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West Gate Tunnel Expert Evidence

Air Quality

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Reference	Date	Prepared	Checked	Authorised
640.11507-R02-v0.1	2 August 2017	Graeme Starke	K Lawrence	G Starke

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INTRODUCTION

1. My name is Graeme Starke and I am a Principal grade air quality consultant employed by SLR Consulting Australia Pty Ltd at 2/15 Astor Terrace, Spring Hill, Queensland. I have worked as an air quality specialist in Brisbane since 2001, originally with Pacific Air and Environment Pty Ltd (2001 to 2010) then SLR Consulting Pty Ltd (2010 to 2013) followed by three years with QGC (2013-2017) and most recently SLR Consulting Pty Ltd (since June 2017) again.

2. My academic qualifications include a Bachelor of Science, Postgraduate Certificate in Information Technology and I am a Member of the Clean Air Society of Australia and New Zealand (CASANZ). A short CV is provided in **Appendix A**.

3. My area of expertise is undertaking air quality impact assessments for environmental projects for road construction, sensitive receiving environments such as childcare centers and retirement villages, power stations, oil refineries, mines, intensive agricultural developments and aluminium smelters. Through the use of air dispersion models such as CALINE3, CAL3QHCR, CALINE4, CALMET/CALPUFF, AUSPLUME, ISC, AFTOX and AERMOD, I have assessed air quality impacts from emissions of particulate matter, criteria pollutants, air toxics and odour.

4. This statement provides a summary of my investigations, findings and opinions in relation to the proposed West Gate Tunnel Project Environmental Effects Statement (EES).

5. My works have included:

   (a) Review of the provided material.

6. I have relied upon previous advice previously given by Alison Radford to Hobson Bay City Council in relation to this evidence.

SUPPLIED INFORMATION AND INFORMATION RELIED UPON

7. My instructions were provided by Harwood Andrews Lawyers in phone discussions and were to provide a review of the provided material relating to the EES with a large number of documents associated with the EES. The most relevant document that relates to my review is listed below**.**

   - *Technical Report G – Air Quality Impact Assessment Report* (9 May 2017) prepared by Golder referred to as the AQIA in this report.

SITE CONTEXT AND POTENTIAL AIR QUALITY ISSUES

8. In December 2015, the Victorian Government announced its intention to partner with Transurban to build the West Gate Tunnel, to provide an alternative river crossing to the West Gate Bridge (described hereafter as the Project).

9. The key components of the Project are:

   (a) A tunnel under Yarraville, including ventilation structures, from norther portals connecting to a new bridge over the Maribyrnong River to southern portals connecting to the West Gate Freeway;

   (b) From the northern portals of the tunnel:

- a bridge over the Maribyrnong River;
- connections to the Port of Melbourne;
- elevated roads along Footscray Road;
- connections to CityLink and the CBD, including an extension of Wurundjeri Way;

(c) From the southern portals of the tunnel to the connection with the Western Ring Road and Princes Freeway (**M80 Interchange**):

- widening the West Gate Freeway; and
- connections to:
  i. the West Gate Bridge;
  ii. Hyde Street / Douglas Parade;
  iii. Williamstown Road / Melbourne Road;
  iv. Millers Road; and
  v. Grieve Parade.

10. The EES The EES objective for the West Gate Tunnel Project relevant to air quality was described as '*To minimise adverse air quality effects on the health and amenity of nearby residents, local communities and road users during both construction and operation of the project*'.

11. The main construction-based impacts from the project, based on my experience, are:

(a) Particulate matter generated by mechanical construction activity, wheel-generated dust, windblown dust and concrete batching activity.

(b) Asphalt odours from road sealing.

(c) Exhaust emissions from construction vehicles.

12. The EES identifies the potential sources of air quality impacts from the operational project as follows:

(a) Exhaust emissions from vehicles using roads constructed as part of the West Gate Tunnel Project or changes to traffic volumes and mix on surrounding surface roads (both positive and negative impacts).

(b) Emissions from the road tunnel ventilation structures.

(c) Combined emissions from exhaust emissions from vehicles and road tunnel ventilation structure emissions.

13. I agree that the above represents the main potential sources of air quality emissions to the site and address these separately in the sections below.

14. The AQIA identified six Environmental Performance Requirements:

- AQP1 – Design and implement a tunnel ventilation system to meet best practice and design criteria of the SEPP(AQM) in accordance with the requirements of the EPA Works Approval;

- AQP2 – Design the tunnel ventilation system to achieve zero portal emissions during operations;

- AQP3 - Design and implement a tunnel ventilation system to introduce and remove air from the tunnels to meet in tunnel air quality requirements for CO;
- AQP4 - Develop and undertake an air quality monitoring program to measure the air quality impacts of the Western Distributor, including at least one year of monitoring before operation, and five years post opening of the Freeway, or as agreed with EPA Victoria;
- AQP5 - Monitor the in-tunnel air quality and ventilation structure emission during operation of the ventilation system to demonstrate compliance with, AQP3, SEPP(AQM) and the EPA licence to the satisfaction of EPA Victoria; and
- AQP6 - Manage construction activities in accordance with EPA Victoria Publication No. 480 Guidelines for Major Construction Sites to maintain air quality to a standard which does not prejudice the health and amenity of nearby residents, open spaces and community facilities. Develop and implement an air quality Management and Monitoring Plan including in respect of dust, odour, and construction vehicle emissions to minimise impacts during construction.

15. It is my opinion that these EPRs along with the Construction related Environmental Management Measures in Section 11 are effective measures to reduce the potential air quality impact pathways created by this project.

BACKGROUND CONCENTRATIONS

16. I have reviewed the siting details of the three Ambient Air Quality Monitoring Stations (Footscray, Altona North and Brooklyn) in proximity to the west gate tunnel project and have the opinion that the choice of Footscray AAQMS in the EES as the background air quality station and meteorological monitoring location was appropriate. This is because the Altona North AAQMS is comparatively closer to the ocean (~1.5k) and would be more heavily influenced by sea breezes and other near-ocean meteorological influences. The Brooklyn AAQMS, while very similarly located geographically to the West Gate Tunnel, is relatively close to the M1 (230 m) and Millers Road (150 m) and is likely to be influenced by the vehicle emissions from these two major roads. The Footscray AAQMS, on the other hand is removed from the Princess Highway (~400 m) and is likely to provide a better representation of background concentrations without the influence of nearby road emissions or unsuitable meteorology enabling incremental project emissions to be adequately assessed.

CONSTRUCTION PHASE IMPACTS

17. The construction-related Environmental Performance Requirements (EPR) outlined in Appendix H of the AQIA (AQP6) and the control measures described in Tables 108, 109 and 110 are appropriate to manage construction air quality impact risks for this Project.

18. It is noted however, that the AQIA states that the '*design, number and location of these temporary ventilation systems is currently not known*' but that they will '*be sited, where possible, at locations away from sensitive receptors*'. It is impossible to predict potential impacts associated with this activity given the current knowledge of the project and it is recommended that during the development of the Construction Environmental Management Plan construction emission source are assessed for the need to undertake quantitative emission impact assessments prior to the works proceeding.

IMPACTS OF EMISSIONS FROM TUNNEL VENTILATION STRUCTURES

19. Dispersion modelling, using the Victorian Environment Protection Agency (VEPA) approved modelling package AERMOD, was conducted to assess the potential impacts of the tunnel ventilation system. Two scenarios were assessed representing the future years of operation; 2022 and 2031 (Scenario A and Scenario B).

20. The results (99.9th percentile in line with SEPP (AQM) Schedule C requirements) of these modelling scenarios, inclusive of background concentrations, were presented in Tables 40 to 45 of the AQIA for Scenarios A and B, while contour plots of the 100th percentile incremental predicted impacts were predicted in Figure 1 through to Figure 22.

21. These results showed '*Predicted $PM_{2.5}$ (constant background assessment), CO, NO_2, BTEX, 1,3-butadiene, formaldehyde and PAHs [as B(a)P TEQ] concentrations comply with the applicable design criteria in 2022 and 2031*'. However, both Scenario A and Scenario B predicted exceedances of the PM_{10} criterion that were driven by exceedances in the background concentrations.

22. The results presented in Tables 40 to 45 all show the Project contribution to the maximum predicted ground level concentration (GLC), however there is no presentation of the Project's maximum incremental impact. This makes it difficult to assess if there are occasions when the Project might contribute significantly to a predicted exceedance or to an additional exceedance which is the second or third highest cumulative impact (for example). Maximum incremental increases may be inferred from Figure 1 to Figure 12, however due to the largest contour being plotted as >20 µg/m³ it is not explicitly clear.

23. An additional four scenarios were modelled as sensitivity analyses to understand the impact that may occur if assumptions made regarding the fleet mix turn out to be incorrect. These four scenarios were:

    (a) Maximum lane capacity (three lanes, operating 24 hours a day, 365 days a year)

    (b) Emissions at in-tunnel air quality limits

    (c) Increased diesel to petrol fuelled car ratios

    (d) Increased proportion of HCVs in fleet mix

24. As in Tables 40 – 45, the results of the sensitivity analysis presented in Tables 46 to 53 of the EES are all shown as the Project contribution to the maximum predicted ground level concentration (GLC) and there is no presentation of the Project's maximum incremental impact. As noted above, this makes it difficult to assess if there are occasions when the Project might contribute significantly to a predicted exceedance.

25. Given that there are already predicted exceedances of air quality guidelines it is therefore recommended that Tables 40 to 45, 46 to 53 and those Tables presented in Appendix D (Discrete Receptor results which summarise the same modelling) be amended to include details of the maximum predicted incremental impact from the Project and associated cumulative impact to provide surety that no additional exceedances of the design criteria for PM_{10} are likely to occur at discrete receptors such as Emma McLean kinder, schools etc.

26. The tunnel ventilation structure emission analysis has made no mention of possible impacts on tall buildings identified in Section 6.2.2.2. It is my experience that pollutant concentrations within the elevated plume centreline from elevated emission sources can be significantly more concentrated than that predicted at the ground level where the current assessment has taken place. It is my opinion that the potential impacts of elevated plume concentrations impinging on tall buildings needs to be addressed in the AQIA, particularly for residential high-rises with open balconies and openable windows.

27. It is also my opinion that despite being required by Schedule C of the SEPP (AQM) to use the VEPA regulatory model AERMOD, there are models that are specifically designed for this application that may have produced a more accurate outcome. For instance, the Westconnex M4 East Environmental Impact Statement utilised the Graz Lagrangian model (GRAL, developed 1999) because it is able to undertake simultaneous modelling of multiple emission sources (surface roads, tall ventilation outlets) thus eliminating the need for multiple models to be run, is able to characterise pollution dispersion in complex terrain including urban buildings, and has been validated in a wide range of meteorological conditions and terrain types.

IMPACTS OF EXHAUST EMISSIONS FROM VEHICLES ON SURFACE ROADS

28. AUSROADS is based on CALINE 4 and is suitable for use in open terrain under homogenous (free flow) traffic conditions. It predicts poorly under low wind speed conditions and/or in urban environments.

29. CALINE 4 has been validated by peer-reviewed studies carried out by the model supplier or a regulatory agency (ie US EPA) but only for straightforward open roads with fairly fast moving (free flowing) traffic.

30. If these conditions are not representative of the road links to be modelled, then model verification should be performed. This involves carrying out checks on model performance at a local level and involves comparison of predicted versus measured concentrations.

31. Additionally, SLR have been given verbal advice from VEPA with regard to AUSROADS that "we *(VEPA)* haven't been actively updating it but we have been using it internally on a few projects" indicating that the model is no longer considered best available technology.

32. It is therefore my opinion that to rely upon the modelling outcomes of the AQIA a comparison analysis of model prediction with data recorded in a similar landuse to justify the use of AUSROAD needs to be undertaken.

33. Pollution barriers were not explicitly investigated though and while regulatory models have no mechanism for incorporating the effects that barrier would have on dispersion outcomes, a qualitative discussion should be included in the assessment such as that found in Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality. (Environmental Protection Agency, 2016).

COMBINED IMPACTS FROM TUNNEL VENTILATION AND SURFACE ROADS

34. The AQIA states that tunnel ventilation emissions have been assessed for compliance with Schedules A and C of the SEPP (AQM), while the emissions from surface roads were assessed for compliance with the intervention levels in Schedule B of the SEPP (AQM).

35. The results of the cumulative impact assessment have been compared to the SEPP (AAQ) Schedule B and NEPM (Ambient Air Quality) standards. But it is stated in Section 4.3.3 that these standards are not relevant to air emissions from individual sources, specific industries or roadside locations and have only been used for comparative rather than compliance purposes in discussing potential impacts of the project on the receiving environment.

36. However, to adequately assess the tunnel ventilation impacts combined with surface roads impacts the existing background concentrations plus the surface roads impacts (increase or decrease in concentration) should be considered as a new background concentration against which the tunnel ventilation emissions are assessed for compliance with Schedules A and C of the SEPP (AQM).

37. For the reasons above, it is my opinion that the combined impacts assessment needs to be assessed against Schedules A and C (AQM).

SUMMARY AND CONCLUSIONS

38. I have reviewed the EES and provided material in relation to potential air quality impacts associated with the proposed West Gate Tunnel.

39. The EES addresses the key environmental air quality sources that could impact the local receiving environment, namely construction phase dust, odour and construction equipment exhaust emissions and operational phase emissions from road tunnel ventilation structures, vehicle exhausts on surface roads and the combined impacts of both.

40. In relation to the construction-phase impacts, I consider that the Construction Environmental Management Plan needs to include an assessment of the need for quantitative assessment of constructionair emissions once the design and location of temporary ventilation structures are confirmed.

41. In relation to operational-phase impacts, Tables 40 to 45, 46 to 53 and those Tables presented in Appendix D (Discrete Receptor results) need to be amended to include details of the maximum predicted incremental impacts from the Project and associated cumulative impacts to provide surety that no additional exceedances of the design criteria are likely to occur as a result of the Project.

42. The potential for plumes from the tunnel ventilation system impacting on tall buildings needs to be addressed as part of the tunnel ventilation assessment.

43. AUSROADS is based on CALINE 4 and is suitable for use in open terrain under homogenous (free flow) traffic conditions. It predicts poorly under low wind speed conditions and/or in urban environments. As such, a comparison analysis of model prediction with data recorded in a similar environment to justify the use of this model to assess the potential air quality impacts of the Project.

44. To adequately assess the tunnel ventilation impacts combined with surface roads impacts, the tunnel ventilation emissions should be assessed for compliance with Schedules A and C of the SEPP (AQM) considering the new surface roads impacts as background. This is particularly relevant to areas that are predicting increased impacts from surface road emissions such as Blackshaw Road and Millers Road.

Yours sincerely

GRAEME STARKE
Technical Discipline Manager and Principal Air Quality

Checked/
Authorised by: KL