Appendix 9. Noise and Vibration

9.3 Noise Model Details and Assumptions

9.3.1 Noise Model

A 3D computer-based prediction model has been prepared in order to quantify the noise level associated with the proposed building. This section discusses the methodology behind the noise modelling process.
Figure 1 presents an image of the developed noise model.

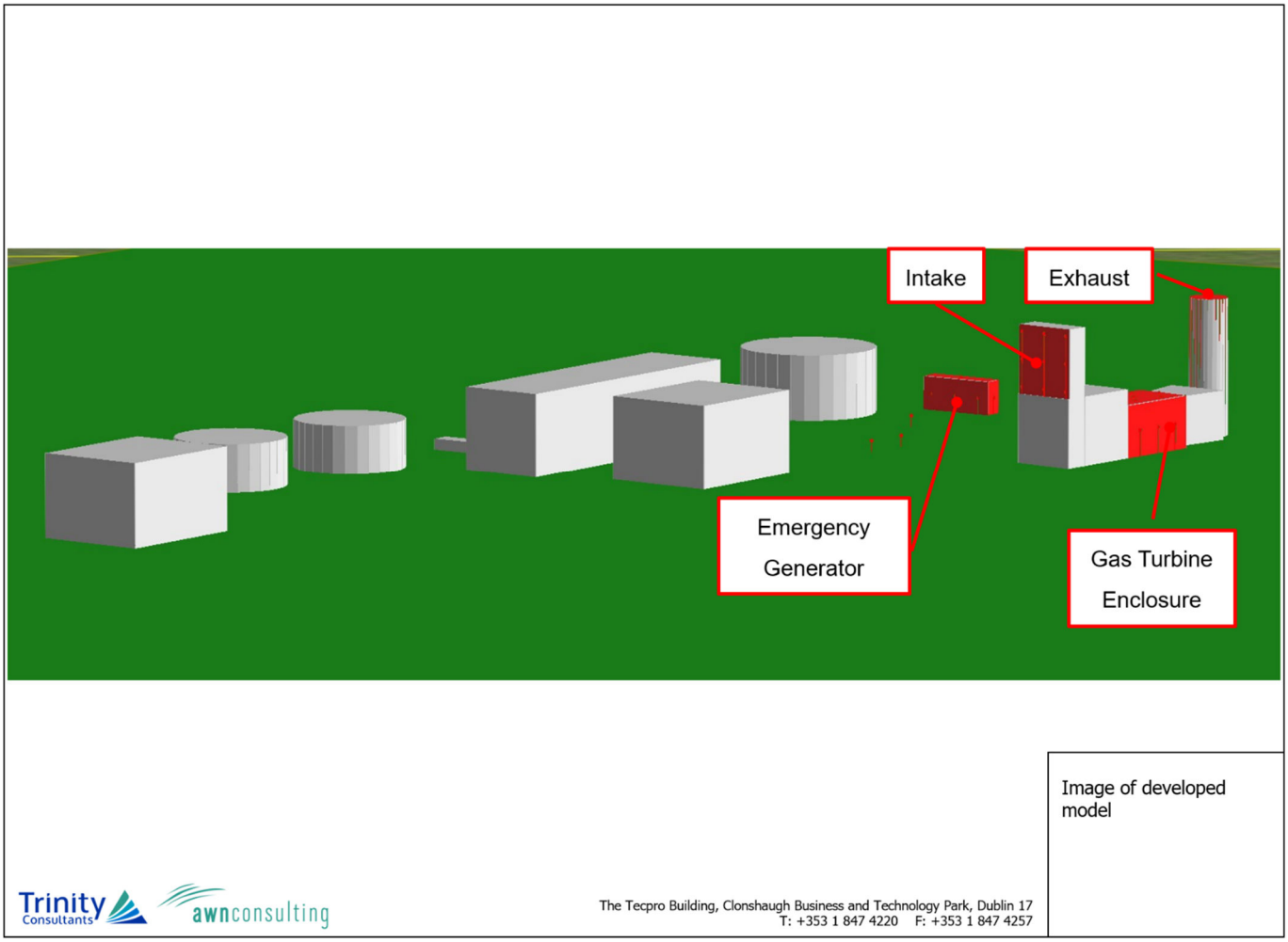

Figure 1 - Noise Model with Noise Sources from Gas Turbine and Emergency Generator

9.3.2 DGMR iNoise

Proprietary noise calculation software has been used for the purposes of this modelling exercise. The selected software, DGMR iNoise 2024.1, calculates noise levels in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: Engineering Metod for the prediction of sound pressure levels outdoors , 2024*.

DGMR iNoise is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. iNoise calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A weighted sound power levels (L_{WA});
- 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 (these have significant impact at distances greater than approximately 400 m).

9.3.3 Brief Description of ISO9613-2:2024

ISO9613-2:2024 calculates the noise level based on each of the factors discussed previously. However, the effect of meteorological conditions is significantly simplified by calculating the average downwind sound pressure level, $L_{AT}(DW)$, for the following conditions:

- wind direction at an angle of ±45° to the direction connecting the centre of the dominant sound source and the centre of the specified receiver region with the wind blowing from source to receiver, and;
- wind speed between approximately 1ms-1 and 5ms-1, measured at a height of 3 m to 11 m above the ground.

The equations and calculations also hold for average propagation under a well-developed moderate ground based temperature inversion, such as commonly occurs on clear calm nights.

The basic formula for calculating $L_{AT}(DW)$ from any point source at any receiver location is given by:

$$L_{fT}(DW) = L_W + Dc - A \qquad \textbf{Eqn. A}$$

Where:

$L_{fT}(DW)$ is an octave band centre frequency component of $L_{AT}(DW)$ in dB relative to $2x10^{-5}$Pa;

L_W is the octave band sound power of the point source;

D_c is the directivity correction for the point source;

A is the octave band attenuation that occurs during propagation, namely attenuation due to geometric divergence, atmospheric absorption, ground effect, barriers and miscellaneous other effects.

The estimated accuracy associated with this methodology is shown in Table 1 below:

Table 1 - Estimated Accuracy for Broadband Noise of L_{AT}(DW)

Height, h*	Distance, d†	
	0 < d < 100	100m < d < 1,000 m
0<h<5m	±3 dB	±3 dB
5m<h<30m	±1 dB	±3 dB

* h is the mean height of the source and receiver.

† d is the mean distance between the source and receiver.

N.B. These estimates have been made from situations where there are no effects due to reflections or attenuation due to screening.

9.3.4 Input Data and Assumptions

The noise model has been constructed using data from various source as follows:

Site Layout The general site layout has been obtained from the drawings forwarded by the project architects.

Local Area The location of noise sensitive locations has been obtained from a combination of site drawings provided by the project architects and others obtained from Ordinance Survey Ireland (OSI).

Heights The heights of buildings on site have been obtained from site drawings provided by the design team. Off-site buildings have been assumed to be 4 m high.

Contours Site ground contours/heights have been obtained from site drawings forwarded by the design team where available.

The final critical aspect of the noise model development is the inclusion of the various plant noise sources. Details are presented in the following section.

9.3.5 Source Sound Power Data

The noise modelling completed indicates the following limits in relation to various items of plant associated with the overall site development. Plant items will be selected in order to achieve the stated noise levels and or appropriate attenuation will be incorporated into the design of the plant/building in order that the plant noise emission levels are achieved on site (including any system regenerated noise).

The main source of noise from the development is the gas turbine. One gas turbine is proposed. For the current assessment, reference is made to the 334MW rated gas turbine as an example. Its sound power emission before and after acoustic treatment is presented in Table 2 and Table 3 respectively. These values will be the same for a 325MW rated gas turbine.

Table 2 - Sound Power Emissions from Gas Turbine (without acoustic treatment)

Source	L_w - Octave Band Centre Frequency									Overall dB(A)
	31	63	125	250	500	1k	2k	4k	8k	
Inlet	124	123	123	130	134	152	147	143	137	154
Exhaust	141	141	143	145	146	151	161	151	140	162
Enclosure (Breakout)	112	122	117	118	114	119	131	125	117	133

Table 3 - Sound Power Emissions from Gas Turbine (with acoustic treatment)

Source	L_w - Octave Band Centre Frequency									Overall dB(A)
	31	63	125	250	500	1k	2k	4k	8k	
Inlet	124	118.3	97.4	96.6	94.6	93.6	92.6	88.6	104.5	105
Exhaust	131.6	116.5	88.4	86.9	84.8	83.8	84.3	79.7	73.4	95.7
Enclosure (Breakout)	83	93	88	89	85	90	102	96	88	104

Table 4 - Sound Power Emissions from Diesel Generator

Source	L_w - Octave Band Centre Frequency									Overall dB(A)
	31	63	125	250	500	1k	2k	4k	8k	
Diesel Generator (Emergency)	87.2	87.2	91.9	94.8	92.8	90.7	88.5	86.1	85.5	100.1

Table 5 - Sound Power Emissions from Other Sources

Source	Overall dB(A)
Unit Transformer	85
GSU Transformer	85
Compressed Air Skid	85
Shunt Reactor	94

Table 6 - Sound Power Emissions from API (American Petroleum Institute) Noise Sources

Source	Unit Sound Power (dB(A))	Quantity	Sub – Total (dB(A))
Boiler	48	10	58
Pump	43	1	43
Pressure Reduce Kiosk	96	1	96
Generator*	95	1	95
		Total	**99**
Sound reduction of enclosure			**26**
		Resultant	**73**

Note* Operates during emergency only.

Based on the estimated sound power level, noise contribution from these are excluded from the model as they are not likely to contribute.