envirotech
Environmental and Engineering
Consultancy Services

PO Box 3086 East Blaxland NSW 2774
P: 1300 888 324 **F:** 02 8834 0760
W: www.envirotech.com.au
E: info@envirotech.com.au

ACOUSTIC ASSESSMENT

134 Old Bathurst Road, Emu Plains NSW 2750

PREPARED FOR:	Vince Hardy
OUR REFERENCE:	REF-19-8489-A
ISSUE DATE:	27th August 2019

CONTROLLED DOCUMENT

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DOCUMENT HISTORY		
Document No.	Revision No.	Issue Date
19-8489	A	27/08/2019

AUTHOR	TECHNICAL REVIEWER
	
Howe Chen B. Eng (Civil) Civil Engineer	Daniel Mathew Environmental Engineer / Managing Director B.Eng. (ENV.)(Hons.)

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1. INTRODUCTION

EnviroTech has been requested by Vince Hardy to undertake an acoustic assessment for the change of use to production of polymer concrete production, internal alteration and refurbishment of existing factory as well as extension in operation hours at 134 Old Bathurst Road, Emu Plains NSW 2750 (hereafter referred to as the site).

The purpose of this assessment is to accurately predict potential noise levels generated by the proposal and to assess the impact of these noise levels on the nearest industrial/residential receptors, in accordance with the NSW Government's relevant noise criteria.

This assessment has been prepared in accordance with:

- NSW Protection of the Environment Operations Act 1997 (POEO Act)
- Environmental Planning and Assessment Act (1979)
- Noise Policy for Industry (2017)
- The Noise Guide for Local Government (DECCW, 2009)
- State Environmental Planning Policy (Infrastructure) 2007
- NSW Department of Planning "Development near rail corridors and busy roads" 2008
- Assessing Vibration: a technical guideline (DECC 2006).
- Building Code of Australia

Proposal

The study site is at 134 Old Bathurst Road, Emu Plains NSW 2750 (Lot 31 in DP 1005063). The layout of the site and surrounding land use is illustrated in Figure 1. It can be identified as an irregular shaped allotment on Old Bathurst Road. The proposal is for the change of use of the premise with alterations and refurbishment of the existing factory as well as a proposed extension in operation hours. In accordance with the EPAs Industrial Noise Policy (INP), the surrounding noise amenity of the site is classified as Industrial/Residential.

Figure 1: Aerial photograph of the site (Sixmap, 2018). Red star indicates logger placement.

Table 2: Hours of operation, as intended by the proposed development

Activity	***Hours of operation***
Concrete Production – Polyester	5:00 am – 5:30 pm
Metal Fabrication	6:00 am – 2:30 pm
Truck Movement Warehouse	7:00 am – 5:00 pm
Plastic Rotation Moulding	5:00 am – 11:00 pm

The facility currently have 100 staff in all its departments and this will increase to 120 following the proposal. The proposal is to be located within a current industrial area in Emu Plains. There are a number of neighboring industrial receptors in the vicinity of the site. The closest industrial property boundary from the proposed is 88m to the south of site. The nearest residential property boundary is located approximate 230m north-east of the site.

2. NOISE ASSESSMENT CRITERIA

This section reviews the NSW Government criteria for other noise sources and developments. These may be used as a basis for realistic noise goals from meeting halls to residential receivers.

NSW Government Criteria

The NSW Government, via the Office of Environment & Heritage provides guidelines for many industrial, commercial and domestic types of noise sources. The primary aim of environmental noise control is to minimise the occurrence of offensive noise in the community.

Offensive noise is defined in the NSW Protection of the Environment Operations Act 1997 (POEO Act) as being noise:

a) That, by reason is of its level, nature, character or quality, or the time at which it is made, or other circumstances:

i. is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

ii. interferes unreasonably with (or is likely to Interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

b) That, is of a level, nature, character or quality prescribed by the regulations or that is made at a time or in other circumstances, prescribed by the regulations.

The NSW Government also state that social surveys have indicated that noise from any particular source will be audible to many people in the community when that noise exceeds the background level by more than 5 decibels (dB). The noise may have characteristics which are pleasant or unpleasant to the listener.

Technically the background is found from the noise level that is present for 90% of the time of the measurement periods (usually 15 minutes each) and this is known as the LA90, 15 minute.

The source noise is found from the 'equivalent continuous A-weighted sound pressure level' (again usually 15 minutes samples), which is known as the LAeq, 15 minute.

The Noise Guide for Local Government

The Noise Guide for Local Government published by the NSW Department of Environment, Climate Change and Water (2004 updated 2009) states:- *'A noise source is generally considered to be intrusive if noise from the source, when measured over a 15 minute period exceeds the background noise by more than 5 dB'*. It is assessed at the most affected point on or within the neighbouring residential property (unless that residence is more than 30 metres from the boundary). Intrusive noise can represent offensive noise. However, it is stated in the Noise Guide for Local Government that this is not always the case and it can depend upon the source of the noise, noise characteristics and cumulative noise levels.

Noise Policy for Industry

The Noise Policy for Industry 2017 is used to assess noise from industrial noise sources, scheduled under the Protection of the Environment Operations Act 1997. This is a statutory document referred to by consultants when attempting to control short-term intrusive impacts upon sensitive receptors (i.e. nearby residents), and when attempting to maintain noise level amenities for particular land uses.

In accordance with the NPI, there are two criteria which need to be considered when assessing industrial noise. These are:

1) Intrusive Noise Criterion
2) Noise Amenity Criteria.

Both of these criterions need to be satisfied under the NPI. In this situation the cumulative impact over the day and evening periods would be significantly less than the peak periods which would cover continuous activity over any one 15 minute period. Therefore, the Amenity Noise Criterion would be the most stringent of the two noise criteria.

Intrusive Noise Criterion

The NSW Government in their Industrial Noise Policy (2000), states that: - *'The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the LAeq descriptor) measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB.'* Thus, when considering the environmental consequence of noise from a specific source, any increase above the background sound pressure level, which exceeds 5 dB, may be offensive. Again, it is assessed at the most affected point on or within the neighbouring residential property (unless that residence is more than 30 metres from the boundary).

The NSW Government state that where the existing background noise level at the receptor is less than 30 dBA, as may occur in a quiet suburban or rural area**,** then 30 dBA should be assumed to be the existing background noise level.

The intrusiveness criterion is primarily used to limit short term noise impacts, and is summarized as follows:

$$L_{Aeq,\ 15\ minutes} \leq \textit{rating background noise level} + 5dB$$

The intrusiveness of an industrial noise source is generally considered acceptable if the equivalent continuous (A weighted) noise level $L_{Aeq,\ 15\ minutes}$ does not exceed the rated background noise level by more than 5dB(A).

Noise Amenity Criteria

The Noise Amenity Criteria is used to limit the potential of noise annoyance over longer periods, which may occur as a result of continual increases in background noise.

The Noise Policy for Industry states that 'To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable.

TABLE 3 – RECOMMENDED NOISE LEVELS FROM INDUSTRIAL AND RESIDENTIAL NOISE SOURCES.

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended LAeq Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	**50**	**55**
		Evening	**45**	**50**
		Night	**40**	**45**
	Suburban	Day	**55**	**60**
		Evening	**45**	**50**
		Night	**40**	**45**
	Urban	Day	**60**	**65**
		Evening	**50**	**55**
		Night	**45**	**50**
	Urban/Industrial Interface – for existing situations only	Day	**65**	**70**
		Evening	**55**	**60**
		Night	**50**	**55**
School Classroom - Internal	All	Noisiest 1-hour period when in use	**35**	**40**
Active Recreation Area (e.g. playground)	All	When in use	**55**	**60**
Commercial premises	All	When in use	**65**	**70**
Industrial premises	All	When in use	**70**	**75**

Notes:

- Daytime is defined as between 07:00 hours and 18:00 hours
- Evening time is defined as between 18:00 hours and 22:00 hours
- Night time is defined as between 22:00 hours and 07:00 hours

Vibration

Human Comfort

Criteria for assessment of the effects of vibration on human comfort are set out in British Standard 6472-1992. Methods and criteria in that Standard are used to set "preferred" and "maximum" vibration levels in the document "Assessing Vibration: A Technical Guideline" (2006) produced by the NSW EPA.

Acceptable values of human exposure to continuous vibration, such as that associated with drilling, are dependent on the time of day and the activity taking place in the occupied space (e.g. workshop, office, residence or a vibration-critical area). Guidance on preferred values for continuous vibration is set out below in Table 4

Table 4: Acceptable vibration dose values for intermittent vibration (m/s $^{1.75}$)

Table 2.4 Acceptable vibration dose values for intermittent vibration (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

1 Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am.

Criteria for building structures

When assessing potential vibration impacts on building structures, the velocity and direction of the movement is measured. The measurement is referred to as the Peak Particle Velocity (PPV), presented in mm/s.

Vibration from construction activities, with regard to building damage, is assessed using the German standard DIN 4150: Part 3 – 1999 *Effects of Vibration on Structures* (DIN Guideline). The DIN Guideline values for PPV measured at the foundation of various structures are summarised in Table 5 below.

Table 5: Guideline Values of vibration velocity for evaluating the effects of vibration.

Type of structure	Guideline values for velocity, vi (mm/s)			
	Vibration at the foundation at a frequency of:			Vibration at horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (eg heritage structures / buildings that are under a preservation order)	3	8 to 10	8 to 10	8
* For frequencies above 100Hz, at least the values specified in this column shall be applied				

From the guidelines outlined above the following vibration criteria have been determined for the Project.

Type of structure	Guideline values for velocity, vi (mm/s)			
	Vibration at the foundation at a frequency of:			Vibration at horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*	
Buildings used for commercial purposes, industrial buildings and buildings of similar	20	20 to 40	40 to 50	40

3. BACKGROUND & AMBIENT NOISE MEASUREMENTS

1.	Determination Method:	Long-term continuous sampling
2.	Noise Logger Location:	See Site Plan, Figure 1
3.	Survey Period:	13th August 2019 (11:30am) – 19th August 2019 (1:30pm)
4.	Assessment Time Period:	All Times
5.	Monitoring Conditions:	No adverse weather conditions No unusual circumstance or activities
6.	Instrumentation:	'ARL' - Type 1 Environmental Noise Logger (Rion NL-42) (Serial number 117376), This instrument conforms to Australian Standard 1259 "Acoustics - Sound Level Meters", (1990) and has an accuracy suitable for both field and laboratory use. The logger was set for the 'A' frequency weighting and 'fast' time weighting.
7.	Calibration:	The environmental noise logger and calibrator have been checked, adjusted and aligned before and after the measurement period, to conform to the Bruel and Kjrer or RTA factory specifications. Both have been issued with conformance certificates within the last 24 months as required by the regulations. The internal test equipment used is traceable to the National Measurement Laboratory at C.S.I.R.O., Lindfield, NSW, Australia. No significant system drift occurred over the measurement periods. Current calibration certificate in appendix

8. Results:

The recorded LA90 levels determine the Rating Background Level (RBL). The RBL is defined as the median value of the tenth percentile value for the recorded LA90 levels for the complete monitoring period. The tenth percentile is also referred to as the Assessment Background Level (ABL).

The resultant RBL (LA90) and ambient (LAeq) levels for each period are summarised below in Table 6. Appendix A contains a geographical presentation of the background noise levels generated from the monitoring period.

TABLE 6 – Summary of existing noise levels.

Time of Day	*Rating Background Noise Level (L90) dBA*	*Log Average Existing Ambient Noise Levels (LAeq) dBA*
Day (7am – 6pm)	56.3	64.4
Evening (6pm – 10pm)	49.0	57.8
Night (10pm – 7am)	43.2	47.5

4. NOISE GOALS

As discussed above the assessment procedure given in the Industrial Noise Policy (2017) has two components: Controlling intrusive noise impacts and maintaining noise level amenity. Based on existing ambient noise levels, site specific intrusiveness criterion noise goals from this proposal should not exceed a LAeq level of 61.3 dBA (56.3 + 5 – intrusive noise criterion) for the daytime. The intrusiveness criterion noise goals from this proposal should not exceed a LAeq levels of 54 dBA for the evening and 48.2 dBA for the night. These are shown in the table below:

TABLE 7 – Noise goal for the proposed landscape supply yard on neighboring receivers

Time Of Day	***Intrusiveness Criterion***	***Amenity Criteria***
Day Time	61.3dBA (LAeq,15min)	**55 dBA LAeq,**
Evening	54.0dBA (LAeq,15min)	**45 dBA LAeq,**
Night	48.2dBA (LAeq,15min)	**40 dBA LAeq,**

Notes:

The criteria in **BOLD** apply being the lower of either the Intrusiveness Criterion or the Amenity Criterion;

TABLE 8 – Noise goal for the Neighboring Industrial Premises.

Time Of Day	***Amenity Criteria***
All Times	**70 dBA** LAeq

5. NOISE SOURCE MODELS

This section provides details of the calculations used for predicting noise levels and the resulting noise levels at the potentially affected residential receptors. The below calculation is of a worst case scenario if all noise generating sources emitting noise at the one time. Whilst this maybe highly unlikely it is best practice to calculate and model this scenario to show noise compliance at neighboring receivers whilst the proposed is at full noise capacity.

Predicted Noise Levels

The major noise sources for the proposed are listed below.

Vehicle Movements up to 12 Vehicles per Working Day (5 Heavy Vehicles inclusive of B-double Trucks and Semi-Trailer and 7 Commercial Vans/Pantech Type Vehicles) – 95 dBA
Forklift (Noise level of standard Nissan 25, 2.5T diesel, Model FJ02A250 used) – 88 dBA
Moulding Equipment – 98 dBA
Sweeping Machine – 92 dBA
Staff x 10 talking loudly at the same time – 80 dBA

The below calculation was determined on a worst-case scenario of all the staff talking and all of the noise generating sources in use.

Total 15 minute average - Daytime	**100.6 dBA**

The calculated maximum worst case noise level of the proposed is 100.6 dBA.

Carpark

The below calculation was determined on a scenario of 10 cars starting at the same time within the carpark.

Total 15 minute average for 10 cars starting	**90 dBA**

Ten cars were modelled as although there are 60 parking spaces and 120 proposed employee , it would be a highly unlikely and infrequent situation that all 60 cars were started at the same time unless an emergency occured.

Predicted External Noise Levels

The source noise has been modelled using the International Standard ISO 9613-2 (1996(E)) 'Acoustic - Attenuation of sound during propagation outdoors Part 2 General method of calculation '. This Standard specifies methods for the description of noise outdoors in community environments. The method described in the Standard is general in the sense that it may be applied to a wide variety of noise sources, and covers the major mechanism of attenuation. The method allows for downwind propagation conditions namely:

- Wind direction within an angle of ± 45° of 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,
- Wind speed between approximately 1 m/s and 5 m/s measured at a height of 3 m to 11 m above the ground.

Basic Noise Modelling Equations

The equivalent continuous downwind sound pressure level (LAeq) at each receiver point has been calculated using the equation below:-

$$L_{Aeq} = (L_{Aeq,\,int} + 10 \log_{10} S - R) - 14 + D_c - A$$

Where:

- $L_{Aeq,\,int}$ is the reverberant noise level within the building;
- S is the area of the building envelope radiating noise;
- R is the sound reduction index of the building envelope component;
- D_c is directivity correction; and
- A is the attenuation that occurs during the propagation from source to receiver.

The attenuation term A in the equation above is given by:-

$$A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc}$$

Where:

- A_{div} is the attenuation due to geometric divergence;
- A_{atm} is the attenuation due to atmospheric absorption;
- A_{gr} is the attenuation due to the ground effects;
- A_{bar} is the attenuation due to a barrier; and
- A_{misc} is the attenuation due to miscellaneous other effects.

6. NOISE ASSESSMENT

The calculation of noise emission to the environment takes into account the surface area of the development radiating noise, the sound reduction index of the structural component and distance to the receiver location. The distance is measured from the proposed noise sources to the nearest industrial and residential receivers.

The distance from the center of the polymer concrete production factory to the nearest industrial property boundary to the south of site is 88m.

100.6 – 20 LOG (88 / 1) = **61.7 dBA**
61.7 dBA < 70 dBA

Therefore, without any attenuation measures of the proposed building considered, the noise output from the polymer concrete production factory meets the industrial noise goals for the subject site.

The distance from the center of the polymer concrete production factory to the nearest residential property boundaries to the north-west of site is 230m.

100.6 – 20 LOG (230 / 1) = **53.4 dBA**
53.4 – 40 = **13.4 dBA**

Therefore, the minimum required 'Weighted Sound Reduction Index (Rw) from the proposed polymer concrete production factory to the nearest residential property boundary is **8.4 dBA** during the evening and **13.4 dBA** during the night. No attenuation will be required during the daytime.

The attenuation that is required can be provided via the building materials of the factory. The external walls of the factory consists of external cladding/single brick leaf or equivalent; followed by what is taken as typical timber studwork, insulation and plasterboard. A brick veneer wall of 110mm clay brick, followed by 35mmx70mm studwork with 20mm internal air-gap, minimum density insulation and 13mm plasterboard will achieve a weighted reduction value of 50 dBA. The roof construction of the factory consists of corrugated aluminum roofing sheets providing attenuation of 30 dBA, far greater than the required 13.4 dBA.

On-Site Vehicle Noise – Carpark

The nearest industrial sensitive noise receptor is located 82m to the west of the carpark for the factory.

90 – 20 LOG (82 / 1) = **51.7 dBA**
51.7 dBA < 70 dBA

Therefore, without any attenuation measures of the proposed building considered, the noise output from the carpark meets the industrial noise goals for the subject site.

The nearest residential sensitive noise receptor is located 212m to the north-west of the carpark for the factory.

90 – 20 LOG (212 / 1) = **43.5 dBA**

Therefore, the minimum required 'Weighted Sound Reduction Index (Rw) from the carpark to the nearest residential property boundary is **3.5 dBA** during the night. No attenuation will be required during the daytime or evening.

The attenuation that is required will be provided via the vegetation, trees and industrial buildings between the carpark and the nearest residential receiver.

Road Traffic Noise

The NSW Road Policy (2011) is applicable to the subject development and applies different noise limits dependent upon the development category and receptor type.

Land use developments with potential to create additional traffic on local roads	Day 7am – 10pm dBA **LAeq(1hr)55**	Night 10pm – 7am dBA **LAeq(1hr)50**	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dBA.

The potential traffic arising from the development will not lead to an increase in existing noise levels of more than 2 dB. The increase in noise levels of traffic can be calculated using the following formula suggested within the NSW Road Policy: Log_{10} (Future Traffic/Existing Traffic) per hour. This development will not lead to an increase in existing noise levels of more than 2 dBA.

With the recommendations correctly implemented, as specified above, the activities from within the proposal **are** predicted to be noise compliant at the neighboring industrial/residential properties.

7. CONCLUSION

The acoustic assessment of the proposed change of use to a polymer concrete production factory including internal alterations/refurbishment and extension in operation hours at 134 Old Bathurst Road, Emu Plains NSW 2750 has determined that the noise generated will be negligible without any attenuation recommendations.

A sound reduction of 13.4 dBA is required for the predicted worst case scenario of noise generating activities from the factory and 3.5 dBA is required for the carpark after calculations were finalised. These reductions will be met by the building materials of the factory along with existing vegetation situated between the subject site and nearest residential receiver.

It is concluded that the polymer concrete production factory and proposed extension in operation hours is predicted to comply with the relevant noise goals.

8. GRAPHED DATA

Measured noise levels.