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NOISE CONTROL REVIEW FOR 4 dB NOISE REDUCTION SCENARIO FOR WAGERUP 3 EXPANSION PROJECT

FOR

ALCOA OF AUSTRALIA

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1 INTRODUCTION

SVT has been requested to review the sound power allocation budget that would be required for the Wagerup Refinery, including the Wagerup 3 Expansion project, to realise a 4 dB reduction in overall noise emission levels for residents surrounding the refinery.

1.1 Background

A noise model for the Wagerup 3 Expansion project has been developed and is described in SVT report A/04/12/005. This model has been used to develop a sound power budget for the expansion project to ensure that there will be no increase in noise received at nearby residents as a result of the expansion. This sound power budget, which includes noise emissions from several existing plant areas, is presented in SVT report A/05/01/010.

This report presents the sound power budget required to achieve a further 4 dB reduction in the noise received at nearby residences, and discusses the noise control measures that would be necessary to implement the budget and comments on their feasibility.

2 METHODOLOGY

The noise sources that most significantly contribute to noise received at nearby residents vary depending on the location of the residence with respect to the plant. In this analysis, SVT has concentrated on two residences, one to the north of the refinery and one to the south of the refinery. The locations selected represent the closest residents to the refinery in each direction and correspond with locations R3 (north) and R6 (south) described in SVT report A/04/12/005 (Noise Model Development Report).

The output from the refinery noise model was reviewed to identify and rank the noise sources that most significantly contribute to noise received at the two locations. The number of sources requiring treatment and the magnitudes of the individual noise reductions required to achieve an overall reduction of 4dB were then reviewed.

3 ANALYSIS

At each location there are many noise sources that contribute to the overall noise level. In fact, there are so many contributing sources that the highest contribution from any single source is approximately 10 dB below the cumulative noise level from all sources at the refinery.

At each location the output from the noise model was used to determine the noise level of the source with the highest contribution to the overall received noise level. Sources whose noise level contributions were within 5 dB and 10 dB of that generated by the highest ranking source were then counted. This provides an indication of the number of significantly contributing sources. Table 3-1 presents the predicted noise levels at each location and provides an overview of the number of significantly contributing sources.

Table 3-1 Summary of Contributing Noise Sources

Location	Predicted Noise Level (After Expansion)	Highest Individual Noise Source Contribution	No of Noise Sources within 5 dB of Highest Source Contribution	No of Noise Sources within 10 dB of Highest Source Contribution
R3 (North)	48.7 dB(A)	39.1 dB(A)	8	22
R6 (South)	46.8 dB(A)	35 dB(A)	12	48

Clearly, in order to achieve any significant overall noise reduction it will be necessary to reduce noise emissions from many noise sources within the refinery.

Having established the number of significant sources at each location, the average noise reduction required per source was determined based on treating all sources whose contributions were within 5 dB and 10 dB of the highest source contribution (Case 1 and Case 2 respectively). The results are presented in Table 3-2.

Table 3-2 Average Noise Reductions for Contributing Noise Sources

	Case 1		Case 2	
Location	No of Sources within 5 dB of Highest Source Contribution	Noise Reduction per Source to Achieve 4dB Overall Reduction	No of Sources within 10 dB of Highest Source Contribution	Noise Reduction per Source to Achieve 4dB Overall Reduction
R3 (North)	8	21.5	22	5.1
R6 (South)	12	Not Possible	48	4.9

Case 1 – Considering only those sources with noise contributions within 5 dB of the highest ranking noise source, an average reduction of 21.5 dB would be required for the top 8 noise sources for location R3 to achieve an overall reduction of 4 dB. For location R6 it is not possible to achieve an overall reduction of 4 dB by treating only those sources with noise contributions within 5 dB of the highest ranking source.

Case 2 – Considering those sources with noise contributions within 10 dB of the highest ranking noise source would require an average reduction of approximately 5 dB for the top 22 and top 48 noise sources for locations R3 and R6 respectively.

In order to rationalise the noise control treatments required for a 4 dB overall reduction, location R6 was considered first since this location requires many more sources to be treated than location R3. Noise reductions greater than 10 dB are probably unfeasible for most existing noise sources. Therefore, this was assumed to be the maximum reduction achievable. (Even assuming that 10 dB reductions can be realised it would be necessary to treat the top 29 noise sources for location R6.)

If the noise controls required to achieve a 4 dB reduction at location R6 were implemented they would also provide an overall reduction of 2.4 dB at location R3. Several further sources would then also require noise reductions to achieve the overall 4 dB reduction at location R3.

The following sound power budget has been developed to obtain a minimum noise reduction of 4 dB at locations R3 and R6.

Table 3-3 Sound Power Budget to Achieve 4 dB Noise Reduction – dB(A)

Building No	Description	Current SWL	Potential SWL after Expansion (Worst-case)	SWL required to Maintain current noise level	SWL required for 4 dB reduction at R3 and R6
15	Conveyor 395 (to stacker)	83*	83*	83*	**73***
15	Conveyor B100	88*	88*	83*	**73***
15	Conveyor B200	83*	83*	83*	**73***
15	C100 Conveyor	86*	86*	83*	**73***
15	C200 Conveyor	n/a	86*	83*	**73***
15	B100 Conveyor drive	112	114	110	**100**
15	B200 Conveyor drive	112	115	110	**100**
15	C100 Conveyor drive	112	114	110	**100**
15	C200 Conveyor Drive	n/a	115	110	**100**
25	Ball Mills (per mill)	n/a	114	104	**94**
25	Existing Mill 4	117	118	108	**98**
30	Bdg 30 - West Side (Existing Digestion Plant)	107	107	107	**97**
30	New Digestion Plant for Expansion	n/a	114	109	**99**
35A	Pumps at Filtrate tanks	106	108	108	**98**
40	Bdg 40-1 - South Side (Existing Heat Exchange Unit)	109	109	109	**99**
42A	Bdg 42A (Evaporator Feed Pumps)	111	111	111	**101**
44	Bdg 44-1 - East Side (Seed Filtration)	103	103	103	**93**
45	Bdg 45 - Green Liquor East Valve 1 (Existing Precipitation)	102	102	102	**92**
45	Bdg 45 - Green Liquor East Valve 2 (Existing Precipitation)	102	102	102	**92**
50	Bdg 50 - South Face (Existing Calcination)	109	109	109	**99**
50	Bdg 50 - Blower 3 Discharge (Existing Calcination)	108	108	108	**98**
50	Bdg 50 Calc 2 Discharge (Existing Calcination)	101	101	101	**91**
50	Bdg 50 Calc 1 Discharge (Existing Calcination)	101	101	101	**91**
50	New Calciner Building (stage 1) for Expansion	n/a	112	107	**97**
50	New Calciner blower inlet (stage 2) for Expansion	n/a	115	105	**95**
50	New Calciner building (stage 2) for Expansion	n/a	112	107	**97**
110	Bdg 110 - East Side (Existing Boiler House)	108	108	103	**93**
110	Bdg 110 - South Side (Existing Boilerhouse)	102	102	102	**92**
110	New GT2 for Expansion	n/a	114	104	**94**

** Sound power level per metre*

4 NOISE CONTROL REVIEW

The noise control measures required to achieve the sound power budget specified above are discussed in the following sections of the report. It is important that the sound power budget is achieved for ALL of the identified sources if the 4 dB overall noise reduction is to be realised.

4.1 Stockpile Conveyors and Conveyor Drives

The sound power levels for the existing stockpile conveyors range from 83 to 88 dB(A) per metre. In order to prevent any increase in noise received at residences near the refinery a maximum sound power level of 83 dB(A) per metre is required. This is considered to be achievable by specifying large diameter, low noise conveyor idlers and providing belt washing or turnover facilities.

To reduce sound power levels a further 10 dB to 73 dB(A) per metre in line with Table 3-3 would almost certainly require the use of noise barriers alongside the conveyors in conjunction with very low noise idlers and belt cleaning facilities.

Noise emissions from the drive stations for conveyors B100 and B200 are dominated by impact noise in the transfer hoppers. To achieve the sound power budget would require these drives / transfer points to be completely enclosed.

The sound power budget for the drives for conveyors C100 and C200 may be achievable by specifying very low noise drives. However, it is more likely that these drives would have to be fully enclosed.

4.2 Ball & SAG Mills, 25

The sound power budgets for the ball and SAG mills are all less than 100 dB(A). This can only be achieved by housing the mills in a substantial building (eg brick or concrete) such that external noise levels are in the region of 60 – 65 dB(A) - depending on the size of the building. Doors, windows, vents, etc would all have to be acoustically rated.

4.3 Digestion Plant, 30

The sound power budget for the west side of the existing digestion plant is 97 dB(A). To achieve this budget would require all large pumps to be fully enclosed. Acoustic lagging would also be required for some pipework. A detailed review of the area would be needed to determine which noise sources would have to be enclosed or lagged and to assess whether or not the sound power budget is achievable.

The sound power budget for the new digestion unit is 99 dB(A). This could be achieved by enclosing all large pumps, applying acoustic lagging to piping, specifying low noise valves etc. Noise generating equipment would also need to be located within the unit to take advantage of the shielding provided by large tanks. Alternatively, the unit could be enclosed in a building or all pumps could be located together and enclosed in a building. A comprehensive noise study of the unit would be required during the detailed design stage of the expansion project to ensure the sound power budget could be achieved.

4.4 Pumps at Filtrate Tanks, 35A

To achieve the sound budget of 97 dB(A) for this area, all existing pumps and new pumps proposed for the expansion would have to be fully enclosed.

4.5 Heat Exchange Unit, 40

The sound power budget for the south side of the existing heat exchange plant is 99 dB(A). To achieve this budget would require all large pumps to be fully enclosed. Acoustic lagging would also be required for some pipework. A detailed review of the area would be required to determine which noise sources would have to be enclosed or lagged and to assess whether or not the sound power budget is achievable.

4.6 Evaporator Feed Pumps, 42A

To achieve the sound budget of 101 dB(A) for this area, all existing pumps and new pumps proposed for the expansion would have to be fully enclosed.

4.7 Seed Filtration, 44-1

To achieve the sound power budget of 93 dB(A) for the east side of this plant area would require an enclosure over all vacuum pumps. The caustic wash pumps would also need to be fully enclosed.

4.8 Precipitation, 45

To achieve the sound power budget of 92 dB(A) for the green liquor valves on top of the existing precipitator building would require a detailed review of the control system and may involve replacement of the valves, acoustic lagging to piping and revised piping layout. (It is possible that the existing valves may be relocated during the expansion process and this would provide an opportunity to review noise emissions from the valves and associated pipework.)

4.9 Calcination, 50

The sound power budget for the various elements of the calcination units is very onerous. A detailed noise control review would be required for the entire area to determine if the budget is achievable and what sources would have to be treated. Significant noise reductions would have to be obtained for the blower inlets and discharges for both existing and new blowers, and this could involve noise reduction at source, a combination of high performance absorptive and reactive silencers, and extensive lagging to ducting and fuel gas piping. Noise control options for all high noise pumps, fans and pipework would also have to be reviewed and the feasibility of closing off the entire south side, and part of the east and west sides, of the existing calcinations units with steel cladding may need to be considered.

4.10 Power Generation

To achieve the sound power budget for the existing boiler house would require high performance silencers to be fitted to the FD fans air inlets and discharge ducting. The cladding to the boilers would have to upgraded, as would the cladding to the entire turbine hall. Roof vents for the building would need to be acoustically rated or replaced by a forced ventilation system (which would also need to be acoustically treated).

The sound power budget of 94 dB(A) for the GT / HRSG proposed for the expansion may not be feasible.

5 CONCLUSION

The noise control measures described in section 4 of this report will be difficult to implement in most cases and in some areas it may not be feasible to achieve the sound power budget required to provide an overall reduction of 4 dB from the refinery (including the plant associated with the expansion project).

Furthermore, the analysis provided relates to only two of the nearest residences. The noise sources that most significantly contribute to received noise vary considerably for each residence and it is highly likely that several other plant areas would also require substantial noise reductions to achieve a 4 dB reduction for all affected residences.

It is SVT's opinion that a 4 dB overall reduction in noise levels is not technically feasible for the expanded refinery.