
Reference number:

Advice from: Dr Lyn Denison

Date of response: 12 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

CRF	Concentration Response Function
NEPC	National Environment Protection Council
NHMRC	National Health and Medical Research 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 Health Impact Assessment and the assessment of the health impacts attributable to the project.

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 and noise attributable to the project which will have health benefits to the community in that area.

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

- Acceptable Risk Levels for the Project
- Risk Assessment Framework that has been applied for air quality
- Dose response relationships used for the noise risk assessment.

These issues are discussed below.

1. Acceptable Risk Levels for the Project

As raised in my Interim Advice there is general agreement by national and international agencies that that an incremental increase in risk is an acceptable risk level and that risks above a 1 in 10,000 risk level are considered unacceptable. Although Dr Wright and I disagree on the applicability on the application of the 'tolerable' risk criteria, from what is presented in the HIA there is agreement that the 1 in 10,000 risk level is considered unacceptable. This is the level that should be used to assess the acceptability, or otherwise, of the impact of the project on the health of the population within the project area.

The data presented in the HIA for both noise and air quality show that although in many areas the incremental risk is within acceptable risk criteria, there are some areas where the acceptable and unacceptable risk levels are exceeded. Some examples are shown in the following table.

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Pollutant	Health Outcome	Location	Risk Level	Source
PM _{2.5}	All-cause mortality 30+ age group	Miller's Road	6x10 ⁻⁵	Table 6.15 Technical Appendix J EES
PM _{2.5}	Hospital Admissions Cardiovascular Disease 65+ years	Miller's Road	9x10 ⁻⁵	Table 6.15 Technical Appendix J EES
Diesel PM	Cancer	Miller's Road	4x10 ⁻⁵	Table 6.15 Technical Appendix J EES
Noise	Mortality all-cause	Westgate Freeway	5 x 10 ⁻⁵	Table 7.2 Technical Appendix J EES
Noise	Hospital Admissions Cardiovascular Disease	Westgate Freeway	1x10⁻⁴	Table 7.2 Technical Appendix J EES
Noise	Hospital Admissions Ischaemic Heart Disease	Westgate Freeway	3x10 ⁻⁵	Table 7.2 Technical Appendix J EES
Noise	Mortality all-cause	Tunnels	1x10⁻⁴	Table 7.2 Technical Appendix J EES
Noise	Hospital Admissions Cardiovascular Disease	Tunnels	3x10 ⁻⁵	Table 7.2 Technical Appendix J EES
Noise	Hospital Admissions Ischaemic Heart Disease	Tunnels	4x10⁻⁴	Table 7.2 Technical Appendix J EES
Noise	Mortality all-cause	Port Access, CityLink and City Access	3x10 ⁻⁵	Table 7.2 Technical Appendix J EES

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Noise	Hospital Admissions Cardiovascular Disease	Port Access, CityLink and City Access	3×10^{-5}	Table 7.2 Technical Appendix J EES
Noise	Hospital Admissions Ischaemic Heart Disease	Port Access, CityLink and City Access	3×10^{-4}	Table 7.2 Technical Appendix J EES
Noise	Mortality all-cause	Westgate Freeway (Ramp M1, Millers Road EB) on ramp,	7×10^{-5}	Table 7.2 Technical Appendix J EES
Noise	Hospital Admissions Cardiovascular Disease	Westgate Freeway (Ramp M1, Millers Road EB) on ramp,	2×10^{-5}	Table 7.2 Technical Appendix J EES
Noise	Hospital Admissions Ischaemic Heart Disease	Westgate Freeway (Ramp M1, Millers Road EB) on ramp,	1×10^{-4}	Table 7.2 Technical Appendix J EES
Noise	Mortality all-cause	Tunnels (Hyde St, Westgate Freeway to Francis St)	3×10^{-5}	Table 7.2 Technical Appendix J EES
Noise	Hospital Admissions Ischaemic Heart Disease	Tunnels (Hyde St, Westgate Freeway to Francis St)	6×10^{-5}	Table 7.2 Technical Appendix J EES
Noise	Mortality all-cause	Port Access, CityLink and City Access (Hawke St between Spencer St and King St)	1×10^{-5}	Table 7.2 Technical Appendix J EES

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Noise	Hospital Admissions Ischaemic Heart Disease	Port Access, CityLink and City Access (Hawke St between Spencer St and King St)	6x10⁻⁵	Table 7.2 Technical Appendix J EES
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The numbers in bold in the above table are those that exceed the unacceptable risk criteria. There are numerous other examples shown in Appendices F, G and H to Technical Appendix J including impacts at the Emma McClean Kindergarten for asthma reliever medication usage and for various outcomes along Millers Road, Geelong Road and Westgate Freeway.

In Appendix E to Technical Appendix J, there is a discussion on what the acceptable and unacceptable risk criteria mean in terms of risk and mitigation measures. In terms of unacceptable risks Appendix E states (page 237):

On this basis, for this project, the calculated individual risks have been considered to be:

- *Unacceptable in excess of 1 in 10,000, where the implementation of additional mitigation measures is considered appropriate to reduce exposures*

It needs to be noted that the risks calculated for the project are actually population risks not individual risks as they are based on the outcomes of population based studies, population baseline health incidence and ambient air quality or noise exposures, no individual data has been used.

Although Dr Wright has set this assessment criteria for the project she has not recommended any additional mitigation measures and in fact stated that the health risk is negligible. This is in direct conflict with what has been set as an assessment framework for the project.

In my opinion, the assessment framework developed for the project, unacceptable risks above 1 in 10,000 requiring additional mitigation measures to reduce exposures, should be adhered to. The goal posts should not be changed mid project. The framework for assessment is consistent with international guidance in regard to unacceptable risks and therefore should be adopted for this project. My opinion re an acceptable risk level of 1 in 100,000 still applies.

Dr Wright stated that NSW Health accepted the risk estimates for the Westconnex and Northconnex projects in Sydney. NSW Health provided written submissions to both projects in which they state that:

NORTHCONNEX (full submission available at https://majorprojects.accelo.com/public/0539b1b177dab618e3ac1ea140fd80aa/NorthConnex_EIS_submission_NSW%20Health.pdf)

According to the framework outlined in the HHRA, the predicted levels described would not normally be considered to be negligible and might fall within the

acceptable or tolerable risk category. As such an investigation should be made into all reasonable and feasible measures to minimise this risk and in the context of a tunnel these measures should be focussed at maximising dispersion. Measures that should be considered include the number of stacks, heights of stacks, outlet velocity flow of emissions from stacks and the location of stacks.

The HHRA of the external air quality impact for residents around the Northern and Southern Stacks demonstrates a non-negligible risk in terms of long term health impacts. The level of risk is such that all feasible and practical measures to improve dispersion of the emissions from the stacks need to be explored to minimise the risk.

The EIS predicts reductions in PM25 and nitrogen dioxide exposure in a number of the areas in 2021 and 2031. There are, however, limited areas of increased PM25 and nitrogen dioxide exposure that appear to align with traffic congestion. The HHRA predicts a non-negligible increased risk of hospitalisation and mortality (to a maximum of increase risk of 5 per 100,000 per annum) for residents who experience an increase in PM2.5 and /or nitrogen dioxide exposure. Based on this assessment, it is recommended that there is further exploration of all feasible and reasonable measures to reduce ground level concentrations in those areas currently predicted to experience an increase.

WESTCONNEX (full submission available at <https://majorprojects.accelo.com/public/7e8f419d3d2cd630c4281b487c16f9e0/11.%20Health%20NSW%20EIS%20Submission.pdf>)

The maximum level of risk from PM2.5 is estimated at 5×10^{-5} per annum for increased mortality risk. According to the framework outlined in the HHRA, this predicted level described would not normally be considered to be negligible (as suggested in Appendix J) and might fall within the acceptable or tolerable risk category. As such all reasonable and feasible measures to minimise this risk should be highlighted and considered.

The HHRA provides limited information on the impacts of noise other than acknowledging that without mitigation, noise levels are likely to result in adverse impacts for sensitive receivers. The lack of information provided on the mitigation measures to protect health limits NSW Health's ability to provide any advice on the likely impacts of noise. Further information on likely mitigation measures and trigger points for their implementation is required. Failure to adequately adhere to proposed measures may result in significant stress and anxiety for individuals and communities, particularly those in very close proximity to the project. It is therefore important that there is a detailed communication plan with individual residents about noise mitigation. It is important that such a plan includes the way in which two-way communication will occur with individuals who may find it difficult to advocate for themselves, especially those who are elderly, who do not speak English, are housebound, or who may be unwell.

As can be seen from the NSW Health submissions they did not consider the predicted risk levels to be non-negligible and recommended that additional mitigation measures be considered to protect health. The maximum predicted risk levels for the Westgate Tunnel Project are higher than those predicted for the Sydney road projects and some in fact exceed the unacceptable risk levels.

Dr Wright in her evidence referred to risk assessment conducted for the Western Sydney Airport EIS and the fact that there were high levels of risk predicted in some locations. Although it is unclear where Dr Wright obtained the risk estimates she quoted, the risk levels predicted for noise and air quality for some health outcomes in Badgery's Creek and parts of Luddenham did exceed acceptable risk criteria. It should be noted that the properties in Badgery's Creek has already been acquired to enable the airport to be built. In the parts of Luddenham that were particularly affected some properties were acquired and noise attenuation measures were proposed for other properties and schools. The exceedances of the acceptable risk criteria and noise guidelines triggered additional mitigation measures to be adopted for the project.

It needs to be noted that the HIA s based on the air quality modelling that was conducted for the EES which did not include non-tailpipe emissions. As shown in the modelling done by Mr Fler for Francis St and Williamstown Road, the inclusion increases the incremental increase from the project. This means that with the inclusion of the non-tailpipe emissions the risks associated with the project may be greater than those presented in the HIA.

KEYPOINTS

The acceptable/unacceptable risk assessment framework outlined in Appendix E to Technical Appendix J of the EES should be adhered to for the project.

In areas where the acceptable risk criteria are exceeded, and especially where the unacceptable risk criteria are exceeded, additional mitigation and management measures should be implemented for both air quality and noise to minimise exposure and reduce health risk.

In considering the economic implications of mitigation measures for both noise and air quality the health costs need to be included in the overall assessment.

2. Risk Assessment Framework that has been applied for air quality

In her evidence Dr Wright stated that there is no framework for conducting risk assessments for air quality in Australia. This statement is incorrect.

In 2006 the NHMRC published a document that established the process for conducting hazard assessments for air pollution. This document provides a detailed framework, building in the enHealth Risk Assessment Guidelines, on how to select studies as the basis of a HRA for air quality, the selection of concentration response functions and identification of sensitive groups to be assessed in the risk assessment process.

NEPC and enHealth published a full risk assessment framework for air quality in 2011 that built on the work of the NHMRC and provided guidance on exposure assessments and risk

characterisation. Although this framework was derived specifically for the derivation of air quality standards, the risk assessment framework is applicable to any risk assessment for air quality and is consistent with WHO and USEPA guidance. This guidance has not been followed in the HRA conducted for the WGTP.

To inform the review of the AAQ NEPM standards NEPC commissioned two large multicity epidemiological studies – The Multicity Mortality and Morbidity study and the Australian Children’s Air Pollution and Health Study. Although the Mortality and Morbidity study was mentioned by Dr Wright the data derived from this study was not used in the HRA even though it contains local CRF data as recommended by NEPC, NHMRC and enHealth. The CRFs used in the HRA are not consistent with the Australian frameworks nor the current recommendations from WHO.

The NHMRC and NEPC Risk Assessment Frameworks are consistent with the recommendations made by Professor Irving, Professor Anderson and the Lung Health Research Institute for identification of appropriate health outcomes and CRFs for use in the HRA for the WGTP.

KEY POINTS

Australian frameworks for conducting health risk assessments for air quality do exist and should have been applied in the HRA for the WGTP.

The frameworks highlight the importance of the use of Australian data where available. This has not been done for the HRA and may underestimate the risks and also the benefits of the project in terms of health outcomes avoided.

3. Dose Response Relationships for Noise

The impacts of noise on health were assessed in the HIA and in some locations the risk levels exceeded unacceptable risk levels. At the hearing, Counsel assisting the IAC asked Dr Wright about dose response relationships for noise and sleep disturbance and the levels at which sleep disturbance becomes significant.

In 2011 the WHO published Night Time Noise Guidelines. In these guidelines dose response relationships are provided for a range of health outcomes and road traffic noise. This diagram is reproduced below:

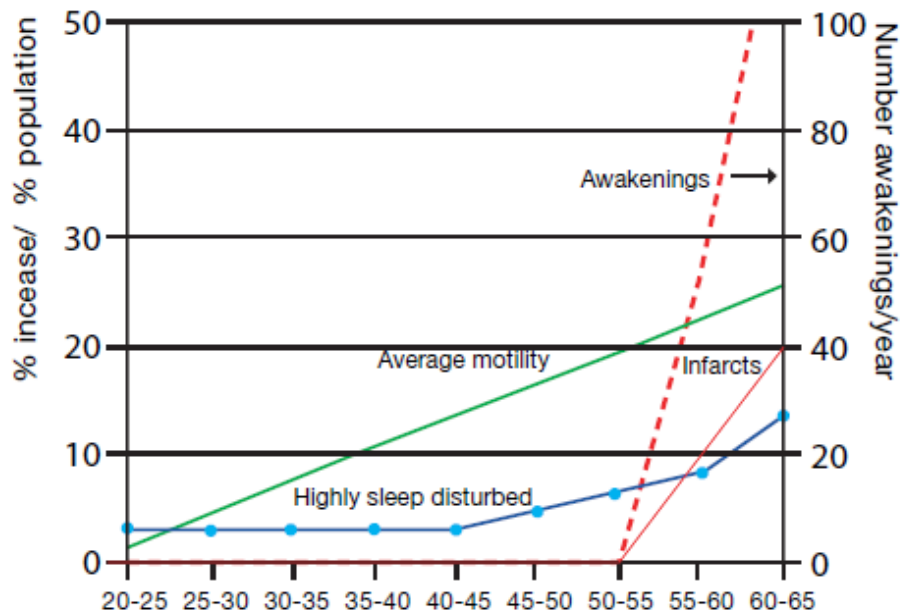


Fig. 3
Effects
of road traffic
noise at night*

*Average motility and infarcts are expressed in percent increase (compared to baseline number); the number of highly sleep disturbed people is expressed as a percent of the population; awakenings are expressed in number of additional awakenings per year.

The number of awakenings is shown by the red broken line. The WHO (2009) state that for a Lnight outside of 60-65dB the maximum number of additional awakenings per year is 300. The WHO Europe Night Noise Guidelines (WHO, 2009) were based on expert-consensus that there was sufficient evidence that nocturnal environmental noise exposure was related to self-reported sleep disturbance and medication use, and that there was some evidence for effects of nocturnal noise exposure on high blood pressure (hypertension) and heart attacks. The WHO Europe Night Noise Guidelines state that the target for nocturnal noise exposure should be 40 dB Lnight, outside, which should protect the public as well as vulnerable groups such as the elderly, children, and the chronically ill from the effects of nocturnal noise exposure on health. The Night Noise Guidelines also recommend the level of 55 dB Lnight, outside, as an interim target for countries wishing to adopt a step-wise approach to the guidelines. It is worth noting that the 40dB Lnight outside guideline represents a very low level of noise exposure, e.g. a refrigerator humming.

According to Appendix H of Technical Appendix J, there are a number of areas where the predicted night time noise levels will decrease and will be below the interim WHO target of 55dB. However, there are areas where an increase in noise is predicted with levels at some locations on Miller's Road and near the Westgate Freeway with night time noise levels above 60 dB. In these locations consideration should be given to additional mitigation measures whether at a large scale such as noise walls or vegetative screening (or a combination of both) or acoustic treatments applied for the most affected properties to minimise sleep disturbance and the associated health effects.

KEY POINTS

The dose response relationships derived by WHO for night time noise should be considered in the adoption of noise guidelines applicable for the project. The relationships show a steep increase in awakenings above an L_{night} of 50 – 55Db.

For the most impacted receptors where increases in noise are predicted that are related to the project additional mitigation measures should be considered to minimise the risk to health.

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 and no EPR was proposed to address health. As recommended in my interim advice I believe that an EPRs aimed at minimising the risk to health from the project, in particular where acceptable risk levels are exceeded, should be included. 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.