Before the Board of Inquiry
Waterview Connection Project

---

in the matter of: the Resource Management Act 1991

and

in the matter of: a Board of Inquiry appointed under s 149J of the Resource Management Act 1991 to decide notices of requirement and resource consent applications by the NZ Transport Agency for the Waterview Connection Project

Rebuttal evidence of **Gavin Fisher (Air Quality)** on behalf of the **NZ Transport Agency**

Dated: 3 February 2011

Hearing start date: 7 February 2011

REFERENCE: Suzanne Janissen (suzanne.janissen@chapmantripp.com)
Cameron Law (cameron.law@chapmantripp.com)

Chapman Tripp
T: +64 9 357 9000
F: +64 9 357 9099

23 Albert Street
PO Box 2206, Auckland 1140
New Zealand

www.chapmantripp.com
Auckland, Wellington,
Christchurch

INDEX

REBUTTAL EVIDENCE OF GAVIN FISHER ON BEHALF OF THE NZ TRANSPORT AGENCY

INTRODUCTION

1 My full name is Gavin Westwood Fisher. I refer the Board of Inquiry to the statement of my qualifications and experience set out in my evidence in chief (*EIC*) (dated November 2010).

2 I repeat the confirmation given in that statement that I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court.

PURPOSE OF EVIDENCE

3 The purpose of this rebuttal evidence is to respond to certain aspects of the evidence lodged by submitters, and on matters raised in the section 42A reports, particularly the air quality report prepared by Emission Impossible Ltd dated 14 January 2010 (*Air Quality s42A Report*). This rebuttal comprises mainly further explanation and detail on work already conducted, as well as some further analysis, modelling and justifications for the assumptions and the detailed methodology used. It also contains the results of new analyses, mainly in response to matters raised in the Air Quality s42A Report (some of which are quite substantial).

4 Of the evidence presented by submitters, some 16 have made specific reference to air quality issues. In order to respond to these I have grouped them by key subject area and referenced the appropriate specific evidence in the footnotes.[1]

COMMENT ON EVIDENCE OF SUBMITTERS

Filtration of vent emissions

5 There is absolutely no need to filter the emissions as requested by several submitters.[2] I have shown in my evidence in chief the rationale for this conclusion and I re-iterate it here.

5.1 Firstly, the emissions are being emitted in a relatively diluted form, with concentrations that are even below the Workplace Exposure Standards. That is, concentrations within the vent, even before they are dispersed, are lower that might be found in many workplace environments around New Zealand, perfectly legally. Natural dispersion decreases these by a

[1] The format of this is the specific submitter's name, including the submitter's EPA reference.

[2] Margaret Watson (252-1, para 17), Robert Black (186-1 para 13 and in "relief sought"), Wendy John (179-1 para 12.6), Bill McKay (185-1 para 8.5), David Shearer (178-1 para 5d), Patrick Aldworth (200-1 para 8c), Alison Town (121-1 para 5), Shirley Upton (85-1 para 5.1).

factor of several hundred, to the point where they have an insignificant effect on air quality anywhere in the area.

5.2 Secondly, filtration can only be effective on some of the contaminants – such as particulates and NOx. It is not feasible to filter others, such as CO and benzene (and numerous other minor contaminants present in vehicle emissions).

5.3 Finally, filtration would have such a small impact on the cumulative effects that its cost is simply not warranted.

6 I would also point out that as a result of the Air Quality experts caucusing there is agreement that filtration is unwarranted and ineffective[3].

7 The concept has also been raised that filtering emissions might mean that the vent heights can be lowered[4]. From an air quality perspective the vent heights could be lower, and I cover this in more detail below. However this can be done without the need for filtration and results in only a small compromise in air quality effects, which are very small to start with.

Dust

8 In several places submitters are concerned with dust effects, particularly during the construction phase.[5] These are not unreasonable concerns as this is a large project with a five-year construction period. However as noted in my main evidence, there is a great deal of detail on the dust management issue, all covered in the Construction Air Quality Management Plan and the Concrete Batching and Rock Crushing Plant Management Plan. In addition, the conditions suggested for these activities (AQ.1 to AQ.19) are specific and detailed, with all of the best practice methods being employed.

9 I would also note that since the Project was lodged, some additional measures have been adopted, as suggested by the Auckland Council in its submissions and evidence.[6] These are the enclosing of the concrete batching plants and the covering of the conveyers. These issues are addressed in more detail in relation to construction noise in the rebuttal evidence of Siiri Wilkening (paragraphs 92-96

---

[3] Expert Caucusing Joint Report, (Topic Air Quality), 28 January 2011 (para. 9) This report is attached in full as Annexure F to my rebuttal evidence.

[4] Robert Black (186-1 para 13), Wendy John (179-1 para 2.6). This was also raised in the 20 December 2011 EMS s42A Addendum Report, at para 3.4.24

[5] Janet Petersen (111-7 para 4.1c), Jinshu Wu (59-1 para 5a), Alex Wardle (61-1 para 8d).

[6] Janet Petersen (111-7 para 4.1d).

specifically address the Auckland Council evidence on this matter). This is also confirmed in proposed condition CNV.9.

10 In addition, there are substantial requirements in the proposed conditions for dust monitoring and considerable emphasis has been placed on rapid responses to, and mitigation of, any dust problems that arise.

11 Finally, this issue has also been raised in detail by the Air Quality s42A Report and as a consequence some changes in the conditions are been sought (detailed later).

Monitoring

12 Some submitters have requested a more extensive monitoring regime.[7] The three issues are (a) monitoring for other pollutants, (b) monitoring at different (or more) locations, and (c) extending the period of monitoring.

13 None of the submitters were particularly specific on precisely want they meant by *"...more monitoring...",* except that it should continue for longer than 2 years.

14 In my view the amount of monitoring currently proposed by the NZTA is perfectly adequate to assess the air quality effects of the Project. However the Air Quality s42A Report has made a more detailed request, and changes to the monitoring regime are being considered (discussed further below).

Perceptions

15 The case has been made by some submitters, that regardless of the actual effects, the discharges – especially those from the vents – will be perceived as degrading air quality in the area[8]. In one case to the extent that people may not send their children to Waterview Primary School.[9] There are a number of points to be made.

15.1 Firstly, the vents are in no way "industrial smoke stacks" as suggested by one submitter.[10] They are vents that extract emissions from an enclosed space mainly to prevent their build-up within that space (the tunnel). This is a very common practice and occurs in many places where vehicles or machinery operate in enclosed spaces – such as parking buildings, garages, workshops, etc. At any given time there

---

7 Janet Petersen (111-7 para 4.1e), Robert Black (186-1 para 13), Bill McKay (185-1 para 8.5), Robert Black (175 & 176-3 para 58).

8 Peter Pablecheque (153-1 paras 27-36), Robert Richards (78-1 para 6a), Springleigh Residents Assoc (43-1 para 8b), Robert Black (175 & 176-2 para 58), Brett Sheen (175 & 176-3 paras 54-62).

9 Peter Pablecheque (153-1 paras 27-36).

10 Robert Black (186-1 para 13).

will be only about 120 vehicles in the tunnel[11] – which is probably fewer that might be found running inside, say, the parking facility at Auckland's Aotea Centre after an event.

15.2 Secondly, the concentrations being emitted are over 2,000 times less than those found in typical "industrial" stacks – including for instance the brick works in the middle of New Lynn, the power stations at Southdown and Otahuhu, and dozens of factories in the Penrose area.[12] All of these are consented for these higher discharge rates and operate satisfactorily in the Auckland urban area.

15.3 Thirdly, many people are unaware of some other sources of discharges that might be much closer to home, and have a greater effect. For instance many schools throughout Auckland have boilers for heating. These used to be run on oil or coal, but have been progressively upgraded to natural gas on the Ministry of Education's "clean heat" initiatives. They are indeed much cleaner, especially on particulate emissions, but still emit a large amount of NOx. Indeed many schools, even relatively small primary schools, will emit more NOx from the heating boilers than will be emitted from the tunnel vents. Furthermore these emissions are (a) closer to the sensitive receivers (children) and (b) much lower in height (producing a bigger effect).[13] This situation is accepted by most people, since having warm children is a healthier option than preventing them being exposed to a relatively small amount of NOx.

15.4 Finally, on the matter of perception of air quality effects, submitters seem unaware that there are already two large "industrial" stacks in the immediate vicinity. At the north–eastern end of the Unitec campus there is a stack on a heating boiler that rises 48m above the ground – some two to three times the height of the proposed vents. Alongside is another about 43m high. These, shown in **Annexure A,** dominate the skyline for several kilometres in each direction, especially to the east of the Waterview route. I do not know whether these cause issues with residents (they probably do

---

[11] Calculated using the peak hourly rate (5pm-6pm weekdays) of 3,800, with a speed of 80 km/hr, over the 2.46 km of tunnel. (3800/80)*2.46 = 117 vehicles.

[12] For instance many industrial discharges are consented at particulate emissions limits of 100 mg/m^3. The concentration of particulate in the tunnel vents will be 0.3 mg/m^3. Even state-of-the-art control systems on industrial discharges are around 10 mg/m^3, some 30 times greater than the tunnel vents.

[13] For instance a typical small school boiler might be 150kW, emitting NOx at between 25-75 mg/m^3. It might have a simple stack that is 6-8m high. Modelling of this under common Auckland winter weather conditions produces peak 1-hour NOx concentrations up to 100 μg/m^3 around the school environs, which is 4 times higher than the peak effects due to the Waterview vent emissions.

for some), but most people have gotten very used to them and they do not raise concerns. The tunnel vents do, simply because they are new, despite the fact that they probably, in my view, have less of an effect on local air quality than the existing Unitec stacks.[14]

General increase in pollution

16 The evidence on behalf of the Springleigh Residents' Association comments that the Project will lead to *"…a general increase in air pollution, including carbon dioxide having greenhouse effects…"*.[15] This is not entirely correct. There are two factors to consider:

16.1 Firstly, what will be the situation in 2016 (or 2026, or indeed any time in the future) compared to the present? The modelling analysis shows that in many cases (for various contaminants and at various locations) the air pollution will be less than it is now. This is not a consequence of the Project, but more a consequence of the ever present trends for vehicles emissions to be lowered, due to pressures on manufacturers in the bigger markets (such as USA, EU, Japan, and increasingly other countries).

16.2 Secondly, what is the difference between the future scenarios for air pollution if the Project did not go ahead versus that if it does? With the Project going ahead there are some small increases at some locations, simply due to the extra traffic. However there are two very important points to be made here:

(a) Although the traffic numbers do go up, the amount of air contaminants released does not go up as much since the traffic is flowing better. That is, there is less congestion and engines are running more effectively resulting in lower emissions.

(b) Secondly, the quantum of increase is small, generally ranging from close to zero, to a maximum of about 25% at a handful of locations. (A perusal of the modelling results tabulated in the main AEE Report G1 at Appendix H shows this).

(c) Finally, the increases, as a result of the Project, do not result in any additional breeches of standards or guidelines. The $PM_{2.5}$ guidelines have been shown to be exceeded on four days in the winter of 2010 at the Alan

[14] This has not been specifically evaluated as it would require a full scale modelling exercise on the Unitec stacks which is well beyond the scope of this current assessment.

[15] Springleigh Residents Assoc. (43-1 para 18.1).

Wood Reserve monitoring site, but in my view this is almost entirely a result of domestic woodburner use and will not be exacerbated to any significant extent by the Project related emissions.

Lead

17 One submitter[16] has made a comment about lead (Pb) being deposited on people from the vent emissions. Since the complete removal of lead as a fuel additive in 1996, it has all but disappeared from the urban environment. Extensive monitoring by the ARC has shown this to the extent that it is no longer routinely monitored to the extent is was 15 years ago. Traces still remain, but these are mainly residual amounts from pre-removal days and from degradation of very old lead based paints. There are no emissions of any consequence from the use of fuel in the land vehicle fleet. In my view there would be no detectable lead emissions in the vents.

COMMENT ON SECTION 42A REPORTS

18 The first s42A report prepared by EMS Ltd. contained only a brief reference to air quality effects.[17] This generally said that the air quality assessment was thorough and robust, but commented on two detailed issues (a) filtration and (b) vent heights.

19 Firstly that filtration should be considered. As covered in my evidence in chief and re-iterated here – it has been considered extensively, and shown not to be required. This conclusion is supported by the experts during witness caucusing.

20 Filtering of vent emissions: The authors of the Air Quality s42A Report now concur with my analysis that shows filtering of the vent emissions is not required[18]. To quote *"We agree that treatment of tunnel ventilation air is unlikely to be cost effective."*

21 Secondly, that inadequate analysis was made on different vent heights. However, the AEE did contain a section on the effects from a 15m vent, as well as for the preferred 25m vent. A further modelling analysis has been undertaken and is discussed further below.

22 The Air Quality s42A Report prepared by Emission Impossible Ltd (dated 14 January 2010) is detailed and extensive, and raises a number of issues that require either (a) further explanation, (b) more detailed justifications and (c) additional analysis.

---

16 Robert Richards (78-1 para 6.9).

17 Waterview Project. Addendum s42a Report, December 2010. Sections 3.4.27-25.

18 Air Quality s42A Report, para 14.

23 A number of matters have been fully resolved in the witness caucusing. These are covered in the caucusing report,[19] and are not repeated here.

24 However several issues that were discussed in the caucusing were not fully resolved and these are covered here, along with new analyses to support the views that I am progressing.

25 **Vent Heights**:[20] For visual amenity reasons, it has been suggested that the vent heights be reduced from 25m to 15m. From an air quality perspective, higher stacks are better. However, a 15m is adequate to avoid any significant adverse air quality effects.

26 A modelling analysis for different stack heights was conducted very early and given in the original assessment[21]. Based on this a vent height of 25m was determined. However more recently, and particularly as a result of the expert caucusing on 18 January 2011, it became necessary to re-evaluate the effects from a lower vent (15m). The Council, at expert caucusing, would only agree to this if a new modelling run could show the effects were acceptable to it.[22] A full featured Calpuff modelling run for this case of varying vent heights has not been able to be completed as the model is very complex and takes several weeks to run. It is expected on or about 10 February. However a simplified and more rapid modelling exercise has been undertaken, summarised in **Annexure B**.

27 This shows that although ground level concentrations due to the vent emissions do go up slightly (a few percent at distances greater than 50m from the vents, and perhaps 50% closer than 50m) with a lower 15m height, they are still very small, and do not result in any exceedences of relevant standards or guidelines at any location.

28 **Construction effects**[23]**:** The two Plans (Construction Air Quality Management Plan and Concrete Batching and Crushing Management Plan) dealing with construction effects are formalised and detailed, however the s42A Report and Council submit that there is insufficient connection between the procedures in the plans and the consent conditions.[24]

---

19 Report to the Board on the outcomes of expert witness caucusing on air quality. 28 January 2010. (Annexure F)

20 Air Quality s42A Report, paras 12,13.

21 Main AEE Report G1 at Appendix K.

22 Report to the Board on the outcomes of expert witness caucusing on air quality. 28 January 2010. para 25 (Annexure F).

23 Air Quality s42A Report, paras 16-18.

24 Air Quality s42A Report, para 264.

29 I submit (supported by the NZTA) that the existing conditions (AQ 1. - AQ 19.) already recognise the issues associated with dust, odour, fumes or hazardous air pollutants that may arise during the construction of the Project. The conditions provide for effective and comprehensive management and monitoring of any such adverse environmental effects. We consider that any additional conditions proposed by the Auckland Council and the EPA's Technical Advisor are unnecessary.

30 **Concrete batching plants**[25]**:** It is now confirmed that the concrete batching plants and conveyers will be fully enclosed.

31 **Separation distances**[26]**:** One of the principal concerns expressed in the Air Quality s42A Report (and previously in the Auckland Council submissions and evidence) was the final separation distances between some residences and the new road route. This is a very site specific factor that depends on local conditions. In my view a separation of 20m is adequate.

32 In support of this view a further modelling analysis has been undertaken to show effects at places very close to the busiest portions of the road. These are on SH16, and the summary results shown in Table 1 below are based on the 2016 year (the 2026 year results are lower), and assuming a maximum daily traffic flow of 135,000, a flow speed of 70 km/hr, and a maximum hourly flow of 10,000. A more detailed result is shown in a separate modelling exercise in **Annexure C**.

Table 1

Distance from road edge	PM_{10} (24-hours) (Standard 50)	NO_2 (1-hour) (Guideline 200)
1m	22.6	222
2m	19.8	196
5m	15.6	153
10m	13.8	116
20m	7.9	78
50m	3.7	36
100m	1.5	15
Background estimate	*35*	*65*

[25] Air Quality s42A Report, paras 261-265.

[26] Air Quality s42A Report, para 271.

33 The results shown in the table above are only for the incremental effects of the vehicles – estimated backgrounds are also indicated that would need to be added to each result. This shows that if someone was able to maintain a position at 1m away from the road, they would be exposed to PM_{10} and NO_2 concentrations in excess of the guidelines. By the time they were 5m away they would be under the PM_{10} guideline, but probably still above the NO_2 one if they remained there for an hour. At 10m and beyond, they would be well within each relevant air quality standard or guideline.

34 With a stretch of credibility, it is conceivable that someone could camp within 10m alongside one of the busiest roads in town, but there are no permanent residences, workplaces or schools within this zone. These results and conclusions would be the case also just about anywhere along SH16, SH1 and beside many other busy roads in Auckland.

35 Finally, in order to gain information on how many properties might be affected – a question asked by the Air Quality s42A Report and the Council – we have conducted an analysis using the GIS tools. I asked the mapping team to produce a detailed assessment of what houses will be left after the NOR has been exercised, along with their distance from the road edge. In particular, I wished to identify all those houses that might be within 20m of the road.

36 There are currently (February 2011) only 3 of these, all along the SH16 extension just west of the Te Atatu interchange. One is at the northern end of Milich Tce and two are along Marewa St. However I am informed by the planning team responsible that it is the intention of NZTA to acquire these properties, and the only reason they have not done so already is that the 2010/2011 budget is used up. There are 3-4 more annual budget cycles to go before the Project becomes operational.

37 Thus I conclude that there will be <u>no</u> houses closer than 20m to the new designations.

38 Here I would make the point that there are currently a number of houses that are closer than 20m to the edge of SH16. The closest I could find was 7.7m from the road, and there are several more between 12-15m and many between 15-20m. A cursory examination of SH1 south of the city (between Greenlane and Manurewa) shows that there are dozens, perhaps hundreds of houses within this zone (less than 20m from the road edge). The implication here is that although in an idea world we would like to have a nominal 20m separation, it is by no means unusual in Auckland to have houses inside this distance.

39 There is one further ameliorating factor. The eventual exposure beside the roadway depends as much, if not more, on the

background levels than on the effects of the roadway. My calculation of the 20m distance has been based on a relatively high background (of 35 $\mu g\ m^{-3}$ for 24 hour PM_{10}), with a contribution of at most 15 $\mu g\ m^{-3}$ from the road (see Annexure C). It is likely that the actual background value along this part of SH16 is less, simply because there are fewer local sources and it is a more exposed location. This means that the greater than 20m separations to the houses will provide an even greater buffer of separation than is strictly required.

40 **Monitoring conditions:** The Auckland Council has requested that the equipment operation and maintenance to be according to manufacturers specifications. This is agreed, and the term *"..operation and.."* has been included in proposed Operational Air Quality condition OA.2.

41 The Council has also requested that the conditions be referenced to the Regional Air Quality Targets. This is agreed and the term *"..and Regional Air Quality Targets"* has been included in proposed Operational Air Quality condition OA.5.

42 **Number of monitors**[27]**:** The Air Quality S42A Report and Council contend there should be a third new ambient monitor. Technical experts, myself included, will almost never disagree with a proposal for "more monitoring". This provides the gold standard for environmental science, data and effects, and in an ideal world monitoring resources would be unlimited. However, this must be tempered with the purpose and objectives of the monitoring, and the costs to be borne by a single project. In this regard I stand by my original assessment that two monitors will give a perfectly adequate assessment of the Project's effects.

43 The Air Quality s42A Report authors (and Council) experts have made the point that at some locations, especially along SH16 near Te Atatu, there are houses left quite close to the roadway after development. They contend that this leaves insufficient separation distance to ensure compliance with the national standards.[28] Houses that are very near to a road may indeed experience high exposure levels. This is very hard to determine absolutely, and even a few metres can make a difference. The Air Quality s42A Report expert contends that the most prudent approach is to establish a new air quality monitor that is in a location no further from the road edge that that of the nearest residence.[29] However, my analysis of separation distances presented earlier shows that this is not the case, and there is little to be gained from establishing a third monitor along SH16.

---

[27] Air Quality s42A Report, para 10.

[28] Air Quality s42A Report, para 271.

[29] Air Quality s42A Report, para 272.

44 **Modelling full year[30]:** In the AEE, the initial stack modelling was only carried out for a 2-week period in winter.[31] This was done to reduce the computational time which takes about 20 days for a full year run, which at the time was appropriate. However the Air Quality s42A Report and the Council have required results for a full year of meteorological modelling.[32] This has now been completed using a new run of the Calpuff model. The summary results (just for 2016 year) are shown in Table 2:-

Table 2

Contaminant	Peak Effect Previously ($\mu g\ m^{-3}$)	Peak Effect with New Modelling ($\mu g\ m^{-3}$)	Reference level ($\mu g\ m^{-3}$)
PM_{10} (24-hour)	0.29	0.60	50
$PM_{2.5}$ (24-hour)	0.19	0.43	25
NOx (1 hour)	29.3	38.0	200
CO (8 hour)	14.0	25.1	10,000
Benzene (annual)	0.007	0.008	3.6

45 The peak effects have increased, by an appreciable fraction in some cases, but are still very small levels of incremental effect on the existing background, and do not result in any significant increase in cumulative effects, nor contribute significantly to any exceedences.

46 **Turning down the in-tunnel fans:** The Air Quality s42A Report and Auckland Council have requested that air quality criteria be applied in respect of when the fans can be turned down, or off.[33] NZTA had earlier considered a time window (only between 11pm and 7am) when it is anticipated traffic flows will be low enough to allow fans to be turned off. I had supported this with some detailed modelling that shows effects – due to contaminants leaking out either portal – will be acceptable.[34] The NZTA had not formally presented this concept as it proposed that these issues are to be covered in the Tunnel Operations Management Plan (rather than in any consent conditions), which I originally supported.

30 Air Quality s42A Report, para 269.

31 Main AEE Report G.1 section 8.2.

32 Full results are not presented here, but were supplied to the Auckland Council, by way of a response to their submission.

33 Air Quality s42A Report, para 259.

34 In the Main AEE Report G.1 at Appendix I.

47 However the Air Quality s42A Report and Council felt that (a) there are no specific assurances that turning the fans off will not have an unacceptable effect, particularly on residences close to the tunnel portals, and (b) that the proposed criteria for turning fans off should be air quality related and not by time of day.

48 The Tunnel Operations Management Plan is still under development, and will probably not be finalised until the tunnel is actually built. This will contain air quality criteria to ensure the health and safety of people in the tunnel, but is not currently subject to any consent conditions. Such criteria are now proposed below.

49 An additional modelling analysis has been undertaken on the effects of portal emissions with the fans turned down. This is summarised in **Annexure D**.

50 These new results show that the operation of the tunnel without the ventilation fans running will not result in any adverse effects, indicated by NO_2 exceedences at a location equivalent to the nearest house (50m from the southern portal), for almost all circumstances when the traffic in the tunnel is less than 1000 vehicles per hour.

51 At peak times the vehicle rate is 3,700 per hour, and during the quieter night times it might be only a few tens per hour. The effect of using this criterion will mean that the fans may be turned off between about 9pm and 7am on most days, with no adverse effects.

52 In response to the concerns expressed by the Air Quality s42A Report and the Council, the NZTA has now proposed a new condition (and drafted into the schedule of conditions as AO.7):-

52.1 *"The tunnel ventilation system shall be designed and operated to ensure that any air emitted from the tunnel portals does not cause the concentration of nitrogen dioxide (NO_2) in ambient air to exceed 200 $\mu g\ m^{-3}$, expressed as a rolling 1 hour average, at any point beyond the designation boundary that borders an air pollution sensitive land use."*

53 To assess compliance, one of the proposed new ambient monitors will need to be located at an appropriate position near the portal. As noted in the proposed conditions (OA.2), this will be done in consultation with the Auckland Council.

54 I support the use of this condition.

55 **Offsets:** The concept of mitigating effects through the use of offsets has formed a central theme of Air Quality s42A Report.[35] I would agree that any measure that reduces emissions – such as those

[35] Air Quality s42A Report, para 14

from domestic woodburners or from vehicles - has clear air quality benefits. However I do not concur with the arguments put forward by the s42A Report authors and the Council justifying offsets in this case. My principals reasons are:-

55.1 The quantum of effect from this Project is not large enough to need offsets.

55.2 Significant contributing sources to the monitoring for $PM_{2.5}$ that shows some exceedences include domestic woodburners and local traffic that are well beyond the control of NZTA.

55.3 The basic cause of emissions is not the roadway or the tunnel vents, but vehicles themselves. Any targeted emissions reduction programme should be aimed at these sources, not the road route. (And if this is done it has air quality benefits for the lifetime of the vehicle, over all the areas it travels – not just in a very small area around Waterview).

56 However, since this matter has been raised in earnest, a number of detailed factors can be examined.

57 The Air Quality s42A Report authors (and Auckland Council) are primarily concerned that for at least one location – around Oakley Creek – the recent NZTA monitoring has shown exceedence of $PM_{2.5}$. Although the contribution of the Project to these exceedences is small, it is nonetheless non-zero.

58 The main area of concern is relatively small, being the area around the southern end of Oakley Creek.[36] However, to determine the actual area there would need to be a more considered analysis that would need to include a more detailed determination of the contributions of various sources to this particular micro-airshed, as well as a determination as to whether there are enough other sources (such as woodburners) in the area to actually achieve the desired offset. These are matters that could take some time, including new investigations and new modelling, to finalise.

59 It is true if there is any area in the entire Project domain that might be subject to mitigation then it is here because:

59.1 The monitoring shows exceedences of $PM_{2.5}$, or it is possible that exceedences could occur in future and/or higher concentrations of other contaminants.

[36] This area cannot be detailed any further until an appropriate study is undertaken, as discussed below.

59.2 It is in a lower lying valley area that might be subject to very localised calm winds more conducive to air pollution build up (a point also made by a number of submitters).

59.3 Any uncertainties in the modelling, or the traffic emissions, could show up here as higher than predicted air contaminant concentration values.

59.4 The area is thought to have a number of woodburners (which contribute to the exceedences, and is thus suitable for mitigation through offsets).

60 Thus any offset programme (if applied) would only need to apply to a relatively distinct area, on a one-off basis. It could involve targeted removal (or upgrade) of domestic woodburners. Alternatively it could be targeted at other contributing sources such as motor vehicles and even industrial dischargers if these were shown to be relevant in this particular area.

61 Before any measures could be considered, however, there would need to a much more detailed assessment on both the size/location of the target area, as well as the degree of mitigation required. This would be an involved study, with a number of disciplines that might take many months to complete.

62 **Summary on offsets:** I have included these details here only because the questions have been raised. In my opinion however it is not sensible from an air quality management perspective to attempt an offset programme in this case. A far more effective approach is to target the primary source of the emissions – vehicles themselves – and this is being done through various government initiatives outside the scope of this Project.

63 **Other tunnels:** Finally a large number of the issues raised by many submitters have been, in my view, concerns associated with the fact that this is a large new project. The Waterview Project is the first time in Auckland where a road tunnel, with a large ventilation system, has been proposed in an urban area. Whist not a specific justification for this Project, it is instructive to examine the environmental outcomes for some other tunnels that have been completed in Australia. Those chosen are one of a similar scale to Waterview, in terms of design, length, and traffic flows. Some summary results for the monitoring of effects of these tunnels are given in **Annexure E**.

64 Of particular note here is a recent large study conducted by the Australian National Health and Medical Research Council, "Air Quality in and Around Traffic Tunnels." Final Report 2008. This 190 page report, which was authored and reviewed by some 40 of the leading experts in Australia, examined the health effects studies

that have been carried out throughout Australia and in many other parts of the world. They examined results from over a dozen tunnels, all of about the same scale and size as Waterview.

65 The précis of this report is most instructive and it is presented here in full:

> "This literature review of air-quality in and around road tunnels evaluates the factors associated with the development of poor air-quality in tunnels. The most effective way to manage this pollution is to deal with it at source through control of vehicle emissions. Solutions will include adopting new automotive engineering and fuels, implementing existing regulatory processes and controlling congestion. Guideline values or health-based exposure limits should be developed for the priority pollutants—including particulates and nitrogen dioxide—based on transit times through tunnels, and realistic estimates of total trip and daily exposure. Guideline values for fine and ultrafine particles should be considered but this would require a review of the current evidence for the health impacts and possibly further research. Future plans for tunnel design should move away from standards based on carbon monoxide levels and exposures alone, to standards based on carbon monoxide, nitrogen dioxide and particulate matter. These revised standards should take into account the fact that all components interact in determining the safety of in-tunnel conditions and the comfort of users. There is evidence that airborne pollutants in tunnels will affect the health of users of these tunnels. The evidence for health effects on people living close to tunnel portals or stacks is more equivocal. Nevertheless, good practice has long been to limit, as far as possible, exposure around tunnel portals and stacks; this practice should be continued and, where possible, reinforced."

66 This identifies a number a factors that have been promoted in depth with the Waterview tunnel, including the development of in-tunnel guidelines, the use of NOx rather than CO to indicate air quality inside the tunnel, and controlling congestion in the tunnel. However most significantly, this study failed to find any detectable health effects associated specifically with emissions from tunnel portals or vents. This is particularly true in Australia where very large , multi-million dollar studies have been carried out around Sydney's M5 and Lane Cove tunnels. These have simply not found any adverse health effects, despite a widespread public perception that they exist. Indeed the opposite has been found. The exposure of people living along the routes displaced by the tunnel route have been shown to have numerous air quality and health effects benefits.

67 This health study report can be confusing since many of the studies conclude that there are significant health effects associated with vehicle emissions. This is undisputed. However a careful analysis

of the study results show that the contribution to these effects by properly vented tunnel emissions is very low. For instance for the Sydney M5, and the Melbourne Eastlink tunnels the conclusions were almost identical *"…less than 1% of the effect is due to vent emissions.."*. In addition for the Brisbane North-South Bypass (Clem7), the conclusion was that *"..effects in Brisbane as whole would be reduced due to the general reduction in congestion..".* These results are included here as I would anticipate a very similar result for Waterview, because of the similarities in design and air quality management between Auckland and the Australian cities.

68 These show that despite early concerns that were remarkably similar to those expressed by Waterview submitters, the outcomes for these tunnels and their effects are all perfectly acceptable, particularly in relation to the key issues of vent discharges and portal emissions. The design criteria and assessment methodologies used in the Waterview Project are very similar to those used in Australia, and it is my view that fully acceptable air quality outcomes will also be shown for the Waterview Project when it is completed.

RESPONSE TO MINUTE FROM THE BOARD

69 In this section of my rebuttal, I respond to 'Issue S' raised by the Board of Inquiry's Minute dated 28 January 2011 (pages 2-3).

70 'Issue S' states:

> *"S. Emission Impossible, in their 14 January report, in section 4.11.1, agree with NZTA's witness Mr Gavin Fisher, that treatment of tunnel air is unlikely to be cost effective. We presently presume that this is a reference to paras 59 and 60 of his evidence (perhaps amongst others). We note his rough estimates in those paras of some extremely large capital and operational costs, but note from 59 that those may be regional, and from 60 unstated, but perhaps national. No analysis of cost appears to have been done regarding <u>this</u> project, which is what is before the Board of Inquiry. Mr Fisher and the Board's reporting experts would appear to need to consider this further, especially as the offsets being suggested by them both appear to involve the tackling of national or regional emission problems, on a national or regional basis, rather than being project specific mitigation. Alternatively there may be project-related aspects, perhaps on some sort of neighbourhood basis, where project-related offsets could be employed, but that is not immediately apparent to us.*
>
> *The Board's current thinking is that a simple rough order breakdown of the costs, efficiency of the selected techniques and design life expectancy of the equipment, and additional environmental adverse effects which result (if any) from the containment by the treatment, would assist, along with any advice about potential cost savings, for instance can the shaft height be reduced if treatment is incorporated? There seems to be a lot of*

> *reliance on past tunnel construction where treatment of air quality in tunnels has more to do with tunnel users than the surrounding environment."*

71 I respond as follows.

72 I have not "suggested" offsets, and indeed my position is that offsets are not warranted as outlined earlier in this evidence.

73 I cite reasons based on my technical analysis that include (a) the quantum of effect is not great enough to need mitigation through offsets, (b) the contribution of the Project's emissions to those monitors showing exceedences is very small, (c) the emissions are not caused by the Project itself, but by vehicles in the area. As noted, if the Board was to consider offsets, there are a large number of factors that need to be the subject of considerably more detailed analysis.

74 The discussion and analysis of offsets given in my evidence in chief (at para 43) and in the expert witness caucusing (Annexure F at paras 43-49) is not, as implied, on a regional or national basis. It is on very specific options for addressing a very specific and local issue – being the measured exceedences of $PM_{2.5}$ at the Alan Woods Reserve site.

75 The concept that the treatment of air quality in tunnels is only concerned with tunnel users and not the wider environment is unfounded. In all new road (and rail) tunnels constructed now, a great deal of weight is put on <u>both</u> aspects. At Waterview, the wider environmental effects have been a paramount concern, and in my opinion the detail in all the assessments conveys this well. There is absolutely no question that if air quality effects had been predicted to result in adverse effects, then mitigation would have been employed (e.g. filtration). But the predictions do not show this, and the wider environment is well protected with the current proposed design.

76 Undertaking a full cost benefit analysis for tunnel vent filtration for this Project has not been carried out in detail, for the simple reason that filtration has never been considered as a viable option. I fully agree with that position. I note that the Auckland Council's and Air Quality s42A Report's air quality experts share that opinion. The Expert Caucusing Joint Report, Report concluded (at para 9):

> "***Filtration:*** *It is accepted and agreed that from an air quality technical viewpoint that it is unlikely that filtering the air from the vents will provide any significant benefits.* "

77 In further response to the Board, however, the following factors are noted:

77.1 There is no one type of "filter". To filter NOx might require a selective catalytic reduction device. To filter particulates might require an electrostatic precipitator. To filter CO might require a chemical treatment device. To filter benzene or hydrocarbons might require and activated carbon filter device. Accordingly, there would need to be multiple filters. They would all have to be very large.

77.2 A performance specification would need to be developed. At some time it would need to be decided *"just how clean do we want this discharged air to be?"* The cost difference between a system that simply cleaned the air to some average urban Auckland air, standard, and a system that cleaned it to some pristine standard would be very large.

77.3 There are a number of different proprietary systems, and the programme of evaluation and procurement would need to be extensive, and would run for many months (indeed such processes for normal industrial stacks can take up to 18 months).

77.4 Since there are no "off the shelf" systems, (nor is there any firm idea of what is to be filtered, and to what standard), commencing a process to establish costs would be a significant undertaking. Manufacturers would need to be engaged, and even preparing quotes would put them to costs in tens of thousands of dollars each. The NZTA, being a responsible contractor, would be reluctant to do this unless the need to do so was clearly established and the prospect of a final contract was realistic. At this stage neither is.

77.5 Also, a number of consequential issues would need to be assessed – not only for cost, but for their environmental effects. For instance, some filtration systems use large quantities of chemicals that would need to be (a) sourced, (b) stored, and (c) disposed of when spent.

77.6 Finally, there is the problem in determining the "benefits" from reducing contaminant emissions to air. I am well aware of this, having been the author of the "Health Effects of Air Pollution in New Zealand" report.[37] This concluded that costs associated with pre-mature mortality due to vehicle emissions throughout NZ were of the order of $700m. There is no

[37] Fisher, G.W; Kjellstrom, T.; Kingham, S.; Hales, S.; O'Fallon, C.; Shrestha, R.; Sherman, M. (2007). Health and air pollution in New Zealand. Final Report to the Health Research Council, Ministry for the Environment and Ministry of Transport. June. 156 p. Available for download at hapinz.org.nz.

universal agreement on this figure, and it has been argued up and down by various people. However even using this as a starting point, we can assess – from the health effects analysis given in the main AEE (Appendix P) – that the increased pre-mature mortality due to vents emissions is considerably less than 0.1 per year. On a cost basis that equates to less than $75,000. It is inconceivable that any sort of filtration system could be had for this amount – or even hundreds this amount (i.e. $7.5m). Even a basic system (only for particulates) installed at each vent, would be of the order of 1000 times this amount (i.e. $75m). I would not consider a cost benefit ratio of greater than 1000:1 a very effective use of public funds.

Gavin Fisher
3 February 2011

ANNEXURE A
UNITEC STACKS

The two stacks at the north-eastern end of the Unitec campus. The right hand one is approximately 48m high, and the left hand one 43m.

(View from the southwest – Waterview is about 4-5 km to the west – left of the photo)

ANNEXURE B
VARYING VENT HEIGHT EFFECTS

Scope

The proposed height for the tunnel vents is 25m. All the effects analysis has been conducted using this height. It is a subjective option. Many similar sized tunnels around the world have lower vents. What would be the effect of using a lower height here?

Method

A simplified modelling analysis has been conducted, to scope out the issue. This uses only a simple Gaussian plume model (Ausplume), and does not take account of two important local effects – terrain and building downwash. However it does indicate well the scale of effects that occur when different vent heights are used.

Only 1-hour peak NO_2 has been modelled (assuming all the emitted NOx is converted to NO_2). NO_2 has been used as it shown to be the limiting factor in most of the effects analysis. A well validated 1996 Auckland modelling meteorological file has been used. In each plot the 20 $\mu g\ m^{-3}$ contour is highlighted in red.

Results

The plots on the next pages show some summary results. The following features are noticeable:

1. Raising or lowering the height, even by appreciable amounts (from 5m to 50m) does not have a large effect on ground level concentrations, except very close to the vent (50m or closer).

2. This is due to the plume buoyancy being dominated by the exit velocity (rather than the temperature), which is overcome by meteorological conditions despite 50m variations in the vent height. Almost all of the higher values occur during summer daytime (mostly afternoon) conditions, when deep convection can mix the plume to the surface, almost regardless of its release height.

3. Higher values near to the vent can also occur during afternoon convection in winter, but they are not as high as the summer ones, and very infrequent.

This analysis does not include building [wake] effects which could change this picture. In general, including building downwash will do two things:-

1. Make ground level concentrations in the far field (>50m) less – due to more turbulent mixing,

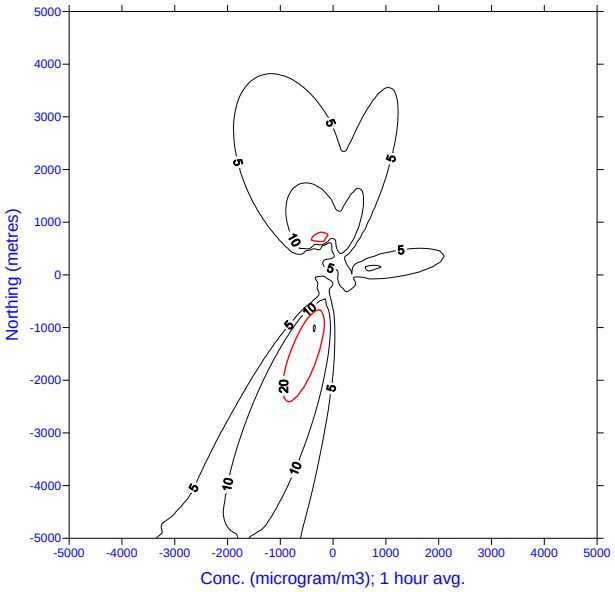
2. Make concentrations in the near field (<50m) slightly higher – due to the building downwash factors.

Summary

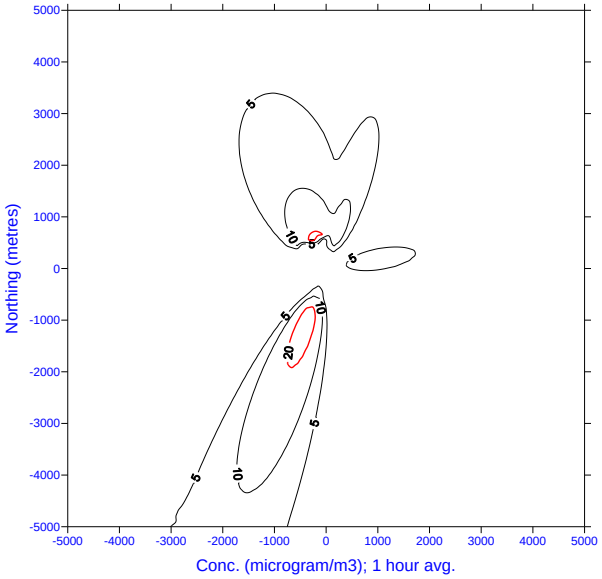
The plume from the vents produces a certain level of ground level effect due to a combination of its exit velocity and the local meteorological conditions. This is not greatly sensitive to vent height – that is there is very little difference between 25m and 15m (or even going to 10m or 5m).

At 15m vent heights the peak cumulative 1-hour NO_2 will be of the order of 110 μg m^{-3} (compared the guideline of 200 μg m^{-3}, and measured values at other Auckland sits up to 150 μg m^{-3}).

Raising the vent height

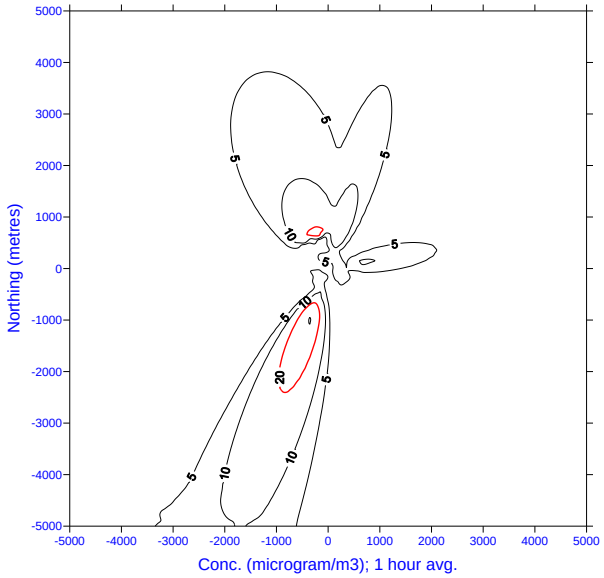


25m

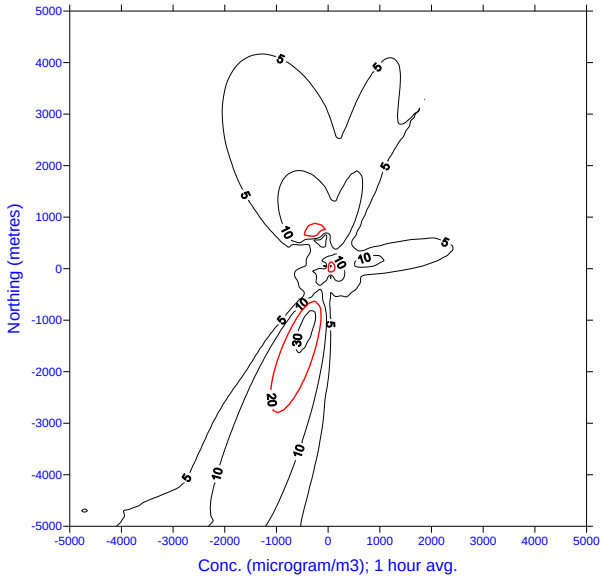


50m: Going from 25m to 50m makes only a little difference. Effects are slightly less, especially closer to the vent (0-200m). Concentrations further out are not affected as much, as these are more dominated by larger scale weather features. (At a 100m vent height, the results start to become significantly lower, but this is certainly not a viable option).

Lowering the vents

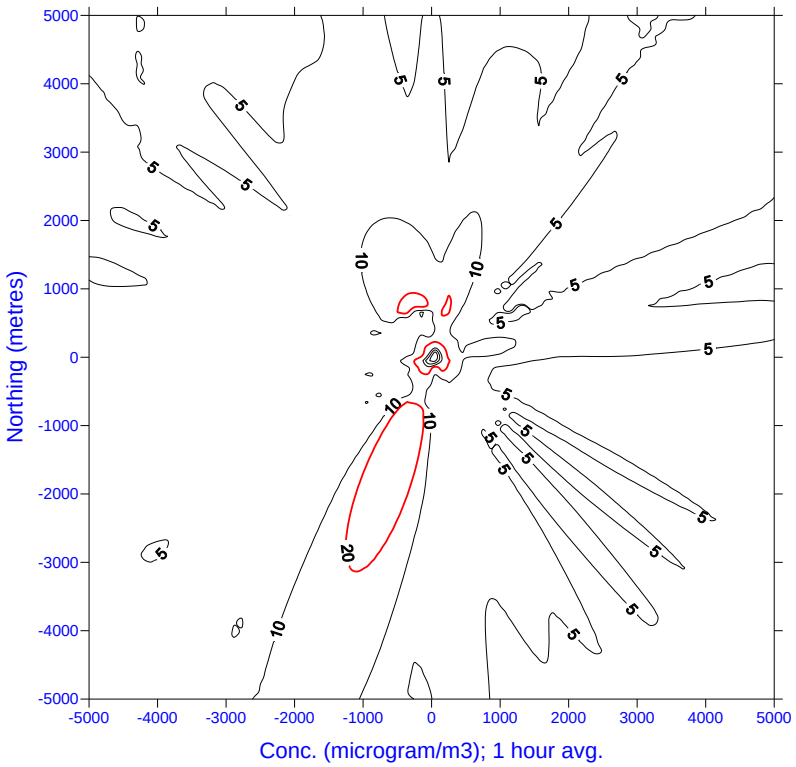


25m



15m: Going from 25m to 15m also makes only a small difference in the bigger picture, however peak 1-hour NOx concentrations very close to the vent (<50m) could go up from around 30 to 130 μg m^{-3}.

(NB: This assumes all NOx=NO_2. In reality this value will be only 35% to 20% of this).



5m: Going down to 5m also makes very little difference in the surrounding terrain. It does have a difference very near (<50m) where the concentrations do increase, but even at this height the peak 1-hour NOx concentration at the first grid point (50m) is still only 132 μg m^{-3}. This might still be "acceptable" when added to the background of 65 μg m^{-3}, and allowing for a realistic conversion rate.

(NB: This assumes all NOx=NO_2. In reality this value will be only 35% to 20% of this).

ANNEXURE C
ANALYSIS OF SEPARATION DISTANCE

In order to inform a decision on what an appropriate minimum separation between houses and busy roads might be, the following analysis was undertaken:

1.1 Use the VEPM model to determine vehicle emission rates.

1.2 Use the data for SH16 – at 135,000 vehicles per day, 2016 year.

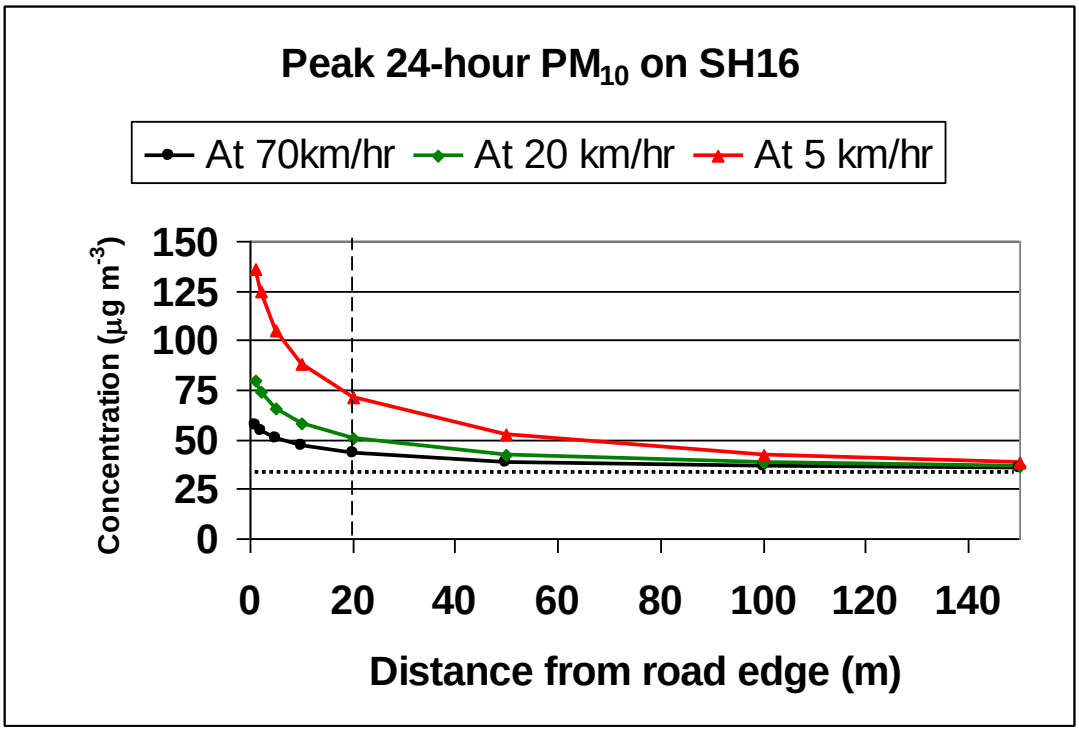
1.3 Use 24-hour PM_{10} as the primary indicator, with a background of 35 $\mu g\ m^{-3}$.

1.4 Use the Caline4 model to determine dispersion from the roadway.

1.5 Use the worst case meteorological conditions (wind speed=0.5m/s).

1.6 Test for three scenarios, based on average vehicle speed (70 km/hr=fleeflow, 20 km/hr = lightly congested, and 5 km/hr= highly congested).

1.7 Plot the results as a function of distance from the road edge (shown below).



This shows that for SH16, at full capacity, the separation of 20m from the road edge provides enough of a buffer under the most common circumstance of freeflow traffic, as well as under moderately congested conditions. It may not under highly congested conditions, but it is doubtful that such conditions as these will ever occur (135,000 vehicles using the motorway going 5 km/hr over 24-hours).

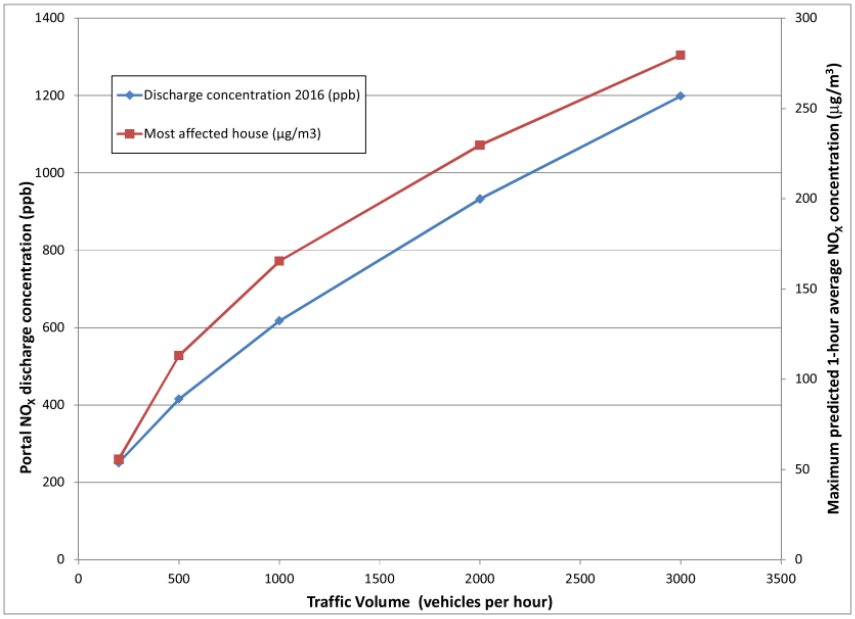
ANNEXURE D
PORTAL EMISSIONS MODELLING

New portal modelling has been carried out using the same model and methodology as presented in the Main Report G1 at Appendix I.

This was done in order to provide more detail on the portal effects under various traffic flow conditions in order to test the effects at time when the fans might be turned off. The full results are not presented here, but can be supplied in a 10 page internal report produced by Beca on 26 January 2011.

Example results for the southern portal only (the worse of the two in terms of effects).

Figure 1. Southern portal NO_X discharge concentrations (ppb) and maximum 1-hour NO_X concentrations ($\mu g/m^3$) predicted at the most affected residential property with respected to traffic volume for the 2016 emission conditions



This plot shows the expected worst case effects of portal emissions in the event the fans are off, for various levels of traffic flow (note that the peak rate is 3,700 vehicles per hour, but there will never be a circumstance when the fans would be off at this peak rate – or even close to it.

The plot shows the expected concentration of NOx at the portal itself (left scale in blue), as well as the expected concentration at the nearest residence which is 50m from the portal (right scale in red).

The results are further summarised in the table below.

Table 3. Summary of maximum 1-hour NO_X concentrations ($\mu g/m^3$) predicted at the most affected residential property near the Southern Portal and portal discharge concentrations (ppb) and with respected to traffic volumes

Traffic Volume (vehicles/hr)	2016 Portal Emission Conditions		2026 Portal Emission Conditions	
	Portal NO_X discharge concentration (ppb)	Maximum 1-hour average NO_X concentration ($\mu g/m^3$)	Portal NO_X discharge concentration (ppb)	Maximum 1-hour average NO_X concentration ($\mu g/m^3$)
200	251	56	177	39
500	415	113	293	80
1000	617	165	435	117
2000	933	230	657	162
3000	1199	280	845	197

This table shows that the maximum portal concentration would be 1199 ppb (equivalent to above 1,700 $\mu g\ m^{-3}$). This would be above the in-tunnel limit of 1000 ppb and would thus require full use of the fans.

At this maximum rate (with no fans) the concentration at the nearest residence would be 280 $\mu g\ m^{-3}$. This is NOx, for which there is no guideline. Using a high (and conservative) conversion rate to NO_2, results in a concentration of 100 $\mu g\ m^{-3}$, which on top of a background of around 65 $\mu g\ m^{-3}$, would be close to (but not exceeding) the air quality guideline of 200 $\mu g\ m^{-3}$.

However once the vehicle numbers fall below 1000 per hour, these concentrations will halve. At this rate the effect at the nearest house will be down to 58 $\mu g\ m^{-3}$, with a cumulative value of 123 $\mu g\ m^{-3}$. This is elevated, but on a par with values found at most other NO2 monitoring sites in Auckland.

The effects reduce further by 2026, due to reductions in vehicle emissions generally.

The traffic flow value of 1000 vph only occur between 7am and 10pm, which means that outside of these hours the fans could be completely turned off without any adverse effects. They could also be turned down at other times when the tunnel usage was lighter than 1000 vph.

ANNEXURE E
OTHER TUNNELS

Scope

It is instructive to place the situation of the proposed Waterview tunnels in context with other recent tunnel developments, in regard to air quality effects. Here a brief summary analysis is made of results from some Australian tunnels.

Method

A great deal of material is available of various RTA (Regional Transport Authority) web sites in Australia. Some of this has been extracted and presented below.

Results

The results and implications are covered for of the two tunnels analysed, including:-

1. The North-South Bypass (Clem7) in Brisbane

2. The Eastlink in Melbourne

Summary

The experience with Australian tunnels, which have been assessed in a very similar fashion to the Waterview tunnels, shows that early concerns with air quality effects have been largely unfounded. Based on the level and detail of analysis for the Waterview tunnels, it is expected that the various concerns expressed here will also be unfounded.

Clem7 Tunnel. Brisbane

Opened: March 2010, toll, under Brisbane River
Length: 4.8 km
Traffic: Unknown, estimate 50,000 per day (only data is 1,000,000+ trips in 3 weeks)
Vents: Two (30m each)

Data:
Data are available (on the Clem7.com.au web site) for both in-tunnel monitoring and ambient monitoring. A representative sample for CO is shown below. Reports are available monthly, for the past 18-20 months (covering also the period of construction before opening). There is not a great deal of month-to-month variation in the results presented, except with slightly higher numbers in winter due to general air pollution being higher in the winter months.

In-tunnel air quality:
These data show that for the one day chosen (the latest available of 31 December 2010), that for the three parameters measured – CO, NOx and visibility – the set criteria for air quality are complied with by a large margin. For instance, the criterion for NOx is 10ppm, but at no time does the in-tunnel concentration exceed 1ppm. The data for some dozen other days examined shows the same. This shows that the tunnel ventilation system is working well within its specification. This example is very relevant, since the NZTA propose to use identical criteria for in-tunnel assessments in the Waterview tunnel. Although the Clem7 north-south bypass is slightly longer than Waterview (4.8 km vs. 2.6 km) it does have a twin tunnel, with similar capacity and a vent at each end. There is no reason why Waterview could not operate to a similar level of high efficiency ventilation.

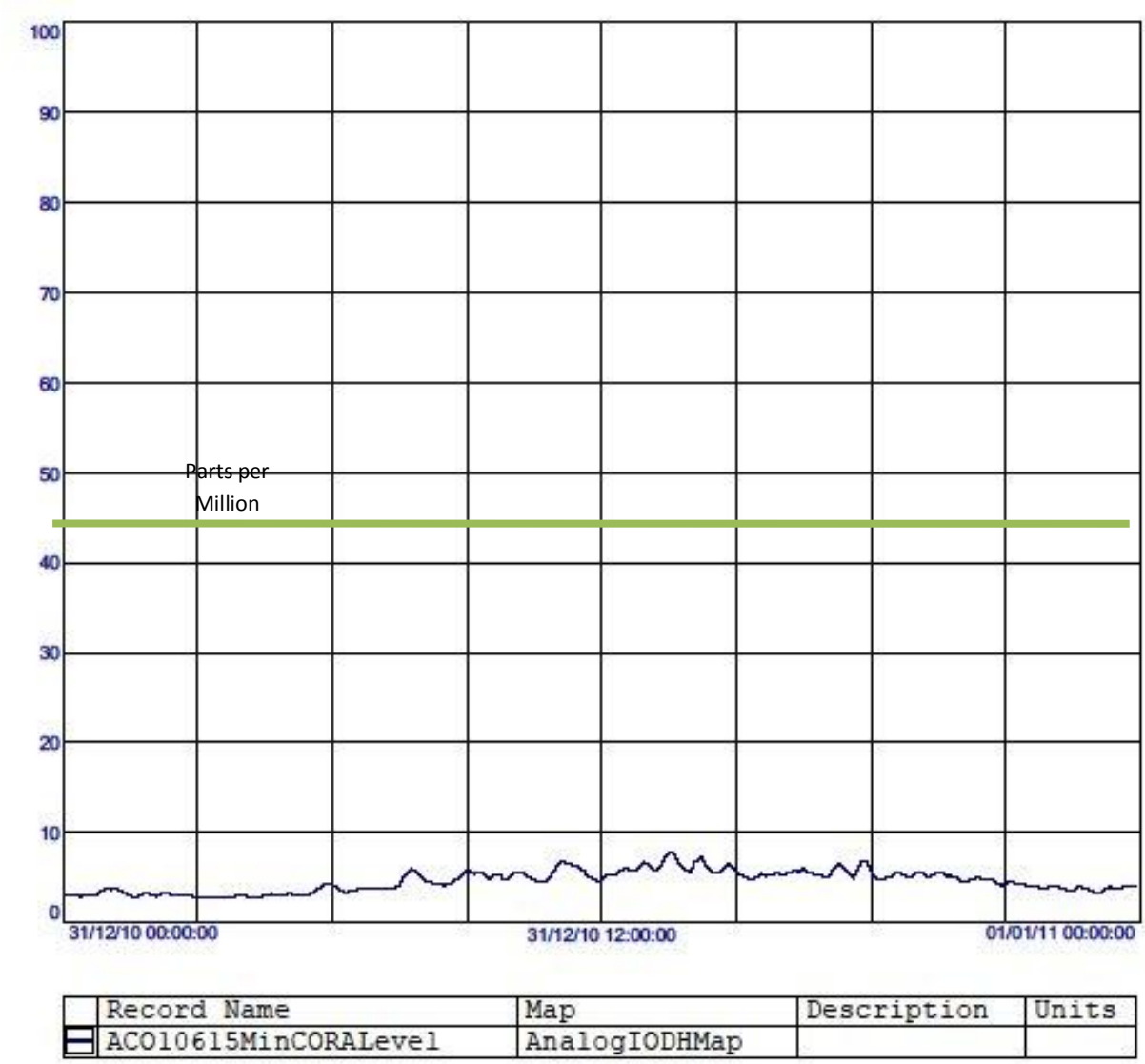
Ambient air quality:
The Clem7 project has 4 monitors, 2 each located around each end. The data shown below are for the recent month-long period of November 2010. Also shown are the standards and guidelines, which are identical to those used in New Zealand. Note that these are the full cumulative ambient values – not just those due to tunnel vent or roadway emissions, but all sources in the area. These show a reasonably good level of compliance, with the possible exception of $PM_{2.5}$. This still appears to comply, but not by as comfortable a margin as the others. This is a very similar circumstance to the monitoring results so far around Waterview, and to those predicted by the dispersion modelling. Without analysis or discussion in great detail, these show that the operation of the Clem7 tunnels does not appear to have resulted in any significant or unacceptable effects in the area. Indeed a cursory examination of the data from before the tunnel opened (not shown here) shows that the operation of the tunnel is hardly even noticeable in the air quality record.

A very similar circumstance is predicted for Waterview (albeit about 10-20% higher because of greater urban density and traffic flows in west Auckland).

In-Tunnel monitoring

Carbon Monoxide (15 minute average 31 December 2010)

Graph 1: Northbound



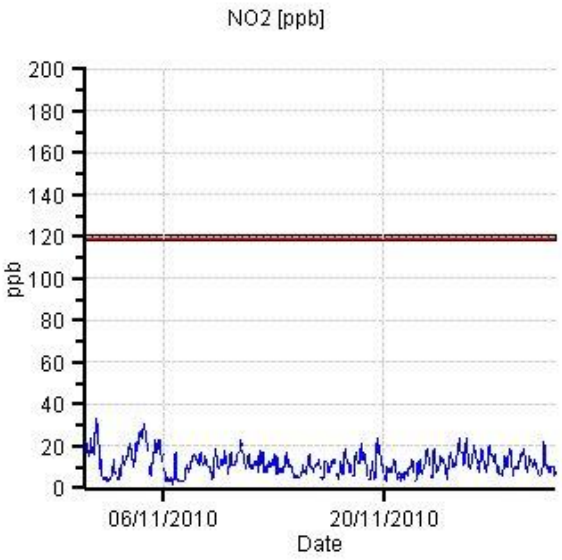
Goal as noted in Project Deed is 70 parts per million

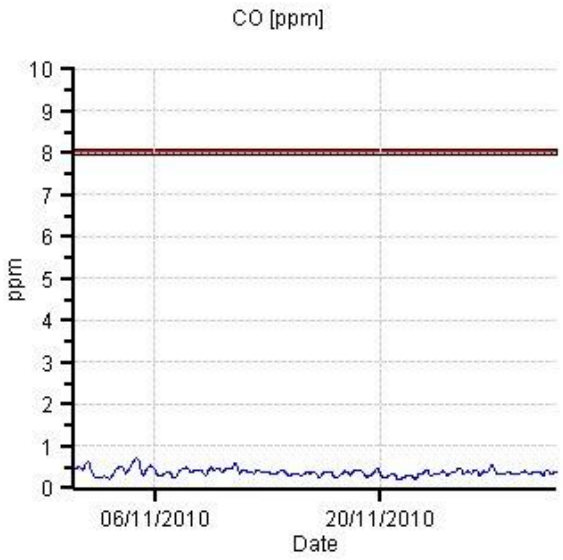
CLEM7 Air Quality Charts (In-tunnel) – 31 December 2010.

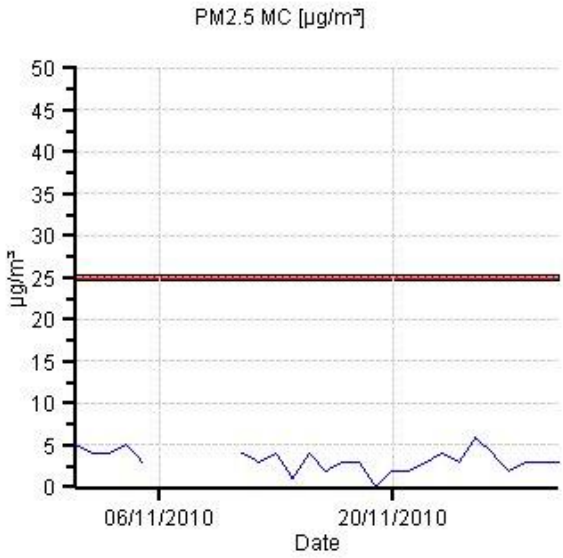
This goal is met, by a wide margin, for all measured contaminants, at all times.

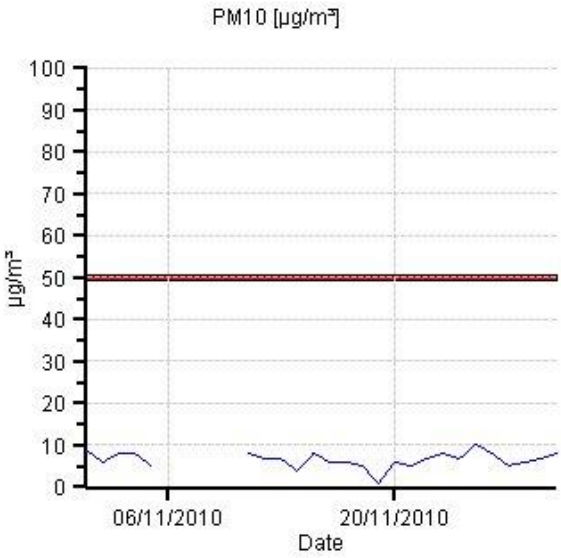
Ambient Air Quality Monitoring Data Report – November 2010

1. Hawthorne St (Southern Low Level) – Maximum Values for November 2010



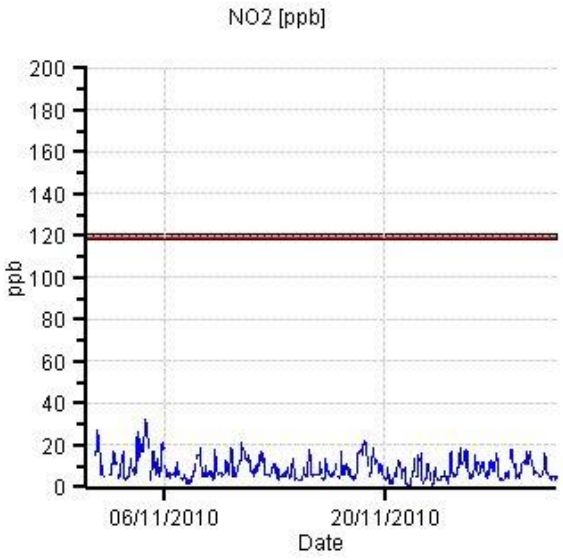


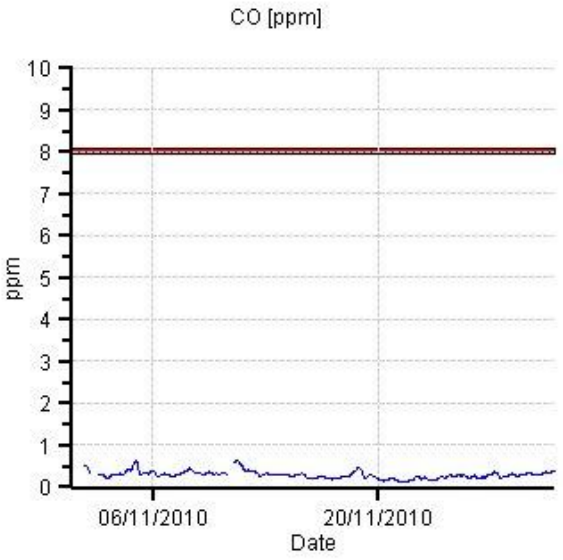


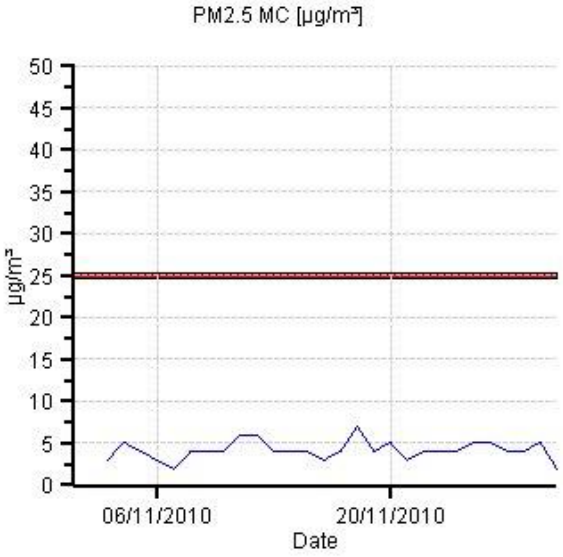


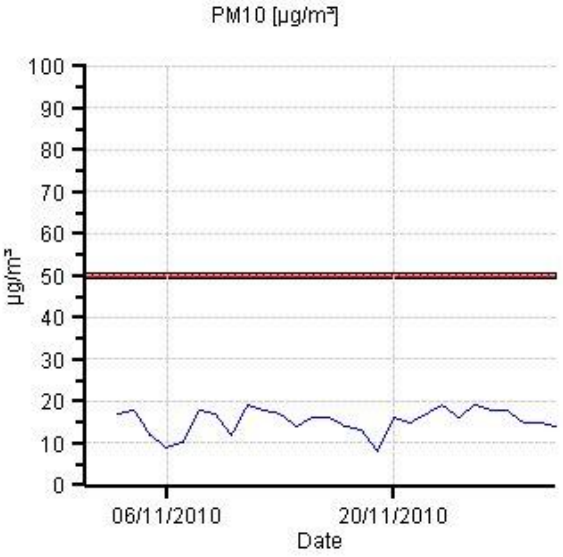
Ambient Air Quality Monitoring Data Report – November 2010

2. Landcentre (Southern High Level) – Maximum Values for November 2010



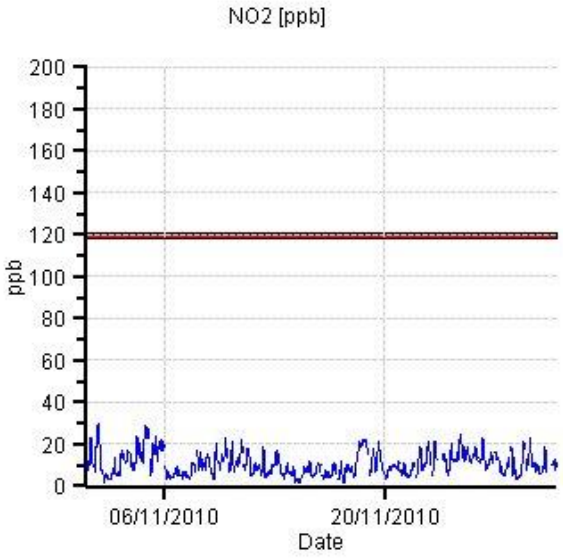


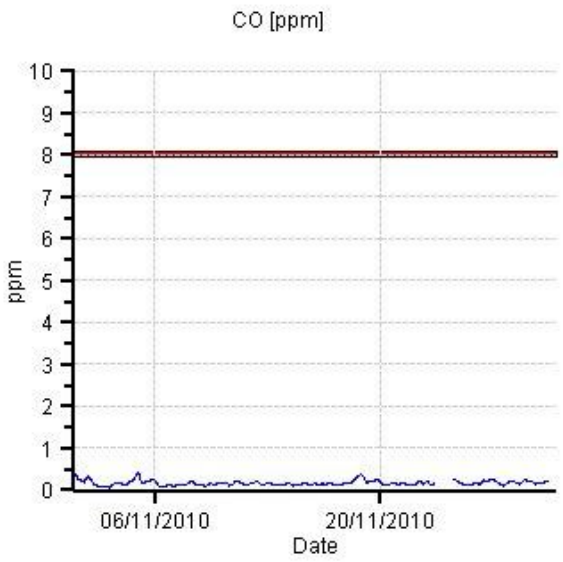


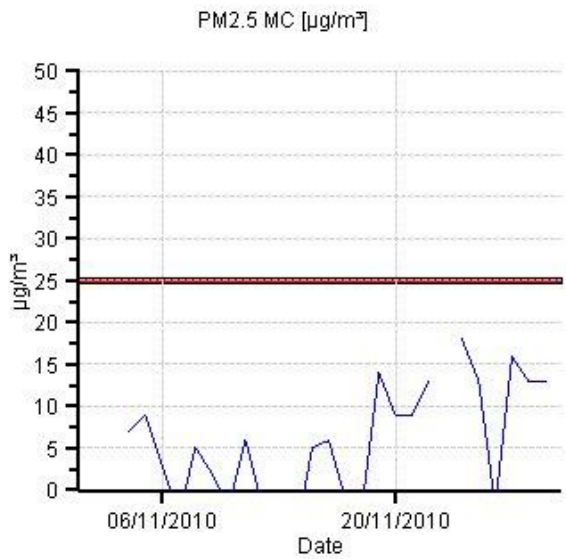


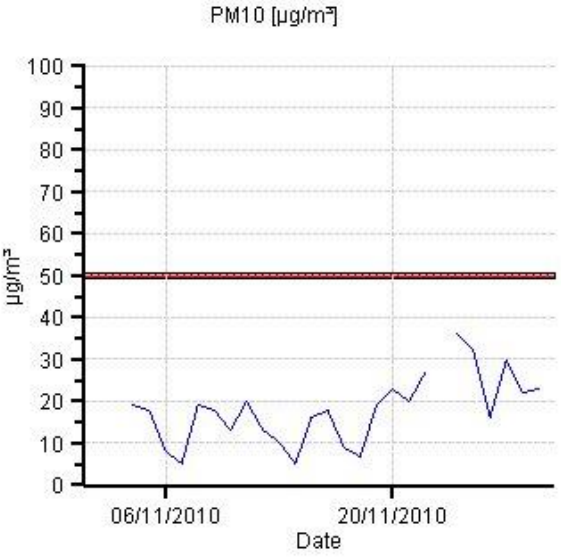
Ambient Air Quality Monitoring Data Report – November 2010

3. Northey St (Northern Low Level) – Maximum Values for November 2010



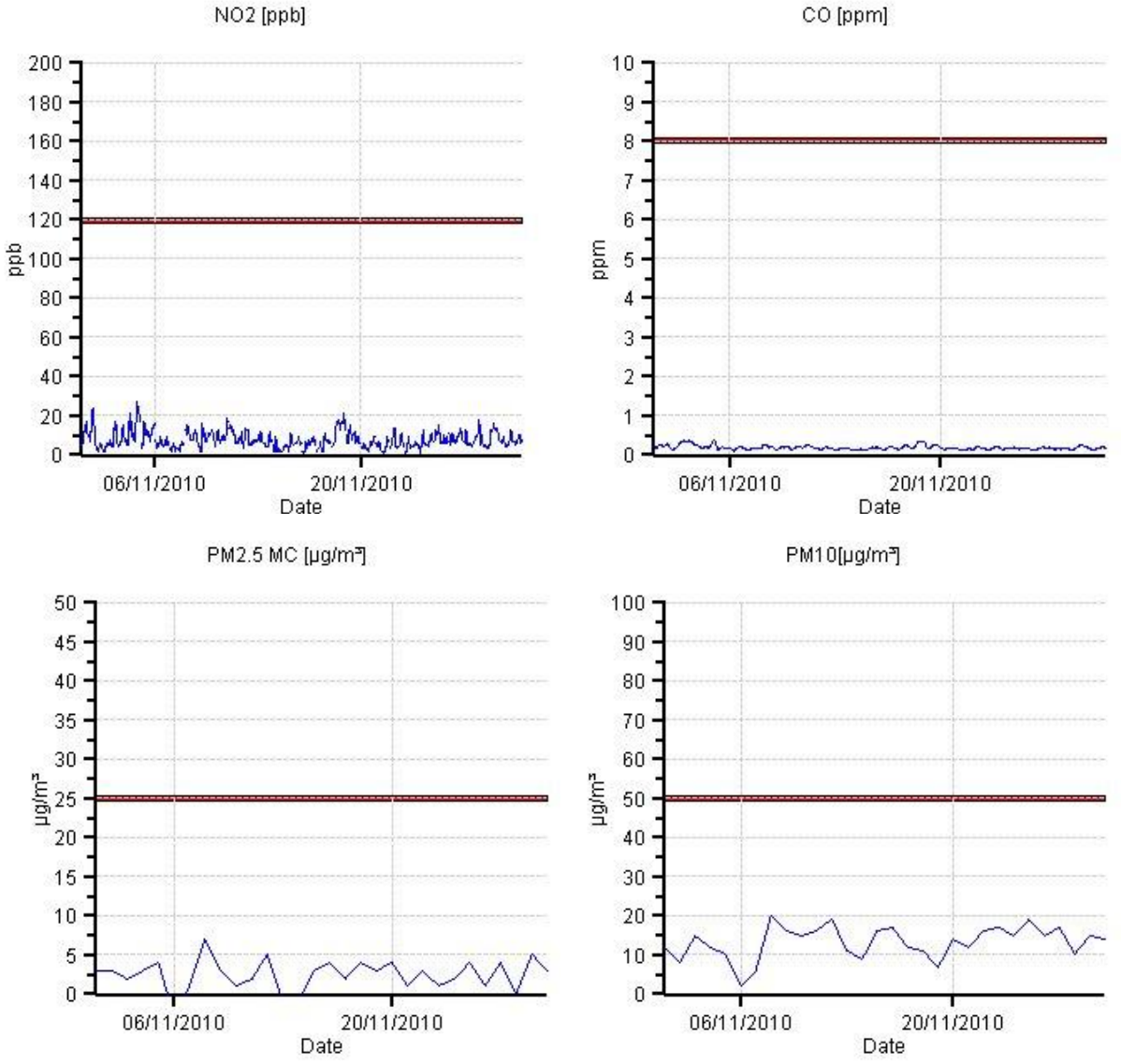






Ambient Air Quality Monitoring Data Report – November 2010

4. Royal Brisbane Hospital (Northern High Level) Maximum Values for November 2010



Eastlink Tunnel, Melbourne

Opened: August 2008, toll, part of 40km eastern route
Length: 1.6 km
Traffic: Peak 71,000 per day in tunnel
Vents: Two (47m each)

Vent emissions

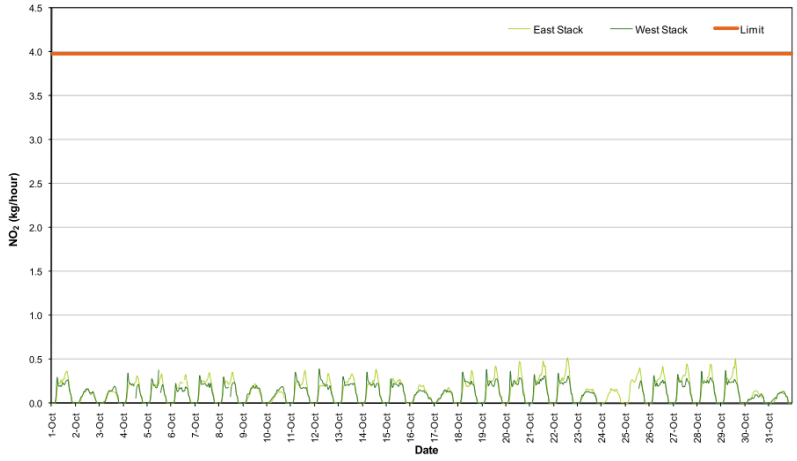


Figure 6: Nitrogen Dioxide Mass Rate (1 Hour Average)

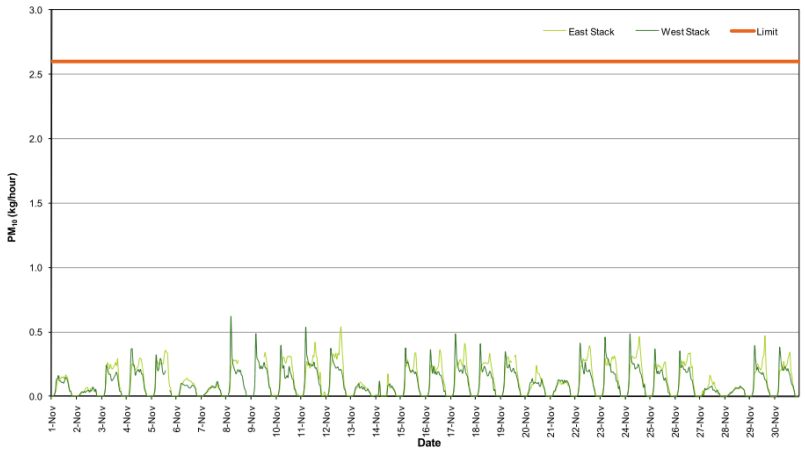


Figure 9: PM_{10} Mass Rate (1 Hour Average)

These show that the emission testing carried out for NOx and PM_{10} are well within the deign criteria (which have never been exceeded). (Indeed the data show that the emission rates as measured in the vents at Eastlink are completely consistent with the emissions data used in the Waterview modelling, adjusted for the number of vehicles and the length of the tunnels).

Ambient monitoring

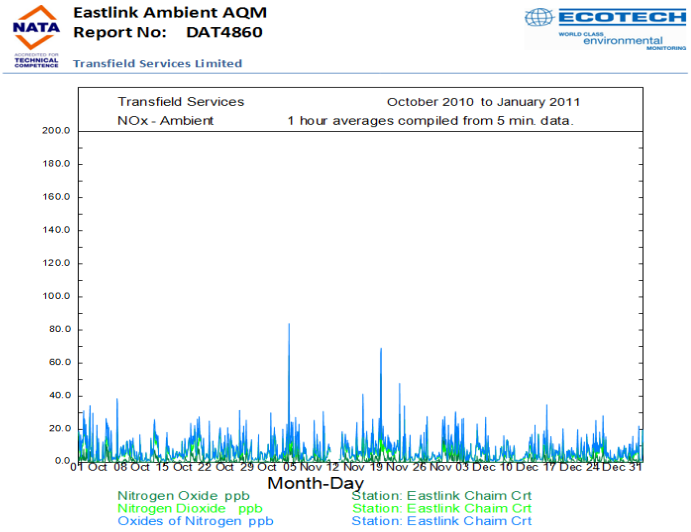
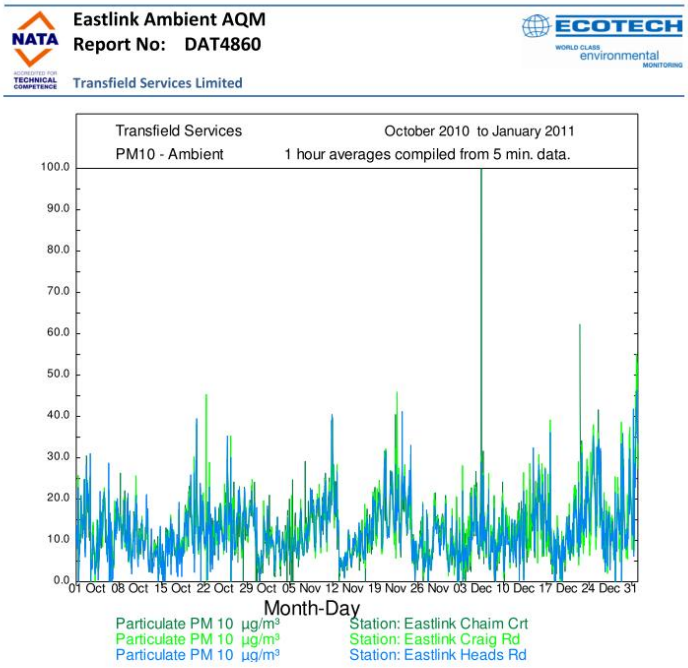


Figure 2: Chaim Crt NO, NO_2, NO_x 1-hour Averages for October to December 2010



These show that the ambient monitoring carried out for NOx and PM_{10} at three stations near the vents are well within the assessment criteria, and have not resulted in any exceedences (despite these monitoring sites having been located at the places predicted to be worst affected).

ANNEXURE F
EXPERT WITNESS CAUCUSING

Before the Board of Inquiry
Waterview Connection Project

---

in the matter of: the Resource Management Act 1991

and

in the matter of: a Board of Inquiry appointed under s 149J of the Resource Management Act 1991 to decide notices of requirement and resource consent applications by the NZ Transport Agency for the Waterview Connection Project

Expert Caucusing Joint Report to the Board of Inquiry – Topic Air Quality

---

Dated: 28 January 2011

Due: 7 February 2011

EXPERT CAUCUSING JOINT REPORT TO THE BOARD OF INQUIRY

INTRODUCTION

1 This joint signed report is written in response to the Board of Inquiry's Minute and Directions dated 23 December 2010. The Directions require the experts, following caucusing, to provide a report by 10am on 7 February 2011 that includes:

1. Areas that have been resolved and how (e.g. by agreement about conditions)
2. Areas that are not resolved, and succinctly why.

2 This report relates to the caucusing topic of **Air Quality**.

3 A caucusing meeting was held on **18 January 2011.**

4 Attendees at the meeting were:

1. Gavin Fisher (Air Quality, for the NZTA)
2. Dr David Black (Public Health, for the NZTA)
3. Janet Petersen (Air Quality, Auckland Council & Transport)
4. Jayne Metcalfe (Air Quality, appointed by the Board of Inquiry, and author of the Board s42a report)

5 Traffic modelling is not an area that the experts present at the first meeting could fully resolve, as this is a specialist subject in its own right. Specific matters were referred to the NZTA traffic expert – Andrew Murray (Beca, for the NZTA) - who attended a second meeting with Gavin Fisher and Jayne Metcalfe on **24 January 2011.**

6 In summary there are few substantive matters of technical disagreement, but the main differences between the parties revolve around how to handle uncertainties, how to ensure post-project compliance, the extent of compliance monitoring required and the issues and options around mitigation and offsets.

7 The question of offsets was central to the discussions. Many of the technical issues raised by the Board s42A report involve fundamental uncertainties in the assessment methodology that are not able to be fully resolved without a substantial re-analysis and more data. However the Board expert has noted that many of these uncertainties could be overcome if a degree of emissions offsetting were to be adopted by the NZTA, and if tighter monitoring and post-project compliance requirements are put in place. The details are covered below.

AREAS THAT HAVE BEEN RESOLVED

8 **Health Effects:** It was generally accepted that due to the nature of exposure to vehicle emissions, health effects of some kind around this project, or indeed any large roadway project, are unavoidable. It was also agreed that although not all potential health effects have been evaluated in the NZTA documents, any further health effects analysis is unlikely to help inform the situation.

9 **Filtration:** It is accepted and agreed that from an air quality technical viewpoint that it is unlikely that filtering the air from the vents will provide any significant benefits.

10 **Induced traffic:** More analysis and detail was presented (at the meeting on 24 January), mainly justifying the methodology and accuracy of the traffic modelling that produced the numbers used in the air quality assessment.

11 The Board expert now agrees that the analysis for the level of induced traffic seems reasonable, subject to agreement in the caucusing of the traffic experts.

12 **Background concentrations:** Since the AEE, and subject to further analysis by both the Board and Council experts, it has become apparent better choices could have been made for some of the background values used. On this there was some agreement. If the project was going to be fully re-analysed, the experts agreed that updated data would have to be used.

13 There was further agreement that despite these different background values, the consequences for the overall effects assessment were minor, and did not require further analysis provided that the offset mitigation, and improved separation distances (discussed in following sections) are implemented.

14 **Models:** The Board expert questioned whether Ausroads or ADMS is the most appropriate model for traffic effects.

15 This matter is covered in the 2008 Users Guide for Meteorological Datasets for the Auckland Region. The experts agree that this guide does not give a clear recommendation for which model is most appropriate in this case.

16 The experts have agreed that the differences between models become inconsequential if the offset programme is applied and that any unresolved differences of opinion on the model used do not have a significant bearing on the assessment.

17 **Models:** stack dispersion modelling for a full year of meteorological data has been completed and full results will be presented in rebuttal evidence.

18 **Consent Conditions:** Auckland Council have proposed a number of specific changes to consent conditions in evidence. These are all accepted by the experts as appropriate. Detailed changes to

consent conditions will be confirmed in NZTA Rebuttal evidence. The only specific conditions where the experts did not agree are in the management of tunnel ventilation air from the portals. This is discussed further in following sections.

AREAS THAT ARE NOT RESOLVED, BUT EXPERTS AGREE HOW TO RESOLVE

19 There are several issues where the technical experts were able to agree an appropriate way forward. However, the work was not complete at the close of caucusing so the outcomes are not yet agreed by the experts.

20 **High traffic day:** The Board report suggests that air quality effects should be assessed for a high traffic day. This is a subjective term. However, there was general agreement from the Board and NZTA experts that comparison of modelled average traffic, with measured traffic will provide adequate data for sensitivity analysis.

21 To provide further information, evidence in rebuttal will be presented by the NZTA Expert in order to demonstrate that a 20% increase (compared with modelled average) represents a "High traffic day", and the air quality effects of a 20% increase in traffic flows, with conclusions of the assessment of effects will be adjusted accordingly.

22 Details on all these effects and the outcomes of the traffic expert caucusing in relation to air quality issues will be presented in the rebuttal evidence of Andrew Murray.

23 **Vent heights:** For visual amenity reasons, it has been suggested that the vent heights be reduced from 25m to 15m.

24 The experts agree that from an air quality perspective, higher stacks are better. However, it is also agreed that lower stack heights (for example 15m) may be adequate to avoid any significant adverse air quality effects.

25 It was agreed that, a stack height of 15m may be appropriate, subject to the results of comprehensive dispersion modelling. This modelling was not available at the close of caucusing, but is being undertaken and is expected to be available by 10 February 2011.

AREAS THAT ARE NOT RESOLVED

26 **Offsets:** The Board and Auckland Council experts have proposed that increased particulate emissions as a result of the project should be offset in some areas, in particular the Oakley Creek Valley. The experts agree in principal that offsets are a practical measure that will provide public health benefits.

27 **Separation distances:** The experts all agree that having someone live too close to a busy road is undesirable, and may result those residents being exposed to unacceptably high levels of pollution. A re-evaluation of critical separation distances between residential locations along the route and the roadway itself is being undertaken. The results of this evaluation were not available at the close of caucusing.

28 **Monitoring and compliance:** All have agreed that it remains difficult to resolve issues around conservatism and uncertainty. However, the Board expert (and the Auckland Council expert) have suggested a way forward. This comprises:-

1. Tighter post project monitoring, evaluation, and action in the event of non compliance.

2. The inclusion of additional post project monitoring

29 These matters (offsets, separation distances and monitoring) are all being put to NZTA, and the outcomes will be covered in the NZTA rebuttal evidence of Gavin Fisher. The overall objectives of these measures were agreed by the experts although the specific implementation will need to come from NZTA, or be imposed by the Board of Inquiry.

30 **Tunnel vent fans**: The Board and Auckland Council experts desire to see air quality criteria applied in respect to when the fans can be turned down, or off. NZTA have proposed a time window (only between 11pm and 7am) when it is anticipated traffic flows will be low enough to allow fans to be turned off. They have supported this with some detailed modelling that shows effects – due to contaminants leaking out either portal – will be acceptable. NZTA have proposed that these issues are to be covered in the Tunnel Operations Management Plan (rather than in any consent conditions).

31 However the Board and Council experts felt that (a) there are no specific assurances that turning the fans off will not have an unacceptable effect, particularly on residences close to the tunnel portals, and (b) that the proposed criteria for turning fans off should be air quality related and not by time of day.

32 The experts agreed on these points in principal.

33 The Tunnel Operations Management Plan is still under development, and will probably not be finalised until the tunnel is actually built. This will contain air quality criteria to ensure the health and safety of people in the tunnel, but is not currently subject to any consent conditions.

34 The Board and Council experts proposed that the tunnel operation could be subject to a consent condition, limiting the concentration of NO_2 inside the tunnel to a concentration to be determined.

35 Post caucusing the NZTA have proposed an alternative condition (possibly as AO.7):-

"The tunnel ventilation system shall be designed and operated to ensure that any air emitted from the tunnel portals does not cause the concentration of nitrogen dioxide (NO_2) in ambient air to exceed 200 $\mu g\ m^{-3}$, expressed as a rolling 1 hour average, at any point beyond the designation boundary that borders an air pollution sensitive land use."

36 The Board and Council experts have not agreed with this condition.

37 The Auckland Council expert also recommended (in evidence) that consent conditions should provide certainty around minimum vent stack flow rates (or efflux velocities). This was not discussed.

38 **Construction effects:** Although the two Plans dealing with construction effects are formalised and detailed, the Board and Council experts are concerned that there is insufficient connection between the procedures in the plans and the consent conditions. The Plans have also been subject to on-going development which has resulted in inconsistencies between consent conditions in evidence and in the management plans.

39 In particular, the Council require a high degree of consistency between the construction controls applied at Waterview, and those required through consent conditions of all other similar activities in Auckland.

40 The Board and Council experts have proposed that new "standard" conditions be adopted to achieve this. Example standard conditions are:-

1 *There shall be no odour, dust or fumes beyond the site boundary caused by discharges from the site which, in the opinion of an enforcement officer, is noxious, offensive or objectionable.*

2 *Beyond the site boundary there shall be no hazardous air pollutant caused by discharges from the site that causes, or is likely to cause adverse effects on human health, environment or property.*

3 *No discharges from any activity on site shall give rise to visible emissions other than water vapour, to an extent which, in the opinion of an enforcement officer, is noxious, dangerous, offensive or objectionable.*

41 From a technical viewpoint, it was agreed that this was desirable. However no specific agreement was made on how these will be incorporated into the conditions.

42 It was confirmed that the concrete batching plants and conveyers will be fully enclosed, and this will be reiterated in rebuttal evidence.

DETAILS OF FURTHER DISCUSSION ON AREAS THAT HAVE NOT BEEN RESOLVED

43 **Offsets:** The experts all agreed that any measure that reduces emissions – such as those from domestic woodburners or from vehicles - has clear air quality benefits. However there was no consensus on the details of how these might be applied or achieved. Such measures require further input regarding economics, social effects, legislative requirements and NZTA internal operational considerations.

44 However there was some useful discussion on this topic that can be progressed. This discussion is listed here (rather than in the "agreed" section), simply because the experts present were not in a position to agree to an NZTA policy prerogative.

45 The Board (and Council) are primarily concerned that for at least one location – around Oakley Creek – the recent NZTA monitoring has shown exceedence of $PM_{2.5}$. Whilst it is accepted that the contribution of the project to these exceedences is small, it is nonetheless non-zero. As such their position is that any contributions at all, no matter how minor, should be mitigated, and preferably to such an extent that any future exceedences are completely mitigated.

46 The main (but not only) area of concern is relatively small, being the area around the southern end of Oakley Creek. It should be noted here that this is not any proposed or agreed area – this actual area will need to be determined by a more considered analysis that includes a more detailed determination of the contributions of various sources to this particular micro-airshed, as well as a determination as to whether there are enough other sources (such as woodburners) in the area to actually achieve the desired offset. These are matters that could take some time, including new investigations and new modelling, to finalise.

47 It is felt that if there is any area in the entire project domain that might be subject to mitigation then it is here because:-

1. The monitoring shows exceedences of $PM_{2.5}$, or it is possible that exceedences could occur in future and/or higher concentrations of other contaminants.
2. It is in a lower lying valley area that might be subject to very localised calm winds more conducive to air pollution build up (a point also made by a number of submitters).

3. Any uncertainties in the modelling, or the traffic emissions, could show up here as higher than predicted air contaminant concentration values.

4. The area is thought to have a number of woodburners (which contribute to the exceedences, and is thus suitable for mitigation through offsets).

48 Thus any offset programme would only need to apply to a relatively distinct area, on a one-off basis. It could involve targeted removal (or upgrade) of domestic woodburners.

49 Before any further moves were made it was agreed that a more detailed assessment would need to be made on both the size/location of the target area, as well as the degree of mitigation required.

50 **Separation distances:** One of the principal concerns expressed in the Board report (and previously in the Auckland Council submissions and evidence) was the final separation distances between some residences and the new road route. The experts all agree that having someone live too close to a busy road is undesirable, and may result in residents being exposed to unacceptably high levels of pollution. All the air quality experts found this a difficult factor to analyse, since it is hard to determine just which houses will be left after the project, and exactly how far from the roadway they will finally be.

51 The NZTA expert has noted that two initiatives are underway by the NZTA. The first is the production of a new model run, with a fine grid of receptors that can show concentrations at many more locations than were presented in the AEE. However because of the model complexity this result is not expected until the first week in February, and could not be discussed. This will show concentrations right to the road edge. It will be presented in rebuttal evidence.

52 The second will be a more detailed analysis of eventual separation distances, with a view to ensuring that the Board concerns are addressed. This will be also presented in the rebuttal evidence of Gavin Fisher.

53 There was not complete agreement on exactly what represents an appropriate separation distance. There are no guidelines, and it is very site specific. The NZTA expert has suggested 20m, whereas the Board expert has suggested a greater distance, even up to 100m. This has to be informed by an analysis of the specific local circumstances. Some analysis has been undertaken by the NZTA expert witness and the results of this will be given in the rebuttal evidence.

54 The experts have not agreed on what constitutes an adequate separation distance. Further work is currently being undertaken on this by Mr Fisher. If houses are closer than an agreed separation distance, then either (a) some mitigation is required, or (b) a

monitor should be established. The results of this, and a recommendation, will be included in the rebuttal evidence of Gavin Fisher.

55 **Monitoring:** Currently two air quality monitors are proposed, running for a period of at least 24 months once the project is operational. These are to be established and run in consultation with Auckland Council. The Board expert has suggested a number of additional monitoring requirements in the s42A report, including that (a) there should be third monitor, and (b) there should be a mechanism for longer running if necessary.

56 **Number of monitors**: Experts will almost never disagree with a proposal for "more monitoring". This provides the gold standard for environmental science, data and effects, and in an idea world monitoring resources would be unlimited. This must be tempered with the purpose and objectives of the monitoring, and the costs to be borne by a single project. The Board expert has made a case for the proposed additional monitoring, which is developed here. This is not in the "agreed" section since only NZTA can agree to the extra costs of such monitoring, or it must be imposed as a new condition in the NOR.

57 The Board (and Council) experts have made the point that at some locations, especially along SH16 near Te Atatu, there are houses left quite close to the roadway after development. They contend that this leaves insufficient separation distance to ensure compliance with the national standards. Houses that are very near to a road may indeed experience high exposure levels. This is very hard to determine absolutely, and even a few metres can make a difference. The Board expert contends that the most prudent approach is to establish a new air quality monitor that is in a location no further from the road edge that that of the nearest residence.

58 **Monitoring period:** The Board expert contends that two years of monitoring is not enough to show compliance. She also expressed a concern that there is no mechanism for addressing the issue if it turns out that the monitoring shows the effects are more than minor.

59 The Board expert has requested two things. Firstly, that there be some process for ensuring that the monitoring can be extended, and secondly some process for actioning monitoring results that show problems.

60 Whilst experts agree that longer monitoring programmes can produce better data, there is not consensus on how or why this should be done in this case. The options are:

1. Leave the monitoring period at two years, and rely on internal NZTA analyses and policies to assess what, if anything, needs to happen after this (the NZTA expert view).
2. Have the monitoring, and any subsequent actions, under the auspices of some independent body, with the power to require further monitoring if their analysis warrants it. The obvious body for this is the Auckland Council (Board expert view).

61 NB. The Auckland Council expert did not express a strong view, and it has to be noted that it is not currently appropriate to commit a third party to any actions here.

Date: 28 January 2011

Gavin Fisher *(Air Quality)*

Email 28/1/2011. I can try and send a signature early on Monday morning 7 Feb - but you can take this email as agreement that I am happy for the document to go out in the meantime.

Janet Petersen *(Air Quality)*

Jayne Metcalfe *(Air Quality)*

Dr David Black *(Public Health)*