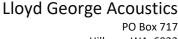
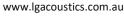


APPENDIX K

ENVIRONMENTAL NOISE ASSESSMENT – LOCKYER GAS DEVELOPMENT PROJECT (LLOYD GEORGE ACOUSTICS 2023)



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Environmental Noise Assessment -Lockyer Gas Development Project

Lot 3558/25116 Midlands Road, Mount Horner WA

Doc Number: LGP-0000-EN-REP-000005 LGA Reference: 23078242-01B

> Prepared for: Mineral Resources



Doc Number: LGP-0000-EN-REP-000005

LGA LGA Reference: 23078242-01B

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Date	Rev	Description	Author	Verified	
02/10/23	0	Issued to Client	Daniel Lloyd	Terry George	
30/11/23	А	Update to 250 TJ/d Plant	Daniel Lloyd	Terry George	
08/12/23	В	Enclosure to compressors and engine	Daniel Lloyd	Terry George	

CONTENTS

1.	INTR	ODUCTI	ON	1
2.	CRITI	ERIA		2
	2.1.	Regula	ntions 7, 8 & 9	2
3.	METI	HODOLO	DGY	4
		3.1.1.	Meteorological Conditions	4
		3.1.2.	Topographical Data	4
		3.1.3.	Ground Absorption	4
		3.1.4.	Source Sound Levels	5
4.	RESU	ILTS		6
5.	RECC	MMEN	DATIONS & CONCLUSION	9
Lis	t of	Table	es established to the second of the second o	
Tab	le 2-1	Adjustm	nents Where Characteristics Cannot Be Removed	2
Tab	le 2-2	Baseline	e Assigned Levels	3
Tab	le 3-1:	Modell	ing Meteorological Conditions	4
Tab	le 3-2:	Source	Sound Power Levels, dB	5
Tab	le 4-1:	Predic	ted Noise Levels, dB(A)	6
Lis	t of	Figur	es	
Figu	ıre 1-1	.: Subjec	t Site Location	1
Figu	ıre 4-1	.: Predic	ted L _{A10} Noise Levels dB	7
Figu	ıre 4-2	: Predic	ted L _{A1} Noise Levels dB	8

Appendices

Appendix A – Processing Facility Layout
Appendix B – Terminology

1. INTRODUCTION

Lloyd George Acoustics was engaged by Mineral Resources to undertake an environmental noise assessment for a proposed 250 TJ/d gas processing facility to be located at Lot 3558/25116 Midlands Road, Mount Horner WA - refer *Figure 1-1 (source Google Earth)*.

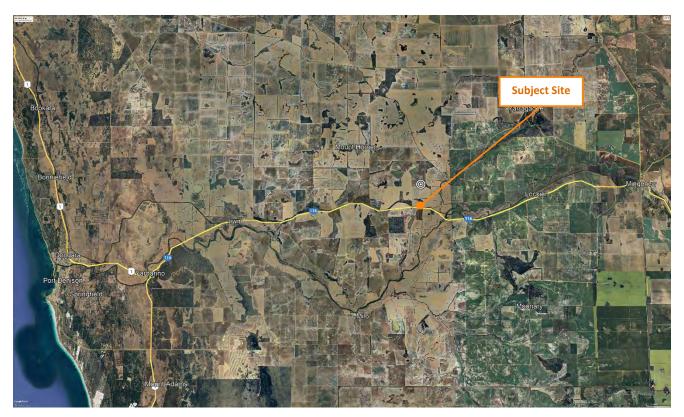


Figure 1-1: Subject Site Location

With regard to noise emissions, consideration is given to noise from the processing plant at neighbouring properties, and compared against the prescribed standards of the *Environmental Protection (Noise) Regulations* 1997.

Appendix B contains a description of some of the terminology used throughout this report.

2. CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

2.1. Regulations 7, 8 & 9

This group of regulations provide the prescribed standard for noise as follows:

"7. Prescribed standard for noise emissions

- (1) Noise emitted from any premises or public place when received at other premises
 - (a) must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and
 - (b) must be free of -
 - (i) tonality; and
 - (ii) impulsiveness; and
 - (iii) modulation,

when assessed under regulation 9.

(2) For the purposes of subregulation (1)(a), a noise emission is taken to significantly contribute to a level of noise if the noise emission ... exceeds a value which is 5 dB below the assigned level at the point of reception."

Tonality, impulsiveness and modulation are defined in regulation 9. Under regulation 9(3), "Noise is taken to be free of the characteristics of tonality, impulsiveness and modulation if -

- (a) the characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and
- (b) the noise emission complies with the standard prescribed under regulation 7(1)(a) after the adjustments in the table [Table 2-1] ... are made to the noise emission as measured at the point of reception."

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where	Noise Emission is Not	Where Noise Emission is Music		
Tonality	Tonality Modulation Impulsiveness		No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

^{*} These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noises present for more than 10% of a representative assessment period, generally applicable to "steady-state" noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Doc Number: LGP-0000-EN-REP-000005

Table 2-2 Baseline Assigned Levels

Premises Receiving	Time 01 Page	Assigned Level (dB)				
Noise	Time Of Day	L _{A10}	L _{A1}	L _{Amax}		
	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor		
Noise sensitive	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing 50 + influencing factor factor		65 + influencing factor		
premises: highly sensitive area ¹	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor		
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor		
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80		
Commercial Premises	All hours	60	75	80		
Industrial and Utility Premises	All hours	65	80	90		

^{1.} *highly sensitive area* means that area (if any) of noise sensitive premises comprising —

As all the land surrounding the proposed processing facility is rural and away from any commercial or industrial land uses, the influencing factor (IF), in relation to noise received at noise sensitive premises, has been calculated as 0 dB. Therefore, it is the baseline levels provided in *Table 2-2* that are applicable.

It must be noted the assigned levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

The Regulations define the Representative Assessment Period (RAP) as "a period of time of not less than 15 minutes, and not exceeding 4 hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission". An inspector or authorised person is a person appointed under Sections 87 & 88 of the Environmental Protection Act 1986 and include Local Government Environmental Health Officers and Officers from the Department of Water Environmental Regulation. Acoustic consultants or other environmental consultants are not appointed as an inspector or authorised person. Therefore, whilst this assessment is based on a 4-hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

⁾ a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and

⁽b) any other part of the premises within 15 metres of that building or that part of the building.

3. METHODOLOGY

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 9.0* with the CONCAWE algorithms selected, as they include the influence of meteorological conditions. Input data required in the model are listed below and discussed in *Section 3.2.1* to *Section 3.2.4*:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1.1. Meteorological Conditions

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation, which would occur during the night period. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1: Modelling Meteorological Conditions

Parameter	Night (7.00pm to 7.00am) ²
Temperature (°C)	15
Humidity (%)	50
Wind Speed (m/s)	3
Wind Direction ¹	All
Pasquil Stability Factor	F

Notes:

3.1.2. Topographical Data

Topographical data was adapted from publicly available information (e.g. *Google*) in the form of spot heights and combined with the site plan.

3.1.3. Ground Absorption

The ground absorption has been assumed to be 0.0 (0%) for the processing area and 0.75 (75%) elsewhere, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass. Using a value of 75% allows for times after harvesting, where the ground may not be covered with crops (i.e. soft ground).

Doc Number: LGP-0000-EN-REP-000005

^{1.} The modelling package allows for all wind directions to be modelled simultaneously.

^{2.} The conditions above are as defined in *Guideline: Assessment of Environmental Noise Emissions*; May 2021

3.1.4. Source Sound Levels

The source sound power levels of the processing plant assumed in the modelling are provided in *Table 3-2*. The processing plant layout is provided in *Appendix A*.

Table 3-2: Source Sound Power Levels, dB

	Octave Band Centre Frequency (Hz)							Overall	
Description	63	125	250	500	1k	2k	4k	8k	dB(A)
Amine Pumps	75	83	87	96	102	99	91	82	105
Compressor > 1750 KW (enclosed)	57	68	77	80	88	89	84	76	93
Condensation Cooler	89	97	96	97	95	93	88	71	103
Cooler Bed	84	92	91	92	90	88	83	66	98
Electric Pump	58	73	83	86	83	86	86	71	92
Inlet Cooler Fan	59	67	66	67	65	63	58	41	73
Inlet Separator				95					95
Methane Gas Flare Discharge	103	97	111	114	110	114	115		120
Methane Gas Flare Normal	76	70	84	87	83	87	88		93
Reciprocating Engines (enclosed)	64	71	78	83	90	89	79	71	93
Reflux Pumps	63	71	75	84	90	87	79	70	93
Slug Catcher				92					92
Engine Exhaust	72	76	73	76	80	80	71	58	85
Dew Point Controllers (JT Jet)				95					95
Launchers/Receivers				92					92
Workshop	46	61	73	89	92	93	88	76	97

The following is noted in relation to *Table 3-2*:

- Sound power levels provided by Mineral Resources;
- Modelling assumes all plant is operating simultaneously;
- The noise data for all sources representative of its L₁₀ level (except methane gas discharge);
- ullet The methane gas discharge is representative of the L_1 level; and
- The assumed enclosures for the compressors and engine is to ensure compliance with occupational health and safety standards of 85 dB(A) at 1 metres. This assessment does not assume any specific design or use of the enclosures.

4. RESULTS

The noise levels were predicted for two scenarios, being the L_{A10} levels representative of normal operations and the L_{A1} level, being during a gas flare discharge. The results are presented in *Table 4-1* and *Figures 4-1 and 4-2* respectively.

Table 4-1: Predicted Noise Levels, dB(A)

Receiver	Predicted L _{A10} Noise Level dB	Controlling L _{A10} Criterion	Predicted L _{A1} Noise Level dB	Controlling L _{A1} Criterion	Comment
6 Strawberry North- East Road	30	35	34	45	Compliant with assigned levels at all times
390 Strawberry North- East Road, Lockier	30	35	35	45	Compliant with assigned levels at all times
3983 Burma Road, Mount Horner	23	35	27	45	Compliant with assigned levels at all times
25033 Midlands Road, Milo	22	35	27	45	Compliant with assigned levels at all times
25116 Midlands Road, Mount Horner	35	-	39	-	Premises on same property so Regulations do not apply

983 Burma Road, MOUNT HORN 390 Strawberry North-East Road, LOCK 25116 Midlands Road, MOUNT HORNER 6 Strawberry North-East Road, LOCKIE

Figure 4-1

Signs and symbols



Sensitive Receiver

Noise Source



Length Scale





Lockyer Gas Processing Facility Predicted L_{A10} Noise Levels from Processing Plant Wind from All Directions

SoundPlan v8.2 CONCAWE Algorithms

8 December 2023

3983 Burma Road, MOUNT HORNE 52 90 Strawberry North-East Road, LOCK 25116 Midlands Road, MOUNT HORNER 35 0 6 Strawberry North-East Road, LOCKIE

Figure 4-2

Signs and symbols

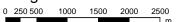


Sensitive Receiver

Noise Source



Length Scale





Lockyer Gas Processing Facility Predicted L_{A1} Noise Levels from Processing Plant Wind from All Directions

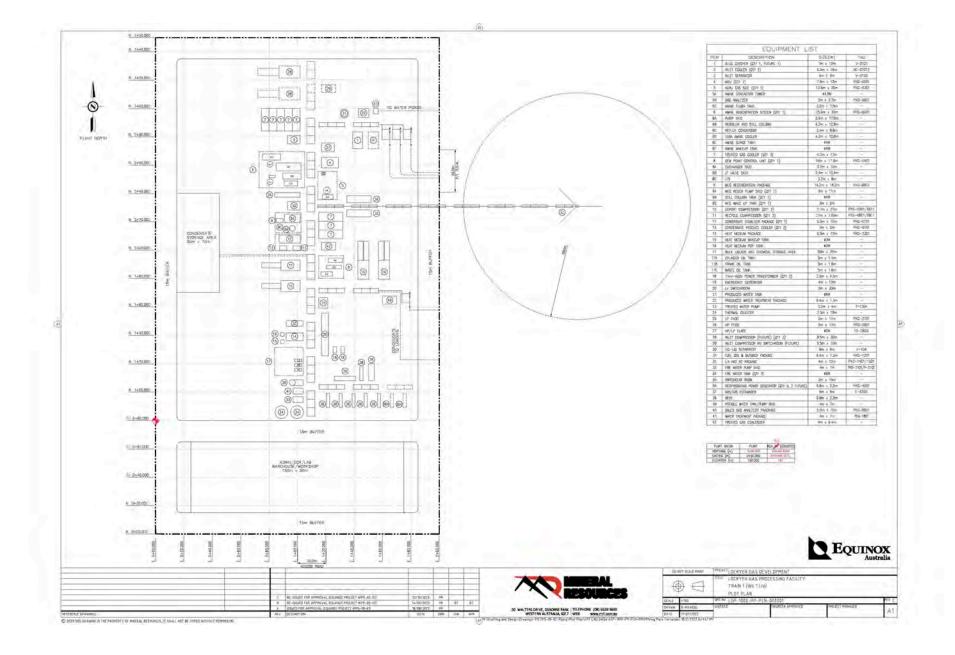
SoundPlan v8.2 CONCAWE Algorithms

8 December 2023

5. RECOMMENDATIONS & CONCLUSION

The predicted noise levels presented in *Section 4*, shows that the noise levels from the Lockyer Gas Development Project can comply with the assigned levels prescribed within the *Environmental Protection* (*Noise*) *Regulations 1997*, at all adjacent noise sensitive premises.

Appendix A – Processing Facility Layout



Appendix B – Terminology

The following is an explanation of the terminology used throughout this report:

Decibel (dB)

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

Sound Power Level (L_w)

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure level at known distances. Noise modelling incorporates source sound power levels as part of the input data.

Sound Pressure Level (Lp)

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc. and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

Laslow

This is the noise level in decibels, obtained using the A-frequency weighting and the S (slow) time weighting. Unless assessing modulation, all measurements use the slow time weighting characteristic.

L_{AFast}

This is the noise level in decibels, obtained using the A-frequency weighting and the F (fast) time weighting. This is used when assessing the presence of modulation.

L_{APeak}

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

L_{Amax}

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{A1}

The L_{A1} level is the A-weighted noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}

The L_{A10} level is the A-weighted noise level exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

L_{A90}

The L_{A90} level is the A-weighted noise level exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

L_{Aeq}

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

One-Third-Octave Band

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

Representative Assessment Period

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

L_{Amax} assigned level

Means an assigned level, which, measured as a LASIOW value, is not to be exceeded at any time.

L_{A1} assigned level

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 1 percent of the representative assessment period.

L_{A10} assigned level

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 10 percent of the representative assessment period.

Tonal Noise

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

- the presence in the noise emission of tonal characteristics where the difference between -
 - (a) the A-weighted sound pressure level in any one-third octave band; and
 - (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A Slow}$ levels.

This is relatively common in most noise sources.

Modulating Noise

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

- a variation in the emission of noise that
 - (a) is more than 3 dB L_{A Fast} or is more than 3 dB L_{A Fast} in any one-third octave band; and
 - (b) is present for at least 10% of the representative assessment period; and
 - (c) is regular, cyclic and audible.

Impulsive Noise

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness means:

a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} is more than 15 dB when determined for a single representative event.

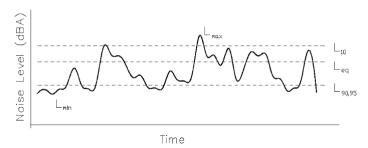
Major Road

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

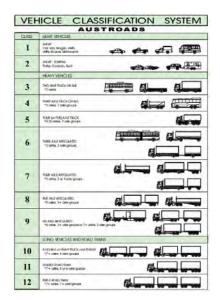
Secondary / Minor Road

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

Chart of Noise Level Descriptors



Austroads Vehicle Class



Typical Noise Levels

