	1,918	+0.1
R152 (South)	9,334	1,140	9,354	1,169	+0.1
R150 (West)	11,126	1,076	11,146	1,082	0
R150 (East)	4,223	394	4,223	394	0
Junction Indaver/R152	**Without Development**		**With Development**		**Increase in noise level, dB**
	AADT (Two-Way Flows)		**AADT (Two-Way Flows)**		
Arm	**LV**	**HV**	**LV**	**HV**	
R152 (North)	15,772	1,821	15,812	1,857	+0.1
R152 (South)	15,789	1,878	15,829	1,912	+0.1

Table 10.19: Change in Traffic Noise Level, Operational Phase 2037

Junction R152/R150	**2037 Opening Year +15**				**Increase in noise level, dB**
	Without Development		**With Development (Phase 1 and Phase 2 Operational)**		
	AADT (Two-Way Flows)		**AADT (Two-Way flows)**		
Arm	**LV**	**HV**	**LV**	**HV**	
R152 (North)	18,173	2,361	18,213	2,395	+0.1
R152 (South)	10,319	1,439	10,339	1,467	+0.1
R150 (West)	12,300	1,337	12,320	1,344	0
R150 (East)	4,668	495	4,668	495	0
Junction Indaver/R152	**Without Development**		**With Development**		Increase in noise level, dB
	AADT (Two-Way Flows)		**AADT (Two-Way Flows)**		
Arm	**LV**	**HV**	**LV**	**HV**	
R152 (North)	17,435	2,282	17,475	2,318	0
R152 (South)	17,454	2,354	17,494	2,388	0

The change in traffic noise level during both assessment years is calculated between 0 to 0.1dB. A change of this magnitude will not result in any notable change in noise level over existing road traffic noise levels. A change in noise levels of this magnitude is neutral, long-term, imperceptible to not significant.

10.5.5 Construction Phase

10.5.5.1 Construction Noise

Construction works associated with the proposed development will involve excavation works, construction of buildings, structures, parking areas, etc., and landscaping/berm reshaping. Due to the nature of the activities required to clear parts of the site and construct the various elements, there is potential for generation of high levels of noise within the site.

Phase 1 Works

Phase 1 is expected to be under construction in 2021 and will become operational in 2022. The schedule for the construction and commissioning of this phase is approximately 16 months.

This phase will involve bulk excavation works, construction of the tank farm, tanker unloading area, bottom ash warehouse, warehouse & workshops, new parking areas, permanent contractors compound, miscellaneous site circulation improvements consisting of realignment of paved areas local to the reception hall, reshaping of berms and landscaping.

Phase 2 Works

Phase 2 will be under construction in 2022 and opened in 2023. This involves construction of the hydrogen generation building, demolition of existing modular office building and construction of new office building, new access road to both areas and additional car parking. A construction site compound will be located within the south-west of the site.

The schedule for the construction and commissioning of the phase 2 elements is approximately 12 months.

Typical working hours during the construction phase will be:

Start	Finish	
0700	1900	Monday – Friday
0700	1300	Saturday

Consideration of safety, weather or sub-contractor availability is likely to necessitate working outside normal hours on occasion. Heavy or noisy construction activities will, however, be avoided outside normal hours.

Construction Noise Calculations

Given the construction will encompass a range of different activities on a day to day and week to week basis, it is not possible to calculate with a high degree of accuracy the specific levels of noise associated with each phase. It is possible, however, to determine a range of potential worst-case scenarios which represent the key construction phases.

Indicative noise levels associated with construction activities may be calculated in accordance with the methodology set out in *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise*. This standard sets out sound power levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations. Using the typical noise levels for construction plant items, construction noise levels at specific distances have been calculated for the main construction activities associated with the project.

The impact at nearby noise sensitive buildings will depend upon a number of variables, the most notable of which are:

- the amount of noise generated by plant and equipment being used at any one time generally expressed as a sound power level;
- the periods of operation of the plant at the development site, known as the "on-time";
- the distance between the noise source and the receptor;
- the attenuation due to ground absorption or barrier screening effects; and
- reflections of noise due to the presence of hard vertical faces such as walls.

The nearest noise sensitive locations to the proposed development are located south east of the development works (NSL 2 – **Figure 10.2**), at approximately

30m from works associated with the berm reshaping. The remaining work areas are at a minimum distance of approximately 90m from properties along this boundary. Closest properties to the west are located between 250m and 500m from the closest working areas.

Table 10.20 presents the calculated noise levels associated with berm reshaping works at the closest noise sensitive locations to this activity. No screening has been included in calculations relating to berm realignment works. The calculations assume that plant items are operating for 66%[4] of the time.

Table 10.20: Calculated Noise Level associated with Berm Realignment Works

Item of Plant (BS5228 Ref)	L_{Aeq} at 10m	No of plant items	Calculated Noise Level, dB at 30m
Tracked excavator (C4.17)	71	3	64
Dump Truck (C4.4)	76	1	65
Combined Noise Level			68

The calculated noise level associated with this activity at the closest property to this works is within the construction noise limit of 70dB L_{Aeq} during daytime periods.

Table 10.21 presents the calculated noise levels associated with remaining construction activities at the closest noise sensitive locations to construction works. A conservative screening correction of 5dB is included in calculations for construction works to account for site boundary berms.

[4] This estimate assumes that the plant will operate a full 8-hour shift over the proposed 12 hour working period which equates to a 66% operating time over a daytime period or 40 minutes over a 1-hour period. The dynamic nature of construction sites is such that this is deemed to be a conservative estimate.

Table 10.21: Calculated Noise Level associated with Construction Works

Item of Plant (BS5228 Ref)	L_{Aeq} at 10m	No of plant items	Calculated Noise Level, dB at 90m	Calculated Noise Level, dB at 200m
Tracked excavator (C4.17)	71	3	50	43
Dump Truck (C4.4)	76	1	50	43
Telescopic Handler (C2.35)	71	2	48	41
Scissor Lift (C4.60)	70	4	50	43
Roller (C2.37)	79	1	53	46
Mobile Crane (C2.28)	67	1	41	34
Crawler Mounted Rig (C3.22)	80	1	54	47
Combined Noise Level			59	52

The calculated noise level associated with this activity at the closest properties to this works are well within the construction noise limit of 70dB L_{Aeq} during daytime periods. The combined noise level assumes all items of plant are operating simultaneously at the same distance which is a highly worst-case scenario.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate within the recommended noise criteria set out in **Table 10.9** during all activities.

10.5.5.2 Construction Traffic

Chapter 7 ***Traffic & Transport*** details the construction phase traffic impacts on the surrounding road network. Construction traffic during Phases 1 and 2 will have 'Peak' construction stages, and 'Nominal Max' construction stages. The 'Peak' stages will occur during the initial weeks during earthworks and excavation which will generate the highest number of HGV's. During the remaining phases, HGV traffic volumes will be reduced, however a higher overall volume of traffic flows will occur due to staff vehicles and other light vehicles accessing the site, this will therefore result in the 'Nominal Max' traffic flows.

From a noise impact assessment view, flows associated with the 'Peak' flows result in highest potential impacts due to the increased HGV volumes.

During the 'peak' construction of Phase 1 (2021), an additional 43 staff vehicle trips (86 vehicle movements) and 50 HGV's (100 HGV movements) per day are predicted.

During the 'peak' construction of Phase 2 (2022) an additional 43 staff vehicles (86 vehicle movements) and 40 HGV's (80 HGV movements) per day are predicted.

The resultant noise impacts associated with the 'Peak' construction traffic scenarios are therefore assessed for the following years:

- 2021 Construction Year (Phase 1 construction);
- 2022 Opening Year (Phase 1 operational, Phase 2 under construction)

Table 10.22: Change in Traffic Noise Level, Construction Phase 1

Junction R152/R150	**Phase 1 Construction Peak Flows - 2021**				**Increase in noise level, dB**
	Without Development		**With Development (Phase 1 Construction Works)**		
	AADT (Two-Way Flows)		**AADT (Two-Way flows)**		
Arm	**LV**	**HV**	**LV**	**HV**	
R152 (North)	14,868	1,537	14,911	1,602	+0.1
R152 (South)	8,436	924	8,457	989	+0.2
R150 (West)	10,056	886	10,078	886	0
R150 (East)	3,814	321	3,814	321	0
Junction Indaver/R152	**Without Development**		**With Development (Phase 1 Construction Works)**		**Increase in noise level, dB**
	AADT (Two-Way Flows)		**AADT (Two-Way Flows)**		
Arm	**LV**	**HV**	**LV**	**HV**	
R152 (North)	14,265	1,487	14,308	1,522	+0.1
R152 (South)	14,281	1,533	14,324	1,598	+0.2

Table 10.23: Change in Traffic Noise Level, Construction Phase 2

Junction R152/R150	**Phase 2 Construction Peak Flows - 2022**				**Increase in noise level, dB**
	Without Development		**With Development (Phase 2 Construction Works)**		
	AADT (Two-Way Flows)		**AADT (Two-Way flows)**		
Arm	**LV**	**HV**	**LV**	**HV**	
R152 (North)	15,088	1,590	15,139	1,668	+0.2
R152 (South)	8,567	957	8,593	1,033	+0.3
R150 (West)	10,212	915	10,237	917	0
R150 (East)	3,876	332	3,876	332	0
Junction Indaver/R152	**Without Development**		**With Development (Phase 2 Construction Works)**		**Increase in noise level, dB**
	AADT (Two-Way Flows)		**AADT (Two-Way Flows)**		
Arm	**LV**	**HV**	**LV**	**HV**	
R152 (North)	14,476	1,538	14,527	1,580	+0.1
R152 (South)	14,491	1,585	14,542	1,663	+0.2

The change in traffic noise level during both assessment years is calculated between 0 to 0.3dB. A change of this magnitude will not result in any notable change in noise level over existing road traffic noise levels. A change in noise levels of this magnitude is neutral, short-term, imperceptible to not significant.

10.5.5.3 Construction Vibration

Potential for vibration impacts during the construction phase programme will be limited given the minimal level of intrusive works required as part of the construction phases. In the parts of the site where the ground levels are raised, or where the bearing strata does not have the required geotechnical properties, foundations will be piled. Continuous Flight Auger (CFA) piling or augured piles will be used for the tank farm foundations only. This will occur for a period of approximately 3 weeks.

The use of augured piling generates the lowest levels of vibration whilst the use of impact driven piles generate the highest. For the purposes of this assessment the expected vibration levels during piling have been determined through reference to published empirical data. The British Standard BS 5228 – Part 2: Vibration, publishes the measured magnitude of vibration of rotary bored piling using a 600mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106):

- 0.54mm/s at a distance of 5m, for auguring;
- 0.22mm/s at a distance of 5m, for twisting in casing;
- 0.42mm/s at a distance of 5m, for spinning off, and;
- 0.43mm/s at a distance of 5m, for boring with rock auger.

Considering the low vibration levels that are experienced at very close distances to the piling rigs during augured piling, vibration levels at the nearest off-site buildings will not pose any significance in terms of cosmetic or structural damage. In addition, the range of vibration levels are below a level which would cause any disturbance to occupants of the nearest off-site sensitive buildings.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in **Table 10.11** during all activities.

Considering the magnitude of vibration associated with the proposed site works, vibration levels at the nearest buildings are not expected to pose any significance in terms of building damage or human perception. The likely vibration impacts during the construction phase are deemed to be of neutral effect and of short term, imperceptible significance.

10.6 Mitigation Measures and Monitoring

10.6.1 Operational Phase

10.6.1.1 On-site Noise Sources

The results of the assessment have confirmed that once noise emission levels associated with the new plant items do not exceed the equipment noise limit applied at the site, discussed in **Section 10.5.4**, the facilities noise emission limit values will not be exceeded. The following best practice measures will be applied to the proposed development to ensure noise levels are controlled to the surrounding environment and to comply with the facilities IE licensed noise emission limits:

- Roller shutter doors within the Bottom Ash Storage building will be maintained closed at all times, except for access/egress during activities; and
- Vehicles parked at the truck parking bay will be required to switch engines off when parked on site.

In addition to the measures outlined above, the following best practice measures which form the basis of ongoing noise management at the site will be applied to the proposed development to ensure operational plant noise levels are kept to a minimum:

- All new items of external plant will be limited to a sound pressure noise level of 82dB at 1m;
- Plant will be sited as far away from noise-sensitive locations as is practicable;
- External plant items (pump, motors, fans) will be switched off when not required, particularly during night-time periods;
- The use of acoustic attenuators/ enclosures etc., will be employed to any items of external plant in order to ensure this limit value is complied with;
- Duct mounted attenuators will be installed on the atmosphere side of all air moving plant, where required;
- Splitter attenuators will be installed providing free ventilation to internal plant areas, where required, and;
- Anti-vibration mounts will be installed on all reciprocating plant, where required.

10.6.1.2 Additional Vehicles on Public Roads

The noise effect assessment outlined above has demonstrated that mitigation measures are not required.

10.6.1.3 Monitoring

The facility is licensed by the EPA under an Industrial Emissions (IE) licence. As part of the IE licence, annual noise monitoring is undertaken at the nearest noise sensitive locations to compare against the operational Emission Limit Values (ELV's).

Monitoring results will be submitted to the EPA for review and will also be included within the facilities Annual Environmental Report (AER) issued to the EPA.

10.6.2 Construction Phase

The impact assessment has determined that construction activities can comply with the construction noise and vibration criteria included in **Section 10.5.2.1** at the closest noise sensitive locations.

Notwithstanding this, best practice control measures from BS5228-Parts 1 and 2 are included. BS5228 offers detailed guidance on the control of noise and vibration from demolition and construction activities that will be complied with during the construction phase. Various mitigation measures should be considered and applied during the construction phase and specific examples of such measures are:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- Any plant, such as generators or pumps that is required to operate outside of normal permitted working hours will be surrounded by an acoustic enclosure or portable screen.

BS 5228 -1:2009+A1 2014 includes guidance on several aspects of construction site practices, which include, but are not limited to selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring.

The ***Construction Environmental Management Plan*** (**CEMP**) prepared as part of this EIAR (see **Appendix 5.1** in **Volume 3**), summarises the overall environmental management strategy that will be adopted and implemented during the construction phase of the proposed development.

The CEMP is a working document and will be finalised by the Contractor following appointment and prior to commencing works on site. For the control of noise, the contractor will be required to conduct construction noise predictions prior to works taking place and put in place the most appropriate noise control measures depending on the level of noise reduction required at any one location.

Further comment is offered on these items in the following paragraphs, however specific control measures will be chosen depending on the works involved and the noise reduction required.

10.6.2.1 Selection of Quiet Plant

The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item of plant will be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action will be to identify whether or not said item can be replaced with a quieter alternative.

For static plant such as compressors and generators used at work areas such as construction compounds etc., the units will be supplied with manufacturers' proprietary acoustic enclosures where possible.

10.6.2.2 General Comments on Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant, or the application of improved sound reduction methods in consultation with the supplier or the best practice use of equipment and materials handling to reduce noise.

- For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. Mobile plant will be switched off when not in use and not left idling;
- For piling plant, steady continuous noise such as that generated by diesel engines, it is possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover;
- For all materials handling, the contractor will ensure that best practice site noise control measures are implemented including ensuring that materials are not dropped from excessive heights and drop chutes/dump trucks are lined with resilient materials, where relevant;
- Where compressors, generators and pumps are located in areas in close proximity to noise sensitive properties/ areas and have potential to exceed noise criterion, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation;
- Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises

can be controlled by fixing resilient materials in between the surfaces in contact;

- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

10.6.2.3 Screening

Screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and receiver.

In addition, careful planning of the site layout will also be considered. The placement of temporary site buildings such as offices and stores between the site and sensitive locations can provide a good level of noise screening during the phasing of works.

10.6.2.4 Hours of Work

Construction noise impacts will be controlled through strict working hours. Construction activity will take place during daytime hours Monday to Friday and Saturdays. It may be necessary to work outside of these hours for example for the consideration of safety, weather or sub- contractor availability.

Consideration will be given to the scheduling of activities in a manner that reflects the location of the site and the nature of neighbouring properties. Each potentially noisy event/activity will be considered on its individual merits and scheduled according to its noise level, proximity to sensitive locations and possible options for noise control.

10.6.2.5 Liaison with the Public

Clear forms of communication will be established between the contractor and noise sensitive areas in proximity so that residents or building occupants are aware of the likely duration of activities likely to generate higher noise or vibration.

10.6.2.6 Monitoring

During the construction phase of the proposed project, spot check noise monitoring will be undertaken at the nearest sensitive locations to ensure construction noise limits set in **Table 10.9** are not exceeded. Refer to Section 11.4 of the **CEMP (Appendix 5.1)** relating to construction monitoring).

Noise monitoring will be conducted in accordance with the International Standard ISO 1996: *Acoustics – Description, measurement and assessment of environmental noise* Part 1 (2016) and Part 2 (2017).

10.7 Cumulative Effects

10.7.1 Proposed Development and Existing Facility

The cumulative effects of the proposed development in terms of noise and vibration take account of the existing environment coupled with the proposed developments at the WtE facility.

The existing environment as measured, takes account of existing sources of noise in the surrounding environment (i.e. operational activities associated with the existing WtE, adjacent industrial facilities i.e. Platin Cement works and road traffic).

Assuming no change to the existing noise environment (i.e. no increase or decrease in the prevailing noise environment occurs as a result of other developments in the area), the following cumulative effects are calculated at the noise sensitive locations measured during the baseline survey.

Table 10.24 Calculated Cumulative Noise Levels at Baseline Survey Locations

Location	Calculated Operational Noise Level, dB $L_{Aeq,T}$	Measured Existing Noise Levels, dB $L_{A90,T}$	Cumulative Noise Level, dB $L_{Aeq,T}$	Increase, dB	Impact Classification
	Daytime				
NSL1	29	46	46	0	Imperceptible
NSL2	24	50	50	0	
NSL3	30	53	53	0	
NSL4	31	53	53	0	
NSL5	26	50	50	0	
Location	**Evening**			**Increase, dB**	
NSL1	27	43	43	0	Imperceptible
NSL2	22	46	46	0	
NSL3	27	45	45	0	
NSL4	24	45	45	0	
NSL5	25	46	46	0	
Location	**Night-time**			**Increase, dB**	
NSL1	27	43	43	0	Imperceptible
NSL2	22	45	45	0	
NSL3	26	34	36	+1	Not Significant
NSL4	23	34	36	0	Imperceptible
NSL5	25	45	45	0	

The results of the cumulative assessment indicate the operation of the proposed development will not add to the prevailing noise environment during day or evening periods.

During night-time periods, there is potential for noise levels to be increased by up to 1dB(A) at noise sensitive properties to the south-west of the facility. The combined noise level at this location is, however well below the night-time noise emission limit value of 45dB.

10.7.2 Developments in Surrounding Area

In addition to the operation of the proposed development, there are a number of additional projects proposed in the vicinity of WtE facility. A full list of projects

which have been considered as part of this EIAR for cumulative effects are listed in **Chapter 18** ***Cumulative Effects, Other Effects and Interactions***.

On review of the projects listed for cumulative impacts, none of these proposed developments are close enough or include any significant noise sources to result in a cumulative noise impact to noise sensitive locations.

The relevant projects reviewed are summarised below:

10.7.2.1 Irish Cement Limited – Planning Reference LB150375 & PL17 .PA0050

These planned developments relates to a dust silo and application for replacement of fossil fuels with alternative fuels respectively. Both proposals have a negligible noise impact on the surrounding noise environment. In addition any amendments to on-site operations within the Platin cement works IE licence are required to operate within the relevant noise emission limit values.

Thus, there is no potential for any significant negative direct nor indirect cumulative impacts to arise from the Indaver Site Sustainability Project in combination with the projects above.

10.7.2.2 SSE Generation Ireland Ltd. Planning Ref : PL17.303678 .

Proposal for 110kV transmission substation at Carranstown and Caulstown, Platin, Duleek, Co. Meath. The environmental report for this development concludes there are no potential significant noise sources identified with respect to the substation, and therefore no operational noise impacts are predicted. On the basis of the assessment presented, the cumulative impact of this development coupled with the proposed development under consideration here is therefore negligible.

Therefore, there is no potential for any significant negative direct nor indirect cumulative impacts to arise from the Indaver Site Sustainability Project in combination with the project above.

10.7.2.3 Highfield Solar Ltd. Planning Reference: PL17 .303568 and PL17.248146.

Garballagh Lower Solar Farm, Co. Meath. This development is over 4km from the Caranstown WtE facility and will not result in any cumulative noise impact to the surrounding environment.

Thus, there is no potential for any significant negative direct nor indirect cumulative impacts to arise from the Indaver Site Sustainability Project in combination with the projects above.

The predicted noise effects associated with the proposed development at the Caranstown WtE facility are therefore well below those in the existing noise environment and hence will be imperceptible in terms of noise to its surrounding environment.

10.7.2.4 Cumulative Effects Summary

On review of the projects discussed above, given their distance to the WtE facility and /or the low predicted noise levels associated with each, the cumulative effect of all projects operating simultaneously will result in a negligible change in the prevailing noise environment. The cumulative noise impact is determined to be not significant.

10.8 Residual Effects

10.8.1 Operational Phase

The assessment has concluded that cumulative operational noise levels associated with the existing and proposed development can continue to operate within the facilities IE licence noise emission limits. The overall effect is imperceptible to not significant when added to the prevailing noise environment.

10.8.2 Construction Phase

During the construction phase of the project, there is potential for a temporary increase in noise levels during site preparation and building construction. Traffic transporting material to and from the site in addition to plant equipment used for developing the proposed buildings and structures are the main potential noise sources during this phase.

Whilst increased noise levels will be experienced during this phase, these will be intermittent and temporary in nature and are below the construction noise limits at the nearest noise sensitive properties.

The application of binding noise limits (**Table 10.11**) and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum.

In summary, the construction phase of the development will be of short term, minor to moderate negative impact.

During the construction phase, no significant source of vibration is expected. Any vibration impacts during this phase will be well below the limit values set out in **Table 9.6** and will not lead to perceptible level of vibration at the nearest sensitive locations to the site.

10.9 References

EPA (2002) Guidelines on the Information to be contained in Environmental Impact Statements

EPA (2003) Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)

EPA (2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports

EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015);

EPA (2016) Guidance Noise for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)

BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1 – Noise.

BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2 – Vibration.

BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration;

BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings

Institute of Environmental Management and Assessment (IEMA) (2014) Guidelines for Environmental Noise Impact Assessment

Design Manual for Roads and Bridges (DMRB), LA111 *Noise and Vibration*, Rev 0, Nov 2019.

ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.

ISO 9613-2: 1996: Acoustics – Attenuation of sound during propagation outdoors.

Transport Infrastructure Ireland (2004) Guidelines for the Treatment of Noise and Vibration in National Road Schemes.