Title:	**Noise Control Assessment Addendum**
Project:	Hastings Generation Project Environmental Noise Impact Assessment
Client:	Esso

Wood Doc No	AU01103-FN02	**Wood Job No.**	AU01103-01

Revision	Description	Prepared	Reviewed	Date
A	Issued for Review	ST	PKL	25 May 2022
0	Issued for Use	ST	PKL	31 May 2022

1 INTRODUCTION

Esso are seeking to obtain regulatory planning approval for the Hastings Generation Project (The Project). The Hastings Generation Project is to be located at an Esso Australia Pty Ltd (Esso) and BHP Petroleum (Bass Strait) Pty Ltd owned site adjoining the existing Long Island Point (LIP) facility. Noise from The Project has the potential to impact noise sensitive areas (hereby referred to as NSRs/noise sensitive receivers) surrounding the proposed operations. The project consists of the use of ethane from LIP to generate power through the installation of power generation packages producing approximately 40MW of electricity. The power generated will be fed into the existing electricity transmission network via the Tyabb Terminal Station. The three components of the project can be summarised as:

- Installation of new piping to transfer ethane from LIP to the adjoining, Esso owned project site;
- Installation of three Solar Titan 130 generators, each with a capacity of 13.5MW producing approximately 40MW of electricity, on the project site that tie-in to the new ethane pipeline; and
- Installing a high voltage electricity line from the generators that links into the existing transmission network powerline on Bayview Road.

Noise impacts at four of the closest noise sensitive receivers were previously assessed, based on noise modelling and background noise monitoring of The Project, as contained in the report document *Rpt01-AU00659-Rev2-25.May.2022 Hastings Generation Project Environmental Noise Impact Assessment*. The assessment results from this report indicate that noise emissions (*effective noise levels*) due to the operation of The Project would fall below the noise limits at all noise sensitive receivers identified in the assessment and are thus compliant with the relevant regulations.

1.1 Scope

The scope for this addendum to the noise assessment report is to:

- Detail the noise controls currently implemented on the Solar Titan 130 generators and any additional noise attenuation control measures that could be installed as part of The Project and assess their practicability; and
- Provide a qualitative assessment on the noise emissions from The Project with respect to whether effective noise levels at NSRs have been reasonably controlled / reduced.

2 NOISE SOURCE EMISSION DATA

Equipment sound power levels for the Titan 130 Package and associated equipment were provided by the nominated vendor (Solar). The noise emissions (sound power levels) associated with this Solar equipment assume incorporation of the following noise reduction treatments in the package:

- Acoustic blanket on engine air inlet silencer and flex duct;
- Acoustic blanket on engine exhaust expansion joint;
- Cladding on web of skid beam;
- Additional enclosure door seals; and
- Acoustic blanket on ventilation inlet elbow and fans.

The performance of these noise control treatments, and effective reduction in emissions of the standard Solar Titan 130 package has been estimated by Solar based on design/materials data, and not based upon direct measurement of performance.

Where vendor sound pressure level or sound power level data was not available (additional equipment items), Wood has used library data of similar equipment measured at existing compression or power generation facilities.

The equipment overall sound power levels is listed in Table 2-1. Octave-band noise source sound power levels for the equipment in the noise model are listed in APPENDIX A.

Table 2-1 Noise Source (Sound Power) Levels for Operational Equipment

Equipment	No. of units	Sound Power Level, Lw, dB(A)
Solar Titan 130 • Enclosure (+ventilation) • Turbine air inlet system • Combustion exhaust stack	3	 107 97 103
Lube Oil Cooler	3	98
Fuel Gas Skid	3	96
Instrument Air Package	1	95
Water Purification Pump	1	92
Transformer	2	90

3 NOISE CONTROL ASSESSMENT

3.1 Proposed Noise Controls

The following noise controls are proposed to be installed on the package as part of Solar's scope of supply, they consist of Standard noise controls offered on all Titan 130 package and Additional noise controls purchased/ implemented by Esso.

Standard Noise Controls:

The following noise controls are offered as standard by Solar:

- Turbine air inlet silencer
- Turbine exhaust silencer
- Ventilation exhaust silencer
- Standard low noise enclosure

Additional Noise Control Options Implemented by Esso:

The additional controls implemented by Esso are listed below, and illustrated in Figure 3-1.

- Acoustic blanket on turbine air inlet silencer and flex duct;

  - This blanket provides attenuation for the turbine air inlet silencer and flexible duct connection to the enclosure. The flange ducting connection to the enclosure and the ducting from the enclosure upstream to the silencer are typically higher noise components of the package. This is due to noise breaking out from within the ducts. The blanket provides noise attenuation for these equipment items.

- Acoustic blanket on engine exhaust expansion joint;
  - Expansion joints are typically an acoustic weak point where noise leakage is likely to occur. Installation of an acoustic blanket over the expansion joint will reduce noise emissions.
- Addition of cladding on web of skid beam (skid skirt);
  - Noise from the turbine base-plate can radiate from under the skid beam and can be a significant noise source. The installation of a skirt reduces noise radiating from under the skid.
- Additional enclosure door seals; and
  - Enclosure doors are typically an acoustic weak point for the enclosure where noise leakage is likely to occur. The installation of door seals will reduce noise break-out from the enclosure.
- Acoustic blanket on ventilation inlet elbow and fans.
  - This blanket provides noise attenuation for the ventilation air inlet including breakout noise from the ventilation fan casing. These can be high noise equipment items – particularly for the fan casing and connections to the ducting. The installation of a blanket over the inlet ducting and fan casing will reduce noise emissions from these equipment items.
- Low noise Lube Oil Coolers
  - The external lube oil coolers selected by Esso include a low noise variable speed fan. Variable speed fans are typically lower noise than the fixed speed fans. The sound wpoer levels provided by Solar for the low noise lube oil coolers are quieter than industry standard and in-line with low noise options provided by gas turbines manufacturers.

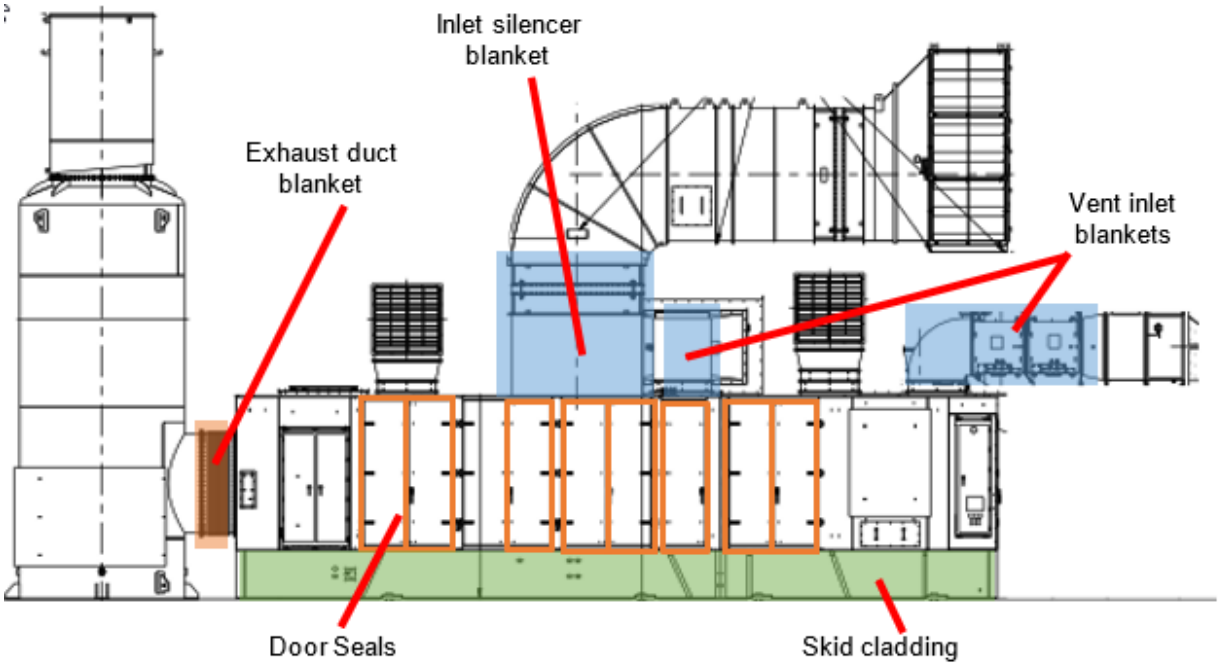

Figure 3-1 Illustration of Additional Noise Controls Procured by Esso (Source: Solar)

3.2 Noise Control Considered But Not Implemented

The following noise controls were considered, however not recommended for implementation, as they were found to be not practicable or provide minimal reduction in noise emissions from the facility.

- Fuel Gas Skids
    - Noise emanating from the fuel gas skid is the result of flow noise generated from within the valves. Valve noise is typically high frequency noise. High frequency noise attenuates readily across long distances. Additionally, noise levels received at NSRs is dominated by the Titan 130 packages. Potential noise control treatments include the installation of low noise trim valves or acoustic insulation over piping downstream of the valve. However, due to the high frequency and low intensity nature of valve noise, installation of these noise controls would likely have an insignificant effect on received noise levels at nearby NSRs.
- Instrument Air Package
    - The instrument air package is an enclosed package which the enclosure readily designed with noise attenuation in mind. Enclosures for modern packages are typically medium to high performance. Implementing a higher specification enclosure to lower emissions even lower would likely have an insignificant effect on the noise levels at received at the nearby noise sensitive receievers due to the low intensity nature of noise from the package.
- Water Purification Pump

- The water purification pump is small pump and noise from these pumps is usually reuslts from the electric motor driving the pump – in particular the motor fan. Installation of a low noise cowling could reduce noise contribution from the pump further, however any installation of noise controls would likely have an insignificant effect of noise levels at nearby noise sensitive receievers due to the package having a low sound power level.

- Transformer
  - Noise from transformer is usually resulting from cooling fans. Installation of low noise fans can reduce noise emissions from the package. However, any installation of noise controls would likely have an insignificant effect of noise levels at nearby noise sensitive receievers due to the package having a low sound power level.

- Noise Walls
  - Implementation of noise wall to the southern side of the compressor packages was considered not practicable due to the following:
    - Any noise wall would need to block line of sight between the packages and the nearest NSRs. To achieve this a noise walls would need to be approximately 70m long and at least 10m tall. A noise wall of this height and length could create significant load bearing issues under strong winds and would therefore require complex strucutal engineering; and
    - The dominant noise source at NSRs is the combustion exhaust outlet (~15 m above ground) which would not be attenuated by a noise wall due to the height of the stack.

3.3 Noise Controls for Low Frequency Noise

Noise modelling predicts that the dominant low frequency noise (inclusive of infrasound) from The Project is resulting from the Titan 130 package, in particularly the exhaust stack outlet and, to a lesser extent, the enclosure and associated ducting and inlets / outlets.

Solar has installed a silencer in the combustion exhaust stack. Silencers typically provide attenuation in the high frequency bands and often have minimal impact on low frequency / infrasound noise. A custom built high performance exhaust silencer would likely provide only a marginal improvement with regards to low frequency / infrasound emissions from the exhaust. Additionally, this would have to be sourced from an alternate vendor and installed post construction of the package.

Solar has provided a number of noise controls for the enclosure, associated ducting and inlets / outlets, listed in section 3.1, that Esso has accepted. These controls primarily provide noise reduction in the higher frequency bands, and while they may provide some reduction in the infrasound and low frequency range, it will be minimal.

Further reduction of low frequency noise and infrasound from the Titan 130 turbine packages is very difficult due to the very long wavelengths of the emissions (e.g. wavelength of 10 Hz noise is 34.4 metres long). Noise control options may need to include changing the operating conditions of the package to reduce emissions of low frequency noise. This change in operational condition is expected to not only yield minimal reduction in the low frequency noise and infrasound emissions but may also lead to stability and reliability issues with the package.

4 CONCLUSION

A number of noise controls are proposed to be installed on the Titan 130 Package provide by Solar, they consist of Standard noise controls offered on all Titan 130 packages and additional noise controls purchased by Esso.

The noise controls include the following standard noise controls offered by Solar:

- Turbine air inlet silencer
- Turbine exhaust silencer
- Ventilation exhaust silencer
- Standard enclosure

The additional noise controls purchased by Esso include:

- Acoustic blanket on engine air inlet silencer and flex duct;
- Acoustic blanket on engine exhaust expansion joint;
- Cladding on web of skid beam;
- Additional enclosure door seals; and
- Acoustic blanket on ventilation inlet elbow and fans.

Further consideration was given to a number of other noise control options for both the Titan 130 packages and anciallary equipment however, the installation of these noise controls is expected to have minimal effect on overall noise levels at NSRs and therefore the controls have not been pursued.

The noise emissions from The Project is considered to have been reduced to a reasonable level and risk of exceedance at the NSRs is low.

APPENDIX A SOURCE SOUND POWER LEVELS

Source Name	Octave Band Sound Power Level, in dB									
	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz	Lw dB(A)
Titan 130 GTG Package	119	117	114	109	103	99	96	98	94	**107**
Combustion Exhaust Stack Outlet	120	121	113	106	94	89	89	89	92	**103**
Turbine Air Inlet	105	110	109	103	86	70	54	64	61	**97**
Lube Oil Cooler	104	104	103	100	95	93	87	81	75	**98**
Instrument Air Package	86	96	91	89	90	83	90	87	83	**94.6**
Fuel Gas Skid Valve	72	72	72	72	77	82	87	92	92	**96.1**
Water Purification Pump	78	80	83	88	87	86	87	77	70	**91.5**
Transformer	77	86	91	90	90	84	79	74	67	**90.2**