APPENDIX 9 – PREDICTION METHOD

Computer Noise Model

Plant noise predictions have been undertaken using CadnaA noise modelling software, which incorporates prediction methodology within ISO 9613: 1993 Acoustics -- Attenuation of sound during propagation outdoors. The ISO 9613 method predicts a long-term equivalent continuous A-weighted sound pressure level (L_{Aeq}) under meteorological conditions favourable to propagation at distances from a variety of sources of known emission. The method is defined for octave bands for 63 Hz to 8 kHz. The model assumes downwind propagation, within +/- 45 degrees of direction connecting dominant source and receiver, wind speeds between 1 and 5 m/s at heights between 3 and 11 m above the ground. The following parameters have been used within the modelling:

- Ground absorption = 0.1 for site, 0.8 for grass areas outside of site;
- All buildings reflective (0.37 absorption coefficient); and
- Atmospheric conditions = 0 degrees c, 50% humidity (representing the conditions during the night-time environmental survey).

Heights of buildings have been approximated from available online photography. Topographical data has been supplied by RSK Environment Ltd, including earthworks and landscaping proposed at the site.

Noise Sources

Generator Louvres

The generators will be housed within an acoustic container and air supplied to the engines via containers on the louvers (the container louvers). These louvers will be built into the wall of the new building. Further louvers will be placed within the same wall to assist with airflow for cooling (building louvers).

Two vertical area sources (0.6m x 2.4m) have been used to model the container louvres on the container and two (1 x 6m and 1 x 3m) for the building louvers (assuming that the rooms shown on plan will not enclose the containers).

Noise levels have been based on data provided by Finning CAT (see **Appendix 7**). A noise level of 77 dB(A) 1 metre from the container louvres has been assumed representative. The sound spectrum measured at a similar generator at the Haughton Main site (see **Appendix 6**) has been used as a spectrum, which has then been adjusted to provide the required 77 dB(A). An attenuation of 10 dB has been assumed for the farm building louvres. This is estimate is based on attenuation of the louvre, attenuation of distance and also reflections within the farm building.

The verification of the sound source within the model to measured levels is as follows.

Table A7.1 Calculations for Modelling Generator Noise

MODELLED GENERATOR	Octave Band Sound Levels (dB)									Broadband (dBA)
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	
Houghton Linear Measurement at 1m	75.7	73.5	77	72.4	63.7	59.2	53.6	47.8	50.6	81.2
A-weighted Houghton	36.3	47.3	60.9	63.8	60.5	59.2	54.8	48.8	49.5	67.9
Adjusted Measurement at 1m to Finning CAT specification	45.4	56.4	70.0	72.9	69.6	68.3	63.9	57.9	58.6	77.0
Modelled Source Level at 1m	45.3	56.3	69.8	72.8	69.8	68.3	63.7	57.7	58.6	76.9
Difference	-0.1	-0.1	-0.2	-0.1	0.2	0.0	-0.2	-0.2	0.0	-0.1

Gas Processing

The gas processing equipment has been modelled as a set of pipework and two dominating emission points (1 at 1.8 m height and 1 at 2.8 m).

Noise levels have been based on data provided by Acoustic Associates for similar gas plant of 67 dB(A) at 10 metres (Noise Assessment of Electricity From Mine Gas at Houghton Main, AAL/BS0531).

The verification of the sound source within the model to measured levels is as follows.

Table A7.2 Calculations for Modelling Gas Processing Noise

MODELLED GENERATOR	Octave Band Sound Levels (dB)									Broadband (dBA)
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	
Houghton Linear Data at 10m	-	67	69	71	65	61	59	58	45	75.0
A-weighted at 10m	-	40.8	52.9	62.4	61.8	61	60.2	59	43.9	68.2
Corrected to 67 dB at 10m	-	39.8	51.9	61.4	60.8	60	59.2	58	42.9	67.2
Modelled Source Level at 10m	-	39.7	51.6	61.1	60.6	59.6	59	57.8	42.9	66.9
Difference	-	-0.1	-0.3	-0.3	-0.2	-0.4	-0.2	-0.2	0	-0.3

It was noted that the noise level at 1 m of 74 dB(A) also matches the noise level measured at the Houghton site for the gas processing area.

Fan Cooled Radiator

The fan cooled radiator has been modelled as a set of 6 point sources at a height of 1.8 m with a directivity dominating in the z plane such that the noise emitting from the top of the fans is 10 dB higher than the side where the point sources have been verified to measurement data.

The noise level and sound spectrum for the fans have been based on data provided by measurements taken at the Houghton Main site at 1 m.

The verification of the sound source within the model to measured levels is as follows.

Table A7.3 Calculations for Modelling Fan Cooled Radiator Noise

MODELLED GENERATOR	Octave Band Sound Levels (dB)									Broadband (dBA)
Frequency (Hz)	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Houghton Linear Measurement at 1m	75.2	82.1	81.6	80.4	75.8	72.3	67.8	60.1	51.2	87.1
A-weighted at 1m	35.8	55.9	65.5	71.8	72.6	72.3	69	61.1	50.1	78.0
Modelled Source Level at 1m	36	56	65.5	71.9	72.4	72.4	69	61.4	50.2	78.0
Difference	0.2	0.1	0.0	0.1	-0.2	0.1	0.0	0.3	0.1	0.0

Transformers

The noise level for the two transformers has been based on RSK's experience of transformer noise. The noise level used for the transformer is as follows.

Table A7.4 Modelled Transformer Noise

MODELLED GENERATOR	Octave Band Sound Levels (dB)									Broadband (dBA)
Frequency (Hz)	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Sound Levels	-	50.8	61.3	70.3	70.6	67.3	63.2	57.5	52	75

It is noted that the noise survey undertaken at the Houghton Main site does not make reference to transformer noise, even 1m from a transformer. It is therefore considered likely that the noise level of the transformer is not a significant noise source.

Generator Exhaust Gas Maximum Limit Calculation

As a worst case scenario, the calculation to provide a maximum sound pressure level limit at 1m from the exhaust stack utilises distance attenuation only (in reality ground and air absorption will also increase attenuation of sound). The calculation is as follows:

- Predicted noise level of all other equipment at nearest receptor (Wellfield Farm) = 30 dB(A)
- Noise target at receptor to avoid contribution of sound from exhaust stack = 20 dB(A)
- Distance to nearest receptor = 265m
- Distance attenuation = 20 x LOG10 (1/265) = -48.5 dB
- Maximum exhaust noise level at 1m = 20 dB + 48.5 dB = **68.5 dB(A).**