Table 40: Results: Scenario A - all receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
						Project	Background		
PM_{10}	$\mu g/m^3$	1 hour	Time-varying	730	80	~~5.3~~6.4	720	~~6.6~~8.0	No
$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	15	50	7.0	8.1	14	Yes
CO	mg/m^3	1 hour	Time-varying	3.5	29	0.014	3.5	0.047	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	1.6	130	0.87	Yes
Benzene	$\mu g/m^3$	3 minute	Constant	11	53	2.9	8.0	5.5	Yes
Toluene	$\mu g/m^3$	3 minute	Constant	53	650	5.9	47	0.91	Yes
Ethylbenzene	$\mu g/m^3$	3 minute	Constant	7.4	14500	2.2	5.2	0.015	Yes
Xylene isomers	$\mu g/m^3$	3 minute	Constant	28	350	5.8	22	1.7	Yes
1,3-Butadiene	$\mu g/m^3$	3 minute	Constant	1.1	73	0.64	0.48	0.88	Yes
Formaldehyde	$\mu g/m^3$	3 minute	Constant	7.7	40	1.2	6.4	3.0	Yes
PAHs [as B(a)P TEQ]	$\mu g/m^3$	3 minute	Constant	0.00086	0.73	0.00031	0.00055	0.0042	Yes

Notes:

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70^{th} percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9^{th} percentile (9^{th} highest value) as required for assessment against SEPP (AQM) design criteria. 100^{th} percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 41: Results: Scenario A - discrete receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Receptor ID	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
							Project	Background		
PM_{10}	$\mu g/m^3$	1 hour	Time-varying	730	80	16	~~0.33~~0.39	720	~~0.41~~0.49	No
$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	9.3	50	15	1.2	8.1	2.4	Yes
CO	mg/m^3	1 hour	Time-varying	3.5	29	19	0.0047	3.5	0.016	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	40	0.57	130	0.30	Yes
Benzene	$\mu g/m^3$	3 minute	Constant	8.6	53	15	0.56	8.0	1.1	Yes
Toluene	$\mu g/m^3$	3 minute	Constant	48	650	15	1.1	47	0.18	Yes
Ethylbenzene	$\mu g/m^3$	3 minute	Constant	5.6	14500	15	0.42	5.2	0.0029	Yes
Xylene isomers	$\mu g/m^3$	3 minute	Constant	23	350	15	1.1	22	0.32	Yes
1,3-Butadiene	$\mu g/m^3$	3 minute	Constant	0.61	73	15	0.13	0.48	0.18	Yes
Formaldehyde	$\mu g/m^3$	3 minute	Constant	6.7	40	15	0.26	6.4	0.65	Yes
PAHs [as B(a)P TEQ]	$\mu g/m^3$	3 minute	Constant	0.00055	0.73	1	<0.00005	0.00055	0.0	Yes

Notes:

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70^{th} percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9^{th} percentile (9^{th} highest value) as required for assessment against SEPP (AQM) design criteria. 100^{th} percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 42: Results: Scenario B - all receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
						Project	Background		
PM_{10}	$\mu g/m^3$	1 hour	Time-varying	730	80	~~5.8~~7.0	720	~~7.2~~8.7	No
$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	17	50	9.2	7.9	18	Yes
CO	mg/m^3	1 hour	Time-varying	3.5	29	0.016	3.5	0.055	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	2.0	130	1.0	Yes
Benzene	$\mu g/m^3$	3 minute	Constant	11	53	3.2	8.0	6.0	Yes
Toluene	$\mu g/m^3$	3 minute	Constant	54	650	6.6	47	1.0	Yes
Ethylbenzene	$\mu g/m^3$	3 minute	Constant	7.6	14500	2.4	5.2	0.017	Yes
Xylene isomers	$\mu g/m^3$	3 minute	Constant	29	350	6.4	22	1.8	Yes
1,3-Butadiene	$\mu g/m^3$	3 minute	Constant	1.3	73	0.77	0.48	1.1	Yes
Formaldehyde	$\mu g/m^3$	3 minute	Constant	8.0	40	1.6	6.4	4.0	Yes
PAHs [as B(a)P TEQ]	$\mu g/m^3$	3 minute	Constant	0.00095	0.73	0.00040	0.00055	0.055	Yes

Notes:

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6).). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 43: Results: Scenario B - discrete receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Receptor ID	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
							Project	Background		
PM_{10}	$\mu g/m^3$	1 hour	Time-varying	730	80	16	~~0.41~~0.49	720	~~0.52~~0.61	No
$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	9.5	50	15	1.4	8.1	2.8	Yes
CO	mg/m^3	1 hour	Time-varying	3.5	29	19	0.0055	3.5	0.019	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	40	0.71	130	0.37	Yes
Benzene	$\mu g/m^3$	3 minute	Constant	8.6	53	15	0.60	8.0	1.1	Yes
Toluene	$\mu g/m^3$	3 minute	Constant	49	650	15	1.2	47	0.19	Yes
Ethylbenzene	$\mu g/m^3$	3 minute	Constant	5.7	14500	15	0.45	5.2	0.0031	Yes
Xylene isomers	$\mu g/m^3$	3 minute	Constant	23	350	15	1.2	22	0.434	Yes
1,3-Butadiene	$\mu g/m^3$	3 minute	Constant	0.63	73	15	0.15	0.48	0.21	Yes
Formaldehyde	$\mu g/m^3$	3 minute	Constant	6.7	40	15	0.30	6.4	0.74	Yes
PAHs [as B(a)P TEQ]	$\mu g/m^3$	3 minute	Constant	0.00055	0.73	1	<0.00005	0.00055	<0.007	Yes

Notes:

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70^{th} percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9^{th} percentile (9^{th} highest value) as required for assessment against SEPP (AQM) design criteria. 100^{th} percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 44: Results: $PM_{2.5}$ (2015 – 2016) - all receptors

Scenario	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
						Project	Background		
A	µg/m^3	1 hour	Time-varying	150	50	0.22	150	0.44	No
B	µg/m^3	1 hour	Time-varying	150		0.24	150	0.49	No

Notes

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 45: Results: $PM_{2.5}$ (2015 – 2016) - discrete receptors

Scenario	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Receptor ID	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
							Project	Background		
A	µg/m^3	1 hour	Time-varying	150	50	41	0.22	150	0.43	No
B	µg/m^3	1 hour	Time-varying	150		41	0.22	150	0.44	No

Notes

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 46: Sensitivity analysis results: maximum lane capacity (three lanes) - all receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
						Project	Background		
PM_{10}	$\mu g/m^3$	1 hour	Time-varying	~~740~~750	80	~~19~~23	720	~~23~~28	No
$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	40	50	32	7.9	64	Yes
$PM_{2.5}$[4]	$\mu g/m^3$	1 hour	Time-varying	160	50	0.74	150	1.5	No
CO	mg/m^3	1 hour	Time-varying	3.6	29	0.066	3.5	0.23	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	140	190	13	130	6.9	Yes
Benzene	$\mu g/m^3$	3 minute	Constant	19	53	11	8.0	21	Yes
Toluene	$\mu g/m^3$	3 minute	Constant	70	650	23	47	3.5	Yes
Ethylbenzene	$\mu g/m^3$	3 minute	Constant	13	14500	8.1	5.2	0.056	Yes
Xylene isomers	$\mu g/m^3$	3 minute	Constant	44	350	22	22	6.3	Yes
1,3-Butadiene	$\mu g/m^3$	3 minute	Constant	4.6	73	4.2	0.48	5.8	Yes
Formaldehyde	$\mu g/m^3$	3 minute	Constant	15	40	9.0	6.4	22	Yes
PAHs [as B(a)P TEQ]	$\mu g/m^3$	3 minute	Constant	0.0020	0.73	0.0014	0.00055	0.19	Yes

Notes:

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value

3 SEPP (AQM) design criterion.

4 Modelling for the period 2015-2016 using hourly time-varying background data.

Table 47: Sensitivity analysis results: maximum lane capacity (three lanes) - discrete receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Receptor ID	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
							Project	Background		
PM_{10}	$\mu g/m^3$	1 hour	Time-varying	730	80	15	~~1.2~~1.4	720	~~1.4~~1.7	No
$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	12	50	16	4.1	8.1	8.3	Yes
$PM_{2.5}$[4]	$\mu g/m^3$	1 hour	Time-varying	150	50	41	0.39	150	0.77	No
CO	mg/m^3	1 hour	Time-varying	3.5	29	19	0.0034	3.5	0.12	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	40	1.9	130	1.0	Yes
Benzene	$\mu g/m^3$	3 minute	Constant	9.8	53	16	1.8	8.0	3.4	Yes
Toluene	$\mu g/m^3$	3 minute	Constant	51	650	16	3.5	47	0.55	Yes
Ethylbenzene	$\mu g/m^3$	3 minute	Constant	6.5	14500	16	1.3	5.2	0.0088	Yes
Xylene isomers	$\mu g/m^3$	3 minute	Constant	26	350	16	3.4	22	0.97	Yes
1,3-Butadiene	$\mu g/m^3$	3 minute	Constant	1.0	73	16	0.56	0.48	0.76	Yes
Formaldehyde	$\mu g/m^3$	3 minute	Constant	7.6	40	16	1.2	6.4	2.9	Yes
PAHs [as B(a)P TEQ]	$\mu g/m^3$	3 minute	Constant	0.00073	0.73	16	0.00018	0.00055	0.025	Yes

Notes

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

4 Modelling for the period 2015-2016 using hourly time-varying background data.

Table 48: Sensitivity analysis results: in-tunnel air quality limits - all receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
						Project	Background		
CO	mg/m^3	1 hour	Time-varying	4.6	29	4.0	0.63	14	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	140	190	15	130	7.8	Yes

Notes

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 49: Sensitivity analysis results: in-tunnel air quality limits - discrete receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Receptor ID	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
							Project	Background		
CO	mg/m^3	1 hour	Time-varying	3.2	29	15	0.22	3.0	0.77	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	40	2.5	130	1.3	Yes

Notes

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 50: Sensitivity analysis results: increased ratio of diesel to petrol cars - all receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
						Project	Background		
PM_{10}	$\mu g/m^3$	1 hour	Time-varying	730	80	~~6.0~~7.3	720	~~7.5~~9.1	No
$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	23	50	15	8.1	30	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	2.0	130	1.1	Yes

Notes:

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 51: Sensitivity analysis results: increased ratio of diesel to petrol cars - discrete receptors

Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Receptor ID	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
							Project	Background		
PM_{10}	$\mu g/m^3$	1 hour	Time-varying	730	80	16	~~0.43~~0.51	720	~~0.53~~0.64	No
$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	10	50	16	2.0	8.1	4.0	Yes
NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	40	0.72	130	0.38	Yes

Notes:

Concentrations rounded to two significant figures.

1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).

2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.

3 SEPP (AQM) design criterion.

Table 52: Sensitivity analysis results: increased proportion of HCVs - all receptors

Increase in proportion of HCVs	Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
							Project	Background		
5%	PM_{10}	$\mu g/m^3$	1 hour	Time-varying	730	80	~~6.5~~7.9	720	~~8.1~~9.9	No
	$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	18	50	9.8	8.1	20	Yes
	NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	2.4	130	1.2	Yes
10%	PM_{10}	$\mu g/m^3$	1 hour	Time-varying	730	80	~~7.2~~8.8	720	~~9.0~~11	No
	$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	19	50	11	8.1	22	Yes
	NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	2.7	130	1.4	Yes

Notes:
Concentrations rounded to two significant figures.
1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).
2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.
3 SEPP (AQM) design criterion.

Table 53: Sensitivity analysis results: increased proportion of HCVs - discrete receptors

Increase in proportion of HCVs	Pollutant	Units	Averaging period	Assessment background type[1]	Maximum predicted GLC[2]	Design criterion[3]	Receptor ID	Contribution to maximum predicted GLC		Project contribution relative to design criterion (%)	Compliance
								Project	Background		
5%	PM_{10}	$\mu g/m^3$	1 hour	Constant	730	80	16	~~0.46~~0.56	720	~~0.53~~0.70	No
	$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	9.7	50	15	1.6	8.1	3.2	Yes
	NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	40	0.83	130	0.44	Yes
10%	PM_{10}	$\mu g/m^3$	1 hour	Constant	730	80	16	~~0.51~~0.62	720	~~0.64~~0.78	No
	$PM_{2.5}$	$\mu g/m^3$	1 hour	Constant	9.9	50	15	1.8	8.1	3.6	Yes
	NO_2	$\mu g/m^3$	1 hour	Time-varying	130	190	40	0.96	130	0.51	Yes

Notes:
Concentrations rounded to two significant figures.
1 Hourly time varying or constant (70th percentile) background concentration (refer to Section 6.2.2.6). Hourly time varying concentrations change from hour to hour over a 24 hour period. A constant background concentration refers to one concentration used to represent background conditions (without the project).
2 99.9th percentile (9th highest value) as required for assessment against SEPP (AQM) design criteria. 100th percentile refers to the maximum value.
3 SEPP (AQM) design criterion.

6.4 Discussion

6.4.1 Scenarios A and B

Emissions from the West Gate Tunnel Project ventilation structures were calculated using PIARC (PM_{10}, $PM_{2.5}$, CO and NO_2) and COPERT Australia (air toxics) emission factors for projected diurnal weekday traffic conditions in 2022 and 2031.

In accordance with the requirements of SEPP(AQM), modelling was conducted to predict the potential impacts of pollutant emissions from the proposed tunnel ventilation structures on ground level concentrations, with the impacts assessed against SEPP(AQM) design criteria. Specifically, the 99.9th percentile maximum predicted concentrations were assessed against the design criteria. In accordance with EPA Victoria guidance, modelling was conducted using five years of meteorological data (2009 to 2013).

When available, SEPP(AQM) requires model predictions to incorporate time varying background concentration data. Time varying hourly average background concentration data were used for PM_{10}, CO and NO_2 for the period 2009 to 2013. When appropriate time varying background concentration data are unavailable, SEPP(AQM) indicates that the 70th percentile of observed concentrations, as a constant value, should be incorporated. Constant background concentrations were used for $PM_{2.5}$ and air toxics for the period 2009 to 2013.

Scenario A (2022)

The hourly background concentrations for PM_{10} at the EPA Victoria Footscray AAQMS exceed the one hour average design criterion on multiple occasions for each year modelled. This effectively imposes an exceedance before the additional impact of the tunnel ventilation structures is considered.

Analysis of the hourly PM_{10} concentrations for 2009 to 2013 showed that exceedances of the 80 µg/m^3 design criterion occurred on 319 occasions during the five year period and on 130 occasions during the worst case year (2009), without any contribution from the project. Project ventilation structure emissions result in only ~~six~~ eight additional exceedances during the worst case year (2009 meteorological data) with project contributions of ~~0.70~~0.83 to ~~6.0~~11 µg/m^3 and corresponding background concentrations of ~~77.1~~70.2 to 79.8 µg/m^3.

The assessment indicated that while the one hour average design criterion was exceeded in 2022, the tunnel ventilation structure emissions only contributed ~~0.7~~0.9 per cent of the predicted 99.9th percentile PM_{10} GLC, which is equivalent to ~~6.6~~8.0 per cent of the design criterion. This exceedance applies to all receptors assessed (gridded and discrete) due to the elevated background concentration.

The contour plot (Appendix E) shows the incremental extent of PM_{10} dispersal across the modelled domain.

Other areas of localised impacts occur approximately two kilometres north-west of the project alignment in West Footscray, possibly due to slightly elevated terrain. The most impacted discrete receptor is predicted to be Edwards Reserve (Receptor 16), located south of the project alignment, although the project contribution is equivalent to less than ~~0.05~~0.06 per cent of the PM_{10} criterion (~~0.33~~0.39 µg/m^3).

Analysis of the hourly $PM_{2.5}$ concentrations for 2015 to 2016 showed that exceedances of the 50 µg/m^3 design criterion occurred on two occasions, without any contribution from the project. Project ventilation structure emissions result in only one additional exceedances with a project contribution of 0.76 µg/m^3 and a corresponding background concentration of 49.6 µg/m^3.

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. The most impacted discrete receptor varies depending on the pollutant, with a maximum project contribution equivalent to 2.4 per cent of the design criterion (1.2 µg/m^3 for $PM_{2.5}$), occurring at McIvor Reserve (Receptor 15), north of the project alignment.

Scenario B (2031)

As described for Scenario A, the hourly PM_{10} background concentrations exceed the design criterion on multiple occasions (319), without any contribution from the project.

The Scenario B assessment indicated that, while the one hour average PM_{10} design criterion was exceeded, the tunnel ventilation structure emissions contributed ~~0.8~~0.9 per cent of the 99.9th percentile GLC, equivalent to ~~7.2~~8.0 per cent of the design criterion. This exceedance applies to all receptors assessed (gridded and discrete) due to the elevated background concentration.

In total, there were ~~nine~~ 11 additional exceedances of the design criterion during the worst case year (2009 meteorological data) with project contributions of ~~0.83~~1.0 to ~~11~~ 13 µg/m^3 and corresponding background concentrations of 70.2 to 79.8 µg/m^3.

The most impacted sensitive receptor is predicted to be Edwards Reserve (Receptor 16), located south of the project alignment, although the project contribution is equivalent to ~~0.5~~0.6 per cent of the PM_{10} criterion (~~0.41~~0.49 µg/m^3).

As described for Scenario A, the hourly $PM_{2.5}$ background concentrations exceed the design criterion on two occasions, without any contribution from the project. There was one additional exceedance of the $PM_{2.5}$ design criterion with a project contributions of 1.3 µg/m^3 and a corresponding background concentration of 49.6 µg/m^3.

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 2031. The most impacted discrete receptor varies depending on the pollutant, with a maximum project contribution equivalent to 2.8 per cent of the pollutant criterion (1.4 µg/m^3 for $PM_{2.5}$), occurring at McIvor Reserve (Receptor 15).

6.4.1.1 Time-varying background $PM_{2.5}$ data (2022 and 2031)

Twelve months of hourly $PM_{2.5}$ background concentration data (EPA Victoria Footscray AAQMS) were available for the period 4 March 2015 to 3 March 2016. Additional $PM_{2.5}$ modelling was conducted for this period.

The hourly $PM_{2.5}$ background concentrations exceeded the design criterion on seven occasions. The $PM_{2.5}$ design criterion was exceeded for Scenarios A and B due to the elevated background concentrations, however the tunnel ventilation structure emissions contributed less than 0.5 per cent of the predicted 99.9th percentile GLC.

6.4.1.2 Summary

In summary, with the exception of PM_{10} and $PM_{2.5}$ with time varying background, compliance with all applicable SEPP(AQM) design criteria was demonstrated for the proposed West Gate Tunnel Project ventilation structures under normal operating conditions. The PM_{10} and $PM_{2.5}$ exceedances were due to the high background concentrations.

6.4.2 Sensitivity analyses

Maximum lane capacity (three lanes; 2031)

As noted above the hourly PM_{10} background concentrations exceed the design criterion on multiple occasions (more than 319) without any contribution from the project. The assessment indicated that while the one hour average PM_{10} design criterion was exceeded, the tunnel ventilation structure emissions contributed ~~2.6~~3.0 per cent of the predicted 99.9th percentile GLC, or ~~23~~ 28 per cent of the design criterion. This exceedance of the one hour average design criterion applies to all receptors assessed (gridded and discrete) due to the elevated background concentration.

In the worst case year (2009 meteorological data), there were ~~32~~ 33 additional exceedances of the design with project contributions of ~~2.9~~3.5 to ~~23~~ 28 µg/m^3 and corresponding background concentrations of 58.3 to 79.8 µg/m^3.

The most impacted sensitive receptor is predicted to be Edwards Reserve (Receptor 16), located south of the project alignment, although the project contribution is only ~~1.4~~ 1.7 per cent of the PM_{10} criterion (~~1.2~~1.4 µg/m^3).

As noted above, the hourly $PM_{2.5}$ background concentrations exceed the design criterion on two occasions, without any contribution from the project. There was one additional exceedance of the $PM_{2.5}$ design criterion with a project contributions of 3.1 µg/m^3 and a corresponding background concentration of 49.6 µg/m^3.

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 for 2031 maximum lane capacity conditions, 24 hours a day and 365 days per year. The most impacted discrete receptor varies depending on the pollutant modelled with a maximum project contribution equivalent to less than 9 per cent of the pollutant design criterion (4.1 µg/m^3 of $PM_{2.5}$), occurring at Edwards Reserve (Receptor 16).

Emissions at in-tunnel air quality limits (2031)

A theoretical worst case traffic scenario was modelled, with tunnel ventilation structure emission rates based on pollutant concentrations equal to in-tunnel air quality limits. Modelling indicated compliance with both the CO and NO_2 design criteria.

Although the maximum ventilation rate of 1050 m^3/s was assumed, the contribution from the project, in relation to the design criteria (14 per cent and 7.8 per cent for CO and NO_2 respectively), indicates that a lower ventilation rate may also achieve compliance.

Increased diesel to petrol fuelled cars ratio (2031)

Due to the uncertain future proportion of diesel and petrol passenger cars, a scenario incorporating a relatively conservative doubling of the proportion of diesel cars from 15 per cent of all cars to 30 per cent of all cars was modelled This focused on the primary pollutants associated with diesel combustion, PM_{10}, $PM_{2.5}$ and NO_2.

The project contributions of PM_{10} and NO_2 to the 99.9th percentile GLCs over all receptors were found to increase by approximately ~~3~~ 4 per cent and 3 per cent respectively. Overall this resulted in an increase to the resultant maximum (99.9th percentile) GLCs of ~~0.2~~0.3 µg/m^3 for PM_{10}, no change to NO_2 and 7.1 µg/m^3 for $PM_{2.5}$ compared with the Scenario B predictions. The $PM_{2.5}$ contribution to the 99.9th percentile GLC increased by approximately 60 per cent, however, the results occurred on different hours and are therefore not directly comparable.

Increased proportion of HCVs in fleet mix (2031)

To understand the consequences of the uncertainty relating to the volume of HCVs predicted to use the tunnels, two traffic scenarios based on Scenario B were modelled. These incorporated increased HCV fleet mix percentages of 5 and 10 per cent. Depending on the original fleet mix of HCVs, which varies depending on the time of day, these increases can result in significant increases in HCV numbers.

For a 5 per cent increase in the proportion of HCVs, the project contribution to the maximum predicted (99.9th percentile) GLCs over all receptors increased by approximately ~~12~~ 14 per cent for PM_{10}, 19 per cent for NO_2 and 7 per cent for $PM_{2.5}$. Overall this resulted in an increase of ~~0.7~~1.0 µg/m^3 for PM_{10}, 1.9 µg/m^3 for $PM_{2.5}$ and 0.4 µg/m^3 NO_2 to the 99.9th percentile GLCs compared with the Scenario B predictions.

For a 10 per cent increase in the proportion of HCVs, the project contributions to the 99.9th percentile GLCs over all receptors were found to increase by approximately ~~25~~ 27 per cent for PM_{10}, 38 per cent for NO_2 and 20 per cent for $PM_{2.5}$. Overall this resulted in an increase to the 99.9th percentile GLCs of ~~1.4~~1.9 µg/m^3 for PM_{10}, 3.1 µg/m^3 for $PM_{2.5}$ and 0.7 µg/m^3 NO_2 compared with the Scenario B predictions.

Conclusion

The sensitivity analyses demonstrated that, while the project contribution to the maximum predicted GLC could increase significantly due to the relatively low project contribution (up to 60 per cent in the case of $PM_{2.5}$ for a doubling in the proportion of diesel cars), there was relatively little change in the maximum predicted GLCs (project plus background).

It should be emphasised that a number of the sensitivity analyses represent unrealistic scenarios that have not occurred in any Australian road tunnel and are highly unlikely to occur in the future.

While traffic at maximum lane capacity can occur during peak periods, the volume of vehicles used in the modelling assessment is extremely conservative, both in the assumed vehicle volumes per lane and the number of lanes in operation. Normal operation of the West Gate Tunnel would involve two lanes in each direction, not three, and maximum capacity conditions would also not occur constantly, as assumed in the sensitivity analysis.