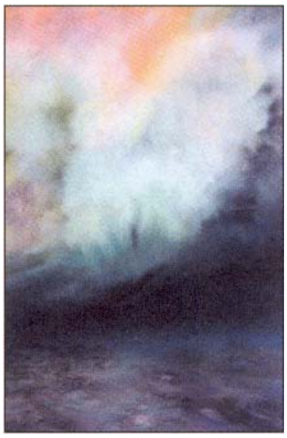


Katestone Environmental
ABN. 92 097 270 276

AN ADDENDUM REPORT FROM KATESTONE ENVIRONMENTAL TO ELP

RESPONSE TO EPA QUESTIONS ON AIR QUALITY REPORT FOR WAGGA WAGGA POWER STATION

March 2004

Level 10, Toowong Tower, 9 Sherwood Road, PO Box 2184, Toowong, 4066
PHONE (07) 3720 8755 FAX: (07) 3720 8766 website: www.katestone.com.au
E-Mail environmental@katestone.com.au

KATESTONE ENVIRONMENTAL PTY. LTD.

DOCUMENT DETAILS

Job Number: *KE0309194*	***Date:*** *26/03/04*
Title: *Response to EPA questions on air quality report for Wagga Wagga Power Station*	
Client: *ELP*	
Document reference: *Addendumreport_EPAconcerns.doc*	

Revision No.	***Prepared by:***	***Reviewed by:***	***Approved by:***	***Date***
Rev 0	*L Jackson*	*C Killip*	*C Killip*	*25/3/04*

CONTENTS:

TABLES:

FIGURES:

1. Introduction

The EPA have raised some concerns (letter from Robert Monteith on 11/3/2003) in regards to the air quality modelling component of the EIS conducted by Katestone Environmental and submitted by ELP for the proposed Wagga Wagga Power Station (Air quality impact assessment for a proposed power station at Wagga Wagga, Katestone Environmental, 2003). This report responds to the issues raised by the EPA.

2. Response

2.1 Meteorological data

The proposed power station site has no meteorological data available on the actual site. The nearest monitoring station is run by the Bureau of Meteorology (BOM) at Wagga Wagga airport, over 20 km east of the site. Some differences in meteorology would be expected between the two sites due to different terrain influences, further distance inland and general characteristics of the sites (soil type, moisture, roughness lengths etc).

A comparison of the winds recorded by the BOM at Wagga Wagga and the TAPM generated winds at the proposed power station site are shown in Figure 1. The TAPM generated winds for the power station site are dominated by east-north-easterly to easterly and south-westerly to west-south-westerly winds while the Wagga Wagga BOM site is dominated by east-north-easterly to east-south-easterly and westerly winds. The Wagga Wagga site is located at the airport and would not be significantly influenced by terrain with increases up to 40-50 m to the east and south to south-west. The elevations of both sites are similar (210-220 m) however the proposed power station site has terrain increases up to 80-90 m to the north, west, north-east and east to south-east. These terrain features at the power station would cause some degree of sheltering of the winds from these directions. A reduction in the frequency of winds from the east to south-easterly sector as well as the westerly sector would be expected for the power station site compared to the winds recorded at Wagga Wagga. The increase in east-north-easterly and south-westerly winds at the power station site would be a result of the channeling of winds around these hills.

The drainage flows for both sites are dominated by winds from the easterly sector. This is consistent with the expected drainage flows due to the Murrumbidgee River which flows from the east through Wagga Wagga and then to the north-west from Uranquinty.

The wind speed versus time of day plots (Figure 2) for the BOM Wagga Wagga site and the TAPM generated winds for the power station site indicate the TAPM winds for the proposed site have slightly higher mean wind speeds, especially at night time. The maximum wind speeds, however, are similar between sites. The difference between the mean wind speeds may be partly due to TAPM overpredicting and partly due to the limited sensitivity of the BOM monitoring equipment. Previous modelling experience with TAPM throughout Australia has often shown some degree of overprediction of wind speeds at night time. As the power station is not expected to operate very often at night time and as the maximum ground-level concentrations were predicted during convective conditions, this likely overprediction of the wind speeds at night should not affect the modelling results significantly. The wind speed sensor used at the BOM AWS at Wagga Wagga is not very sensitive and records calms unless the wind speed is over 2 km/hr (and generally over 5 km/hr). Comparing the wind speed profiles shows the 95th percentiles to be similar, however the low 5th percentile has the most significant difference. The low equipment sensitivity may contribute to these differences. Lower extreme wind speeds would be expected at the power station site due to the more sheltered nature of the site.

A comparison of the temperatures measured at Wagga Wagga with the proposed power station site (Figure 3) shows the TAPM mean temperatures to be slightly lower at night (up to 4°C) and higher during the day time (up to 3-4 °C). A small difference could be expected due to the general exposure differences between sites and the power station site being further inland than the Wagga Wagga site (over 20 km). However, it is also likely that TAPM over predicts the extreme temperatures. Adjusting the soil moisture may result in a better agreement between the temperatures but may alter the wind speeds. This was therefore not conducted.

It should also be noted that the BOM automatic weather station data is only based on the 10 minutes leading up to the averaging period. As the BOM data is half-hourly the measurements would therefore only be based on measurements for the 10 minutes leading up to the half-hour.

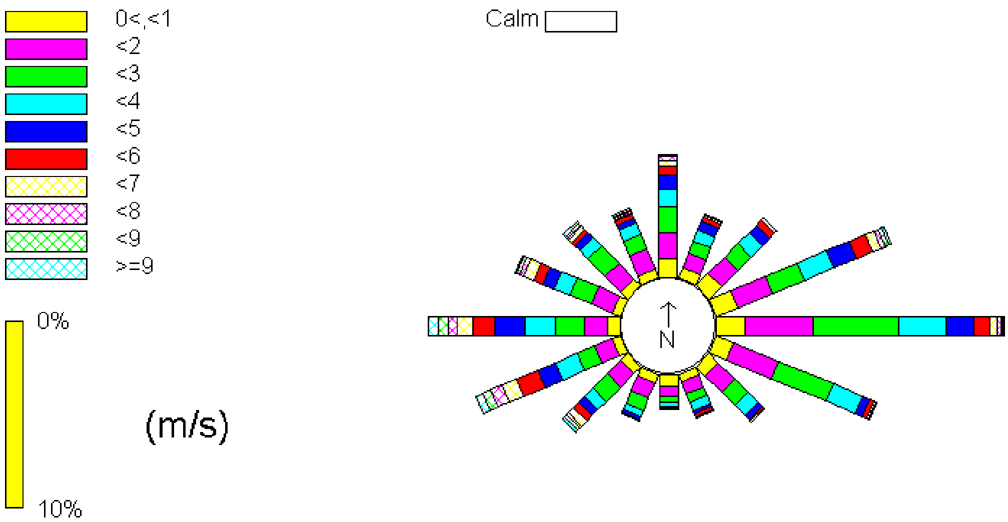
The atmospheric stability has been calculated by TAPM at the Wagga Wagga and proposed power station site and is presented in Table 1. Only minor differences have been predicted by the TAPM model. However it is noted that TAPM does not use stability class directly in the dispersion calculations but uses the actual micro-meteorological conditions for each hour across the modelled domain.

Table 1: Percentage of occurrence of atmospheric stability conditions generated from TAPM for Wagga Wagga and the proposed power station site.

Stability Class	**A**	**B**	**C**	**D**	**E**	**F**
Frequency (%) Wagga Wagga site	5.8	10.8	13.6	33.9	19.8	16.1
Frequency (%) proposed power station site	4.5	10.1	14.3	36.9	20.7	13.5

Figure 1: Wind rose for all hours for the year 1998 for (a) Bureau of Meteorology monitoring site at Wagga Wagga and (b) TAPM generated winds at the proposed power station site.

(a) Bureau of meteorology site



(b) TAPM generated winds at proposed site

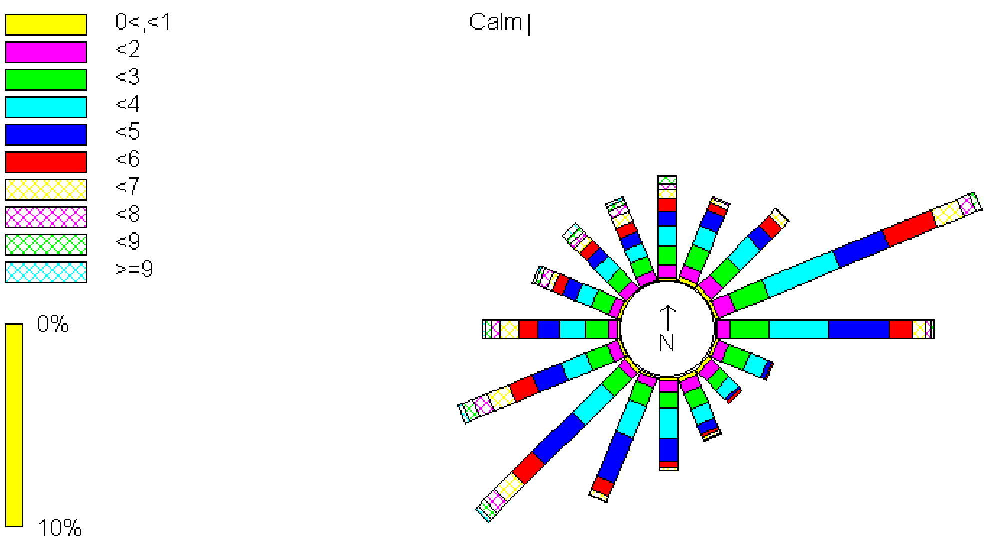
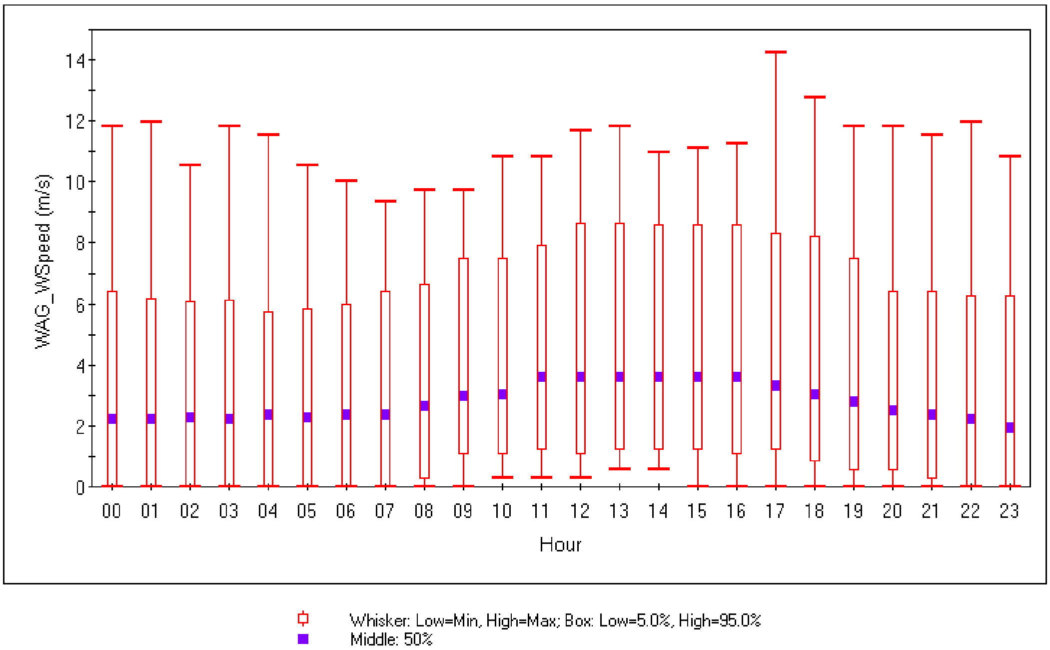


Figure 2: Box and whisker plots of wind speed (m/s) versus time of day for the 1998 period for (a) Bureau of Meteorology Wagga Wagga site and (b) proposed power station site.

(a) Bureau of Meteorology Wagga Wagga



(b) TAPM generated wind speed at proposed power station site

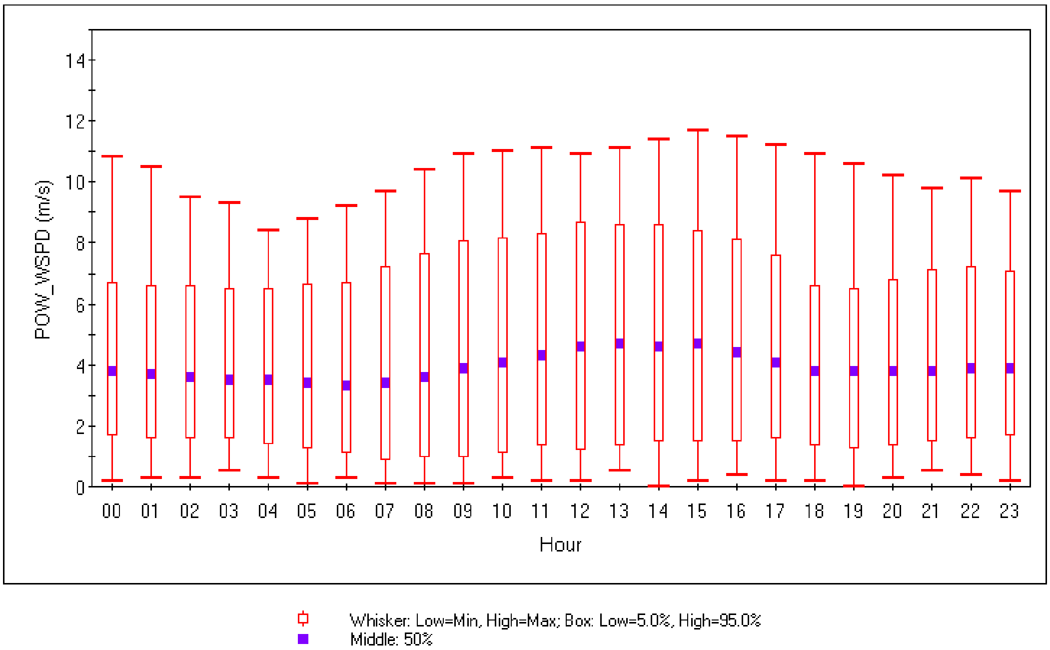
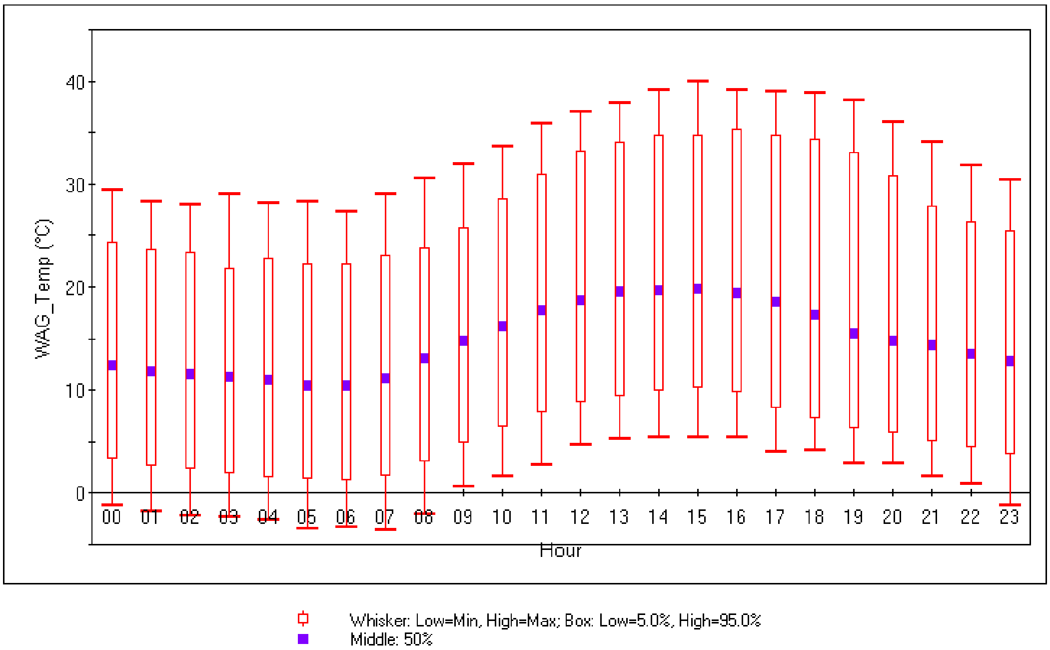
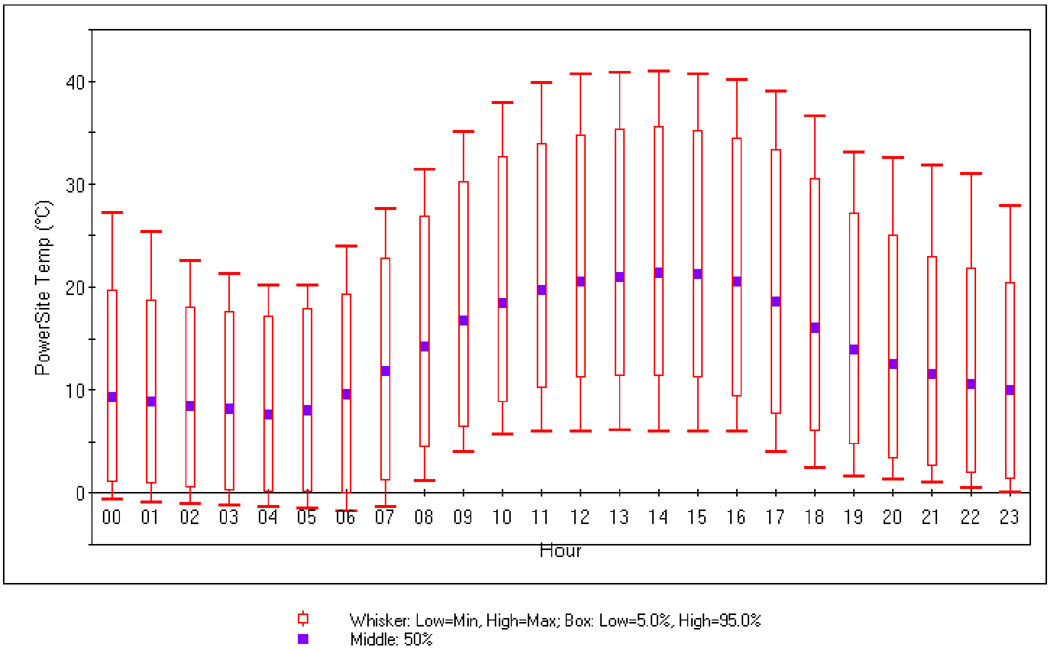


Figure 3: **Box and whisker plots of temperature (°C) versus time of day for the 1998 period for (a) Bureau of Meteorology Wagga Wagga site and (b) proposed power station site.**

(a) Bureau of Meteorology Wagga Wagga



(b) TAPM generated temperature at proposed power station site



2.2 Emissions

The EPA have requested details on the calculation of SO_2 emission rates as used in the modelling assessment. Emissions information for all other pollutants were supplied by the client based on in-stack concentrations from the design specifications of the turbines. A copy of this information is attached in Appendix 1. The stack characteristics shown on page 3 of the Appendix titled Exhaust Gas System MBR is for flows at ISO conditions. ERM has advised that the temperature of the stack will be in the range 545-560 °C for most operating conditions. The 600 °C temperature is the design value however for the modelling we have assumed the average of the temperature range for the actual operating conditions of 552°C. The volume flow was adjusted to reflect the slightly reduced flow for this temperature. ERM advised that the stack characteristics during diesel fuel operations would be similar. The SO_2 emissions were determined using the Australian Greenhouse Office and AP-42 emission factors as the sulphur content in the gas was unknown.

Details of the SO_2 emission calculations are provided below:

Natural gas (Scenario 1 and 2)

Australian Greenhouse Office emissions factor for SO_2 is 2.3 Mg/PJ.

The gas consumption is expected to be 4.575 PJ/annum.

Therefore, 2.3 Mg/PJ x 4.575 PJ/a = 10.52 Mg/annum.

The power station will operate for a maximum of 1768 hours/annum. We have assumed two turbines to be operating continuously with the other two turbines operating occasionally, giving a total of 4250 hours for all of the turbines to be operating per year (2.4 times 1768 hours).

Assuming the number of hours of operation of the turbines of 4250 per year with 10.52 Mg/annum gives 0.0025 Mg/hour or 0.7 g/s.

The Scenario 2 emission rate was calculated based on scaling the in-stack concentrations with the different flow rates.

Diesel engine (Scenario 3)

The emission factor from AP-42 is 8.09E-03 times the percent sulphur content to give a unit of lb/hp-hr (where the SO_x is taken as SO_2).

The diesel fuel specifications provided by the client was for a maximum sulphur content of 0.5 %.

1 HP = 745.7 W
1 lb = 0.4535 kg

Each turbine is 150 MW (or $150x10^6$ W) which is equal to 201,153 HP (150000000/745.7).

Assuming 0.5 % S, then the emission factor of 8.03E-03 x 0.5%S x 201,153 = 813.66 lb/hr

This is equivalent to 369.07 kg/hr or 102.52 g/s.

Diesel generator (Scenario 4)

The information provided by the client for the generator was for the fuel consumption to be 144.2 L/hr and an average density of 0.845 kg/L. The sulphur content again was assumed as the maximum of 0.5 %.

Therefore, 144.2 L/hr x 0.845 kg/L x 0.005 (sulphur content) = 0.61 kg/hr of sulphur.

To convert the emission rate from sulphur to sulphur dioxide the emission rate is scaled by the molecular weights. The molecular weight of sulphur is 32 and sulphur dioxide is 64 resulting in 1.22 kg/hr or 0.3 g/s of SO_2.

2.3 Compliance with Clean Air (Plant and Equipment) Regulation 1997

Page 4 of Appendix 1 shows the change in in-stack NO_x concentration versus capacity of the turbines. At 50 % capacity the in-stack NO_x concentration reaches a peak of 159 ppm (or 0.3 g/m^3). This exceeds the EPA requirements specified in the Clean Air (Plant and Equipment) Regulation 1997 of 0.07 g/m^3 for gas using fuel. However, operating at 50 % capacity would not be likely for this power station as it would not be economical to run at this capacity. The plant could operate at this level for a very short period during start up and ramping up the turbines to the normal operating level of 100 %. If the capacity were increased to more than 50 % then the NO_x in-stack concentration would comply with the regulation.

Reference:

Katestone Environmental 2003 "Air quality impact assessment for a proposed power station at Wagga Wagga, December 2003", Report from Katestone Environmental to ELP