AIR QUALITY ASSESSMENT
PROPOSED DARLING WALK DEVELOPMENT

December, 2007

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CONTENTS

FIGURES

(All figures at end of report)

1 INTRODUCTION

This report has been prepared by Holmes Air Sciences on behalf of the Sydney Harbour Foreshore Authority. It presents the results of a dispersion modelling study of the Cross City Tunnel ventilation stack and the potential for impacts associated with a proposed building at Darling Walk. It comprises the following sections:

- Background to the study
- Description of dispersion modelling undertaken
- Conclusions

2 BACKGROUND TO THE STUDY

Holmes Air Sciences undertook the air quality assessment during the Environmental Impact phase of the Cross City Tunnel project and has undertaken subsequent modelling studies to determine the potential impact of the ventilation stack on future buildings in the vicinity of the stack. Part of the Minister for Planning's Approval Condition 274 for the project was that for any future building, a protocol would need to be developed to allow an assessment of the impact of both the ventilation stack plume on any proposed building and the potential for the building to affect dispersion of the plume.

There is now a proposal to develop a building at Darling Walk which is within 100 metres of the ventilation stack for the Cross City Tunnel. Two building designs are shown in **Figure 1** and are referred to as Arc Massing and Wedge Massing. The study presented here addresses both aspects of Approval Condition 274, that is, the potential impact of the ventilation stack plume on these buildings and the effect of the buildings on the dispersion of the plume.

3 DISPERSION MODELLING

Dispersion modelling was undertaken using AUSPLUME version 6, assuming the Approved Design of the ventilation stack and emission rates based on predicted rather than actual traffic volume through the tunnel. This presents a more pessimistic outcome but is required as the traffic could eventually reach the levels predicted for the Environmental Impact Assessment (EIA) and the subsequent studies. Meteorological data from Goat Island was used as in the EIA. Windroses prepared from these data are shown in **Figure 2**.

Modelling was undertaken for carbon monoxide (CO), nitrogen dioxide (NO_2) and particulate matter less than 10 micrometres in diameter (PM_{10}). A summary of the emission conditions is presented in **Table 1**. The conditions were those assumed in the most recent modelling of the ventilation stack undertaken for approval purposes (**Holmes Air Sciences, 2002**).

Table 1 : Summary of assumed emission conditions for CCT ventilation stack

2006						
Hours starting	Exhaust Stack Air Flows m^3/s	Exhaust Stack Cross Section Area (m^2)	Exhaust Stack Velocities (m/s)	Total CO g/s	Total NOx g/s	Total PM$_{10}$ g/s
0	73	28	2.6	5.02	1.17	0.05
1	50	28	2.5	3.44	0.78	0.03
2	35	28	2.5	2.44	0.54	0.02
3	30	28	2.5	2.06	0.45	0.02
4	49	28	2.5	3.40	0.72	0.03
5	149	28	5.3	10.33	2.13	0.08
6	585	28	20.9	53.86	7.46	0.58
AM Peak 0700	585	28	20.9	57.91	8.68	0.64
8	585	28	20.9	55.79	8.38	0.64
9	310	28	11.1	21.45	4.82	0.19
10	308	28	11.0	21.28	4.88	0.20
Business peak 1100	343	28	12.2	23.70	5.54	0.22
12	296	28	10.6	20.47	4.55	0.18
13	280	28	10.0	19.33	4.08	0.16
14	298	28	10.6	20.60	4.12	0.16
15	585	28	20.9	52.23	6.07	0.48
16	585	28	20.9	54.25	5.98	0.45
PM Peak 1700	585	28	20.9	56.78	5.94	0.42
18	585	28	20.9	52.89	5.71	0.44
19	233	28	8.3	16.08	3.04	0.11
20	181	28	6.5	12.51	2.50	0.10
21	163	28	5.8	11.25	2.38	0.09
22	139	28	5.0	9.59	2.13	0.08
23	106	28	3.8	7.35	1.72	0.07

NOTE: (1) Background concentrations in intake air agreed with Holmes Air Sciences 17/3/00 are:
CO = 0.012 g/m^3
NOx = 0.00075 g/m^3
PM$_{10}$ = 0.000045 g/m^3

An impact zone was defined which took account of the possible background concentrations of the various pollutants to ensure compliance with the respective air quality goals. The prescribed concentrations are based on current air quality goals, they are as follows:

- Carbon monoxide – 20 milligrams per cubic metre (mg/m^3) 1-hour maximum. This assumes a background level of 10 mg/m^3 to achieve the goal of 30 mg/m^3.
- Nitrogen dioxide – 150 micrograms per cubic metre (μg/m^3) 1-hour maximum, assuming that 20% of the total emissions of oxides of nitrogen are nitrogen dioxide. This assumes a background of 96 μg/m^3 to achieve the goal of 246 μg/m^3.
- Particulate matter less than 10 microns in diameter (PM_{10}) – 10 μg/m^3 24-hour average. This assumes a background of 40 μg/m^3 to achieve the goal of 50 μg/m^3. It is also consistent with the change in PM_{10} concentration which is typically used to assess epidemiological health impacts.

Modelling was undertaken for the two building designs at elevated receptors at heights from ground level to 145 m above ground level.

The results of the modelling are shown in Figures 3 – 14. The areas where the goals are exceeded are shown in red. A comparison is made between the existing conditions and the proposed alternative building configurations. The height of 40 metres above ground level would approximate the top of the proposed buildings.

4 CONCLUSIONS

The main conclusions that can be drawn from the results of the modelling are as follows:

1. There are no predicted exceedances of any air quality goals at the proposed buildings for either configuration.
2. There is very little change in the behaviour of the plume under the influence of either building configuration. This is based on comparison with previous modelling of the stack emissions without the building present, **Holmes Air Sciences, 2004**). The observed effects are not sufficient to result in any significant changes to the impacts on any existing surrounding buildings.
3. There is little difference between the two building configurations in terms of the impacts on the plume or the impacts of the plume on the buildings.

5 REFERENCES

Holmes Air Sciences (2002)

“Proposed alterations to the modified activity as outlined in the supplementary Environmental Impact Statement for the Cross City Tunnel” prepared by Holmes Air Sciences for the RTA NSW, October 2002

Holmes Air Sciences (2004)

“Draft: Cross City Tunnel Buffer Analysis” prepared by Holmes Air Sciences for the RTA NSW, March 2004

FIGURES