Appendix 11B

Acoustic Modelling Details

[THIS PAGE INTENTIONALLY LEFT BLANK].

AECOM

SSE Tarbert Next Generation Power Station

Environmental Impact Assessment Report (EIAR)

Volume II

Appendix 11B: Acoustic Modelling Details

SSE Generation Ireland Ltd.

November 2023

Delivering a better world

Prepared for:

SSE Generation Ireland Limited

Prepared by:

AECOM Ireland Limited
4th Floor
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin A96 T927
Ireland

T: +353 1 238 3100
aecom.com

Table of Contents

Tables

Appendix 11B: Acoustic Modelling Details

B.1 Site Layout

The Site Layout is based on Drawing Number 60695232-TBT-DR-001, as presented in EIAR Volume II Figures, accompanying Chapter 5 ('Description of Proposed Development). However, EIAR Volume III Figure 11.1 provides a simplified layout labelling the main sound sources.

B.2 Acoustic Modelling Input Data

Data Sources

Data sources used for construction sound modelling were reviewed and approved by the Applicant and have been based on a representative equipment lists used for similar scale power station developments in Ireland.

Data sources used for operational sound modelling were provided by the Applicant and have been based on a representative equipment created by General Electric (GE) and Siemens and provided to the Applicant. The Applicant has also confirmed the unit and grid transformer data published as part of a planning application for similar development (ESB Aghada 299MW OCGT, County Cork, File 235140) is also representative of that for the Proposed Development and has been used in the assessment, The Applicant confirmed that selective catalytic reduction (SCR) would not exceed the 85dBA at 1m, and this has been used to determine a maximum sound power level.

Sound Source Sound Power Levels

Construction Phase

Construction noise sound sources were modelled using the following approaches:

- An area source 3m high covering the main power plant construction area as shown in EIAR Volume III – Figure 11.1 with a total sound power level assigned to represent either the peak or typical month of the construction programme.
- As a point source, 20m high representing impact piling, modelled at locations 1 and 2 as shown in EIAR Volume III – Figure 11.1 with representative sound power levels and spectrum from BS 5228-1 (2009+A1-2014) Table C.3.1.
- As a line source from the main access gate to the main power plant construction area, with sound power level and spectrum appropriate for an HDV and LDV vehicle and an associated on-time correction based on the number of average number of vehicles per hour anticipated over a day.

- Sound propagation from the construction activity has been undertaken using the BS 5228 methodology as implemented in CadnaA 2022 MR2. Construction levels have also been checked using ISO 9613-2 calculation method and result in lower predicted levels at receptors, demonstrating that using the BS 5228-1 sound propagation method is also the more conservative approach. A table of construction plant and associated on-time and broadband A-weighted sound power levels is provided in the EIAR Volume I Chapter 11, along with LGV and HGV spectra.

Operational Phase

Operational sound sources were modelled using two approaches:

- As a point source with an associated sound power level and elevation above ground.
- As a box made up of four noise emitting walls and a roof according to the stated dimensions mentioned in the following section. The reported sound power level was distributed evenly over the total surface area in the absence of any detailed information about any bias in the directional characteristics of the sound emissions. Note the dimensions are only representative for modelling purposes.
- The octave frequency spectrums for each sound source are provided in EIAR Volume I Chapter 11 under *Power Plant Proposed Equipment*

Table 1: Operational Plant Dimensions and Sound Levels

<table>
<tr><th></th><th rowspan="2">Item</th><th rowspan="2">ID</th><th colspan="3">Dimensions</th><th>Supplied</th><th colspan="2">Unmitigated</th><th colspan="2">Mitigated Option A</th></tr>
<tr><th></th><th>L</th><th>W</th><th>H</th><th>L_{WA}</th><th>L_{WA}</th><th>L_{WA}''</th><th>L_{WA}</th><th>L_{WA}''</th></tr>
<tr><td rowspan="3">GT - Air Inlet</td><td>Air Inlet - Filter Face</td><td>S3</td><td rowspan="3">N/A</td><td rowspan="3">15m</td><td rowspan="3">11.5</td><td>98</td><td rowspan="3">103.8</td><td rowspan="3">-</td><td rowspan="3">93.6</td><td rowspan="3">-</td></tr>
<tr><td>Air Inlet - Ducting</td><td>S3</td><td>92</td></tr>
<tr><td>Air Inlet - Plenum</td><td>S3</td><td>102</td></tr>
<tr><td rowspan="7">Gas Turbine Package*1</td><td>Internal - Turbine Compartment</td><td>S1</td><td rowspan="7">40</td><td rowspan="7">50</td><td rowspan="7">30</td><td>104</td><td rowspan="7">103.2</td><td rowspan="7">64.5</td><td rowspan="7">101.4</td><td rowspan="7">62.7</td></tr>
<tr><td>Internal - Lube Oil / Gas Module</td><td>S1</td><td>102</td></tr>
<tr><td>Internal - GT Enclosure Fan Casing + Outlet Exhaust (x2)</td><td>S1</td><td>106</td></tr>
<tr><td>Internal - Exhaust Enclosure Fan Casing + Outlet (x2)</td><td>S1</td><td>104</td></tr>
<tr><td>Internal - Generator Enclosure</td><td>S1</td><td>102</td></tr>
<tr><td>Internal – GT Aux Transformer (-15dB during sinusoidal load)</td><td>S1</td><td>104</td></tr>
<tr><td>Internal – BoP Aux Transformer (-15dB during sinusoidal load)</td><td>S1</td><td>95</td></tr>
<tr><td rowspan="3">GT Exhaust</td><td>Exhaust duct & Diverter damper</td><td>S2</td><td rowspan="2">14</td><td rowspan="2">6.5</td><td rowspan="2">35</td><td>103</td><td rowspan="2">104</td><td rowspan="2">72.2</td><td rowspan="2">104</td><td rowspan="2">72.2</td></tr>
<tr><td>GT Exhaust Diffuser Compartment</td><td>S2</td><td>99</td></tr>
<tr><td>Stack Top</td><td>S4</td><td colspan="3">Point Source</td><td>109</td><td>109</td><td>-</td><td>109</td><td>-</td></tr>
<tr><td rowspan="4">Balance of Plant</td><td>Generator Fin Fan Cooler</td><td>S6</td><td>30</td><td>6.5</td><td>5.6</td><td>112</td><td>112</td><td>84.2</td><td>112</td><td>84.2</td></tr>
<tr><td>Lube Oil Fin Fan Cooler</td><td>S7</td><td>9</td><td>8</td><td>5.1</td><td>112</td><td>112</td><td>88.1</td><td>112</td><td>88.1</td></tr>
<tr><td>Grid Transformer</td><td>S8</td><td>10.1</td><td>5.1</td><td>4.5</td><td>109</td><td>101</td><td>78.3</td><td>101</td><td>78.3</td></tr>
<tr><td>Unit Transformer</td><td>S8</td><td>10.1</td><td>5.1</td><td>4.5</td><td>109</td><td>85</td><td>62.3</td><td>85</td><td>62.3</td></tr>
<tr><td colspan="2">Selective Catalytic Reduction (SCR)*2</td><td>S5</td><td colspan="3">Point Source</td><td>96</td><td>96</td><td>-</td><td>96</td><td>-</td></tr>
<tr><td colspan="11">Lw'' is Sound Power Level Per Unit Area of the top and side surfaces (i.e., wall and roof elements) that make up the sound source in the 3D model</td></tr>
</table>

B.3 Prediction Methodology

Modelling of sound levels from the development have been undertaken using CadnaA 2022 MR2 acoustic modelling software. This software implements the sound propagation calculation methodology set out in the ISO 9613-2:1996. The propagation model described in this standard provides for the prediction of sound pressure levels based on either short-term downwind (i.e., worst case) conditions or long-term overall averages. The highest sound levels at NSRs occur under down wind conditions (wind blowing 1 to 5m/s from the Site towards the nearby receptors), and these have been adopted within the model. When the wind is blowing in the opposite direction, sound levels may be significantly lower than those predicted. The ISO propagation model calculates the predicted sound pressure level by taking the source sound power level for each source and subtracting a number of attenuation factors according to the following:

$$\text{Predicted Sound Level} = L_{WA} + D - A_{geo} - A_{atm} - A_{gr} - A_{bar} - A_{misc}$$

These factors are discussed in detail in the following paragraphs.

The Sound Power Level (LWA) defines the total acoustic power radiated by a noise source expressed in decibels (dB re 1 pW).

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. No directivity factor is considered within this assessment.

The geometrical divergence (A_{geo}) accounts for spherical spreading of the sound from the source within free-field conditions. Different sources at the Installation have been modelled to take account of their geometry, as area, line or point sources. The divergence factor is calculated from the distance from the source to the receiver, and the relationship between the attenuation provided and distance is dependent on the type of sound source assumed.

The atmospheric absorption factor (A_{atm}) considers the attenuation offered by the atmosphere as a result of the conversion of sound to heat. The degree of attenuation is dependent on the relative humidity and temperature of the air through which the sound is travelling and is frequency dependent. Increasing attenuation occurs towards the higher frequencies of sound.

Modelling parameters have assumed an ambient temperature of 10 °C and 70% relative humidity which are found to result in worst case noise propagation. The corresponding atmospheric attenuation factors are summarised in Table 2.

Table 2: Atmospheric Attenuation (dB/km) at 10° C and 70% Relative Humidity

Octave Band Centre Frequency / Hz	63	125	250	500	1k	2k	4k	8k
Atmospheric Absorption Coefficient dB / km	0.122	0.411	1.04	1.93	3.68	9.66	32.8	117

The ground effect (A_{gr}) is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver, and the interaction of the sound with porous and absorptive ground cover. The prediction of ground effects depends on the source height, receiver height, propagation height between the source and receiver and the ground conditions.

The ground conditions are described according to a variable defined as ‘G’, which varies between 0 for ‘hard’ ground (includes paving, water, ice, concrete and any locations with low porosity) and 1 for ‘soft’ ground (includes ground covered by grass, trees or other vegetation).

The effect of any barrier or topographical obstruction (A_{bar}) between the sound source and the receiver position is that sound will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the sound.

B.4 Acoustic Calculation Settings

Acoustic modelling has been undertaken using the following model settings:

- ISO 9613-2 for construction and operational phases
- Maximum search radius of 5000m
- Maximum number of reflections: 2
- Free field noise level predictions carried out at 1.5m and 4m above ground to represent ground and first floor levels respectively at sensitive receptors for day and night-time assessment.
- Side diffraction enabled.
- Ground absorption has been set as:
  - A ground absorption value of G=1.0 (representing soft ground) has been assigned to the surrounding agricultural areas.
  - Areas of hard standing set to G=0 (representing hard ground) has been assigned across the Proposed Development Area as appropriate.

B.5 Uncertainty in Modelling

It should be noted than any predictions of sound levels have an associated degree of uncertainty. Whilst best endeavours have been made to minimise that uncertainty in this work, it is unavoidable that some remains. In particular, the following sources of uncertainty have been noted:

- Sound source levels have been based on client's instruction regarding sound pressure level at 1m or sound power levels from the plant and typical frequency spectrum data obtained from previous measurements by AECOM and literature references. It is possible that depending on the plant to be used, source spectrum may differ.
- Predictions of sound pressure levels according to ISO 9613 assume moderate downwind propagation, and hence could be considered as a worst-case calculation. However, the standard also indicates an estimated accuracy of ±3 dB LA in predicted levels.
  Noise information from suppliers is based on running on diesel and not Hydrotreated Vegetable Oil (HVO). Effect on noise of the GT based on HVO operation is not fully understood.

aecom.com