SUBMISSION 2:
SUMMARY OF ADDITIONAL CONCERNS IN RELATION TO THE PROPOSED NORTHCONNEX TUNNEL

Application number - SSI 13_6136

This is an objection to many aspects of the proposed NorthConnex tunnel.

As stated in our first submission dated 6th August 2014, we have serious concerns with regard to the tunnel project as it is currently proposed in the NorthConnex Environmental Impact Statement (EIS). Since filing our first submission we have learnt of new information in relation to our original concerns and a number of additional issues have surfaced.

We are really concerned that the proposal put forward, that is, the *Unsolicited Bid*, does not appear to take account of best practice from either a health or a technology perspective. Current international research and practical application provide clear evidence that this Bid is not world's best practice – nor does it appear to take full account of Governments' (State and Federal) 'Duty of Care' obligations under their respective Work, Health and Safety Legislation.

This tunnel will be the longest urban road tunnel in the World.

Australia has an opportunity to be a World Leader yet NorthConnex is proposing a project that falls short of contemporary best practice. Why are the governments of Australia, State and Federal, allowing construction of infrastructure in Australia that does not take account of known international advances in technology?

This submission lists concerns falling into six sections:

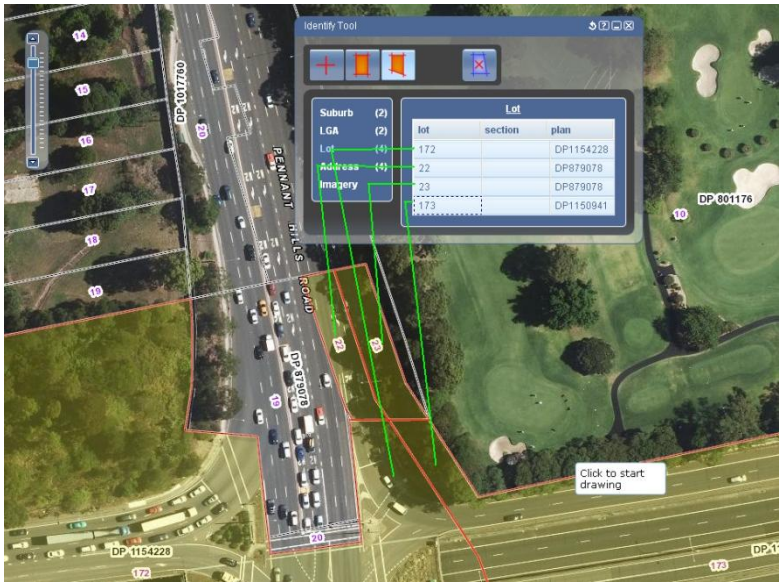
SECTION A:
THE LOCATION OF THE NORTHCONNEX SOUTHERN VENTILATION FACILITY

Environmental Impact Statement (EIS) Page 448 asserts that:
"The most efficient location for ventilation outlets is close to the main alignment tunnel exit portals. This is because vehicles travelling through the tunnels create a piston effect, which draws air into the tunnel and pushes it forward in the direction of traffic flow. Locating the ventilation outlets near the main alignment tunnel exit portals maximises the benefit of the piston effect and minimises the need for additional energy consumption to operate tunnel jet fans and to transport the exhaust air from the tunnel to the outlet. This approach provides environmental benefits through the reduction in energy consumption and greenhouse gas emissions from the project."

According to this statement the most efficient, effective and economical location of the Southern Stack would be on the highest ground close to the vicinity of the portals, that is, the south-western region of the Pennant Hills Golf Club, directly above the twin tunnels. (A significant change to the original M5 East proposal was to move from three stacks situated on high ground, to a single stack positioned in the valley. The outcome is well known. We should learn from history, otherwise we are doomed to repeat it)

When we questioned the proposed location with the NorthConnex staff at the many briefing sessions we attended, we were consistently informed that the Roads and Maritime Service (RMS) already owned the land on the opposite side of Pennant Hills Road and that this land was therefore the best place for the Southern Stack.

A simple search of the NSW Land and Property Titles and confirmed by the Hills Shire Council, revealed that the RMS owns FOUR blocks of land in the exact position where the Stack needs to be. See diagram and extract below.



New South Wales Land & Property > Titles

Title | Street Address | Owner Name | Sub Folio | Historical | CT Enquiry | Lots Created | Prior Title | CAC | Reverse Street Address | Reverse Proprietor | Cancelled

Please enter a Title Reference (eg 1863/1000001, 6/22052, 48/SP63903)

Matter	Title Reference	CP	Proprietor	Address	Parish	County	LGA	Fee
	172/1154228		ROADS AND TRAFF		FIELD OF MARS	CUMBERLAND	THE HILLS SHIRE	$13.40
	22/879078		ROADS AND TRAFF		FIELD OF MARS	CUMBERLAND	THE HILLS SHIRE	$13.40
	23/879078		ROADS AND TRAFF		FIELD OF MARS	CUMBERLAND	HORNSBY	$13.40
	173/1150941		ROADS AND TRAFF		FIELD OF MARS	CUMBERLAND	HORNSBY	$13.40
	10/801176		PENNANT HILLS G	539 PENNANT HILLS RD, BEECROFT 2119	FIELD OF MARS	CUMBERLAND	HORNSBY	$13.40
								$13.40
								Total: $67.00

This land is the ideal location for the southern ventilation stack.

Speakers at the NorthConnex Air Quality Forum spoke of the importance of the topography in the placement of the ventilation facilities. In the NorthConnex proposal the southern ventilation facility is at the lowest point of the M2 intersection where it is surrounded on three sides by hillside cuttings. In this location the "discharge point" will barely be above the adjacent high ground**.**

How can this be the most suitable position for the outlet when land that is more suitable is already owned and available?

Much is made of the intention to discharge the polluted air through the stack at 13 – 19m/s. Given that the stack is only 15m above Pennant Hills Road, a simple calculation indicates that the particles will be ejected to a height of between 23m and 33m above Pennant Hills Road. That will only be sufficient for them to be dispersed by prevailing winds IF there is wind and it is strong enough. For instance, the weather history graph showing the wind speed and direction at West Pennant Hills measured on the 24th August 2014 indicated that there was no wind until 9am and what wind there was, came from the west. Wind speeds of less than 2m/sec (ie about 8km/hour) are not considered sufficient to disperse pollution from the stack. Only a very few gusts on this day were in excess of 8km/hour.

[redacted]

The EIS does **not contain all** available information that is relevant for a fair assessment and understanding of the project, and it is more than misleading **– it is patently incorrect. As documented above, the RMS owns FOUR blocks of land in the exact position where the Southern Stack needs to be.** It is accepted that a small amount of additional land may have to be purchased to accommodate access.

The absence of relevant information appears to be a deliberate strategy but the question must again be asked – why? One has to ask why the community appears to have been consistently misinformed by omission, when the RMS is in a position to place the Stack, (by its own admission in the EIS), in its most effective and efficient location!

Requirement 1:

That the Government ensures that the southbound ventilation facility ie the Stack, be located at the south-west corner, on the RMS owned land, at the edge of the Pennant Hills Golf course. In this location, the southbound tunnel can be efficiently, effectively and economically ventilated.

The impact of the stack plumes on the surrounding residential areas must be modelled using its current proposed position and height and also modelled with the stack positioned on the golf course side of Pennant Hills Road, where it is topographically higher. This would allow an objective, impartial, scientifically based assessment to be made of the most effective location for the stack.

(NB: RMS were asked to carry out the golf course related modelling but verbally declined).

In addition, to ensure best health outcomes for the residents, the ventilation facility must be properly filtered.

SECTION B:
LESSONS LEARNED FROM THE PROBLEMATIC M5 EAST TUNNEL

Given the dubious history associated with the M5 East AND other tunnels such as the Lane Cove Tunnel, there is significant West Pennant Hills community concern in respect of the standards of "modelling" that have been undertaken in relation to the proposed NorthConnex ± 9km twin tunnel project. Having attended all the drop-in information sessions, we became aware that many of the NorthConnex staff had worked on other tunnels around Sydney. Not surprisingly no one owned up to being involved in the M5 East tunnel.

The design of the stacks and the ventilation mechanisms are dependent on reliable raw data such as the anticipated volume of traffic. With respect, Government has miscalculated appallingly in relation the M5 East tunnel where they estimated an increase in traffic numbers of 1% per year, whereas the real figure was 1% per month! The Government is being litigated against for over-representing the vehicle numbers in the Lane Cove Tunnel . Given this recent history, it is reasonable to question the accuracy of the current estimates in relation to both the traffic volumes and the plume modelling of particulate matter and nitrogen dioxide. The Government does not have a good track record with regard to modelling.

The modelling of dispersal of the pollutants by the prevailing winds using data gathered from weather stations at Sydney airport and Terrey Hills is clearly not satisfactory. Both the airport station and the Terry Hills weather stations are close to the coast where the winds are influenced by the ocean. The Southern and Northern ventilation stacks are much further inland and in valleys where there is frequently little or no wind. Instead, as currently proposed, there will inevitably be considerable **plume strike** (location(s) unknown). A well-designed tunnel filtration system would make this questionable "modelling" obsolete

The issues associated with the M5 East tunnel have resulted in numerous reports and studies commissioned by the NSW Government in an attempt to allay fears. These have included studies into the effects of portal emissions, of apparent exceedances of air quality limits by the stack and three Parliamentary inquiries, all of which led to the uncovering of new and greater problems. In many cases, these problems were only identified by the release of confidential records of Government departments supplied under the motions of the NSW Legislative Council[1].

Of particular note in relation to the M5 East Tunnel, it became apparent that in 2003/4, the tunnel operator, with the approval of RMS but contrary to the tunnel's conditions of approval, dumped large volumes of vitiated air (in excess of 400 m3/sec) from both tunnel portals in response to apparent high carbon monoxide levels in the tunnel. These emissions occurred day after day and lasted for in excess of 8 hours in some cases. In fact these 'levels' were the result of a faulty monitor which gave results in obvious error for almost 12 months before the fault was identified.

The net result of this mistake (which only came to light just before the tabling of documents relating to the operation of the tunnel in the Legislative Council), is that there had been a marked increase in eye irritation, headaches and asthmatic-related incidents in the vicinity of that portal. In fact, Health Department documents from that time stated that there was "*prima facie evidence of adverse health effects related to the vent stack*". There never were excessive levels of carbon monoxide in the tunnel, simply shortcomings in maintenance and management oversight systems. It is not surprising that it is felt by many, that Government has little credibility and cannot be trusted to always do the right thing!

It is accepted that the filtration systems put into place in the M5 East Tunnel were less than efficient. Questions should firstly be asked as to why, with the first version of the filtration trial, it took almost two years to reach a decision to determine which of the three groups short-listed would be granted the tender; (originally 13 companies registered an interest in providing the filtration system). The net result of this Government bureaucracy and apparent Ministerial procrastination was that the Government was left with no option but to go with the only company that still displayed an interest. With no competition, Siemens Ltd/FILTRONtec Gmbh was the only option.[2]

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[1] Submission to the Senate of the Commonwealth of Australia Standing Committee on Community Affairs Reference Committees' Inquiry into the Impacts on Health of Air Quality in Australia (March 2013): Mark Curran representing 'Residents Against Polluting Stacks Inc.

[2] Mark Curran (RAPS Inc): Personal communication documents.

The outcome is well documented. There were technical, operational and oversight issues related to the:

- Air flow turbulence associated with the design prior to entering the electrostatic filter; no stabilizing pre-filter; the lack of clarity associated with the functioning of the attenuators;
- High voltage generator faults, unexplained alarms, failures to start, fan issues, pre-ioniser HV faults;
- Air velocity in the filter, ionizer voltage, collector voltage issues;
- Leakage of NO_2 past the carbon beds;
- Reliability of the equipment – in particular the EP system; but in particular,
- An apparent lack of substantial root cause analysis.

What appears to have been studiously ignored in all of the analysis of the filter system installed in the M5 East tunnel, is that it was and is a trial, installed into a working tunnel under exceptionally difficult and challenging conditions. It is tendentious in the extreme to suggest that the costs of such an exercise give any guidance about the likely costs of a properly designed system installed by an experienced supplier in a new tunnel, where appropriate provision has been made for its installation. The use of such figures is dismissive towards modern filtration technologies. The going price for electrostatic precipitator equipment on the world market, supplied, installed and commissioned in a prepared space is €1-2 million per 100m^3/sec treated, based on actual prices from recently completed projects.

In spite of all of the problems with the 'trial', when operating, the filter system produced a noticeable reduction in haze and respiratory discomfort in the west end of the tunnel and a measurable reduction in the stack emissions. Government appeared to down-play this success by claiming that the 'reduction' was only between 4-5%, however this was determined on the basis of a 24 hour average when the filter never operated for more than 6 hours a day.

Taking into account the size of the filter system and the volumes of air treated, the MAXIMUM filter effect possible was a reduction of between 14 and 18%. The measured reductions in stack emissions carried out while the filter was operating were close to these figures.

In fact, the trial was successful. Both forms of filtration worked but significant practical and operational problems were identified, along with severe technical and reliability deficiencies in the actual equipment chosen. The only inexplicable thing was the apparent failure of RMS or the operator to force the equipment supplier to get the equipment to operate at the particle removal efficiency levels (in excess of 90%) which were claimed and still are being claimed by this particular supplier.

The M5 East tunnel has been described as one of the dirtiest tunnels in the world.

It must be asked why the M5 East filtration system was considered “not value for money”? The filtration system was operating for only six hours each day, yet over that short time it was removing a FULL TWO THIRDS of the air pollutants from the air that was filtered!!

- **What criteria were used to decide what is “value for money”?**
- **Were the health and well-being of Australian citizens calculated in this “cost benefit analysis”?**
- **Were hospital and medical costs included?**
- **Who owns the money that has such a high value that the health and well-being of Australian citizens is ignored?**
- **Are the profit margins considered of more importance than the health of Australian citizens?**

NorthConnex has decided not to filter the Pennant Hills twin tunnels as it ‘did not represent value for money’ basing their argument on the $65 million cost of the M5 system. Clearly the $65 million cost of the installation in the M5 does not provide any guidance as to the likely cost of a system such as would be appropriate for the NorthConnex tunnels. The problematic M5 East filtration system DOES NOT mean , that State and Federal Governments allow the proposers of this unsolicited bid to have no filtration system at all. What it SHOULD mean, is that in the interests of Australian citizens’ health, well-being and safety, the Government requires Transurban to investigate systems that are working more effectively, efficiently and cheaply in other countries.

We do not have to re-invent the wheel.

Why has the Government not required Transurban to investigate filtration systems that are working more effectively, efficiently and cheaply in other countries?

Why, knowing that the M5 East tunnel filtration was not as efficient as expected, was effective filtration not an integral requirement for this "Unsolicited Bid'?

Requirement 2:

That as a condition for any further progress in the planning process, Transurban must be required to issue an international registration of interest by suitably qualified and experienced filtration suppliers for the design, supply, installation and commissioning of an efficient filtration system for the NorthConnex tunnel.

Sufficient of the results of the registration should be made public to enable an assessment of the actual cost and likely impact of the use of such equipment on both the economics of the tunnel operation and its long term health and environmental impacts.

SECTION C:
THE CASE FOR FILTRATION OF SYDNEY TUNNELS

- There are **no safe levels of exposure to diesel emissions** which are a Group 1 carcinogen.
- Governments, both state and federal, have a duty of care to the public.
- The precautionary principle of duty of care to the public health must be regardless of cost.
- Medical evidence is overwhelmingly clear that long term exposure to air pollution increases death rates; (Recent data indicates that in 2010, 223,00 deaths from lung cancer resulted from air pollution)[3];
- Exposure to particulate pollution is associated with reduced lung function growth in children which persists into later life, even when exposure stops. The damage for growing lungs is permanent.[4/5/6]
- Exposure to traffic-related air pollution during pregnancy and during the first year of life is associated with autism.
- There is an overwhelming amount of documented medical evidence on the adverse effects of air pollution on human health. A letter recently signed by 260 Australian medical professionals has been sent to Minister Duncan Gay outlining their concerns with regard to the adverse health effects on the public if the NorthConnex tunnels are not filtered.

Our concern is that there is absolutely no intention to **filter** any of the four ventilation outlets: northern and southern ventilation stacks and the two emergency vents. This is despite the assurances throughout the Environmental Impact Statement (EIS) published on the 15th July 2014 that the project is fully aligned to 'best practice' as is mentioned frequently throughout the documents (eg EIS Volume 1A page 64). This appears to be a direct result of the poor decisions made in respect of the M5 East Tunnel. **The fact that Australia got it so wrong in the M5 East tunnel does not mean that we don't ever even try to filter another tunnel. Educated people learn from their mistakes and try to do better.**

NorthConnex has chosen not to filter as it 'did not represent value for money'. NorthConnex has modelled the likely increases in environmental pollutants including $PM_{2.5}$. *(EIS Technical Working Paper – Air Quality Page151 Table 37)* Taking into account the topography and likely wind conditions, traffic and tunnel engineering, modelling indicates an increasing level of 25% per annum over the maximum reporting standards of 8µg/m^3 (ie 10.1µg/m^3) by 2019. We understand that this projection is over the 9km of the surface area above the tunnel. However, what does this mean for those residing near the tunnel exit portals or driving regularly through the tunnels and how can we mitigate this risk?

[3] Straif K. IARC Scientific Publication No. 161: Air Pollution and Cancer. eISBN 978-92-832-2161-6.
[4] Dockery DW, Cunningham J, Damokosh AI, et al. Health effects of acid aerosols on North American children: respiratory systems. *Environ Health Perspect* 1996; 104: 500-505.
[5] Raizenne M, Neas LM, Damokosh AI, et al. Health effects of acid aerosols on North American children: pulmonary function. *Environ Health Perspect* 1996; 104: 506-514.
[6] Spengler JD, Koutrakis P, Dockery DW, Raizenne M, Speizer FE. Health effects of acid aerosols on North American children: air pollution exposures. *Environ Health Perspect* 1996; 104: 492-499.

To give these comments context – the following reports need to be considered. The National Environment Protection Measure (NEPM) for Ambient Air Quality published in 1998 under the then auspices of the National Environmental Protection Council (NEPC) saw fit to set air quality advisory standards that are meant to be binding on all levels of Government. These standards were set on the basis of scientific studies together with an appraisal of other standards such as those of the WHO. In 2011, the NEPC made 23 recommendations that included introducing compliance standards for $PM_{2.5}$. This set of recommendations is to be fed into a National Plan for Clean Air, which will be put to the Council of Australian Governments (COAG) at the end of 2014. **Will this project be forced to comply with these recommendations when they are introduced?**

The NEPC Review supported a reduction framework that would reduce exposure for communities living in close proximity to large emission sources given that as a rule of thumb**,' there is no safe level of exposure that does not cause some level of harm'.**

The fact that the predicted increases should be regarded as acceptable is clearly a misuse of the NEPM goals. Statements such as : "*The maximum predicted contribution from the project would be 2.1* ***m****g/m3 ('with project – expected traffic flows' in 2029), which is substantially less than the applicable impact assessment criterion of 50* ***m****g/m3"* and *"The highest cumulative concentrations (background plus the project) occur at times where the maximum predicted project contributions for the assessed scenarios are all low (less than or equal to 0.3* ***m****g/m3) and well below the applicable impact assessment criterion of 50* ***m****g/m3"* appear to misuse and misrepresent the NEPM goals.

The NEPM goals do not represent a level up to which it is permissible to pollute. The NEPM documentation clearly states *"…. the air quality of some localised areas within major airsheds are dominated by local activities such as that experienced in a road tunnel or a heavily trafficked canyon street. Air quality management in these areas is complex and needs a different approach to that directed at meeting ambient standards intended to reflect the general air quality in the airshed".* p 13 NEPM 1998. Stacks and portals cannot be treated as part of the airshed. They are specific localised, permanent pollution sources, similar to industrial chimneys and must be treated as such. In addition, the particulate matter emissions from stacks are fundamentally different from those found in the general airshed, and, on the best available knowledge, are significantly more harmful, gram for gram, than emissions from other sources.

It is accepted that filtration of the emissions like PM are not totally successful as documented by CSIRO in their 'Assessment of the Electrostatic Particle Technology' associated with the M5 East Air Filtration System (69% of $PM_{2.5}$ removed and 70% of PM_{10} removed)[7] and AMOG Consulting in their M5 East Tunnel filtration trial evaluation (65% PM_{10} removed and well below the target 80%)[8]. It is also understood that filtration does incur both a significant capital and recurrent maintenance cost. However, a full two thirds of pollutants were removed from the air that was filtered in that trial and yet it is still considered not "cost-effective"? We consider such an outcome very good value for money when set against the cost of providing long term health care for those affected by the air pollution. The Health Impact Assessment of Air Pollution[9] carried out by the Public Health Institute in Madrid reported that a drop in annual levels of Particulate Matter would result in fewer post-neonatal deaths and fewer hospital admissions.

Historically, it appears that in NSW, tunnel design has been focussed on carbon monoxide levels as the World Road Association Permanent International Association of Road Congresses or PIARC is unequivocal about the maximum levels associated with CO emissions. However, tunnel design should not be based on carbon monoxide levels alone and should include the development of a health-based exposure limit for nitrogen dioxide and Particulate Matter[10] (particularly $PM_{2.5}$ and PM_1). **People need to also be aware that Work, Health and Safety exposure limits are designed for healthy active people – not the vulnerable.** The effects on the vulnerable will only be known after research and extensive long term monitoring[11]/[12].

7 Final Report of CSIRO entitled 'Air Filtration Plant of the M5 EAST Tunnel. Determination of Particle Removal Efficiencies'. Nov 2011.
8 Report by AMOG Consulting entitled 'M5 EASTEast Tunnel Filtration Trial Evaluation Program – Review of Operational Performance'. February 2012.
9 The Health Impact Assessment of Air Pollution; ENHIS-1 Project: WP5 Health Impact Assessment. Local City Report; Madrid. L L Carrasco & B Z Torras (2002).
10 PM refers to particulate matter. PM10 is well researched and studied and refers specifically to the maximum size of the particles in a specific sample, not the average size, the size distribution, the source of the chemical composition of the particles in question. It is the weight to f the particles with an 'aerodynamic' diameter of less than 10 microns (millionths of a metre) contained in one
cubic metre of air. The Australian standard is 50µg/m3. There is no standard for PM2.5. Almost all particles emitted from diesel engines < 1micron (PM1).
11 Beelen R. Effects of long-term exposure to air pollution on natural-cause mortality: an analysis of 22 European cohorts within the multicentre ESCAPE project. Lancet 2014; 383: 785-795.
12 Guilia. Long term exposure to Urban Air Pollution and Mortality in a Cohort of More than a Million Adults in Rome. Environ Health Perspect: DOI: 10. 1289/ehp.1205862.

The National Health and Medical Research Council (NHMRC) published its report in 2008 entitled 'Air Quality in and around Tunnels'[13] and made a number of recommendations which included:

- "Tunnels can cause adverse health impacts";
- "The development of a health based exposure limit for NO_2 and PM as a precautionary interim measure appropriate to both average and above average tunnel transit times in order to capture normal and congested conditions" and because health effects on people living close to stacks/portals remain difficult to assess,
- "…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".

'Impacts on Health of Air Quality in Australia' Senate Inquiry, published by the Federal Government Senate Committee in August 2013, heard evidence that particulate matter of a certain size, (particularly $PM_{2.5}$) is:

- 'primarily derived from direct emissions from combustion processes, such as petrol and diesel vehicles….';
- 'has negative impacts on health …is the ninth leading cause of global disease burden (Lancet 2012[14]);
- that the size of the PM was the principal determinant of how deeply it is inhaled;
- that epidemiological studies concluded that there was a statistically significant relationship between fine particles and human health effects (CSIRO submission[15]); and that
- $PM_{2.5}$ is believed to be the most health-hazardous pollutant, responsible for 10 to 20 times as many premature deaths as the next worse pollutant (CSIRO submission[15]); further that
- so far, no limit of exposure where there is no impact has been identified (Leech *et al*[16]);
- the populations at greatest risk are those who are exposed the most, and those inherently more susceptible ie children, the elderly, those with lung dysfunction and asthma, socio-economically disadvantaged and pregnant women. Buffer zones between pollutants and the population of >2km were suggested by some.

The measurement of tunnel environmental factors like Nitrogen Dioxide (NO_2) and $PM_{2.5}$ is difficult and often inaccurate. These limitations are acknowledged in EIS (4.2.14). Perhaps in support of this difficulty, the 2012 study on the unfiltered Lane Cove tunnel published by Senior Research Fellow Dr Christine Cowie entitled 'Respiratory Health before and after the Opening of a Road Traffic Tunnel: A Planned Evaluation'[17] The findings stated that no apparent deterioration in air quality was found near the ventilation stacks (which are unfiltered). However, increased reporting of some symptoms and decrements in some lung function measures in people within 650m of the stack zone in one study was reported (but not in a subset of that study).

It is interesting in this context to consider the significance of the observations made in the executive summary of the 2008 NHMRC report:

"*No clear evidence exists to show that monitoring such as that carried out to assess compliance with air-quality goals, especially for PM_{10}, can reliably predict the size, nature and course of adverse health impacts*."

Also,

"*People who live near to tunnels or their stacks may be at risk if the presence of the tunnel alters the ongoing quality of the neighbourhood ambient air. Risks to cardio-respiratory health might arise if people are exposed to*

[13] "Air Quality in and around Tunnels" 2008 (Ian Longley and Francesca Kelly)
http://www.nhmrc.gov.au/publications/synopses/_files/eh42.pdf

[14]Stephen S Lim; Theo Vos, Abraham D Flaxman, Goodarz Danaei, Kenji Shibuya, Heather Adair-Rohani et al. 'A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990—2010: a systematic analysis for the Global Burden of Disease Study 2010.' The Lancet, 2012; 380(9859): 2224-60.

[15]Commonwealth Scientific and Industrial Research Organisation, Submission 48, p.8.

[16]Judith A Leech , William C Nelson, Richard T Burnett, Shawn Aaron and Mark E Raizenne
'It's about time: A comparison of Canadian and American time–activity patterns', *Journal of Exposure Analysis and Environmental Epidemiology* (2002) 12, 427–432.

[17] Christine T Cowie, Nectarios Rose, Wafaa Ezz, Wei Xuan, Adriana Cortes-Waterman, Elena Belousova, Brett G Toelle, Vicky Sheppeard, Guy B Marks. 'Respiratory Health before and after the Opening of a Road Traffic Tunnel: A Planned Evaluation'; PLOS One Research Article'. Nov 2012.

contaminated air from tunnel emissions. Important indicators for this risk are levels of NO_2 and particulates. Of particular concern is an association between impaired lung development in children and emissions from traffic. Particulates from tunnels and volatile compounds including benzene may produce an increased lifetime risk for cancer."

Nonetheless, the Senate Committee did recommend pollution monitoring of proximate population exposure to pollution point sources (Recommendation 4 of 'Impacts on Health of Air Quality in Australia' Senate Inquiry').

Much is made of improvements in vehicle technology to reduce the harmful impact of submissions. The EURO design rules have caused a progressive change to the composition of particle and resulted in a decrease of 80% or more, in gravimetric terms (ie weight) but the changes have resulted in an increase in the number of smaller (more harmful) particles[18] . However, this improvement appears to have increased the concentration of smaller particles which literature indicates is capable of being ingested deep into human lungs and absorbed into corresponding tissue[19]. The only real solution to this is to move the stacks well away from residential areas and/or filtration.

We also fully understand that allowable pollutants in the atmosphere are a necessary compromise between human health and economic growth necessity. For instance, it is anticipated that the tunnel will be take 5000 trucks and 9000 cars off the Pennant Hills Road traffic every day; this should improve the air quality along this road. It is also appreciated that the efficiency of diesel vehicles has been regulated since 2002 and that CSIRO anticipate a significant reduction of emissions by 2030. However, it must also be noted that the proportion of diesel vehicles in the national fleet increased by almost 40% between 2006 and 2013.

Although it is never included into cost accounting, it can be argued that the greatest cost of tunnel emissions arises from their potential to cause short, medium and long term adverse health effects to pockets of the community. A true accounting, that is, a proper long term cost benefit analysis of the real costs and savings of any tunnel ventilation system should include an assessment of the cost of potential health impacts to the community. In this regard, it is both right and just to expect that a portion of the profit resulting from the management of the tunnel, be set aside to cover these health contingencies.

In the meantime, in the construction of these twin tunnels, the precautionary principle used in proper scientific analysis must be paramount to meet the State and Federal Governments' duty of care.

Filtration is best practice. Filtration provides identifiable health benefits. Filtration systems are operating successfully in First World countries and they can equally successfully operate in Australia. Care for the welfare of its citizens is the mark of a progressive society. Governments set the standards of a progressive society; these high standards appear to be lacking in this Unsolicited Bid, and this needs to be addressed.

Requirement 3:

That Air Filtration Systems must be included in this twin tunnel proposal;

In addition, this project must be forced to comply with the National Plan for Clean Air recommendations when they are introduced in late 2014.

[18]Particulate Emissions from Vehicles by Peter Eastwood (2008) John Wiley & Sons. Sec 11.2 'Smaller particles in larger numbers; or larger particles in smaller numbers.' Pp393-396

[19] Brown DM. Size dependent pro-inflammatory effects of ultrafine polystyrene particles: a role for surface area and oxidative stress in the enhanced activity of ultrafines. Toxicol Appl Pharm. 2001; 175: 191-199.

SECTION D
PROPERLY DESIGNED FILTRATION SYSTEMS

The first basic ventilation (transverse) system for highway tunnels was installed in the Holland Tunnel in the America in1927. The transverse design has been regarded as the safest and most reliable ventilation system for decades.

There is clearly scope for a reconsideration of a cost effective filtration system operating 12 hours a day during peak times – not just 6 hours per day as occurred in the M5 East. The cost of operating the EP filtration system (3kw per 100 m3/sec) is likely to be significantly less than the cost of operating the lighting systems for the tunnel. Despite the M5 East outcomes, filtration technology by means of electrostatic precipitators is mature and sufficiently well proven for road tunnel applications.[20] The conclusion of the September 2010 CETU Tunnels Study Centre document[21] states' It is now an established fact that, technologically speaking, electrostatic precipitators furnish excellent results in terms of filtration performance'.

Therefore, literature suggests that there appear to be two basic filtration design options:

1). Filtration could be affected through a three tier system – a pre-screening filter to remove large PM (so as not to overload the electrostatic precipitator equipment) and a contemporaneous electrostatic precipitator capability to remove the very fine PM; in addition, activated charcoal filters to remove the gases such as NO_2;

or

2). Install electrostatic precipitator units in the ceiling at approximately 2 km intervals along the length of the tunnel (or at a frequency that matches the pollution as do the Japanese and Norwegians) which will remove the majority of the PM from the air. The balance of the PM and the NO_2 and CO are removed at the ends of the tunnel in the stacks. Progressive filtration means that it is not only safer for the community at the tunnel portals but it is also much safer for those travelling routinely through the tunnels – and that is where a significant risk also lies.

There is also evidence that because the requirement to routinely vent and filter the large volume of air at only two exit points of the tunnel, progressive filtration provides a significantly cheaper solution to the end-to-end filtration process. When comparing costs of running tunnels (including maintenance and replacement costs) such as the old fashioned Japanese transverse system with stacks (Sasago), with stacks and EP installed filtration systems (Kan-Etsu) and with longitudinal, ventilated tunnels (Fukuchiyama), Japanese researchers concluded that longitudinal systems with electrostatic precipitators have a cost advantage over a transverse stack system of 2:3 depending on tunnel design.

Continuous longitudinal ventilation systems using EPs consume relatively small amounts of electrical power and are deemed economical systems in terms of total cost including maintenance and repair. We argue that there is sufficient evidence to show that filtration inside the tunnel can give rise to significant savings in operational costs. The Japanese are certainly doing this showing a whole of life power cost reduction of +/-30% for ventilation systems in longish tunnels (over about 3km). EP filtration does not add to the cost – it reduces it***. The health benefits come for free*** and it is imperative that the health care costs for the community living in the vicinity of the ventilation stacks and exit portals should also be taken into account. A comparison made by a Sydney University academic concluded that the M5 East is at least 2.5 times more expensive than the Japanese tunnels listed above.

If you examine the results from well-considered, well-engineered filtered tunnels in Norway, Japan and Spain, their assessments indicate particulate matter removal of greater than 80% up to 95%+. In addition, the Norwegian firm Clean Tunnel Air International (or CTA) has reported tunnel filter efficiencies based on number counts of between 0.3µ and 10µ+ since 2001. Why do we not bring in overseas expertise as appropriate? Furthermore, there are modern designs that indicate that a properly filtered, longitudinal air filtration system could make the process more efficient and cheaper. Why do we not learn from relevant overseas experience? That does NOT mean New Zealand expertise where the population and road traffic is neither comparable nor relevant. Unfortunately, there is no equivalent suburban tunnel model worldwide that we can learn from, given that a 9

[20] A Goria; M Bettelini & G Gianola. (2008). World Tunnel Congress. 'Exhaust –treatment technologies for the tunnel Lugano – An investigation on the state-of-art'.

[21] [http://www.cetu.developpement-durable.gouv.fr/IMG/pdf/CETU_DocInfo_Air_treatment_EN_2011.pdf]

kilometre suburban tunnel will be the longest suburban tunnel in the world. If we get this right, this is a chance for Australia to be a leader in this field.

Of particular note is the fact that First World countries are continually striving to improve the percentage of air pollutants removed from their tunnels using a combination of ventilation and filtration. Why is the State of NSW and Australia satisfied with merely dispersing the pollutants rather than removing them? Why is the Australian Government satisfied with standards that do not appear to be comparable with those used by technologically advanced countries?

Requirement 4:

That Australia investigates expertise and technology in countries where they have been successful in removing 95% of harmful emissions.

That Ventilation Facilities at both the northern and southern intersections **must be** filtered using this modern technology.

That the Southern Ventilation Facility must be located and filtered on RMS land '*near the main alignment tunnel exit portals to maximise the benefit of the piston effect and minimise the need for additional energy consumption to operate tunnel jet fans and to transport the exhaust air from the tunnel to the outlet. This approach provides environmental benefits through the reduction in energy consumption and greenhouse gas emissions from the project'.*

SECTION E:
ONGOING MONITORING OF SURFACE AIR QUALITY AT THE TUNNEL PORTALS

Given the experience of the M5 East Tunnel, the decision to monitor air quality on the surface along Pennant Hills Road for only 12 months (particularly in the vicinity of the portal exits), clearly needs to be revisited as does transparency around the results. The indicative costs of monitoring the surface, (that is $3,000 per monitor unit per week), appears very excessive and should be verified.

It has been suggested that it would be much cheaper if the air monitoring system was set up on RMS land at both interchanges and at the two emergency facilities at Wilson Road and Trelawney Street . The system could be easily automated and therefore ongoing if on RMS land.

NorthConnex are happy to state loudly and frequently that OVERALL the air quality along Pennant Hills Road will be improved but we reiterate our contention **that a decrease in diesel emissions from location 'A' should not mean an increased concentration at location 'B', particularly given that the World Health Organisation (WHO) listed diesel emissions as a Group 1 carcinogen.**

The NorthConnex modelling acknowledges a decrease of air quality at both the northern and southern interchanges. This should not be allowed to occur. The installation of a good quality, world-class filtration system in all the tunnels in Sydney would see an overall improvement in air quality for the whole of Sydney.

Our position is that filtration of the tunnel and ventilation facilities would prevent the decrease in air quality around the tunnel exit portals and lead to an overall improvement in Sydney's air quality.

Requirement 5:

That independent, on-going monitoring of air quality around the tunnel exit portals must be undertaken for the life of the tunnels, to ensure that the air quality remains of the highest standard. This will guarantee that the long term health effects of the tunnel can be appropriately assessed.

SECTION F:
FLOODING PROBLEMS DOWNSTREAM OF THE SOUTHERN INTERCHANGE – IMPACT OF THE WATER TREATMENT PLANT

A further concern is the potential impact on those properties downstream of Blue Gum Creek. A number of properties already have flooding problems when there is excess rain. Clarification needs to be provided regarding the volume of water that will flow into Blue Gum Creek from the water treatment plant adjacent to the Southern Stack.

Will the water leaving the tunnel storage plants be absolutely pollutant free? What guarantees are there? Who will be responsible for monitoring the purity of the water discharged from the storage treatment facility downstream?

What procedures and checks have been put in place to ensure that properties near the Blue Gum Creek are not flooded as a result of water released by the storage treatment plant?

We are cognisant of the fact that filtration brings with it the necessity to clean and wash the filter systems. However, it is noted that the wash water can be cleaned and recycled for use as is the case with the PV1 filtration station in Madrid.

Requirement 6:

That an independent organization should monitor the toxicity of the water and the rate at which it is released into Blue Gum Creek.

Every care should be taken to avoid flooding the homes located close to the creek.

SECTION G:
SOUTHERN INTERCHANGE - DETENTION BASIN: LISLE COURT RESERVE

The RMS are in the process of compulsory acquisition of the Public Reserve on the Northern side of the M2 behind the residences of Lisle Court and Savoy Court, West Pennant Hills, (Lot 15, DP 841778), for the purpose of extending the detention basin on the Western end of the Reserve.

This Public Community facility is well used by local residents and their children for numerous activities, from riding bikes and ball games to walking dogs. It is valued for being separated from local roads with access only via two pedestrian laneways and is therefore safer, particularly for small children.

There are at least three large Sydney Blue Gums at the Western end that may be impacted if this extension to the detention basin is not minimised. There is also a natural creek line that flows through the Reserve. It should also be noted that this creek provides for a considerable population of birds, frogs, ducks, etc. Even eels and water monitors have been seen here. Vegetation screens the very high wall of the M2 at this point, but the centre area has been left open for use by local residents.

No doubt the Design Engineers for the detention basin are also aware that the main sewer line for this area runs through the centre of the Reserve.

Requirement 7:

That any extension to the existing detention basin **must be minimised as far as possible** so that it does not unduly encroach on this Council Reserve. Furthermore, it is imperative that the residual land, after completion of the works, is not denied to the local community.