Reference number:	
Advice from:	Dr Lyn Denison
Date of response:	13 September 2017
This advice is in response to request:	Following the completion of expert evidence, provide a brief final report to the IAC no later than the end of Week 4 of the Hearing which complies with the PPV Practice Note – Expert Evidence and sets out: a. any changes of opinion since your interim report (if any) and the reason for that change in opinion; and b. your opinion on the latest version of the Proponent's proposed approval documents (if any) and any other party's suggested changes to the approval documents.

List of Abbreviations

NEPM	National Environment Protection Measure
NEPC	National Environment Protection Council
WGTP	Westgate Tunnel Project

1 Change of Opinion

(i) Question

Are there any changes of opinion since your interim report? If so, what are the reasons for that change in opinion?

In answering this question, please discuss the extent (if any) to which the written and oral evidence, conclave reports and any further Project Notes have resolved any issues previously raised in your interim report.

Please include a succinct summary in dot point form of any significant outstanding concerns you have in relation to the Project (if any).

(ii) Response

There was no evidence given that has changed my opinion expressed in my Interim Report to the IAC in regard to the Air Quality Impact Assessment and the assessment of the potential impacts attributable to the project. However, there are some areas of clarification that are required.

The information provided in Project Note 1 regarding removal of the toll point between Grieve Parade and Miller's Road potentially resulting in a significant reduction in trucks on Miller's Road has merit and should be considered in the final design of the project. The removal of 3,000 trucks per day on Miller's Road will lead to reductions in air pollution. It isn't possible to provide an estimate of the reduction without air dispersion modelling however there would be a reduction associated with this measure.

One issue that requires clarification from my interim advice is in relation to the selection of sensitive receptors within 1 km of the stacks. In Mr Fleer's evidence and his response to the interim advice it appears that my comment has been interpreted that I did not understand that the modelling had been done across a much larger modelling domain. At no stage did I question this and I fully accept that the model grid, including the finer model grid, was modelled across a much larger area than the 1 km area that the discrete sensitive receptors were selected. My question was specifically related to why the selection of these discrete receptors was limited to 1 km from the stack. In Mr Fleer's written response this question has still not been clarified.

A number of issues were raised in the hearing and through cross-examination of the experts that require further consideration. The key issues are:

- Dispersion of the pollutants from the stack
- The selection of what represents the worst-case scenario for emissions
- Results of modelling with inclusion of brake and tyre wear
- Potential mitigation measures for surface roads

These are discussed below.

1. Dispersion of the pollutants from the stack

At the hearing Mr Fleer tabled a graph showing the maximum ground level concentrations in relation to the ventilation stacks (Document 95). The graph showed an unusual pattern of dispersion with the maximum concentrations predicted very close to the base of the stack. When asked Mr Fleer commented that he thought that it was an unusual pattern but they had not investigated this further than what was presented in the Technical Appendix G. Mr Starke during his evidence was also questioned about this and he commented that he thought it could be building downwash due to the ventilation structures but that he had also not done any modelling to test that. With the maximum concentrations being predicted close to the ventilation structures this means that normal dispersion of the plume is not occurring with the current design and effective dilution of the pollutants before they reach ground level may not be occurring.

My understanding of the current design, which is based on what is currently within the EES documentation, is that the ventilation stacks terminate level with the external structure. This may affect the dispersion of the plume from the ventilation stack. At this stage, from documentation that I have seen, the impact of raising the height of the ventilation stacks above the external structure on the resulting ground level concentrations has not been tested and should be done prior to completion of the final design of the ventilation structures. If increasing the stack height, although it may not be optimal from a visual amenity perspective, improves the dispersion of the pollutants from the stacks and reduces the ground level concentrations this is worth considering in the final design. In the sensitivity analysis that has been conducted assuming all three lanes of the tunnel are at capacity, the maximum 1-hour ground level concentration for PM_{10} was 23 $\mu g/m^3$ which is nearly 25% of the design criteria in SEPP (AQM). This is a significant increase and should be minimised where possible.

If the height of the stacks relative to the external structure is not responsible for the unusual dispersion pattern, then the accuracy of the modelling and performance of the model should be investigated more fully for its applicability for this project.

2. The selection of what represents the worst-case scenario for emissions

In my interim advice, I raised concerns in regard to what constituted the most realistic worst-case normal operating scenario for the tunnels. The normal operating scenario adopted by Golder was 2 lanes operating for 24 hours per day, 365 days per year at 80km/hr. A sensitivity analysis was conducted with 3 lanes operating for 24 hours per day, 365 days per year, 40 km/hr. In reality, neither of these scenarios are realistic. There will be periods in the day where there is free flowing traffic, 2 lanes operational. However, there will also be hours in the day, during peak periods, where the traffic is congested and all three lanes are at capacity. The most realistic scenario is a combination of the two described above.

Therefore, the modelling for the sensitivity analysis is relevant in assessing compliance with SEPP (AQM). The modelling outputs are not 24-hour averages for the stack emissions but are 1-hour averages. Therefore, the maximum concentration for the sensitivity analysis is applicable to the worst case 1-hour situation if the more realistic scenario is adopted. This maximum ground level concentration, project alone, is 23 $\mu g/m^3$ which is nearly 25% of the

design criteria in SEPP (AQM). This is a significant increase and should be minimised where possible. Further mitigation measures should be considered to reduce this impact. This modelling has not included reintrained road dust which will further increase the predicted ground level concentrations.

3. Results of modelling with inclusion of brake and tyre wear

The emission factors used in the modelling were subject to significant discussion by all expert witness for air quality. For the surface roads in particular the inclusion of tyre and brake wear in the modelling of Francis St and Westgate Freeway (Document 100) showed an increase in the predicted PM_{10} levels both with and without the project. The incremental increase above the no project scenario for Westgate Freeway was greater than with the exhaust only modelling. This means that there would also be an increase in health risk. No modelling was done for the other surface roads such as Millers Road, and Geelong Road. Based on modelling that has been conducted it is clear that increases in PM_{10} and $PM_{2.5}$ levels at these roads would also increase. The greater the increase in traffic would lead to a greater increase in PM levels near these roads. It is recommended that modelling of the roads where there is predicted to be an increase in traffic including tyre and brake wear and reintrained road dust should be conducted to guide the selection and effectiveness of any mitigation measures that may be required to minimise the impacts, including health impacts at these locations.

4. Potential mitigation measures for surface roads

During the hearing there was discussion with all of the experts on what mitigation measures could be implemented to reduce the impacts from increased traffic on surface roads. In Professor Irving's evidence (Document 181) he referred to a number of documents from the USEPA and Californian EPA that provided examples of how to reduce the impacts on local communities from heavily trafficked roads.

Post Professor Irving's evidence I accessed the documents from the USEPA and Californian EPA websites and reviewed them to gain an understanding of the effectiveness of these measures. Three key measures are used:

- Noise walls
- Vegetative screening
- Combination of noise walls and vegetative screening

All three options have been found to be effective in reducing air pollution levels at residences close to major roads. The most effective is the combination of noise walls and vegetative screening however vegetative screening alone has been shown to be effective in reducing pollution levels. The extent of the reduction is dependent on the type of vegetation used and this is discussed and recommendations made on what type and how the vegetation should be planted to maximise the effectiveness of the screening. The USEPA (2016) document notes that vegetation can permanently remove gaseous pollutants, such as NO_2, from the air. For particles, they can be washed off the vegetation when it rains but they are effective in reducing the airborne PM levels near roads. There are also other benefits such as improving

aesthetics etc that have been attributed to vegetation screening. As the trees can affect air flow along a street canyon the breaks in the trees are not as significant as the breaks in noise walls in reducing the effectiveness of the screening.

Other mitigation measures that are discussed in these reports include setting strict speed limits to minimise sudden braking which increases emissions, used of roundabouts which slows traffic down and other traffic management measures that can all lead to a reduction in near road pollution levels.

I have not attempted to give a complete analysis of the information contained in these reports but simply to provide the IAC with information that mitigation measures do exist for surface roads and have been successfully implemented internationally. These should be considered in the final design of the surface roads for the project.

2 Approval Documents

(i) Question

What is your opinion on the latest version of the Proponent's proposed approval documents (if any) and any other party's suggested changes to the approval documents (if you have seen those changes by the time you write this report)?

Please include a list of your recommended changes to the proposed approval documents (if any) including any changes to the EPRs or changes to the design plans (in so far as such changes fall within the IAC's terms of reference)?

(ii) Response

In the latest version of the EPRs provided to me, there were no changes proposed to the air quality EPRs. In my interim advice, I suggested that the inclusion of provision for retrofitting of pollution control equipment be included in the EPRs. I acknowledge that there is currently such a requirement in EPR AQP3 for in-tunnel air quality and this should be supported. However, I am also of the opinion that this should be extended to external air quality should the air quality monitoring show that there is a significant impact from the ventilation stacks on ambient air quality. This could be framed in similar terms to that proposed for East West Link

An EPR should be included to include consideration of mitigation measures for the surface roads where significant increases in traffic are predicted. This could be framed in terms of the implementation of mitigation measures to reduce exposure and health risk to exposed communities. The measures outlined in the USEPA and Californian EPA documents discussed by Professor Irving in his evidence have been identified to be effective in near road environments.

The AQIA has assumed that an in-tunnel air quality limit for NO_2 would be adopted for the project similar to that adopted in the NSW tunnels. Some of the sensitivity analyses have assumed that this would limit the in-tunnel NO_2 and the modelling has been done on this basis. Consideration should be given to AQP3 including in-tunnel limits for NO_2 as well as CO. This is not currently included in the EPRs.

The recommendation in my interim advice to specify the air quality standards to be used to assess air quality monitoring results still stands.