Westgate Tunnel Project EES Expert Witness Statement – A/Prof Louis Irving

I, Louis Irving, c/o Department of Respiratory and Sleep Medicine, Royal Melbourne Hospital, Grattan St., Parkville, 3050, have been requested to prepare an expert witness statement by Hobsons Bay City Council related to public health effects from air pollution arising from the West Gate Tunnel project.

My expertise related to this matter is based on the following:

1. I have worked full-time for 30 years as a public hospital based Respiratory and Sleep Physician, and clinical researcher. I am currently director of Respiratory and Sleep Medicine at Royal Melbourne Hospital. I have been a visiting respiratory physician at Peter MacCallum Cancer Centre since 1989.

2. Throughout this time I have held academic appointments and been a teacher in the Department of Medicine and Department of Physiology at the University of Melbourne, and am a senior member of the Lung Health Research Centre.

3. I have developed particular clinical and research expertise in chronic lung disease, lung cancer and asthma. I have received a number of NHMRC research grants and have published 170 scientific articles on these and other subjects.

The specific questions I was asked to address were:

1. The adequacy of the health impact assessment (HIA) which forms part of the EES, including whether it identifies and responds appropriately to the most current scientific literature regarding health impacts from air pollution;

2. Whether the EES Performance Objectives and Environmental Performance Requirements relating to Air Quality adequately protect human health having regard to the evolving science in relation to health impacts from air pollution; and

3. Any modification to the design of the Project or mitigation measures in response to the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes in relation to health impacts from air pollution.

My responses are below. I can expand on these opinions to the Panel, if required, during the hearings.

1. The adequacy of the health impact assessment (HIA) which forms part of the EES, including whether it identifies and responds appropriately to the most current scientific literature regarding health impacts from air pollution

The HIA does not include important data and new insights from the most current scientific literature. Nor does it fully consider all the relevant adverse health impacts due to traffic pollution. Some key examples are given below.

Concerning all cause mortality, studies by Lepeule 2012 (1) and Beelan 2014 (2) are large cohorts that give robust estimates of mortality due to long term exposure to air pollution. The mortality estimates in these studies are higher than those stated in the HIA. Both of these more recent studies included relatively low levels of exposure to small particulate matter (PM 2.5) relevant to the West Gate Tunnel project. They demonstrated an increase in mortality related to exposure to PM 2.5, even at low concentrations. The lack of an apparent safe lower limit of exposure to PM2.5 (and to ozone) has been underscored by a remarkably large study from the USA involving almost 61 million adults followed for 12 years recently published in the New England Journal of Medicine by Di and colleagues (3). They showed an increasing mortality as levels of PM 2.5 and ozone increased. This study also identified that there were groups of people, who were more susceptible to the adverse effects of air pollution than the rest of the population. In this study the risk of death was higher in men, people of African descent and people with Medicaid eligibility, illustrating important biological and sociological principles that might be relevant to the West Gate Tunnel project.

Concerning cancer, the HIA has not incorporated recent studies that demonstrate that air pollution is an important cause of lung cancer. The International Agency for Research in Cancer (IARC), a division of the World Health Organisation (WHO), raised the alarm in 2013 (4). Also in 2013, one of the studies from the European Study of Cohorts for Air Pollution Effects (ESCAPE), by Raaschou-Nielsen et al (5), showed that exposure to PM 10 and PM 2.5 increased the risk for lung cancer. A meta-analysis of 18 studies by Hamra in 2014 (6) confirmed the carcinogenic nature of outdoor exposure to PM 10 and PM 2.5. A second meta-analysis by Chen et al in 2015 (7) included 22 studies involving occupational exposure to air pollution among professional drivers. Again exposure to fine particulate matter increased the risk of lung cancer, and the risk was greater in professional drivers than in other people. IARC currently lists diesel engine exhaust and particulate matter as class 1 carcinogens. Because of the poor survival from lung cancer in Australia (< 14% of sufferers are alive after 5 years), it is essential that preventable causes, including air pollution, are minimized.

Concerning the adverse respiratory impacts of traffic pollution on children, there are a number of very important studies that were not included in the HIA. These include data from ESCAPE in 2013 showing that exposure to PM 2.5 during pregnancy was associated with an increased risk of low birthweight at term, even at levels of PM 2.5 less than the current EU annual limit of 25 ug/m^3 (7). This study concluded that “a substantial proportion of cases of low birthweight at term babies could be prevented in Europe if urban air pollution was reduced”. A second ESCAPE study in 2014 showed an increase in respiratory infections in early childhood for some components of traffic pollution (8). A further study showed small reductions in lung function in children, raising concerns that exposure to traffic pollution in early life might inhibit lung development (9).

There is evidence that exposure to traffic pollution in early childhood also increases the risk of developing asthma and sensitization to aeroallergens and food allergens. This was demonstrated in a meta-analysis of follow-up of birth cohorts from a variety of countries by researchers at the University of Melbourne; Bowatte (10). Also, a meta-analysis of 19 other studies of children by Gasana (11) showed that increased exposure to particulate matter was associated with wheeze. This data is very important because there is already a higher than average incidence of childhood asthma, and asthma admissions, in the areas involved in the West Gate Tunnel project (HIA p 61). As indicated in the HIA, asthma pathogenesis is a complex mix of genetic and environmental factors. If there is already a susceptible population in the region of the proposed West Gate Tunnel, it is essential that environmental factors relevant to the development of asthma, such as air pollution, are mitigated.

There are a number of other significant adverse health effects of traffic pollution that have not been fully explored in the HIA. Important examples are the acute and chronic cardiovascular effects (12,13). One of these studies was performed in Melbourne, and confirmed studies from other cities (including Perth) showing that when the ambient concentration of PM2.5 increased, there was a corresponding increase in out-of-hospital cardiac arrests. There is now a possible biological explanation for this association, with recent data from the Framingham Heart Study showing that short term exposure to air pollution generates a systemic inflammatory response, which is linked to cardiac disease (14). Other important adverse effects are cognitive impairment (15,16,17), type 2 diabetes (18) and stroke (19). This study estimates that globally, nearly one third of all strokes are attributable to air pollution.

2. Whether the EES Performance Objectives and Environmental Performance Requirements relating to Air Quality adequately protect human health having regard to the evolving science in relation to health impacts from air pollution.

This is more concerning than the inadequate HIA. There does not appear to be any provision to monitor the levels of PM 2.5 in the tunnel and in surrounding areas, despite overwhelming evidence that particulate matter from traffic pollution causes very significant immediate and long term adverse health effects. It is quite possible that the West Gate Tunnel project will have significant effects on local PM 2.5 concentrations – increases or decreases depending on design, traffic flow and other factors.

An accurate, regionally based monitoring system needs to be established of mean and peak levels of particulate matter, especially PM 2.5. Peak levels are important because some of the acute adverse health effects such as asthma and cardiac instability are directly influenced by this (13). Also some mitigation measures, such as avoiding areas, staying in-doors or increasing preventer medication can be used for acute peaks in pollution (providing there is a monitoring system). Measurements of baseline pre-construction levels will be required, to interpret post-construction levels and any changed incidence of adverse health effects. There is already a high incidence of some health conditions such as asthma, and possibly lung cancer in the region of the proposed West

Gate Tunnel (HIA). Careful monitoring of air quality, including PM 2.5 will foreshadow changes in the incidence of these conditions. Decreases in adverse health outcomes such as hospital admissions for asthma, the prevalence of bronchitis in children and improved lung function in children, have been observed with decreases in particulate matter following interventions (20,21,22).

Whilst it is essential that monitoring of particulate matter, especially concentrations of PM 2.5 occurs, it will also be important to have flexible EES Performance Objectives and Environmental Performance Requirements that are responsive to changes in our understanding of the adverse health effects of air pollution given there is a steady stream of new scientific insights in this field.

3. Any modification to the design of the Project or mitigation measures in response to the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes in relation to health impacts from air pollution.

I do not have expertise in environmental or traffic engineering. However, mitigation is a pillar of the OECD approach to reducing the impacts of traffic pollution (23). Also there are examples where implementation of air pollution mitigation strategies resulted in a downward trend in air pollution which has been associated with significant health improvements. One of the most notable has been the significant improvement in lung function over 3 cohorts of children (n= 2120) in California corresponding to the time periods 1994 – 1998, 1997 – 2001 and 2007- 2011 (22). Declining levels of nitrogen dioxide and PM due to a range of mitigation strategies were associated with significant improvements in lung function growth and persisted after adjustment for potential confounders. Improvements were noted in children both with and without asthma. Children with clinically low lung function declined from 7.9% to 6.3% to 3.6% across the three time periods as air quality improved ($p = 0.001$). The benefits of improved lung development in children extend throughout their lives.

Mitigation strategies that should be considered for the West Gate Tunnel project include filtration of the tunnel air before it is dispersed, measures to reduce near-road air pollution, and traffic control management. Examples of filtration of tunnel air before dispersal include tunnels in Madrid, Tokyo, Milan and Hong Kong. In the Yamate tunnel in Tokyo, in tunnel filtration was installed to reduce the cost of ventilation of the tunnel by reducing the volume of air required to maintain good conditions for people in the tunnel. In contrast, I understand that the decision to install filtration in the Madrid Calle 30 ring route was influenced by a desire to reduce emissions from the stacks into an already polluted Madrid environment in order to protect the local population.

Measures to reduce road side pollution exposure are highlighted in the booklet “Best Practices for Reducing Near-Road Air Pollution Exposure at Schools” which has been developed by the Californian EPA (24). Measures include legislated minimum distances

for schools or childcare centres from sources of truck traffic emissions, the use of vegetation to form barriers and prohibition of idling outside schools at “pick-up” time.

It is likely that novel or unique air pollution mitigation strategies will be found for the West Gate Tunnel project, especially if this principle is made a high priority. The improvements in health, especially for children, that have been achieved in California are certainly a strong incentive for those people involved in the planning, construction and maintenance of the West Gate Tunnel project in Melbourne.

Statement of completeness

I have made all of the inquires that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

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