Appendix M: Child, N. (2006) ‘An overview of current air treatment technologies and applications relevance to Sydney Road Tunnels’.

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Mr Les Wielinga
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Dear Mr Wielinga

An Overview of Current Air Treatment Technologies and Applications
Relevance to Sydney Road Tunnels

I refer to my recent discussions with you regarding the current status and application of various air treatment technologies throughout the world, and the potential relevance of these technologies to current and prospective road tunnels in Sydney.

As you are aware, I completed an independent report on such technologies and their applications for the NSW RTA and the NSW Department of Planning, in September 2004. My purpose in writing is to provide concise advice as requested regarding developments that have taken place in this area since the preparation of my September 2004 report, in particular regarding the proposed use of air treatment technologies as part of the ventilation of a major road tunnel network currently under construction in Madrid, Spain.

1 The Madrid Calle 30 Project - Overview

The Madrid Calle 30 project involves the refurbishment and renewal of an existing and major ring road by rerouting major sections through a matrix of tunnels, and the associated replacement of former surface road areas with green park areas, footpaths, cycle paths and new housing. The "southern" half of the project is scheduled for completion between now and 2007, while the second phase or "northern" part will be completed from 2007/2008 onwards.

Some eighteen months ago, at a fairly advanced stage of the overall project development, it was decided that air treatment technologies would be included in the ventilation systems to be used in the various tunnel sections. The current or "southern" phase of the overall project will involve the treatment of tunnel exhaust air at some 25 individual locations, with flow rates varying between 70 and 700 cubic metres per second at each location. In all cases, treated exhaust air will then be discharged via vents at ground level.

2 The Madrid Calle 30 Project – Air Treatment Technologies

Madrid authorities have elected to use a range of air treatment technologies and providers in the current phase of the project, in part as a qualified and selective trial, with decisions for the second phase to take into account performance in this current phase.

The technologies and suppliers involved in the Madrid project are generally consistent both with those identified in my September 2004 report, and with those subsequently short listed by the NSW RTA as providers for a possible pilot study of air treatment technology in a Sydney road tunnel. Majority service providers/technologies are understood to include Aigner/Alstom (9 locations), Filtrontec (Germany) and National Panasonic, heading a combined Japanese consortium. It is understood that Filtrontec and National Panasonic will be contracted to provide treatment technology at between 14 and 16 locations in total, and that CTA/Alstom is under consideration for 2 of the 25 treatment location.

The treatment technologies to be provided include fine particle removal by electrostatic precipitation and filtration; nitrogen dioxide removal by activated carbon and other absorption

means; and hydrocarbon removal in conjunction with some of the nitrogen dioxide treatment technologies proposed. These technologies are essentially as described in my September 2004 report.

3 Relevance to Sydney Road Tunnels

The September 2004 report identified a number of technologies that were, in my view, "market ready" for the treatment of exhaust road tunnel air in appropriate circumstances. The scope of my 2004 report did not extend to a consideration of "appropriate circumstances". At that time, the use of air treatment technology in road tunnel applications had been limited in the main to Norway and Japan (both the subject of previous RTA assessments and reports), with prospective but limited applications in Korea, Vietnam and Italy. In many respects, at the time of my 2004 report the outcomes of the Norwegian experience remained somewhat ambivalent, and the Japanese applications, while extensive and successful, did not necessarily provide a direct match with prospective needs or circumstances in Sydney.

In my view, the significance of the Madrid Calle 30 project to local circumstances is twofold.

Firstly, it represents the first major use of air treatment technology in continental Europe; the first major use of such technology by an EU member nation; and the single largest application of such technology yet undertaken internationally. In many respects, the Madrid Calle 30 has progressed, and will continue to progress, the mainstream acceptance and use of air treatment technology as part of road tunnel ventilation systems, in appropriate circumstances. It will provide significant reference and support information, and will also in my view inevitably prompt further advancements and refinements in relevant technologies.

Secondly, the treatment of tunnel exhaust air in volumes between 70 and 700 cubic metres per second, and the subsequent discharge of treated air at or near ground level, are issues of interest and possible relevance to any prospective application of such technologies in Sydney.

4 The M5 East Tunnel

Road tunnels are highly individual and circumstance specific elements of transport infrastructure. This reality is of considerable importance in any consideration of the relevance and application of air treatment technologies.

Sydney's M5 East Tunnel, and in particular its ventilation system, involves particularly individual and unique circumstances. The ventilation system in the M5 East is required to contain the exhaust air from two parallel, unidirectional, 4-kilometre tunnel tubes within one overall tunnel system, and to discharge this air only (in terms of general operating conditions) through one single central discharge stack. The M5 East has also been called upon to accommodate significantly greater traffic numbers than were originally forecast. These high traffic volumes include a significant percentage of diesel powered trucks – often older trucks generating high individual levels of smoke particulates and other exhaust pollutants.

Under these circumstances when peak traffic flow occurs in conjunction with an incident, I understand that it is sometimes necessary to use traffic management and portal emissions to maintain air quality within the required goals.

It is likely, in my view, that the constraints currently applicable to the M5 East Tunnel and its ventilation could be resolved by the discharge of exhaust tunnel air either from the portals at each end of the tunnel, or from ground level discharge vents located near these portals. It is also likely, however, that the discharge of untreated tunnel exhaust air in either of these ways would require careful management to avoid breaches of air quality standards, particularly in relation to nitrogen dioxide, near the tunnel portals, or the vents.

However, it is considered likely that the use of appropriate, current generation, air treatment technology could assist in allowing for the discharge of treated air from the tunnel portals, or from vents near the portals, without prejudicial impact on local air quality. This would in turn remove the constraint that, in my view, currently applies to the effective circulation of air within the tunnel itself, and the air quality issues that result, and in my view would allow the tunnel to accommodate current and projected peak hour traffic loads without utilising traffic management, or other traffic flow limiting measures.

5 Implications for Stack Discharges, and Other Sydney Tunnels

In my view, the circumstances applicable to the M5 East Tunnel, as generally described above, are unique among Sydney's existing road tunnels. I understand that none of Sydney's other currently operating road tunnels are subject to traffic constraints as a result of in-tunnel air quality issues. Similarly, from what information is currently available to me and once again subject to appropriate review and confirmation, I do not believe that there is any evidence to suggest that the impacts of air discharged from existing Sydney tunnels, either directly from portals or in the case of the Harbour, M5 East and Cross City Tunnels from stacks, is causing significant or prejudicial impacts on air quality near those stacks.

Therefore, in my view, any prospective application of air treatment technology to enhance, and in effect to "de-bottleneck" the ventilation system in the M5 East Tunnel, would provide no rational basis for the automatic application of such technology in other Sydney road tunnels.

The Lane Cove Tunnel is scheduled to open in late 2006 or 2007. There has been, and is, a campaign in some quarters for the application of air treatment technology to the Lane Cove Tunnel – in the form of both "in-tunnel" and "stack" filtration. In my view, the circumstances described above in relation to the M5 East Tunnel are unique to that tunnel, and are not directly relevant to the circumstances of the Lane Cove Tunnel.

6 Recommendation

In my view, changes in circumstances – in particular the proposed use of air treatment technology in the Madrid Calle 30 project – now provide a sound basis for a further evaluation of the use of appropriate air treatment technology in the M5 East Tunnel, as generally described above.

It is my recommendation that the NSW RTA considers the installation of an air treatment system able to process 200 – 250 cubic metres per second of tunnel air at the western end of the M5 East Tunnel.

This installation could take place in conjunction with other measures available to the RTA.

I recommend that this system once installed can be evaluated, on an operational cost/benefit basis, with benefits to be taken into account to include the avoidance of traffic congestion cost penalties that might otherwise be incurred, and any energy savings resulting from the optimisation of the overall tunnel ventilation system resulting from the impact of the proposed modifications.

I also recommend that, if this matter proceeds as generally described, that every effort be made to communicate the basis of the decision to the general public, in particular the unique nature of the M5 East Tunnel, and the need to consider the ventilation of this and other tunnels on the basis of individual circumstances.

Thank you for the opportunity to present this overview, and the recommendation involved. I would be pleased to provide any further information that might be of assistance.

Yours Very Truly

Noel Child
Child & Associates