

Orora B9 June monitoring

ORORA GROUP

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Contents

Glossary	1
1. Introduction.....	4
1.1. Background.....	4
1.2. Objective.....	4
1.3. Monitoring limitations	4
2. Operational noise limits.....	6
3. Operational noise monitoring	7
3.1. Monitoring results	7
3.2. Comparison with previous monitoring.....	9
3.3. Discussion of results.....	9
3.4. Background noise levels.....	10
4. Summary and recommendations.....	11

Glossary

Acoustic and vibration related terms:

- **Acoustic Spectrum:** A representation of a sound sample (usually short term) of the amount of energy or sound level per frequency.
- **Ambient Noise:** Ambient noise encompasses all sound present in a given environment, being usually a composite of sounds from many sources near and far.
- **CONCAWE:** noise modelling algorithm to predict the geographical propagation of noise from various noise sources
- **CoRTN:** Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3, UK Department of Transport 1988)
- **dB(A):** A unit of sound measurement which has frequency characteristics weighted so that it approximates the response of the human ear to sound waves
- **ENMM:** Environmental Noise Management Manual (RMS, 2001)
- **eVDV:** Is the estimated vibration dose for predicting an assessing human comfort exposure, measured as $ms^{-1.75}$
- **Heavy Vehicle:** A truck, transport or other vehicle with a gross vehicle weight above a specified level (for example: over 8 tonnes)
- **L_{A10}:** Descriptor used to define noise level which is exceeded 10 per cent of the time and is to the average of maximum noise levels
- **L_{A10 (18hr)}:** Is the arithmetic average of the L_{10(1hr)} levels for the 18-hour period between 0600 and 2400 hours on a normal working day.
- **L_{A90}:** Is the noise level that is exceeded 90 per cent of the measurement time. This parameter is commonly referred to as the background noise level
- **L_{Aeq}:** Noise level that represents the energy average noise from the source during a specified time period, and is the equivalent continuous sound pressure level for a given period
- **L_{Aeq(15hr)}:** The L_{eq} noise level for the period from 7 am to 10 pm.
- **L_{Aeq(9hr)}:** The L_{eq} noise level for the period from 10 pm to 7 am.
- **NCA:** Noise Catchment Area. Grouping dwellings or receivers together in terms of similar noise environment.
- **Noise barrier:** Generally a wall or an earth mound that obstructs or restricts the passage of sounds waves from a noise source
- **Noise Logger:** A data logging (data and audio in some cases) which records noise. Usually used for unattended noise monitoring of background or ambient noise.
- **NML:** Noise Management Level as detailed in the NSW Interim Construction Noise Guideline. The NML is the noise goal for construction activities.
- **Octave Bands:** Sounds that contain energy over a wide range of frequencies are divided into sections called bands. A common standard division is in 10 octave bands identified by their center frequencies 31.5, 63, 250, 500, 1000, 2000, and 4000 Hz
- **PPV:** Peak Particle Velocity is used to measure vibration through a solid surface. When a vibration is measured, the point at which the measurement takes place can be considered to have a particle velocity. This particle vibration will take place in three dimensions (x, y and z) and will usually end up back where it started. The Peak Particle Velocity is the maximum velocity that is recorded during a particular event.

- **RBL:** *Rating Background Level is the overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used for determining the appropriate construction noise criteria.*
- **RNP:** *Road Noise Policy (OEH, 2011)*
- **Sound Level Meter:** *An instrument consisting of a microphone, amplifier and data analysis package for quantifying and measuring noise.*
- **Sound Power Level (L_w):** *Sound power level or acoustic power level is a logarithmic measure of the sound power in comparison to a specified reference level.*
- **Sound Pressure Level (SPL or L_p):** *The level of noise, usually expressed in dB(A), as measured by a standard sound level meter.*
- **VDV:** *Measured vibration dose value to indicate compliance with human comfort criteria*
- **Vibration:** *Vibration is a force which oscillates about some specified reference point. Vibration is commonly expressed in terms of frequency such as cycles per second (cps), Hertz (Hz), cycles per minute (cpm) or (rpm) and strokes per minute (spm). This is the number of oscillations which occurs in that time period. The amplitude is the magnitude or distance of travel of the force.*

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to report on the quarterly monitoring for the Orora Paper Machine B9 operational noise levels in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been produced based on the data sample taken during the field survey of noise and vibration impacts and the conclusions in this assessment reflect the limitations of this data set.

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1. Introduction

1.1. Background

In May 2012, Orora began constructing the new B9 Paper Mill at its Botany site in Sydney, NSW. The New Paper Mill replaces the two existing papermaking machines (No. 7 and No. 8) at the site, increasing paper making capacity from the previous 250,000 tonnes per year to around 345,000 tonnes per year.

The New Paper Mill is subject to operational noise conditions set out in Ministers Conditions of Approval (MCoA) (including subsequent modifications) and the Environment Protection Licence (EPL) No. 1594. As part of the EPL there is a requirement to undertake quarterly monitoring at receivers surrounding the site to show compliance with set noise limits. Also, as part of the MCoA, there is a requirement to undertake a 'noise validation study' to confirm that the noise emissions from the site match those predicted within the Environmental Impact Statement (EIS) and do not exceed the noise limits at each of the closest receivers set out in the MCoA and EPL.

At the time of preparing this report, the New Paper Mill has been operating for 14 months and is currently operating at 85% production. Traffic movements within the site are using the Botany Road entry and the McCauley Road exit as per the site traffic plan.

1.2. Objective

This report is an interim document addressing the noise emissions of the plant as it currently operates assists with determining the most appropriate methodology for undertaking future quarterly monitoring and the noise validation studies required by the MCoA.

The purpose of this document is to satisfy Condition M6.1 and M6.2 of EPL 1594:

- **M6.1** The licensee must undertake noise monitoring at least once every three months to check compliance with the noise limits specified in Condition L4.1.
- **M6.2** All monitoring required by this licence must be undertaken in accordance with Australian Standard 2659.1 – 1998: *Guide to the use of sound measuring equipment – Portable sound level meters*, or any revisions of that standard which may be made by Australian Standards Authority, and the compliance monitoring guidance provided in the *NSW Industrial Noise Policy*.

1.3. Monitoring limitations

The Orora site is located within a predominantly industrial area having residential properties located to the north and at the north eastern boundary. The local noise environment beyond the Orora boundary varies throughout the day depending on the contribution of sources such as high volume traffic and heavy vehicles using Botany Road, aircraft noise, port noise, local commercial noise and local traffic. Meteorological conditions also vary, particularly in the night period where temperature inversions may occur.

Direct monitoring of Orora noise is unlikely to provide an accurate determination of compliance as the noise level measurements at the monitoring locations include all audible sources during the day or night, not necessarily just the Orora operations. This means total measured noise, though potentially exceeding the criteria, may not be wholly due to Orora operations.

In the most recent noise monitoring survey, night time noise emissions from the Orora operations were the dominant source of audible noise at receiver locations; however the presence of conditions suitable for a temperature inversion were observed. This means an increase in measured noise levels occurs due to a layer of warm air over cold reflecting sound back towards the earth.

The sum of the above factors means that monitoring at receiver locations may result in an unacceptable level of uncertainty as to the actual level of noise contributed by the Orora operations. An alternative method to

demonstrate compliance is permitted under Condition 2 of the MCoA where the direct measurement of operational noise is not practical.

2. Operational noise limits

The operational noise limits for the new Orora Paper Mill are detailed in condition L4.1 of EPL 1594 and Condition 10 of the MCoA. These are replicated in **Table 1** with the location of receivers presented in **Figure 1**.

■ Table 1 Noise Limits

ID	Location	Day $L_{Aeq,15min}$, dB(A)	Evening $L_{Aeq,15min}$, dB(A)	Night $L_{Aeq,15min}$, dB(A)	Night L_{Amax} , dB(A)
R1	Cnr. McCauley Street and Australia Avenue	46	45	43	55
R2	Australia Avenue	45	45	43	55
R3	Murrabin Avenue	46	45	43	55
R4	Partanna Avenue	42	41	41	55
R5	Cnr. Partanna and Moorina Avenues	42	42	39	55
R6	Moorina Avenue	43	43	39	55

■ Figure 1 Compliance monitoring locations



3. Operational noise monitoring

3.1. Monitoring results

Attended noise monitoring was undertaken using a SVAN 958 Type 1 sound level meter at the receivers identified in **Table 1**. Monitoring during each period was undertaken for 15 minutes at each, as per the requirements of EPL 1594. Daytime monitoring was undertaken on July 4 between the hours of 12 pm and 2 pm. Weather conditions during the daytime monitoring were clear, a slight non directional breeze (approximately 0.5 ms^{-1}) and an air temperature of about 21°C .

Night time monitoring was completed on the night of July 3 between 10pm and 1 am. Weather conditions for the night time monitoring period were slight to moderate winds (less than about 1 ms^{-1}) with clear skies and air temperatures around 6°C . These conditions were ideal for temperature inversions during the night time, which is expected to have an impact on the monitoring results.

The results of the monitoring for the parameters of L_{Aeq} , L_{A90} and L_{Amax} , are presented in **Table 2**. An estimate of Orora's noise contribution to measured noise levels at each location has been provided as a subjective reference to assist in interpretation of the overall levels. These estimates are based on the perception of the operator at the time of monitoring judged against the composition and direction of the contributing sources.

■ Table 2 Operational noise monitoring results (15 minute samples)

ID	Location	Time period		Noise level dB(A)			% Orora Contribution	Identified noise sources
				L_{Aeq}	L_{A90}	L_{Amax}		
R1	92 Australia Avenue	Day	12:23	54.1	45.0	75.1	50%	<ul style="list-style-type: none"> - Bird song - Regular aircraft movements - Paper yard reversing beeper - Plant noise Orora - Traffic on Botany Road - Local road traffic - Truck movements Orora site
		Night	22:05	52.4	47.4	70.0	75%	<ul style="list-style-type: none"> - Paper yard reversing beeper - Aircraft movements - Traffic on Botany Road - Reverse quacker (Weighbridge) - Truck movements (McCauly St) - Distant traffic (Beauchamp Rd) - Local traffic
R2	Australia Avenue and Purcell Park	Day	12:42	49.1	43.4	68.9	50%	<ul style="list-style-type: none"> - Orora plant noise (boiler relief) - Aircraft movements - Bird song - Plant noise Orora - Traffic on Botany Road
		Night	23:46	53.6	50.0	60.4	80%	<ul style="list-style-type: none"> - Orora plant noise (boiler relief) - Plant noise Orora - Traffic on Botany Road - Paper yard reversing beeper - Truck movements Orora site - Reverse quacker (Weighbridge) - Traffic (Beauchamp Rd)
R3	Murrabin Avenue	Day	13:05	48.8	44.3	66.2	40%	<ul style="list-style-type: none"> - Plant noise Orora - Regular aircraft movements - Bird song - Traffic (Beauchamp Rd)

ID	Location	Time period		Noise level dB(A)			% Orora Contribution	Identified noise sources
				L _{Aeq}	L _{A90}	L _{Amax}		
								<ul style="list-style-type: none"> - Waste paper yard (quiet) - Truck movements Orora site
		Night	22:28	54.8	52.3	63.3	75%	<ul style="list-style-type: none"> - Plant noise Orora - Orora plant noise (boiler relief) - Aircraft movements - Reverse quacker (Weighbridge) - Paper yard reversing beeper - Truck movements (McCauly St) - Traffic on Botany Road
R4	Partanna Avenue	Day	13:28	49.2	43.8	69.2	30%	<ul style="list-style-type: none"> - Regular aircraft movements - Bird song - Plant noise Orora - Occasional reversing beeper - Distant Port noise - Traffic (Beauchamp Rd) - Truck movements Orora site
		Night	22:45	47.7	46.8	62.9	80%	<ul style="list-style-type: none"> - Orora plant noise (boiler relief) - Paper yard reversing beeper - Plant noise Orora - Daymaker (Orora B8) - Botany road traffic
R5	Cnr. Partanna and Moorina Avenues	Day	14:05	50.3	40.8	78.0	40%	<ul style="list-style-type: none"> - Regular aircraft movements - Plant noise Orora - Bird song - Botany road traffic - Distant Port noise - Occasional reversing beeper - Distant traffic
		Night	23:27	48.7	45.7	72.2	70%	<ul style="list-style-type: none"> - Paper yard reversing beeper - Orora plant noise (boiler relief) - Plant noise Orora - Botany road traffic - Port noise - Truck movements Orora site - Distant traffic (Beauchamp Rd)
R6	Moorina Avenue	Day	13:46	47.9	40.6	66.8	20%	<ul style="list-style-type: none"> - Regular aircraft movements - Bird song - Botany road traffic - Distant Port noise - Occasional reversing beeper - Plant noise Orora - Distant traffic
		Night	23:08	45.4	44.3	63.1	85%	<ul style="list-style-type: none"> - Orora plant noise (boiler relief) - Botany road traffic - Paper yard reversing beeper - General site clanging & crashes - Plant noise Orora - Distant Port noise

*Estimation of Orora operational noise to the L_{A90, 15min} level

The measured noise levels at night indicate a higher contribution of Orora operational noise to the total level. During any 24 hour period, the operations of the B9 plant remain fairly constant with the only significant variation being reduced truck movements at night. Any increase in audibility from the Orora operations has been attributed to the influence of a temperature inversion. This observation is corroborated by the monitoring results which indicate that the background noise levels at night were higher than the daytime background noise levels in all locations.

3.2. Comparison with previous monitoring

This report represents the most recent short term noise monitoring and should be considered in conjunction with other monitoring surveys for the site to build an overall picture of the noise environment.

Table 3 presents a comparison of noise levels measured during the corresponding survey last year (August 2013) at the same locations. Daytime noise L_{Amax} , L_{Aeq} and L_{A90} levels are generally lower across the board while night time L_{A90} noise levels show increases since the previous survey. Previous operating conditions were similar to the latest survey, at about 85% of capacity, but meteorological conditions of the previous survey did not report a temperature inversion during the night time monitoring.

- Table 3 Change in noise level from previous monitoring

ID	Location	Time	L_{Aeq} dB(A)	L_{A90} dB(A)	L_{Amax} dB(A)
R1	Cnr. McCauley Street and Australia Ave	Day	1	1	0
		Night	0	3	5
R2	Australia Ave	Day	-2	-2	2
		Night	0	4	-10
R3	Murrabin Ave	Day	-5	-3	-2
		Night	0	4	-5
R4	Partanna Ave	Day	-9	-3	-2
		Night	3	5	-5
R5	Cnr. Partanna Ave and Moorina Ave	Day	0	0	0
		Night	1	4	13
R6	Moorina Avenue	Day	-7	2	-9
		Night	-6	0	-3

3.3. Discussion of results

The L_{Aeq} noise level is affected to a greater degree by loud short-term noise levels such as bird noise or aircraft and vehicle movements. Considering general plant and equipment within the site operate at more or less a constant load, having little variability in noise emissions, this noise environment is most appropriately described using the L_{A90} statistical parameter, which has been considered in conjunction with the L_{Aeq} noise level when assessing compliance of the Orora site.

Observations during the survey indicated a large variety of acoustic influences at the monitoring locations and demonstrated that direct measurement of Orora operational noise is not practical, tending to overestimate the contribution from the Orora site when neutral weather conditions are present.

The likely presence of a temperature inversion increases the audibility of the Orora operations which, when combined with other noise sources in the area results in exceedances of the EPL noise goals. While the noise goals apply under light inversion conditions, the strength of the atmospheric inversion during the survey cannot be accurately determined.

During the latest daytime measurements, the Orora site is audible but not dominant at the closest receivers. At some locations, such as Moorina Avenue (R6), noise emissions from the site are only just audible. Compared to the previous night's measurements, L_{A90} noise levels are significantly lower during the daytime, which is contrary to general diurnal acoustic patterns.

During the night time, the observation made for the July monitoring period indicates that the Orora site was the dominant noise source, with specifically identifiable items of equipment such as the boiler pressure relief valve and a vehicle reversing beeper clearly audible. These observations are in contrast to other night time noise surveys where plant and equipment on the Orora site are not clearly audible from all locations.

The L_{Amax} noise levels at each measurement location was not attributed to the B9 paper mill or waste paper yard operations. The main source of maximum noise levels are generally the result of aircraft flyovers, animals such as dogs and birds or traffic movements on local roads.

3.4. Background noise levels

An indicator of the contribution of Orora operational noise to existing noise levels was provided by a noise survey in 2012 during a shutdown of the B7 and B8 paper machines and prior to commissioning of the B9 machine. A comparison of background noise levels has been made for the night period, which provides a suitable baseline of operational noise adjacent to the site.

This comparison has been extended to the most recent noise monitoring results to provide an historical and evolutionary picture of the noise environment at the nearby Port Botany residences. The data in **Table 4** provides an indication of the degree of variability in the noise environment at these locations. In particular, measurements recorded in July 2014 are representative of background noise levels resulting from adverse meteorology.

■ Table 4 Comparison of and background noise (rounded)

ID	Location	Criteria	Background Noise May 2012	Operational noise August 2013	Operational noise July 2014	Difference (operational noise vs. previous)
		Night $L_{Aeq,15min}$, dB(A)	Night $L_{A90,period}$	Night $L_{A90,15min}$	Night $L_{A90,15min}$	
R1	Cnr. McCauley Street and Australia Avenue	43	46	44	47	+3
R2	Australia Avenue	43	46	46	50	+4
R3	Murrabin Avenue	43	42	48	52	+4
R4	Partanna Avenue	41	41	42	47	+5
R5	Cnr. Partanna and Moorina Avenues	39	43	42	46	+4
R6	Moorina Avenue	39	43	44	44	0

From **Table 4** we see that background noise levels for the night time periods are generally 3-5 dB(A) higher than previously measured for a similar seasonal monitoring period. This increase in noise level is most likely attributable to the presence of a temperature inversion during the monitoring survey, and provides an indication of the inversion strength.

The exception to the general trend in the most recent results is the receiver location at R6. This location has a greater degree of shielding from direct noise emissions from the Orora site and also has a greater noise influence from other sources not associated with the paper mill.

4. Summary and recommendations

The operations of Orora B9 paper machine and site infrastructure have been the subject of several monitoring surveys since its commissioning in 2012. Measured noise levels at residential locations around the Orora site indicate a degree of variability.

The recent measured L_{Aeq} noise levels exceed the noise limits at all locations for the night time assessment periods. The daytime noise emissions measured at the receiver locations were below the limits in EPL 1594.

These exceedances are due to the combined influence of all noise sources within the Port Botany area surrounding the Orora site as well as the contribution from the paper manufacturer. This monitoring confirms that direct measurement of noise emissions from the Orora site do not provide conclusive data to support the case for compliance with the EPL.

A noise model for the site has been developed to provide detail on noise impacts of the B9 operations. This model is being further refined through continued noise monitoring campaigns for the site. Information from the monitoring and noise model is in turn used to identify potential benefits from a noise reduction program for the site.