AUSTRALIAN DEFENCE FORCE ACADEMY

THE UNIVERSITY OF NEW SOUTH WALES

Review of
Environmental Noise Management Proposal for
Wagerup Unit Three Expansion

AVU 01005

for

Alcoa Australia
Wagerup Expansion Team

by

Marion Burgess
BSc (Hons) MSc (Acoust), FAAS
Acoustics & Vibration Unit
School of Aerospace, Civil & Mechanical Engineering
UNSW at ADFA

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Marion Burgess

BSc (Hons) MSc (Acoust), FAAS
Acoustics & Vibration Unit
School of Aerospace, Civil & Mechanical Engineering
UNSW at ADFA
Tel 02 6268 8241 m.burgess@adfa.edu.au

1.0 Introduction

This report has been prepared by the Acoustics and Vibration Unit (AVU) of the University of New South Wales at the Australian Defence Force Academy, following the request from the Wagerup 3 expansion Team. It is understood that as part of the community consultation associated with the Environmental Impact Assessment, this desk top review is required to address the following issues:

- the completeness of the information presented;
- the suitability of the measurements performed for assessing the project impacts;
- the correctness of the analysis performed on the data presented;
- the suitability of methodology used to make predictions.
- conclusions reached in the report being reviewed.

The following documents have been provided for this review:

- Aerial photo of the refinery, residue areas and surrounding land;
- Refinery Layout sketch
- Predicted Noise Contours 2004 for existing refinery
- Process summary doc
- List of building numbers
- Refinery Noise Compliance Status ppt presentation
- Noise Model Development Report, SVT Engineering report A/04/12/005

- Environmental Noise Management Strategy for the Wagerup 3 Expansion project, SVT Engineering report A/05/01/010
- Noise Control Review for 4dB Noise Reduction Scenario for Wagerup3 Expansion Project, SVT Engineering report A/05/02/002
- Noise Model Predictions for existing refinery (current case)
- Noise Model Predictions for expansion with no acoustic control
- Noise Model Predictions for expansion with acoustic controls

This review is based on assessment of these documents and does not include investigation of the accuracy of the data used in the noise modelling.

2.0 Background

The following background overview is extracted from information provided in email of 31 Jan 2005 from Anita Logiudice, Environmental Supervisor Wagerup Refinery and following telephone discussions.

As well as the scattered houses in the largely agricultural area, the town of Yarloop is located to the south of the refinery (approx 1.5km) and the town of Hamel is to the north west of the refinery (approx 5km). The refinery complex consists of the lower end of the overland conveyor which brings bauxite from the mine site to the refinery, fixed plant associated with the refining process, ore and residue transport within the refinery and residue storage. The refinery commenced single unit operation in 1984, a second refining unit was commissioned in late 1992 and the current expansion proposal is for a third unit.

The program to reduce noise emissions began at the refinery in 1995. Substantial noise reduction measures have been applied to the refinery, removing tonality and reducing noise levels to the south of the refinery by 5 dB(A). Modelling of the noise impact has been compared with long term measurements of the noise levels. The model has been modified and the current predictions are based on the revised noise model. Part of Alcoa's land management plan incorporates all residences that are exposed periodically to noise levels greater than 35 dB(A) at night. Alcoa has offered to purchase these properties or acoustically treat the homes.

3.0 Completeness of the Information Presented

The key documents relevant to the proposed expansion are the three reports from SVT Engineering Consultants (hence referred to as SVT).

3.1 Report A/05/01/010 "Environmental Noise Management Strategy for Wagerup 3 Expansion Project". The Introduction aptly states that the document

> *"…describes the noise control philosophy to ensure the Expansion Project complies with the target noise emissions"*

The report identifies the main noise sources and the general principles for minimising noise deal with the two main aspects namely control at source, ie low speed motors, electric rather than hydraulic etc, and control of the propagation of noise, ie enclosures, barriers etc. Compliance with the allocation of sound power levels to each of the identified items, Section 7 of the report, is essential to achieve the goals in the modelled sound contours.

While it is appreciated that it is still early in the planning process it would be useful to have an indication on this schedule for which items the sound power allocation for each item could possibly be met using control at source and those which require both control at source and control of the propagation with barriers, enclosures etc.

Suggestions about location of some items are made in Section 5 of the report but it is not clear if these suggested locations have been assumed in the model and hence the development of the sound power allocation schedule. For example in relation to the Milling it is stated that:

> *"To further mitigate noise from the mills they should be located to the south of the existing mills ie further away from the neighbours to the north of the refinery"*

but it is not clear if this location has actually been assumed in the noise modelling.

A plan of the assumed locations of the items for the noise modelling should be included in this report. If those locations need to be changed the sound power allocation and the noise control strategy may need to be re-examined. This plan

should also indicate the assumed locations for stockpiles as it is stated (Section 4) these are important for '*controlling noise emissions*"

The report states that it will be essential to also reduce the nose from some existing sources, Table 7.2. Thus it is assumed Figure 3 for 'expansion with noise control' actually includes both noise reduction for the existing plant and the compliance with the sound power allocation for the expansion plant. It would be useful to have an intermediate figure which shows noise contours for the expansion but without the noise reductions for the existing sources.

3.2 Report A/04/12/005 is the Noise Model Development Report and the Introduction states it:

> *"describes the methodology and assumptions used in developing the noise model for the Wagerup 3 expansion project"*

The subsequent sections deal with each of the major noise sources and discuss the general strategies for suitable control methods; either at the source or by controlling the propagation. The sound power data in the Appendices has been used in the noise model to determine the location of the contours. For the majority of noise sources the required noise reduction has been applied across the frequency range, ie if overall 10 dB reduction is required then in Appendix B the octave band levels are all reduced by 10 dB. This may not be achievable, for example it usually more difficult to achieve noise reduction for enclosures and barriers at lower frequencies than in the higher frequencies. However it is appreciated that this is early in the design process and the majority of the noise sources have most sound energy in the mid to high frequencies but it will be important to refine the data in Appendix B as the design develops to ensure that the goals are met.

The noise model provides the basis for the noise management plan. This report states that the modelling uses SoundPlan and the CONCAWE algorithms. It is understood that validation of the model has been undertaken by comparison with data from the monitoring points. It would be valuable if the Section 2 methodology was expanded to summarise the validation process which has been undertaken and the nature of any amendments that have been made to the model to improve the accuracy for application to Wagerup.

The allocation of sound power levels is likely to have required an iterative process with the noise model to achieve the required location for the contour with noise mitigation methods that are technically feasible. It is possible there are some key items for which is it essential that the allocated level is not exceeded by even 1 dB while for others it may be possible that if the allocated level for one item is exceeded by a small amount this excess could be offset if another item came in with a lower than allocated sound power level. There is a hint this may be the case in some places in the text, ie in the discussion on the conveyor and the ball mills it is suggested these are critical noise producing items. One of the reports should include a section giving a clear indication of any items for which it is critical the allocation is not exceeded. This could form part of a recommended strategy for managing the noise should any item not be able to meet its allocation.

3.3 Report A/05/02/002 is an assessment of the noise control measures which would be necessary to achieve a 4dB noise reduction for the facility including all the current operations plus the expansion. The introduction states the review of the sound power allocation

> *" to realise a 4 dB reduction in overall noise emissions levels for resident surrounding the refinery"*

In view of the complexity of the operation with the vast number of sources, it is appropriate at this stage to focus on two of the worst case locations to identify the major noise sources and the reduction in sound power allocation. However it would be useful to provide a predicted noise level based on this sound power allocation at locations R1 and R7 close to the 40 dB(A) contour line on Figure 3 of the management strategy report, to verify this assumption.

It is clear that substantial noise mitigation is necessary both for the existing plant and for the new plant for Warerup3. But it is not clear how much mitigation is necessary additional to the mitigation proposed in the noise management strategy and model development for Wagerup3. It is suggested that Table 3.3 in the 4 dB reduction report include additional data so that columns become:

- one column giving the unattenuated sound power for the Wagerup3 items extracted from Table 6-1 of the noise model development report and the sound power levels of the relevant items for the current plant;

- second column giving the attenuated sound power levels for the new items, Table 6-1 of noise model development report and attenuated sound power level for any relevant items for the existing plant, Table 7-2 of the strategy report; and
- third column then is the budget sound power level from the 4dB scenario report.

This will provide consistency between the three reports, remove the 'n/a' items and highlight the extent of additional mitigation that is required for the overall 4 dB reduction with the expansion.

The noise control review is only a brief overview of the possible approaches to noise reduction. While it would involve duplication of some of the previous reports, the extent of the necessary additional mitigation would be clearer if each item in section 4, there is a summary of the proposed measures to meet the goals in the management strategy report then the additional measures to meet the 4dB reduction.

Most of the requirements would seem to be very demanding and there would need to be considerable more investigation to establish if a reasonable and feasible solution could be developed. For some items the suggestions include changes in the operational characteristics, such as widening belt size, but for the majority the suggested solution is enclosure when perhaps more attention to the source of the noise could be considered. For example it is stated that the drive stations for B100 and B200 are '*dominated by impact noise in the transfer hopper*" yet there is no suggestion for investigating improved damping of this impact.

4.0 Suitability of the Measurements Performed for Assessing the Project Impacts

The Noise Model Development Report refers to noise measurements at existing or similar items of plant and these appear to be appropriate. It is assumed that the data from the noise monitoring stations has been used in the validation of the model and, as mentioned in section 2 above but some reference to this should be provided in the Noise Model Development Report.

5.0 Correctness of the Analysis Performed on the Data Presented

At this stage of the process it is difficult to be too precise as many details for accurate analysis are still unknown. One concern about the attenuation applied across the frequency range is discussed in Section 3 above but overall the approach taken thus far appears to be correct.

6.0 Suitability of Methodology Used to Make Prediction

It would appear that the noise model is appropriate but the detail of the accuracy of the data used in the model is not part of this review. As discussed above, there needs to be a summary of the validation of the model.

7.0 Conclusions Reached in the Report Being Reviewed

The noise contours indicate that compliance with the sound power allocation table should lead to noise levels in the surrounding area after the expansion similar to those existing before the expansion.

The 4 dB scenario report concludes that the 4 dB reduction is '*not technically feasible*' however Section 4 has summarised possible mitigation measures. While it is acknowledged that many of these measures may be difficult to implement, especially in a retro- fit manner for existing plant, it may be more appropriate for the conclusion to include a qualifier like '*reasonably*'.

8.0 CONCLUSION

This is very large project and the work presented in these reports has been undertaken early in the design process when not all the details are available for precise noise assessments. Some suggestions for inclusion of additional information and for the presentation of the information have been given in this review. Overall it would appear that the noise assessment, the determination of sound power allocations and the nature of the mitigation measures for the items have been undertaken in a careful and appropriate manner.

Marion Burgess
February 2005

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Marion Burgess
BSc (Hons) MSc (Acoust), FAAS
Acoustics & Vibration Unit
School of Aerospace, Civil & Mechanical Engineering
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Marion Burgess

BSc (Hons) MSc (Acoust), FAAS
Acoustics & Vibration Unit
School of Aerospace, Civil & Mechanical Engineering
UNSW at ADFA
Tel 02 6268 8241 m.burgess@adfa.edu.au

1.0 Introduction

This report has been prepared by the Acoustics and Vibration Unit (AVU) of the University of New South Wales at the Australian Defence Force Academy, following the request from the Wagerup 3 expansion Team as part of the community consultation associated with the Environmental Impact Assessment. This desk top review supplements report AVU 01005-1 which was undertaken before the reports on the noise impact from the conveyor and at the Bunbury Port were available. As for Part 1 this report is required to address the following issues:

- the completeness of the information presented;
- the suitability of the measurements performed for assessing the project impacts;
- the correctness of the analysis performed on the data presented;
- the suitability of methodology used to make predictions.
- conclusions reached in the report being reviewed.

The following documents have been provided for this part of the review:

- Environmental Noise Management Strategy for the Wagerup 3 Expansion project, SVT Engineering report A/05/01/010, version D of 8/3/05 with identification of the parts which have been added to the document since the time of the review AVU 01005-1
- Summary of Wagerup Noise Propagation Model Validation Process, Herring Storer Acoustics report 4373-2-05029-4-2-8
- Figure A2 Noise Contours for Existing Ore Transport System
- email from Ian Butland clarifying the various components of the conveyor systems both for the existing and the proposed situations.

This review should be read as a supplement to AVU 01005-1 as it only addresses the new material which has been incorporated in SVT Engineering report A/05/01/010. In common with the previous report it does not include investigation of the accuracy of the data used in the noise modelling nor the detail of the noise modelling program.

2.0 Background

The new sections in SVT Engineering report A/05/01/010 are

- Section 2.1 - second paragraph of the scope
- Section 3 - final paragraph which refers to Appendix Figure A2 which presents the noise contours for the ore transport system only. Figure A2 was not in the main document and was provided separately.
- Section 5.2 - whole section which deals with the ore transport system
- Table 8.1 – sound power allocation table which includes the additional allocations for the ore transport system
- Noise contours in appendices - Figures B2, B3, C2 and C3

- Section 7 – noise impacts at Bunbury Port

3.0 Completeness of the Information Presented

3.1 Ore Transport System

The sections in the SVT report on the ore transport system provide identification of the sources of additional noise impact of changes to the existing convey and two options for the extension. The two options would be easier to understand if a sketch identifying the key points ie Larego, Orion and Arundel plus the conveyor numbers was provided.

Concern is expressed about the increased noise impact from the increase in speed and belt width for the existing portion of #371 and this is considered to be the '*most significant noise impact*'. Yet from comparison of Figure A2, noise contours for existing transport system and Figures B2 and B3 it is not easy to see what residents would be exposed to increase noise levels. There only appear to be very minor changes in the location of the contours. Perhaps this is because of the reduced scale necessary to show the entire conveyor system. It would be valuable to have an expansion of the contour map showing just the portion of the conveyor from Wagerup to Arundel, to a similar scale as Figure B1, and also showing the locations of the residents. The three figures to be provided would be the existing and for the increased capacity conveyor with and without noise reduction. Similarly a diagram is required to identify the location of the modules referred to in Table 5.1.

There appears to be very little difference on the figures between the contour lines for Option A and C yet the text indicates a clear preference for option A. Are there other details on the predicted noise levels which could justify this preference? The maps for Option C include the point source for the additional drive station at the junction of #371 and # 373. Is there a missing point source at the Larego end of #373 which is the termination of this conveyor? Is it just missing from the figures or has it been omitted from the modelling?

Now that the estimation for the noise impact from the conveyor has been determined there should be new additional figures showing the noise impact from the expansion including the conveyor ie a combination of noise impacts shown on Figure C1 and Figure C2.

3.2 Bunbury Port

It would seem that the additional operations following on from the expansion will not have an adverse impact on the surrounding area. It is understood that the impact of the rail operations was not within the scope of the SVT study but is the subject of another study that considers the noise impact of the additional trains entering the dock and the noise impact of those trains along their route.

3.3 Summary of noise validation model

This report by Herring Storer Acoustics summarises the validation of the noise model. Figures 1 and 2 should have 'wind direction' on the horizontal axis.

The sentences using wording similar to this

> "*the L_{A95} value was a reasonably true indication of the refinery L_{A10} value*"

are somewhat confusing. Although it is stated that the L_{A10} is

> *"heavily influenced by background noise and generally do not represent refinery noise contribution"*

there should be some explanation of the nature of the 'background noise" and perhaps it should be referred to as "foreground noise" as background noise normally influences the L_{A90} and not the L_{A10}. As this paragraph sets the basis for the validation it is essential it is explained clearly.

It is not clear why at location 3 the L_{A99} data is used. Figure 3 shows the modelled noise levels under downwind propagation to be greater than the L_{A99}. As L_{A95} usually has a greater magnitude than L_{A99} it is puzzling why L_{A99} has been chosen for the comparison at this location only.

4.0 Suitability of the Measurements Performed for Assessing the Project Impacts

No reference is made to any noise measurements relative to the ore transport system.

5.0 Correctness of the Analysis Performed on the Data Presented

At this stage of the process it is difficult to be too precise as many details for accurate analysis are still unknown. Overall the approach taken thus far appears to be correct.

6.0 Suitability of Methodology Used to Make Prediction

It would appear that the noise model is appropriate and the summary of the validation of the model appears to support this

7.0 Conclusions Reached in the Report Being Reviewed

The conclusions seem to be relevant and well supported by the modelling data.

8.0 CONCLUSION

Some suggestions for inclusion of additional information and for the presentation of the information have been given in this review. Overall it would appear that the noise assessment, the determination of sound power allocations has been undertaken in a careful and appropriate manner.

Marion Burgess
March 2005