8th October 2018

Prof Hugh Durrant-Whyte
NSW Chief Scientist & Engineer
Chair: Advisory Committee on Tunnel Air Quality

Dear Prof Durrant-Whyte

We received from your office a request to review aspects of the F6 Extension – Stage 1 EIS specifically relating to tunnel ventilation on behalf of the Advisory Committee on Tunnel Air Quality. Please find below our review.

Yours sincerely

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Review of the F6 Extension – Stage 1 EIS – Tunnel Ventilation

Written by Ian Longley and Åke Sjödin on behalf of the Advisory Committee on Tunnel Air Quality

8th October 2018

The review is based on the F6 Extension – Stage 1 Environmental Impact Statement (EIS) published in August 2018. In detail we consider those sections relating to emissions from the ventilation stacks only.

Background

Tunnel ventilation stacks work by moving the vehicle emissions from ground level to points higher in the atmosphere, which result in longer time and distance for emissions to disperse before reaching ground level. In Sydney, stacks are assisted by ventilation fans that are used to direct the emissions higher into the atmosphere. Dispersion is improved by winds that tend to become stronger higher up into the atmosphere, while wind and turbulence increase mixing of the emitted and background air resulting in dilution.

In developing Environmental Impact Statements for future infrastructure such as roads, proponents rely on modelling for future scenarios, both expected and worse case. Modelling for road tunnels draws on measurements of background air quality, projections of future vehicle emissions on roads, information on tunnel operations, and utilises meteorological and dispersion models. This results in estimations of the maximum concentrations of different pollutants at different locations, including in the vicinity of ventilation stacks and locations in the surrounding area. Therefore, key to a scientific review of a project's air emissions from ventilation stacks is consideration of the data use and modelling approach.

In considering the future impacts of ventilation stacks a number of elements are assessed including the overall methodology, the approach used to calculate the nature and concentration of emissions within the tunnel and thus exiting the stack, and finally the dispersion from the stack. These are discussed in the following sections.

Main findings of the review

Our overall conclusion of the F6 Extension – Stage 1 EIS is that it constitutes a thorough review of high quality. It covers all of the major issues and areas that an EIS for a project of this scale should. The information presented is of suitable detail and logical in order. The choices made regarding data used and methods followed have been logical and reasonable and it is our view that the benefit of exploring alternative approaches would be questionable or marginal.

Specific issues

1. Modelling
    a. General comments on assessment methodology

We find that the assessment methodology is sound and represents best practice. All of the models and data used are appropriate and expertly used. We have found no significant errors nor important omissions.

    b. Emission modelling

The methodology used to estimate in-tunnel emissions to assess in-tunnel air quality and also being used as input to the dispersion modelling of exhaust emitted through the tunnel ventilation stacks, is very thoroughly and clearly described in the EIS. Although the method used (PIARC 2012) for deriving emission factors does not explicitly provide those for years beyond 2020, the applied approach provides conservative estimates of the emissions of all substances for the scenario years 2024, 2026 and 2036, thus the in-tunnel emissions are more likely to be overestimated in the EIS rather than underestimated. The approach to use the most recent knowledge on NO_2/NO_X-ratios, as represented by the last update of the EMEP/EEA Air Pollutant Emission Inventory Guidebook from June 2017, to derive primary NO_2 emissions, is very adequate and fit for purpose for the assessment of in-tunnel air quality, as is the modelling of in-tunnel air concentrations of NO_2 for the worst case scenarios with tunnel traffic average speeds down to 20 km/hr. Furthermore, we acknowledge the attempt to validate the calculated emissions against measured air pollutant concentrations in the M5 East Tunnel in 2015, as well as deriving input data on heavy vehicle mass for the emission modelling based on measurements of actual heavy vehicle mass with a 1 hour resolution (0-24) on heavy vehicles at the Botany WIM (Weigh-in-motion) station near the M5 East motorway.

    c. Use and evaluation of meteorological and dispersion models (GRAMM, GRAL)

The EIS has given careful attention to the location of the project close to the coast and its implications for meteorological modelling. Coastal locations are likely to experience higher wind speeds than inland locations and potentially different wind directions due to local land-sea breezes. We find that the approach used to address this using the 'Match-to-Observations' function in GRAMM (as recommended in the recent evaluation study of the GRAMM-GRAL package) is highly appropriate in this situation and are comfortable that this is likely to provide the most representative results whilst retaining slight conservatism.

The GRAMM-GRAL dispersion modelling suite has been used appropriately and appears to be giving credible results. The evaluation of the models provided in the EIS (Annexure H) relates to the model's ability to capture dispersion from open roadways. The model's apparent success in doing this (albeit with some conservatism) may be used to infer that they will perform similarly well in predicting dispersion from a ventilation stack, although this cannot be directly verified due to the non-existence of an observational dataset for the ventilation stacks only.

    d. Method to estimate NO_2 concentration

The method used has limitations, which the EIS appropriately acknowledges. However, we find the empirical approach of estimating NO_2 concentrations using observational NO_2 and NO_x data to be sound, appropriate and the approach most suited to the purposes of the EIS.