APPENDIX 26-3

MODELLING PARAMETERS

APPENDIX 26-3 CALCULATION PARAMETERS AND SETTINGS FOR OCC OPERATIONAL NOISE MODEL

Noise Model

A 3D computer-based prediction model has been prepared in order to quantify the noise level associated with the proposed electrical onshore compensation compound (OCC). This section discusses the methodology behind the noise modelling process.

DGMR iNoise

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

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 400m).

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, LAT(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 3m to 11m 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 LAT(DW) from any point source at any receiver location is given by:

$$LfT(DW) = LW + Dc - A \qquad \text{Eqn. A}$$

Where:

LfT(DW) is an octave band centre frequency component of LAT(DW) in dB relative to 2x10-5Pa;
LW is the octave band sound power of the point source;
Dc 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.

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 shape file provided by the client for a 1km radius from the OCC site boundary.

Heights The heights of buildings on site have been obtained from site drawings forwarded by the project architects. No off-site buildings have been included in the noise model, which leaves a highly conservative assessment of the OCC plant as there is no screening effect from the offsite buildings.

Contours In this instance the DTM ground topography for the site was provided by the client.

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.

Source Sound Power Data

The noise modelling indicates that the EPA, Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) limits for an area of low background noise are achieved in relation to various items of plant associated with the overall OCC site development. Plant items will be selected in order to achieve the stated noise levels and or appropriate attenuation including a 7.5m barrier) will be incorporated into the design of the plant/building in order that the plant noise emission levels are achieved on site.

The following sources have been provided by the client and modelled as vertical noise sources for the external plant areas in the model:

Table 11.3.2 *OCC Plant Items included in Model and A-Weighted Sound Power Level Spectrums*

Plant Item	Dimensions (L X B X H , m)	Octave Band Centre Frequency (Hz)								Overall dB (A)
		63	125	250	500	1000	2000	4000	8000	
Harmonic Filters (3 no.)	21 x 15 x 6	61	97	62	94	92	35	31	31	95
MV Reactor 1	18 x 5 x 6	51	87	52	84	82	25	21	21	85
MV Reactor 2	9 x 4 x 6	51	87	52	84	82	25	21	21	85
Shunt Reactor	22 x 11 x 8.5	Manufacturer sound power spectrum not available.								90
MV Transformer	18.5 x 12.5 x 8.5	Manufacturer sound power spectrum not available.								80

Plant Item	Dimensions (L X B X H , m)	Octave Band Centre Frequency (Hz)								Overall dB (A)
		63	125	250	500	1000	2000	4000	8000	
Statcom Cooling	27.5 x 6 x 3	Manufacturer sound power spectrum not available.								85
MV House Transformer	6.5 x 5.5 x 5	Manufacturer sound power spectrum not available.								60

All plant (excluding the harmonic filters) have been modelled as emitting facades and the top as an emitting roof noise source. The sides of the harmonic filters have been modelled as vertical area sources and the top as an area source. All the plant is modelled operating simultaneously 100% of the time.

Noise Model Parameter Inputs

Prediction calculations for turbine noise have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation, 2024*. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

Directivity Factor: The directivity factor (D) allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. In this case the sound power level is measured in a down wind direction, corresponding to the most conservative propagation conditions and needs no further adjustment.

Ground Effect: Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions.

The noise predictions have been carried out using various source height specific to each plant item, a receiver heights of 1.5m for single storey properties and 4m for two storey properties. An assumed ground factor of G = 0.5 has been applied off site. Noise contours presented in the assessment have been predicted to a height of 4m in all instances.

Geometrical Divergence: This term relates to the spherical spreading in the free-field from a point sound source resulting in an attenuation depending on distance according to the following equation:

$$A_{geo} = 20 \text{ x } \log(\text{distance from noise source in meters}) + 11$$

Barrier Attenuation: The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise. The barrier attenuations predicted by the ISO9613 model have been shown to be significantly greater than that measured in practice under down wind conditions. 3D ground topography data supplied by MKO was used in the noise prediction modelling.

Atmospheric Absorption

Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies.

In these predictions, a temperature of 10°C and a relative humidity of 70% have been used, which give relativity low levels of atmosphere attenuation and corresponding worst case noise predictions.
The atmospheric attenuation outlined in Table 11.3.3 were used for all calculations.

Table 11.3.3 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (°C)	% Humidity	Octave Band Centre Frequency (Hz)							
		63	125	250	500	1000	2000	4000	8000
10	70	0.12	0.41	1.04	1.93	3.66	9.66	32.77	116.88

OCC Site Plan Layout with Modelled Noise Sources

Figure 11.3.1 below illustrates the plant noise sources and position of the 7.5m noise barrier overlaid on the OCC site plan.

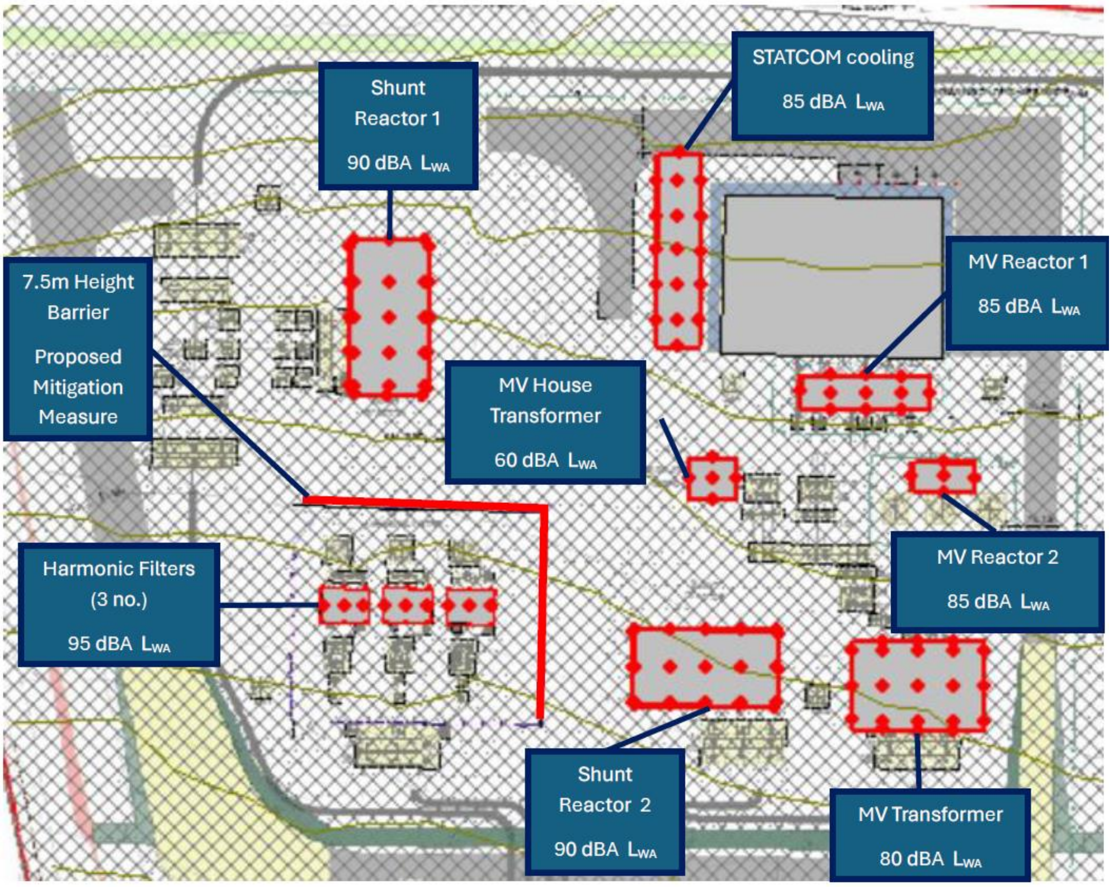

Figure 11.3.1 Modelled Noise Sources and Noise Barrier at OCC Site