HEGGIES

27 October 2009

10-8328 Independent Review AQ Bayswater B FINAL 20091027.doc

Attention: Dinuka McKenzie

Dear Dinuka

Independent Expert Review
Bayswater B Power Station Expansion
Air Quality Impact Assessment

1 Introduction

Heggies Pty Ltd (Heggies) has been requested by the NSW Government Department of Planning - Major Infrastructure Assessments (the Department) to undertake an independent expert review of the Concept Approval Air Quality Impact Assessment for the proposed Bayswater B Power Station Project (the Project).

The independent expert review panel consisted of Dr Peter Manins (CSIRO Fellow), Mr Scott Fishwick (Heggies) and Dr Martin Doyle (Heggies).

1.1 Reports of Reference

The documents which have been examined as part of this independent expert review were:

- Chapter 9- Air Quality – Bayswater B Power Station Environmental Assessment, Main Report – dated September 2009, prepared for Macquarie Generation by AECOM
- Appendix D - Air Quality Impact Assessment for the proposed Bayswater B Power Station Project – dated September 2009, prepared for Macquarie Generation by Katestone Environmental Pty Ltd.
- Appendix E – Inter-Regional Transport Study of the Bayswater Power Station Expansion – dated March 2006, prepared for Macquarie Generation by Katestone Environmental Pty Ltd.

The following outlines the findings of the independent review.

2 Review Summary

The findings of the review have indicated that several issues need to be addressed prior to Concept Plan Approval or Project Approval being granted for either fuel option. The review has raised issues regarding:

1. Selection of representative meteorology;
2. Use of observations within TAPM meteorological modelling;
3. Selection of emissions data used in dispersion modelling;

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4. No inclusion of Redbank Power Station in assessment;
5. The cumulative impact assessment methodology for all pollutants;
6. The assessment of coal handling, transport and storage; and
7. The assessment of Inter-regional air quality impacts resulting from the gas-fired Project option.

The following sections provide further detail around these issues.

3 Local Air Quality Impact Assessment (Chapter 9 and Appendix D)

Following a review of Chapter 9, Appendix D and associated documents, a number of areas requiring clarification or further investigation were identified.

3.1 Meteorology

3.1.1 Selection of Representative Meteorology

A detailed discussion of the methodology used in the selection of representative meteorological years for use in dispersion modelling is included as Appendix C to the Air Quality Impact Assessment. This provides a robust methodology for selection of representative years based on both meteorological and pollution variations.

Section 8.3 on Page 62 of Appendix D outlines the process for selection of the three representative years, using fifteen years of observational data. However, point 5 states that:

> *"A selection of years representative of the variety of conditions was presented to MacGen, and three representative years were selected."*

Recommendation:

The reviewers would like confirmation as to whether and how MacGen selected the three representative years for use in dispersion modelling. The impression is given that although a statistical exercise was performed on a significant dataset, the final selection of meteorology was based on the subjectivity of the client.

3.1.2 TAPM Meteorological Modelling

Section 8.4.1 on Page 63 of the Air Quality Impact Assessment details the TAPM Meteorological Setup. TAPM meteorology was run for the three individual years selected by MacGen (see **2.1.1** above). However, it is not clear as to whether observational data from any or all of Mount Arthur North, Lake Liddell or Ravensworth has been included in the TAPM runs to 'nudge' the model predictions to obtain a more realistic meteorological dataset for the region.

TAPM predicts the local meteorology as a response to surface properties, including terrain, and the large-scale thermal and pressure fields. These predictions are improved by including observed data since there are always errors and approximations in the predictions. As has been shown in numerous studies, the statistical improvement is usually small. The greatest improvement occurs near the observation locations, and if these are at points of interest, then it is likely that the predictions of air pollution will also be improved at these same points.

A detailed comparison study between concurrent observed and TAPM-predicted meteorological datasets for the study area has been conducted within sub-appendix B of the Air Quality Assessment. This analysis concluded that, in general, TAPM performed well in simulating local meteorological conditions. It is considered that the inclusion of actual observations from the network of available stations in the study area as input to TAPM simulations of meteorology would enhance the accuracy of low level meteorology.

It is acknowledged that the emission release points are at heights in excess of 250 m and inclusion of lower level observations may have little effect on modelled meteorology at that height. However, surface meteorology will become important once modelled plumes approach ground level.

***Recommendation*:**

Please include further details on the TAPM meteorological modelling carried out as part of this assessment. Also, please clarify whether observational data from any or all of Mount Arthur North, Lake Liddell or Ravensworth has been included in the TAPM runs to 'nudge' the model predictions to obtain a more realistic meteorological dataset for the region.

3.2 Model Selection and Performance

3.2.1 TAPM Pollution Model Setup

Section 8.4.2 on Page 65 of the Air Quality Assessment provides details of the TAPM pollution model setup. Pollutant modelling was conducted over a 50 km domain, with a grid cell resolution of 500 m. It is considered that given the extent of the modelling domain and the implications of this size on model run time, the resolution of the grid spacing is suitable for the prediction of regional pollutant concentrations. However, the suitability of the 50 km modelling domain for the purpose of resolving the extent of impacts is questionable based on the results of the atmospheric dispersion modelling provided within this assessment. Further discussion relating to this matter is provided in **Section 3.4** of this document.

3.3 Emissions

Section 5 on Page 20 of Appendix D outlines the source and emissions characteristics of the gas and coal-fired options for Bayswater B.

For the coal-fired option, emission rates have been derived from the Clean Air Regulation (2002) emission concentration limits, NPI handbook and Load Based Licensing (LBL) data for coal fired power stations. For the gas-fired option, emissions data have been derived from the US EPA AP-42 emission factors for gas turbines.

The hierarchy for obtaining emissions data is generally considered to be:

1. Site specific emissions monitoring data.
2. Manufacturer's specifications.
3. Emission factors.
4. Licence conditions.

For a proposed facility, as is the case here, emission data collection through option 1 will not be achievable. However, it is considered that emissions data from the manufacturer/supplier of the proposed gas turbines or similar coal-fired boilers would be obtainable for the same or similar equipment in use at other facilities.

***Recommendation*:**

It is recommended that for the coal-fired option, the use of manufacturer's specifications or emission factors be used in preference to the use of LBL conditions emission limits not yet imposed. For the gas-fired option, it is recommended that manufacturer's specifications be sought in preference to US EPA AP-42 emissions factors.

If the proponent wishes to use the emission concentration limits specified in the Clean Air Regulations (2002), then further discussion is required as to how these concentration limits will be met in practice.

3.4 Impact Assessment

The choice of sensitive receptor locations for use in modelling initially seems valid, with receptors identified on the basis of:

> *"..being private residential, non-commercial/non-industrial premises within a 10 km radius of the Bayswater B Coal Fired Power Station Stack. Also included were receptors at locations further than 10 km where there are currently ambient air quality monitoring stations."* (Chapter 9, Page 9-3)

A cumulative assessment of pollutant concentrations has been carried out in a number of ways.

- For NO_2 and SO_2, the background has been determined from observations recorded at a network of monitoring stations, with receptors not co-located with a monitoring station having a representative background assigned from the nearest monitoring station.
- For PM_{10}, no background has been assumed as the data from Ravensworth is not considered to be representative of the entire modelling domain.
- For HF, the background concentrations have been modelled due to a lack of observations at appropriate locations and averaging times. Background concentrations have been modelled using existing Bayswater and Liddell power station emissions.
- For CO and Pb, insufficient background monitoring data was available and due to the low incremental contributions from the power station, addition of background was not considered to be necessary.

It is considered that this approach has several limitations:

1. In the assessment of background HF, no assessment has been made of the contribution of Redbank Power Station, a 151 MW of coal fired capacity power station 22 km southeast of Bayswater (see Figure 1). Due to the significant proportion of south-easterly winds, it is considered that this source may have the potential to impact upon receptors within the modelling domain. It is acknowledged that the receptor of most significance for HF impacts is R10 which is not in alignment with Redbank and Bayswater / Liddell. However, for the sake of completeness it is recommended that this source be included in the assessment of all pollutants.
2. Sub-appendix B to the Air Quality Assessment has provided an in-depth analysis of the performance of TAPM in predicting ground level concentrations of SO_2 from the existing Bayswater and Liddell Power Stations through the comparison of recorded concentrations with TAPM predictions between June 2000 and July 2001 at key monitoring locations in the local region. This comparison has shown that the performance of TAPM is acceptable based on a range of statistical tests, despite variance across the monitoring locations.

   So it is a surprise to see that the cumulative assessment at individual sensitive receptors has been assessed from a pairing in time and space of modelled and observed pollutant concentrations at the nearest monitoring location rather than by a cumulative modelling approach (as has been done for HF and possibly CO) which presents a better understanding of the likely variation of plume footprint away from monitoring locations. It is possible that by using the presented approach, the additional impact of the Project is questionable and potentially misleading, particularly in the populated region to the W of the Project (i.e. Denman, 22 km).
3. It is not clear why chemical transformation of NO_X to NO_2 was not conducted using TAPM.

4. It is not clear as to whether background CO was modelled or not, as Figure 51 provides a cumulative assessment across the modelling domain. Table 46 indicates that the incremental impact only has been assessed and Section 8.6.1 confirms this. The approach taken is requested to be confirmed.

5. Given the importance of PM_{10} to the general public of the Upper Hunter Valley, it seems necessary to attempt some kind of cumulative impact assessment, rather than just present the increment to PM_{10} due to the coal-fired Power Station proposal. There are probably past studies that could be called upon to provide guidance on suitable background levels for the days of high increments from the proposal. Resolution of this point is likely to be important for the residents of Denman.

   If the Assessment had explicitly modelled emissions of PM_{10} from not only the new power station but also the existing power stations and other known sources, i.e. made a cumulative impact assessment, then the effects of all sources would have been predicted and so it would have been possible to judge whether and how frequently air quality standards for PM_{10} might be breached. By presenting only the "increment to PM_{10}" from the new station, the reader is left to guess what the consequences might be.

Figure 1 Location of Redbank Power Station in Relation to R10 (Jerry's Plains) and Bayswater & Liddell Power Stations

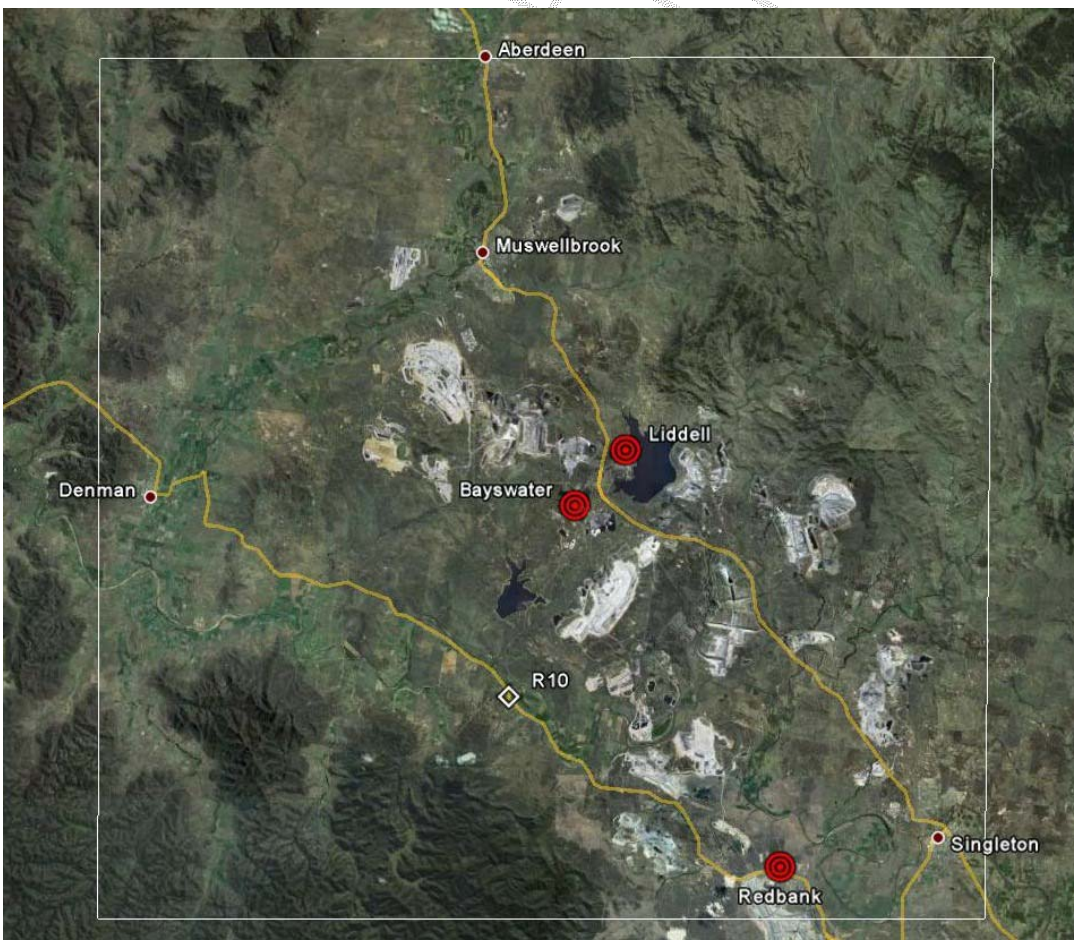

Image source: Google Earth (2009)

Note: Assessment modelling domain within white boundary

Recommendations:

1. It is considered that a more robust approach to the assessment of cumulative impacts would involve the following scenarios:

- An existing operations scenario, incorporating emissions from the major SO_2 and NO_2 and HF sources in the local region – at minimum Bayswater, Liddell and Redbank power stations.
- Future operation scenarios, including emission sources incorporated within the previous scenario.

The results of the existing operations scenario could then be used as a quasi-background dataset against which the percentage increase in emissions attributable to the Bayswater expansion options could be assessed and presented graphically. Comparison could also then be made with recorded concentrations at the surrounding monitoring stations.

It is acknowledged that the lower concentration results from modelling existing operations scenario may well be lower than actual concentrations that may be recorded in the region as it may not be possible to incorporate all local sources of pollutants, however it is considered that this approach would provide a greater level of meaning to the results for the future operational scenarios.

2. Please provide details as to why the chemical transformation of NO_X to NO_2 was not performed using TAPM.
3. Please confirm the approach with respect to the assessment of CO background concentrations.
4. It is recommended that the Proponent undertake a cumulative assessment of PM_{10} for the region surrounding the proposal.

4 Inter-regional Air Quality Impact Assessment

The Inter-regional Air Quality Impact Assessment was conducted in 2006 in conjunction with the CSIRO and builds on work undertaken by CSIRO in the 2002 IRTAPS study.

The findings of the study have indicated that the addition of a coal-fired Bayswater B will not lead to additional exceedances of the 1-hour ozone impact assessment criterion within the study region during the case days examined.

No assessment of the gas-fired Bayswater B option has been carried out as part of this assessment, although it is acknowledged that the impact from a gas fired power station will likely be lower. Nevertheless, no discussion of the possible impact of the gas-fired option has been included within the study.

Recommendation:

It is recommended that for the sake of completeness, an assessment of the impact of the proposed gas fired Bayswater B configuration is undertaken.

5 General Comments

Figures 57 and 58 on Pages 171 and 172 of Appendix D show erroneous impact assessment criteria for HF. These should be 0.84 µg/m^3 and 0.4 µg/m^3 for the 30 day averaging period, and 0.5 ug/m^3 and 0.25 µg/m^3 for the 90 day averaging period, not 1.7 µg/m^3 and 0.8 µg/m^3 as shown in both figures. It is noted that the correct criteria have been applied to the Figures themselves.

The impacts of coal handling, transport and storage prior to combustion are deemed to be outside the scope of the Air Quality Impact Assessment. According to Section 4.1.1 on Page 13 of Appendix D, the management of dust emissions from coal handling activities will be addressed in the Environmental Management Plan.

Approximately 17,000 tonnes of coal will be combusted each day by the coal-fired option. This will involve significant on-site handling. Although this may not impact upon the surrounding area, this should be confirmed by either examination of existing particulate monitoring data surrounding a similar existing facility, or through a dispersion modelling exercise. Such an exercise will assist in the formulation of any Environmental Management Plan as the most effective mitigation measures can be identified.

6 Concept Plan Conditions of Approval

Prior to Project approval for either the coal or gas fuelled option at Bayswater, further assessment with regard to air quality is recommended to be undertaken. It is considered that the recommendations provided below may be included within the Concept Plan instrument.

1. The Proponent must provide assurances through a detailed cumulative dispersion modelling exercise that the impact of the Project will not result in significantly degraded air quality at any identified sensitive receptor. An existing and future operations scenario should be provided to allow community understanding of the absolute impact of each option.
2. Once further information is known as to the equipment to be used, or likely to be used, as part of the Project, emissions data based on the manufacturer's specifications should be sourced and used in dispersion modelling in preference to possible licence conditions or emission factor documentation. Detailed information should also be provided as to the actual emissions control options to be installed as part of the Project.
3. The Proponent must undertake a dispersion modelling exercise of the coal handling, transport and storage proposed for the coal-fired Project option. Include in this a cumulative assessment of PM_{10} concentrations resulting from Project operation and surrounding sources.
4. Undertake a detailed inter-regional air quality impact assessment for the gas-fired option, such that comparisons on the impact on can be made between the coal and gas-fired options.
5. Should dispersion modelling predict that either additional exceedances of air quality criteria are forecast, or significant increases in pollutant levels are expected at certain identified sensitive receptor locations, a detailed air quality monitoring strategy/plan should be formulated.

I trust this meets with your immediate requirements,

Yours sincerely

Martin Doyle
Senior Consultant