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Penrith Regional Gallery - Kitchen Plant Noise Assessment

1 INTRODUCTION

This report presents our assessment of noise emissions generated by the proposed kitchen plant at the Penrith Regional Art Gallery.

There are two units – an exhaust fan and an evaporative cooler. The units could operate between the hours of 8am and 3:30pm.

The potential noise impact at the nearby properties and on the Gallery from the operation of the facility has been assessed by:

- Predicting the noise levels at the nearest residential properties and in the Gallery based on manufacturer's data.
- Comparing the noise levels generated by the plant to criteria (for the residences) determined using EPA Industrial Noise Policy Guidelines, using background noise levels established from previous long term unattended noise monitoring. Assessing the noise level within the Gallery based on noise levels determined to be suitable based on Australian Standards and previous experience.
- Determining whether the noise levels comply with the noise assessment criteria and recommending treatment to reduce noise levels where they would exceed the criteria.

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Source: Google Maps

Figure 1 – Site Plan Showing Plant and Monitoring Location

2 EXISTING CONDITIONS

2.1 LOCAL NOISE SOURCES

Existing ambient noise levels are dominated by transportation noise from vehicles using the surrounding streets and local industrial/commercial noise.

2.2 NOISE MONITORING

Long term unattended noise monitoring was conducted in order to characterise the existing noise environment at the nearest potentially affected receiver.

2.2.1 Locations Monitored

Unattended noise monitoring was conducted on the gallery site as indicated in Figure 1. This location was selected as being representative of background noise levels experienced by the nearest potentially affected residential receivers in the absence of noise generated by the plant.

2.2.2 Environmental Noise Levels

Environmental noise constantly varies in level, due to fluctuations in local noise sources including road traffic. Accordingly, a 15 minute measurement interval is normally utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In the case of environmental noise three principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source depends on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of industrial noise.

2.2.3 Period of Measurement

Unattended noise monitoring was conducted between the period of 8th April and 15th April 2015.

2.2.4 Measurement Equipment

Unattended noise monitoring was conducted over a seven day period in order to characterise the existing noise environment using an Acoustic Research Laboratories Pty Ltd noise monitor. The monitor was programmed to store 15-minute statistical noise levels throughout the monitoring period. The monitors were calibrated at the beginning and end of the measurement period using a RION NC-73 sound level calibrator with no significant drift detected. All noise measurements were taken on A-weighted fast response mode.

2.2.5 Existing Background and *"Amenity"* Noise Levels

Ambient noise levels dominated by distant vehicular transportation noise. The EPA Industrial Noise Policy details specific steps in determining the background noise level for assessment of the day, evening and night time periods.

In this case, only the day time noise level is of relevance given the plant would only operate during this period.

The representative night background noise level was determined from the measured 15 minute L_{90} levels to be 42 dB(A) L_{90}. It is noted the measured L_{90} levels typically exceeded this however the data indicates there was some influence from plant on the site and the lower RBL level has been selected to exclude any influence of plant on the gallery site in accordance with the INP.

3 NOISE EMISSION LIMITS

Penrith City Council recommends the adoption of the Environment Protection Authority *(EPA)* New South Wales Industrial Noise Policy to assess noise emissions from commercial properties. It is noted the Policy has been replaced by the "Noise Policy for Industry", but the criteria in this case are unchanged from the INP.

3.1 INDUSTRIAL NOISE POLICY OBJECTIVES/GUIDELINES FOR NOISE TO RESIDENTIAL RECIEVERS

The EPA NSW Industrial Noise Policy provides guidelines for the assessment of noise impacts from industrial and commercial/retail premises. The recommended assessment objectives vary depending on the nearest potentially affected receivers, the time of day and the type of noise source. The EPA NSW Industrial Noise Policy has two requirements that must both be satisfied; that is, an intrusiveness criterion and an amenity criterion.

3.1.1 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions, and requires that noise emissions measured using the L_{eq} descriptor not exceed the existing background noise level by more than 5 dB(A) Where applicable, the intrusive noise level should be penalised *(increased)* to account for any annoying characteristics such as tonality.

3.1.2 Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The EPA NSW Industrial Noise Policy sets out acceptable noise levels for various localities. Table 2.1 titled *"Amenity Criteria"* on page 16 of the Policy designates four categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface. The EPA NSW Industrial Noise Policy also includes recommended noise levels for other land uses such as commercial and industrial premises. The EPA NSW Industrial Noise Policy states that residential receivers such as those neighbouring the gallery, by virtue of their location and surroundings, are classified as "suburban" amenity criterion is applied. Table 4 presents the amenity criteria applicable to residential receivers.

Table 4 – EPA Recommended Acceptable Noise Levels for Nearest Potentially Affected Residential Receivers

Time of Day	Recommended Acceptable Noise Level dB(A) L_{Aeq}	Recommended Maximum Noise Level dB(A) L_{Aeq}
Day (7am to 6pm)	55	60

3.1.3 Sleep Arousal from Transient Noise Events

Sleep arousal is a function of both the noise level and the duration of the noise. The EPA in its Environmental Noise Control Manual states that noise controls should be applied with the general intent to protect people from sleep arousal. The noise sources being assessed would not operate at night and a sleep arousal assessment is not required.

3.2 NOISE ON THE GALLERY SITE

AS 2107 provides recommendations for internal spaces as follows:

- Commercial Kitchens – 55 dB(A)
- Restaurants – 45 dB(A)

It is noted that 45 dB(A) would also be a suitable noise level for outdoor restaurant seating in this case.

It is further noted that the recommended noise level for kitchens is typically exceeded in practice given the difficulty in treating kitchen exhaust ducts with attenuators particularly when the fan is close to the hoods. A noise level of 60 dB(A) is more typical in such situations. For the kitchen a 55 dB(A) target will be adopted to be achieved if feasible.

3.3 PROJECT SPECIFIC NOISE CRITERIA

A project specific noise criterion for emissions to the surrounding properties has been determined based on the night time intrusiveness criterion, this being the most stringent of all the requirements of the INP. Based on a RBL of 42 dB(A) the noise level at the residential properties impacted by the plant should not exceed 47 dB(A).

Noise levels at the patron areas on the Gallery site should not exceed 45 dB(A), and in the kitchen a 55 dB(A) target will be adopted.

4 PLANT NOISE MEASURMENTS AND NOISE PREDICTIONS

Plant noise levels were predicted based on the preliminary mechanical services and architectural drawing supplied, and the manufacturer's data for the proposed plant.

The noise level predictions (without treatment) are summarised in the following table.

Table 1 – Predicted Plant Noise Levels

Location	Predicted Level*	Objective	Comment
Exhaust Fan - closest boundary	36 dB(A)	47 dB(A)	Complies
Evap Cooler - closest boundary	45 dB(A)		Complies
Exhaust Fan - Seating Area	49	45 dB(A)	Exceeds
Evap Cooler - Seating Area	58		Significantly exceeds on max speed
Exhaust Fan - Kitchen	62	55 dB(A)	Exceeds
Evap Cooler - Kitchen	74		Significantly exceeds on max speed

* predicted level at maximum fan speed

We are advised the evaporative cooler is over-sized for the required duty as this is the smallest suitable unit and that the cooling duty will typically be met on low speed. The manufacturer does not have data for low speed operation however we anticipate noise level will be 10-15 dB(A) lower than max speed operation. Taking this into account, noise from the evaporative cooler will still exceed at the seating area and in the kitchen, but the exceedences will be significantly reduced.

It is noted that:

- Noise in the seating area will still be exceeded by both units (especially when considering the noise levels will add by up to 3 dB(A) when both units are running).

- Noise in the kitchen will be around 65 dB(A) with the EC on low speed and the exhaust fan operating (there is roughly equal contribution from both units).

5 RECOMMENDED TREATMENT

5.1 BARRIER

It is recommended that a solid barrier screen be installed on the edge of the kitchen roof. The height of the barrier should be sufficient to prevent line of sight from the top of the exhaust fan and the EC, to the top of the louvres in the punched roof around the outside dining area. The horizontal extent should be sufficient to maintain the line of sight barrier.

The barrier will be sufficient to comply with the criterion provided the EC is not operated at a speed that is midway between low and maximum.

The screen should be constructed as low to the roof as possible noting that any leakage through small gaps at the bottom will reduce the effectiveness of the screen and no gap is preferred.

The barrier can be constructed from any of the following materials:

- Sheet metal with a BMT>0.5mm.
- CFC sheet >4mm thickness
- Coolroom insulated panel - >50mm thickness.
- Plywood >12mm thickness

The barrier screen should not have any unsealed gaps. Note that timber boards could be used however it is recommended that these be fixed to a ply backing to prevent gaps between the boards.

5.2 DUCT TREATMENT

- Internally insulate the whole of the EC supply duct with 50mm thick 32kg/m^3 glasswool insulation faced with perforated foil.

- Internally insulate from the exhaust fan intake to the tee with 50mm thick 32kg/m^3 glasswool insulation faced with 25 µm Mylar/Melinex and min 30% perforated metal.

This treatment will be sufficient to achieve a noise level of 55-60 dB(A) provided the EC is operated between low and high speed. On high EC speed the noise level will be around 65 dB(A).

5.3 AIRFLOW REGENERATED NOISE

The following recommendations are made to control regenerated noise:

- The velocity in the exhaust duct should be limited to 7m/s.

- A diffuser should be installed behind the EC supply grille rather than a sharp change in dimension between the grille plenum and the duct from the unit. Currently the effective diffuser area is around 500 x 500mm which means at maximum fan speed the grille velocity will be around 7m/s.

6 CONCLUSION

Noise emissions from the mechanical plant to the neighbouring residential properties and within the Gallery have been assessed. Treatment has been recommended to reduce noise to acceptable levels.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Victor Fattoretto