

**Submission
No 210**

INQUIRY INTO IMPACT OF THE WESTCONNEX PROJECT

Name: Dr Raymond Nassar

Date Received: 30 August 2018

30/08/2018

To whom it may concern,

I, Dr Raymond Nassar, am willing to appear as a witness in this parliamentary enquiry if it is requested by the investigating body.

Dear Honorable Members of Parliament and members of the parliamentary enquiry,

My name is Dr Raymond Nassar. I am a specialist anaesthetist practicing in Sydney, NSW. I wish to present to you my submission regarding the health effects of air pollution associated with motorised traffic especially in reference to road tunnels.

Infrastructure projects in NSW are currently undergoing a boom. It is of great concern, however, that public health seems to be placed low down on the list of priorities when designing and approving many of these projects. Public health reassurances frequently accompany such projects, however the science behind these reassurances is often questionable.

Projects designed for large and small vehicular transport users pose a special risk for public health. All motorised vehicles, especially diesel vehicles emit dangerous substances which contribute to a worsening of overall air quality. As a result of these types of projects, the overall number of vehicle users increases. As the dangers of air pollution become more and more evident, infrastructure projects such as road tunnels pose special risks to public health. Especially at risk are users of tunnels who are exposed to dangerous levels of in-tunnel pollutant levels, as well as people in the surrounding vicinity of ventilation facilities (stacks), portals and entry and exit ramps. The overall increase in air pollution emitted from such projects acts to worsen the overall air quality of the entire urban area, ie the Sydney Basin.

My background knowledge regarding this topic arises from personal research and peer review of the scientific literature into air pollution and the resultant health effects. I authored an evidence based summary and petition of the health effects in 2014 which was co-signed by over 200 medical practitioners. I also chaired an independent health forum regarding health impacts of air pollution in 2014. Guest speakers included leading researcher into respiratory impacts of air pollution Professor Bin Jalaludin, as well as the CEO of the NSW AMA Ms Fiona Davis, senior lecturer and cardiothoracic surgeon Professor Richard Chard, as well as the CEO of the Asthma Foundation Mrs Michele Goldman. I have been involved in raising public awareness of the dangers of air pollution by providing radio and television interviews, printed media interviews and speaking at public meetings.

My key message is that the medical and scientific world is waking up to the dangers of air pollution.

We are seeing an explosion in the number of large and significant scientific articles which are finding adverse impacts on health from air pollution globally. The popular media is increasingly reporting these results and communities around the world are realizing the potentially devastating effects of exposure to air borne toxins.

Environmental Protection Agencies around the world have exposure limits for some of the known toxic particles and molecules. These levels act as a protective public health measure. However, upper or "safe" limits of exposure to differing particles vary from country to country. The scientific research is showing that major health impacts are occurring with exposure to levels that are considered "safe". In other words, there is currently no safe exposure level to air pollution.

As the scientific evidence becomes clearer about the health effects of air pollution, we are seeing more and more reports of individual occurrences being linked to air



pollution. The recent tragic death of a 9 year old girl in England is the world's first directly linked death to exposure to air pollution.

As these links are being established, we are seeing a greater incidence of institutions and individuals being held accountable for the adverse impacts that their decisions or policies are having.

A recent example of this is the well reported intentional breach of emission restrictions on new vehicles by major Automotive companies resulting in criminal charges being laid and heavy fines being imposed.

The initial catalyst, in 2014, for my public health campaigning was the announcement of the NorthConnex road tunnel. This was going to be Australia's longest road tunnel at 9km length, with an emphasis on heavy vehicle use. There are two ventilation facilities for this tunnel. One at either end - Wahroonga and West Pennant Hills. The most unique design feature of this tunnel was that the unfiltered ventilation stacks would be placed in a residential area within close proximity of 7000 school students. I could find no other example of this occurring anywhere else in the world. Common and best practise in developed countries is to install filtration systems in urban tunnels or to place ventilation stacks away from sensitive receptors, such as children.

As this tunnel is intended to carry large numbers of trucks, the overall diesel particle emissions would be significantly greater than in any previous tunnel project in Australia. Not only was I concerned about the public health impacts of levels of pollution around the ventilation facilities, but I was also concerned about in-tunnel pollution levels.

During the subsequent public health campaign, I approached local members of parliament, both State and Federal, as well as the minister for Planning to raise my concerns. I met with the project managers but my concerns were not addressed. The responses were predictable and repetitive. The strategy was to create false reassurance by using engineering jargon and by quoting health statistics which had been calculated using assumptive data, ie: they were a best case scenario guess. Again, the science behind these attempts at reassuring the impacted communities was very weak. Ultimately, the NorthConnex EIS did admit three important points:

1. Levels of in tunnel air pollution would reach very high concentrations.
2. Background levels of air pollution would increase around the stack sites, and
3. An increase in mortality could be calculated in the surrounding communities as a result of the project.

These conclusions are

The bulk of my submission consists of a power point presentation with slides and accompanying transcript which I gave to a community group concerned about the Northern Beaches Link. It is based on recent medical and scientific data concerning the health impacts of air pollution. The slides are referenced.

The key points are:

- There is no safe level of exposure to air pollution. The majority of deaths in the UK from air pollution occurred in people with exposure to “safe” current levels.
- Air pollution is now known to cause numerous health problems including cancer, heart attacks, strokes, asthma, impaired lung growth.
- It is also linked to atherosclerosis, Alzheimer’s disease, diabetes, obesity, autism, and low birth weights
- Both short terms exposure and long term exposure have been found to have health impacts.
- More and more adverse effects from air pollution exposure are becoming evident as further research is conducted.
- All residents of urban centers are affected by air pollution. In Sydney, air pollution is often trapped in the Sydney Basin. Ventilation stacks act to disperse pollution into the air, however, particles are subject to gravity and fall back to ground level, thereby increasing pollution (see slides).
- Tunnel users are at particular risk of adverse effects of air pollution. NorthConnex EIS demonstrates very high levels of particulate matter along the length of the tunnels. Likely scenarios of in-tunnel traffic jams would increase these levels and tunnel user exposure further. Air pollution has been shown to penetrate into vehicle cabins even when all windows are shut.

Health Effects of Air Pollution

March 2018

When my family and I found out that we were going to live within 500m of a pollution stack from one of the road tunnels, the nine-kilometre-long NorthConnex road tunnel. I had a 2- and a 4-year-old child at the time, and I really wanted to stay where we were living, so I started to research all the health impacts to try to reassure my wife and my family that it was going to be safe to stay in this area. However, the more research I did and the more literature I read, the more worried I got.

There was nothing in the medical literature that reassured me that it was going to be safe to live near an exhaust stack, with pollution radiating from it, so we ended up moving.

Even as a specialist anaesthetist, a lot of the information available was very new to me, and it is quite amazing how this field of medicine is evolving so rapidly at the moment. There are more and more landmark studies coming out almost on a monthly basis from all around the world that outline the detrimental effects of air pollution.



This slide is from the WHO and shows that air pollution causes 1 in 9 deaths around the world at the moment.

Types of Air Pollution

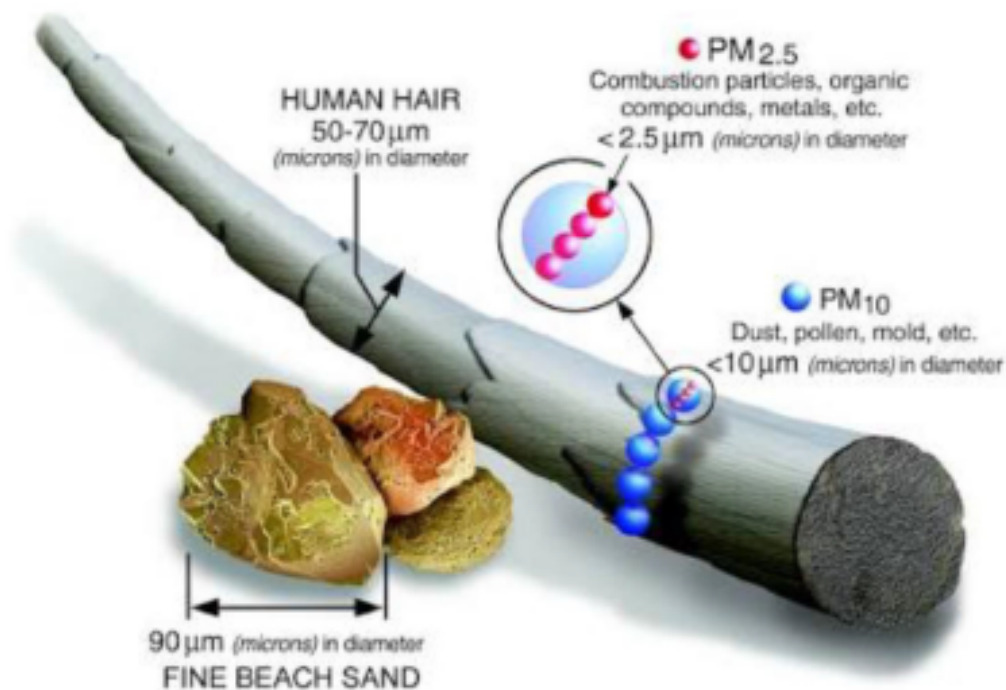
- Molecules:

- Sulphur dioxide (SO₂)
- Nitrogen Dioxide (NO₂)
- Carbon Monoxide (CO)
- Carbon Dioxide (CO₂)
- Benzene, Formaldehyde, Lead, Toluene

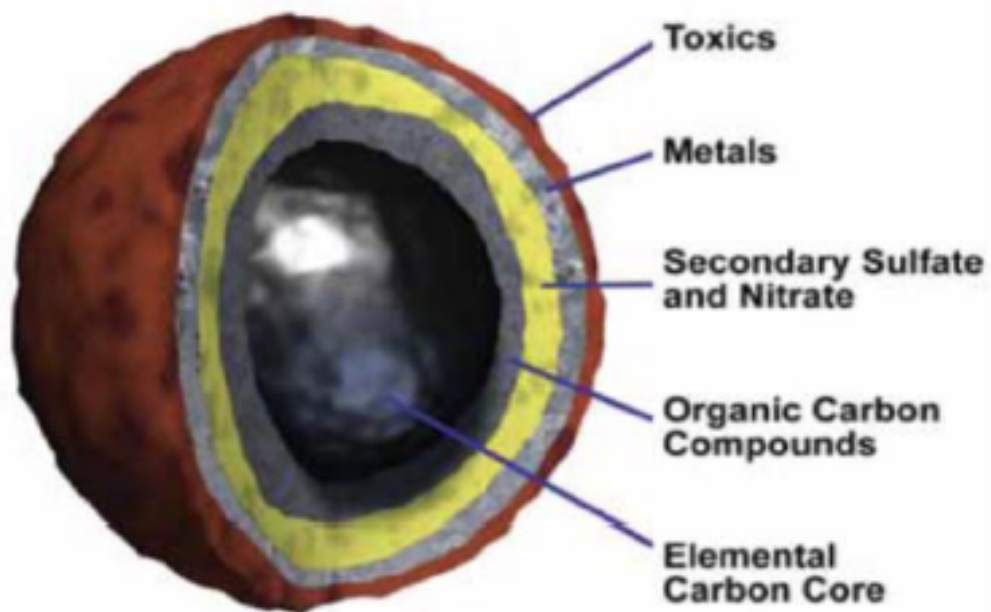
- Particles:

- PM₁₀
- PM_{2.5}
- PM_{<1} (Ultrafine)

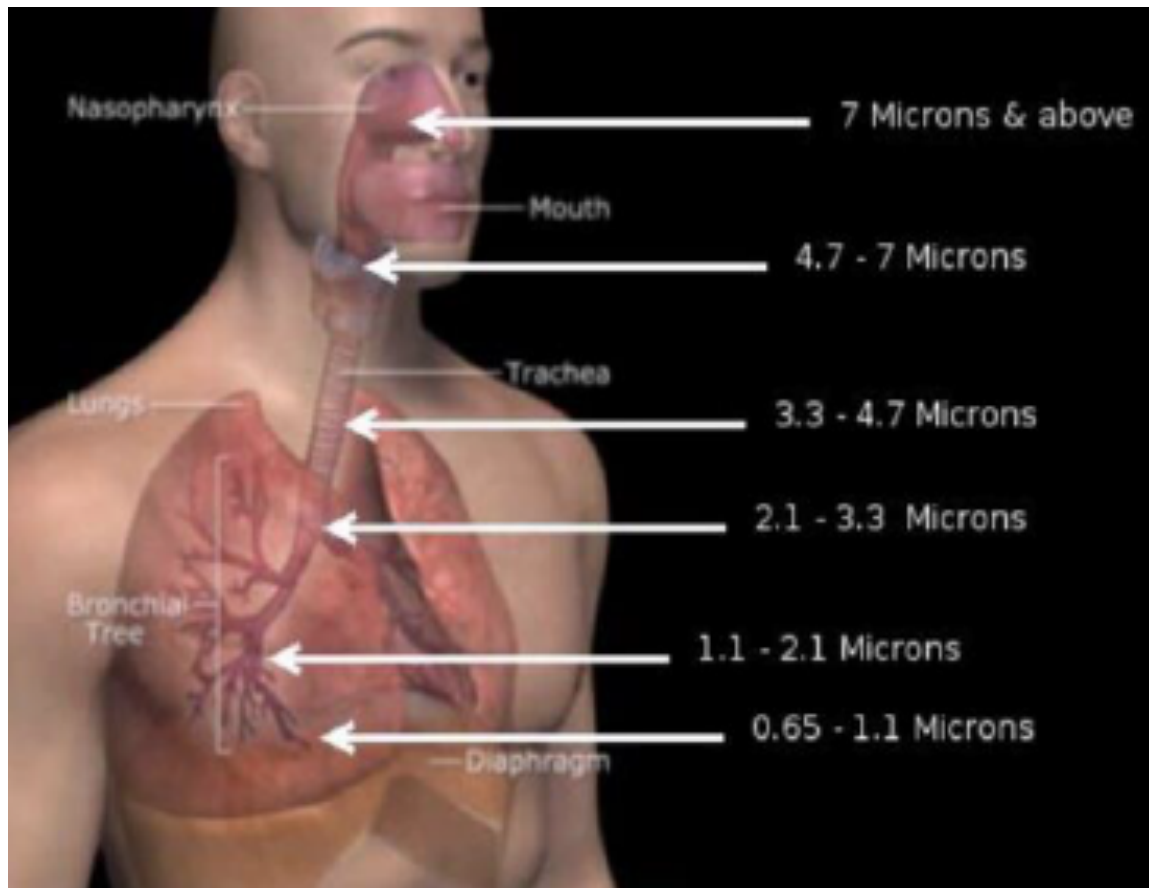
There are 2 types of air pollution: molecules and particles. I'll focus on particles today as they are the ones about which the new literature is coming out. The most important is PM_{2.5}, which means particles of less than 2.5 microns in diameter. Medical literature has also identified ultrafine particles as being very harmful, and they are mostly produced by diesel engines.



To give you an idea of the size of these: to the left is a grain of sand, the blue circles are the PM₁₀s, the pink circles are PM_{2.5}s - they are so small you can't see them with the naked eye.



These particles are made of shells of substances, including heavy metals, such as lead and arsenic. Not only do the particles have an effect by being the shape and size they are, the lead and arsenic by themselves also have an effect. And these particles come from a diesel combustion engine.



What happens to these particles when we breathe them in - the smaller they are, the further they penetrate into the lungs. The upper airways will capture most of the larger particles, but the smaller they are, the further the particles will penetrate into the depths of the lungs and there they get absorbed into the blood stream. Our lungs are there for exchanging substances - mostly oxygen and carbon dioxide - but small particles will also enter the blood stream and from there travel around your whole body and have an effect. Asbestos only stays in the lungs and has an effect on the lungs. Unlike asbestos, these particulates stay in the lungs, but also enter the blood stream and that's what makes them so dangerous.

International Agency for Research on Cancer



PRESS RELEASE
N° 213

12 June 2012

IARC: DIESEL ENGINE EXHAUST CARCINOGENIC

Lyon, France, June 12, 2012 – After a week-long meeting of international experts, the International Agency for Research on Cancer (IARC), which is part of the World Health Organization (WHO), today classified diesel engine exhaust as **carcinogenic to humans (Group 1)**, based on sufficient evidence that exposure is associated with an increased risk for lung cancer.

The World Health Organisation released this statement about 6 years ago: diesel engine exhaust is a class 1 carcinogen to humans, which means it is proven to cause cancer in humans.

International Agency for Research on Cancer



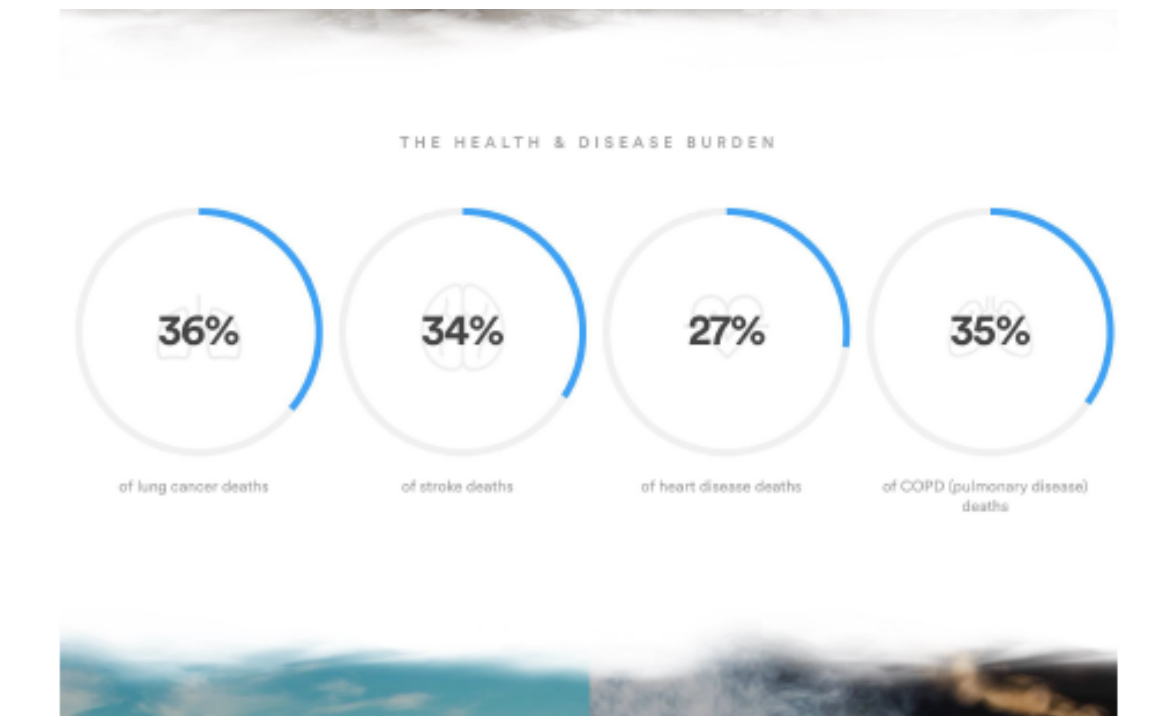
PRESS RELEASE
N° 221

17 October 2013

IARC: Outdoor air pollution a leading environmental cause of cancer deaths

Lyon/Geneva, 17 October 2013 – The specialized cancer agency of the World Health Organization, the International Agency for Research on Cancer (IARC), announced today that it has classified outdoor air pollution as **carcinogenic to humans (Group 1)**.

A year later that was expanded to encompass all outdoor air pollution being considered a class 1 carcinogenic material.



Around the world the WHO states that about a third of all lung cancer deaths, stroke deaths, heart disease deaths and pulmonary deaths are due to air pollution.

PEOPLE MOST SUSCEPTIBLE



Children, pregnant women, unborn children, elderly people and people with chronic disease are more susceptible. Children are so susceptible because they breathe at a faster rate than adults and they circulate their blood more frequently. So when children are often playing outdoors, breathing harder, they tend to absorb a lot more pollution and that gets carried around their bodies. Elderly people and people with chronic disease are probably most at risk of cardiovascular side-effects. So when these particles enter the blood stream, they seem to have an inflammatory effect, which means they make your blood more sticky or thicker, which predisposes people to heart attacks and strokes.

AIR POLLUTION NUMBER CRUNCH

27,519

HEALTHY YEARS OF
LIFE ARE LOST BY
AUSTRALIANS EVERY
YEAR FROM EXPOSURE
TO AIR POLLUTION

1041

NUMBER
OF TIMES
BETWEEN 2000
AND 2006
THAT COAL
MINES IN THE
HUNTER
REGION
BREACHED
THEIR
POLLUTION
LICENCES

UP TO \$8.4
BILLION

ANNUAL ESTIMATED
HEALTH COSTS
OF AIR POLLUTION
IN SYDNEY

TOTAL ECONOMIC COST
IN THE YEAR 2000 OF AIR
POLLUTION FROM MOTOR
VEHICLES ALONE WAS

\$2.4 BILLION

3000

AUSTRALIANS DIE PREVENTABLE
DEATHS EACH YEAR FROM
AIR POLLUTION



ZERO

THE SAFE
LEVEL OF
EXPOSURE
TO MANY OF
THE MAJOR
AIR POLLUTANTS



www.environmental.org.au

NSW GOVERNMENT



3000



**AUSTRALIANS DIE PREVENTABLE
DEATHS EACH YEAR FROM
AIR POLLUTION**



www.envirojustice.org.au

Environmental Justice Australia estimate that 3000 Australians die every year from air pollution.

UP TO \$8.4 BILLION

**ANNUAL ESTIMATED
HEALTH COSTS
OF AIR POLLUTION
IN SYDNEY**



Environmental Justice Australia estimate that air pollution costs Sydney \$8.4 billion a year.

ZERO

**THE SAFE
LEVEL OF
EXPOSURE
TO MANY OF
THE MAJOR
AIR POLLUTANTS**



There is no safe level of exposure to any of these substances.

Most countries around the world have guidelines and recommendations in which they try to stay within, but evidence shows that the majority of cases of health impacts occur when people have exposure to the so-called 'safe' level - people living in normal communities where the air quality is within the guidelines are still having a lot of these problems.

Every breath we take: the lifelong impact of air pollution

Report of a working party
February 2016



This document has been put together by two of the most respected medical groups in the worlds, the British Royal College of Physicians and the Royal College of Paediatrics and Child Health. It is a summary of a lot of the health impacts and was released in 2016.

Impacts of air pollution can be divided into short-term and long-term categories.

Health Impacts

- Short term
 - Asthma
 - Myocardial Infarction
 - Stroke

In the short term people are affected by asthma, myocardial infarction and strokes.

- Long Term
 - Cancer – especially lung and bladder
 - Respiratory illnesses and impaired lung development
 - Cardiovascular disease
 - Obesity
 - Diabetes
 - Premature labour, low birth weight
 - Cognitive decline and Dementia
 - Association to Autism

In the long term people are affected by cancer - especially lung and bladder, respiratory illnesses and impaired lung development, cardiovascular disease, obesity, diabetes, premature labour, low birth weight, cognitive decline, dementia and autism.

Air pollution can stay around for days or weeks after it's created.

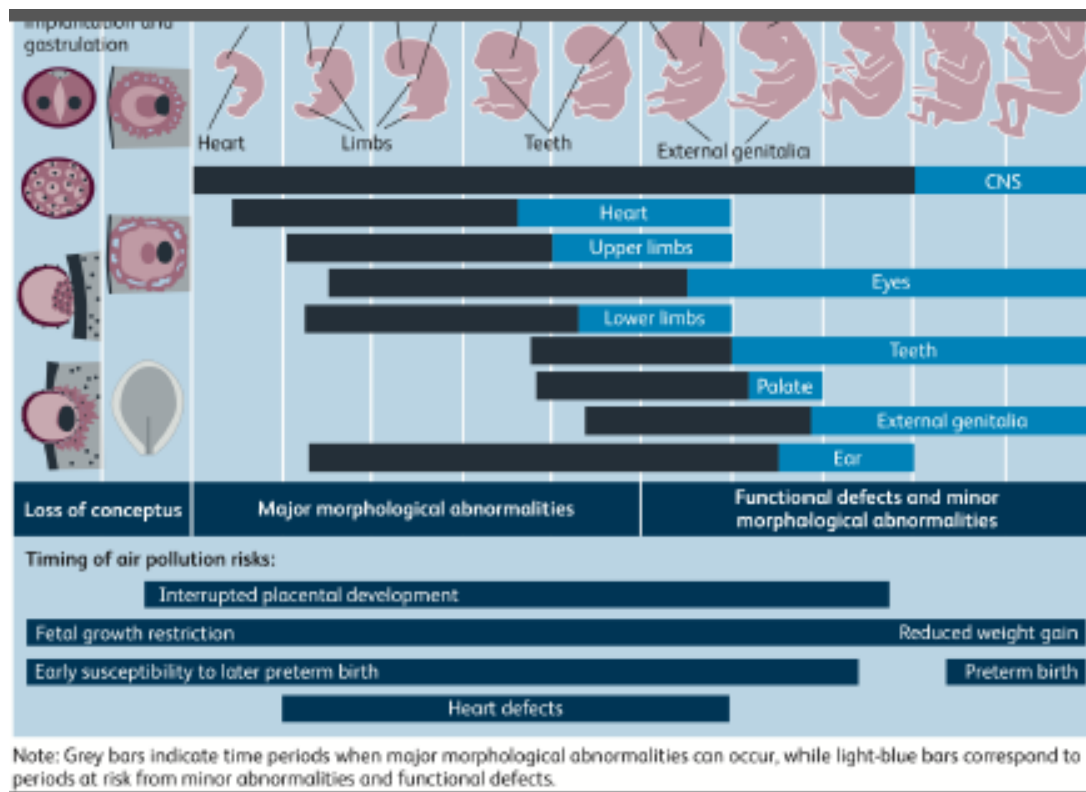
One type of chemical may interact with others in the atmosphere, to cause even more pollution.

The Royal College of Physicians note that air pollution can stay around for days or weeks after it's created. They further note that one type of chemical may interact with others in the atmosphere to cause even more pollution.

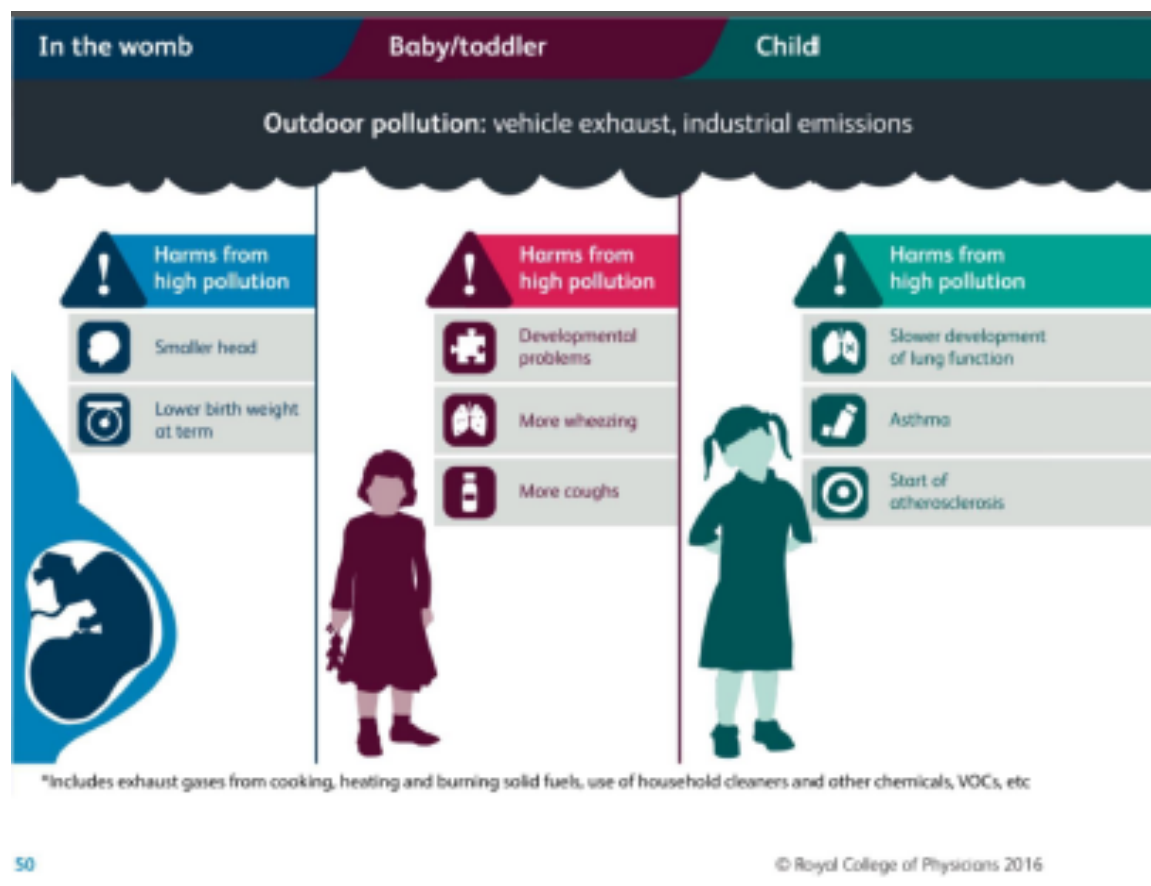
The Placenta

- Acts as a barrier to toxins for the foetus
- Some heavy metals and fine particles such as PM2.5 and smaller are able to cross the placenta and have the potential to cause damage
- DNA is susceptible to changes
- Even seemingly trivial interferences during critical periods can harm organs and tissues
- The fetal brain and CNS are exquisitely sensitive to this

The placenta's role is to provide nutrition to the foetus as well as a barrier to toxins. However, some of these particles, including some heavy metals and fine particles such as PM2.5 and smaller can penetrate the barrier, cross the placenta, enter the foetal blood circulation and potentially cause damage there. DNA is susceptible to changes at this stage. Even seemingly trivial interferences during critical periods of development can harm organs and tissues. The foetal brain and central nervous system are exquisitely sensitive to this.



This schematic shows the gestational period with times when major morphological abnormalities can occur in dark blue and minor abnormalities in light blue which result in birth defects.



Throughout a human's life, they are susceptible to air pollution. Toddlers can have developmental problems, more wheezing and more coughs, whilst school-age children can have slower lung development, asthma and the start of atherosclerosis.

FEV1 Growth vs NO2 average over 8 years in School children

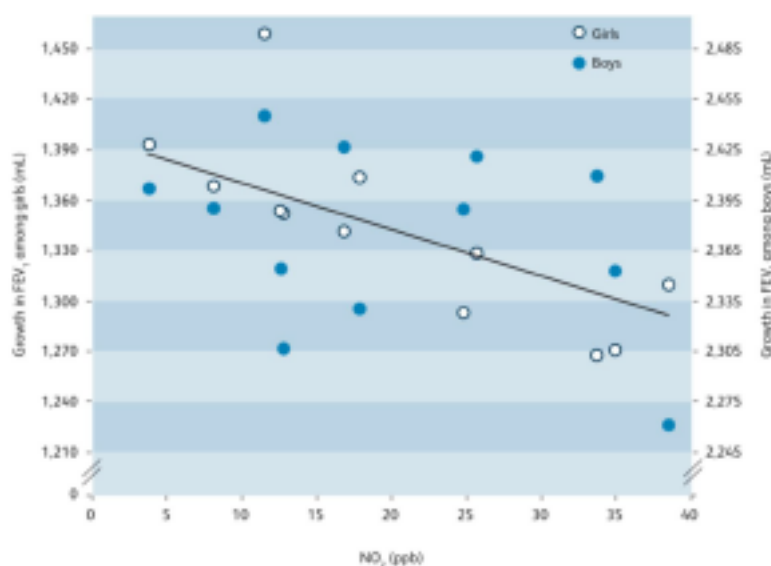


Fig 11. Average growth in FEV₁ in school-age girls (open circles) and boys (closed circles) during an 8-year period, plotted against average NO₂. Each dot represents a separate community. As background NO₂ increases in communities, the rate of growth in FEV₁ decreases. A similar effect was observed for background PM. Adapted with permission from Gauderman et al.⁵ © 2004 Massachusetts Medical Society.

This graph shows the permanent, irreversible inhibition of lung growth in children who were exposed to air pollution. The graph shows nitrogen dioxide levels on the x axis, on the left is the girls, on the right are the boys, and it shows that over a 8-year period - as you increase the levels of background air pollution, the less your lung growth develops.

More direct evidence that air pollution causes suppression of lung function growth is provided by a cross-sectional study of healthy schoolchildren in Leicester, UK.⁷ This study used the capacity of macrophages resident on the mucosal surface of the lower airways to take up inhaled material, including pollution particles (PM) (Fig 12).

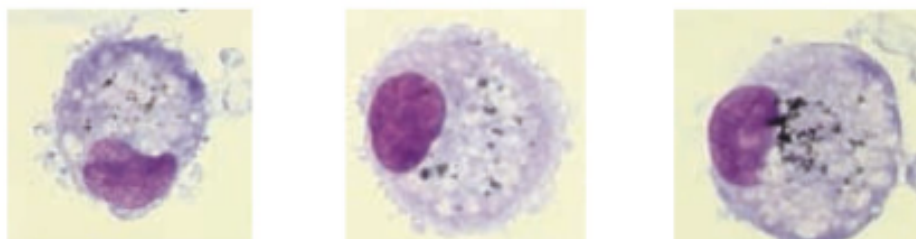


Fig 12. Examples of macrophages recovered from the lower airways of healthy children living in Leicester. The black spots in some of the cells are inhaled fossil fuel-derived particles.

In this study, each 1 μm^2 increase in the area of macrophage black carbon was associated with a 17% reduction in the expected FEV₁ (Fig 13).

This shows a white blood cell from a healthy child's lung. Inside the white cells you can see the black dots, which shouldn't be there as they are air pollution, which have been taken up by a healthy child's lungs. For a certain increase in the area of air pollution in the white blood cells, a 17% reduction in lung function.

Pre school Children

- Increased risk of pre school asthma with increased NO₂ and PM₁₀ exposure during both gestation and first year of life.
- Increased risk of developing early school aged asthma with higher markers of traffic associated outdoor air pollution near the home and with exposure to background NO₂



It is clear that preschool children have an increased risk of wheeze and asthma if they have an exposure to air pollution such as NO₂ and PM₁₀ during both gestation and first year of life.

Schoolchildren

- Exposure to higher NO₂ concentration associated with new-onset asthma (Californian Children's Health Study)
- Lifetime risk of asthma higher if living near major highway
- 1.5 fold increased risk of new-onset asthma with increased traffic-related air pollution near home and school
- 19 studies show that :
 - Increased exposure to NO₂ is associated with new-onset asthma
 - Increased exposure to PM is associated with new-onset wheeze

School children also have an increased risk of wheeze and asthma which continues with age.

THE LANCET

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Volume 383, No. 9919, pT85–T95, 1 March 2014
[Next Article >](#)

Articles

Effects of long-term exposure to air pollution on natural-cause mortality: an analysis of 22 European cohorts within the multicentre ESCAPE project

Dr Rob Beelen, PhD, Ole Raaschou-Nielsen, PhD, Massimo Stafoggia, MSc, Zorana Jovanovic Andersen, PhD, Gudrun Weinmayr, PhD, Prof Barbara Hoffmann, MD, Kathrin Wolf, PhD, Evangelia Samoli, PhD, Paul Fischer, MSc, Mark Nieuwenhuijsen, PhD, Prof Paolo Vineis, MD, Wei W. Sun, MSc, Prof Kees Katsouryanni, PhD, Konstantina Dimakopoulou, MSc, Anna Padoa-Schioppa, PhD, Prof Beate Eschweg, PhD, Lars Mølgaard, PhD, Ali S. Hashizawa, PhD (arch), Tamas L. Szabo, PhD, Andrzej

- 360 000 people followed for 14 years
- Results:
- 7% increase in natural cause mortality with each 5 $\mu\text{g}/\text{m}^3$ increase in $\text{PM}_{2.5}$ concentration (hazard ratio [HR] 1.07, 95% CI 1.02–1.13).
- 18% increase in lung cancer incidence for each 5 $\mu\text{g}/\text{m}^3$ increase in $\text{PM}_{2.5}$ concentration
- Findings are from populations exposed to $\text{PM}_{2.5}$ concentrations below recommended limits

The Lancet has studied the effects of air pollution on 360,000 people for 14 years and has found a dose dependent relationship, so that the more air pollution that was breathed in, the worse the results were; there was a 7% increase in mortality with every 5 microgram per metre cubed increase in the $\text{PM}_{2.5}$ air pollution. There was also an 18% increase in lung cancer incidence for every 5 microgram per metre cubed increase in the $\text{PM}_{2.5}$ air pollution. It is important to note that these findings were from populations exposed to $\text{PM}_{2.5}$ concentrations below recommended limits; so they were within so-called safe limits.

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812

OCTOBER 21, 2004

VOL. 351 NO. 17

Exposure to Traffic and the Onset of Myocardial Infarction

Annette Peters, Ph.D., Stephanie von Klot, M.P.H., Margit Heier, M.D.,
Ines Trentinaglia, B.S., Almut Hörmann, M.S., H. Erich Wichmann, M.D., Ph.D., and Hannelore Löwel, M.D.,
for the Cooperative Health Research in the Region of Augsburg Study Group

ABSTRACT

BACKGROUND

An association between exposure to vehicular traffic in urban areas and the exacerbation of cardiovascular disease has been suggested in previous studies. This study was designed to assess whether exposure to traffic can trigger myocardial infarction.

METHODS

We conducted a case-crossover study in which cases of myocardial infarction were identified with the use of data from the Cooperative Health Research in the Region of Augsburg. Myocardial infarction was defined as a death or hospital admission for the

From the Institute of Epidemiology (A.P., S.K., M.H., H.T., H.E.W., H.L.) and the Institute for Health Economics (A.H.), GSF—National Research Center for Environment and Health, Neuherberg; and the Department of Epidemiology, Medical Faculty, Ludwig-Maximilians-Universität, Munich (H.E.W.) — all in Germany. Address reprint requests to Dr. Peters at the Institute of Epidemiology, GSF—National Research

The *New England Journal of Medicine* and numerous other publications have found evidence of links between heart attacks, strokes and air pollution.

Results:

- Association found between exposure to traffic and onset of Myocardial Infarction within 1 hour of exposure.
- Time spent in traffic was consistently linked with an increased risk of MI

This study found an onset of myocardial infarction (MI or heart attack) within one hour of exposure to air pollution and that was consistent with time spent in traffic.

Relation Between Short-Term Fine-Particulate Matter Exposure and Onset of Myocardial Infarction

Jeffrey Sullivan, Lianne Sheppard, Astrid Schreuder, Naomi Ishikawa, David Siscovick, and Joel Kaufman

Background: Epidemiologic studies have reported increases in the incidence of cardiovascular morbidity and myocardial infarction (MI) associated with increases in short-term and daily levels of fine-particulate matter air pollution, suggesting a role for particulate matter in triggering an MI.

Methods: We studied the association between onset time of MI and preceding hourly measures of fine-particulate matter using a case-crossover study of 5793 confirmed cases of acute MI. We linked data from a community-wide database on acute MI from 1988–1994 in King County, Washington, with central site air pollution monitoring data on fine-particulate matter determined by nephelometry. We compared air pollution exposure levels averaged 1 hour, 2 hours, 4 hours, and 24 hours before MI onset to a set of time-stratified referent exposures from the same day of the week in the month of the case event.

Results: The estimated relative risk for a 10- $\mu\text{g}/\text{m}^3$ increase in

fine-particulate matter air pollution is a risk factor for acute cardiovascular events.^{1–6} Time-series analyses have demonstrated that daily average levels of particulate matter are associated with increased cardiovascular mortality, hospital admissions for myocardial infarction (MI), and automatic implantable cardioverter-defibrillator discharges.^{3,7–11} A case-crossover study of hospital admissions for MI demonstrated a 0.8% increase in MI admissions per 10- $\mu\text{g}/\text{m}^3$ increase in fine-particulate matter (PM_{2.5}).¹²

Moreover, short-term peaks in fine-particulate matter exposure may trigger cardiac ischemia. A recent case-crossover analysis in 772 individuals with acute MI participating in the Boston Determinants of Myocardial Infarction Onset Study demonstrated that an increase of 25 $\mu\text{g}/\text{m}^3$ PM_{2.5} during a 4-hour period before the onset of MI was associated with

Result: 0.8% increase in MI per 10mcg/m3 increase in PM

This study shows that for every 10 micrograms per metre cubed increase in particulate matter (PM), there is a 0.8% increase in the risk of heart attack (MI).

The Lancet 2016 – progression of atherosclerosis

- J. Kaufman looked at Coronary artery calcification in 7000 people over 10 years
- He compared this to long term measured background PM2.5 levels
- Ranges of PM2.5 were 9.6-22.6mcg/m3 (WITHIN “SAFE” LEVELS)
- Average rate of CAC progression was 24 Agatston units
- CAC was accelerated by 4.1 units per year for every 5mcg/m3 increase in PM2.5
- Therefore Coronary atherosclerosis progressed 38% faster for levels of 22mcg/m3 compared to 11 mcg/m3

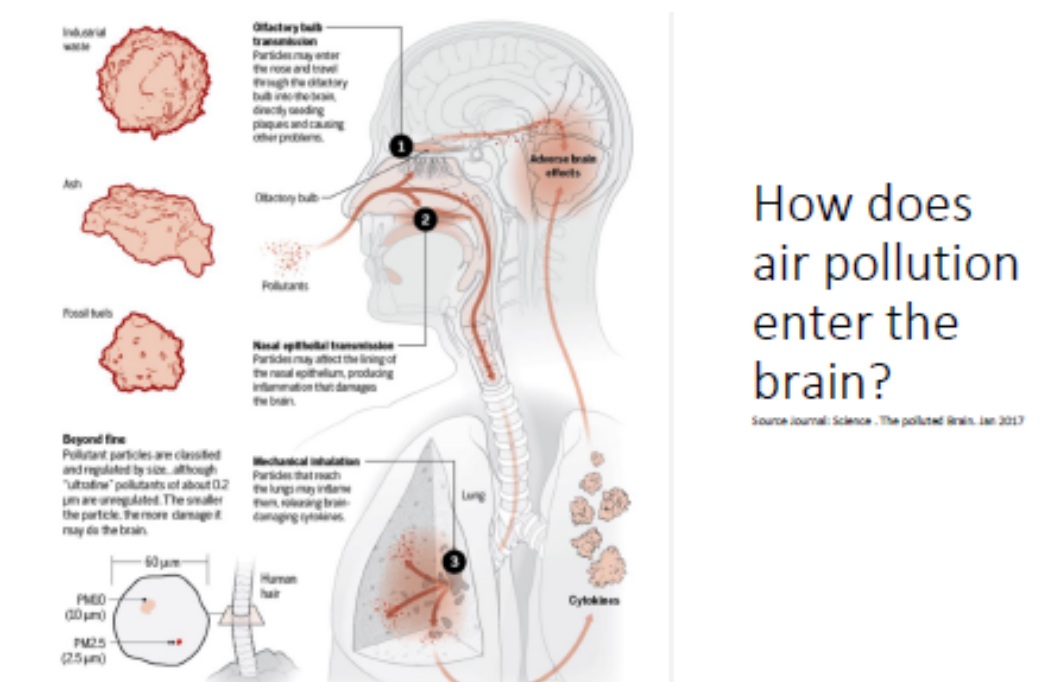
Atherosclerosis is plaques on vessel walls, which predisposes people to heart attacks and strokes. This recent article in *The Lancet* shows that there were two communities, one in a low exposure group, one in a high exposure group. Their atherosclerosis growth was studied, and it was found that even if you lived in an area still within the ‘safe’ limits of PM2.5 ranges of less than 22.6 micrograms per metre cubed, you still had a 38% faster growth in atherosclerosis compared to people that had half that level of exposure.

Alzheimer's Disease

- Evidence is early but mounting for association B/W AD and pollution
- Epidemiological studies have found that in some cases women exposed to higher levels of PM2.5 had faster rates of cognitive decline and a higher risk of developing dementia.
- Older women living in places where PM2.5 levels exceeded the U.S. Environmental Protection Agency's standard ($>12\text{mcg}/\text{m}^3$) had an 81 percent greater risk of global cognitive decline and were 92 percent more likely to develop dementia, including Alzheimer's.
- This environmental risk raised by long-term PM2.5 exposure was two to three times higher among older women with two copies of the APOE4 gene, compared with women who had only the background genetic risk with no APOE4 gene.
- Mouse studies found that exposure to nano particles lead to increased levels of beta-amyloid in the brains of the mice. These levels were greater in mice with the APOE4 gene. Beta-amyloid levels are raised in Alzheimer's in humans.

The evidence is early but mounting for an association between Alzheimer's disease and air pollution, especially in females and especially in females and the elderly who have a genetic predisposition; those people are 2 to 3 times more likely to develop dementia.

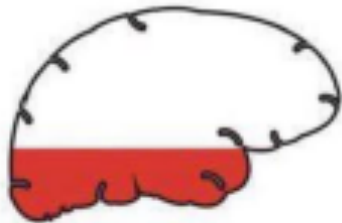
There are numerous animal studies that show protein growths in brains which we use to identify and monitor Alzheimer's Disease.



This slide shows some of the possibilities of how air pollution actually enters your brain. It can enter through your olfactory bulbs, which are your nerves that give you smell sensation. Air pollution can cause inflammation in the lining of your nose, or it can be breathed into your lungs, which causes inflammation, which causes proteins to enter your brain and cause damage that way.

THE INVISIBLE KILLER

Air pollution may not always be visible, but it can be deadly.



34%
OF DEATHS FROM
STROKE

BREATHELIFE.
Clean Air. Healthy Future.



World Health
Organization



CLIMATE &
CLEAN AIR
COALITION

34% of deaths from stroke are due to air pollution.

THE ISSUE

**Air pollution causes 1 in 9 deaths. It is the biggest
environmental health crisis we face.**

We may not always see it, but air pollution is the cause of some of our most common illnesses.

[LEARN MORE](#)

- The Global Burden of Disease study ranks exposure to outdoor air pollution as the ninth leading risk factor for mortality, respectively, with outdoor air pollution accounting for 3.2 million deaths each year

There are about 3.2 million deaths per year from air pollution.



www.envirojustice.org.au

3000 Australians die every year from air pollution.

Air pollution and mortality in Europe

Jeremy P Langrish and Nicholas L Mills

Lancet, The, 2014-03-01, Volume 383, Issue 9919, Pages 758-760,
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Air pollution has long been associated with detrimental effects on human health, from the treaty presented by John Evelyn, a founding member of the Royal Society, to



Lancet, The

Volume 383,
Issue 9919

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Finding:

With each 10mcg/m³ reduction in PM there is a increase in life expectancy of 0.61 years.

With every 10 micrograms per cubic metre decrease in air pollution, you get an increase in life expectancy of 0.61 years.

National Environment Protection Measure Guidelines (NEPM) 2014

Table 3: Air NEPM advisory standard for PM_{2.5}

Pollutant	Averaging period	Maximum concentration	Goal
Particles as PM _{2.5}	1 day 1 year	25 µg/m ³ 8 µg/m ³	Goal is to gather sufficient data nationally to facilitate a review of the Advisory Reporting Standards as part of the review of this Measure scheduled to commence in 2005.*

ppm = parts per million

µg/m³ = micrograms per cubic metre

*The review was completed in 2011

The Australian guidelines for air pollution PM_{2.5} currently stands at 25 micrograms per cubic metre for one day exposure.

There is no safe exposure limit

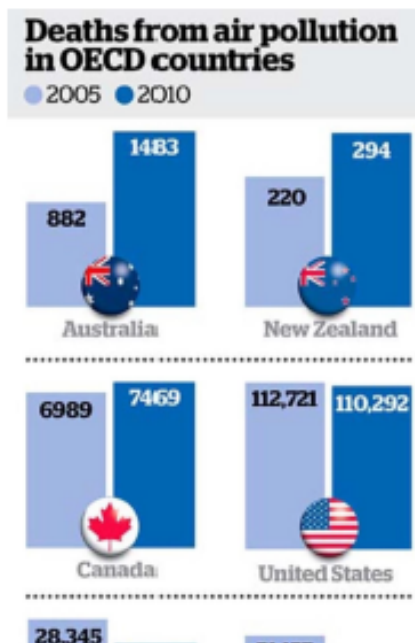
- Legislated concentration limits do not represent a “safe” level for the population as a whole, but are considered to not pose a “significant risk” to health
- Estimated 29000 deaths annually in UK from exposure to PM2.5.
- Only a small fraction of these are due to exposure in excess of legal limits.



However there are no safe exposure levels. In the UK there are an estimated 29,000 deaths annually in the UK from exposure to PM2.5. Only a fraction of those deaths are due to exposure in excess of the so-called safe levels.

Australian air getting worse

- Organisation for Economic Co-operation and Development, report called *The Cost of Air Pollution: Health Impacts of Road Transport*, shows Australia has failed to halt the dangerous rise in air pollution.
- It estimates the economic cost of that failure has run into the billions.
- The report shows that between 2005 and 2010, the number of deaths from air pollution in Australia jumped from 882 to 1483, representing a 68 per cent rise.



The OECD report shows that Australia is actually having an increase in the number of deaths due to air pollution.

No Safe levels

- All predictions of air quality for infrastructure projects are modelled using computer software
- Not based on actual measured data
- Dependent on input factors such as topography, wind speeds etc
- Statement such as “Levels of pollutants will be closely monitored to ensure that they are within acceptable levels” are misleading
- There are no acceptable levels

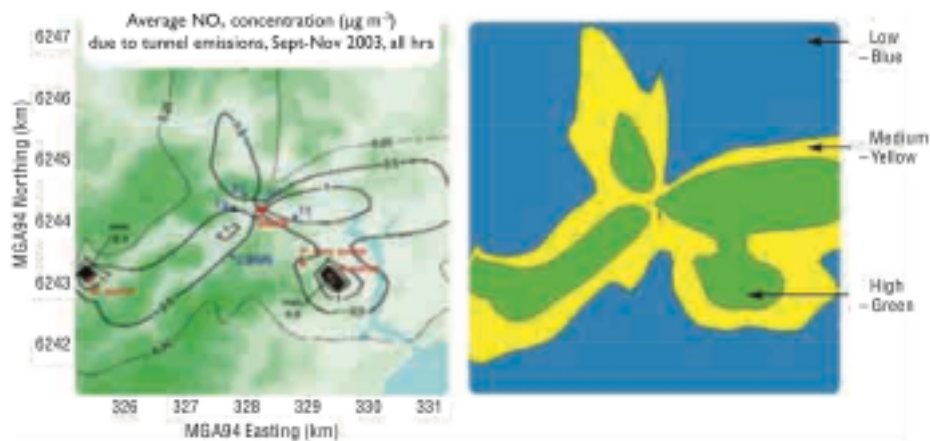
There are no safe levels of air pollution.

Question?

- Is it not better to get the air pollution away from the ground level and shoot it into the sky?

The shape of the 'high' exposure zone describes the interaction of prevailing meteorology with the emitted NO_x plumes from these three sources.

FIGURE 5.1 Modelled average NO_x concentrations (left) and resulting assigned NO_x exposure zones (right) for the M5 East tunnel



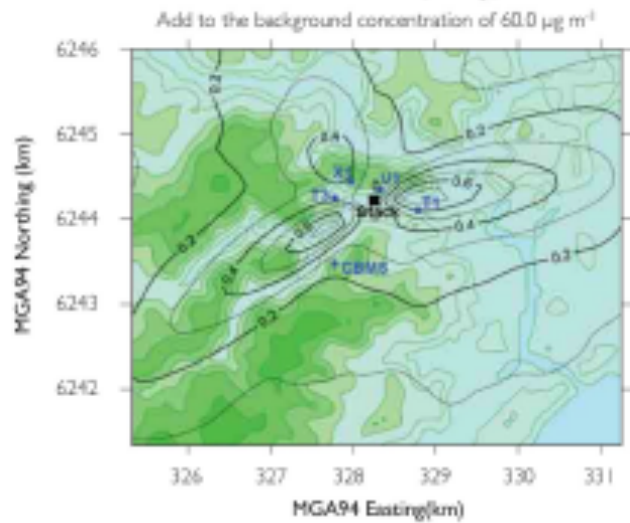
Source: *Investigation into the possible health impacts of the M5 East motorway stack on the Turella community – reanalysis report by NSW Health, November 2006 (see Chapter 6)*

This slide shows some of the data from the NHMRC document on the M5 East, and it shows an increase in ground-level air pollution around ventilation shaft sites due to tunnel emissions, with high exposure > 0.54 micrograms per cubic metre of Nitrogen Oxide in green, medium exposure > 0.30 and < 0.54 micrograms per cubic metre of Nitrogen Oxide in yellow, and low exposure < 0.30 micrograms per cubic metre of Nitrogen Oxide in blue.

Source: <http://www.health.nsw.gov.au/environment/Publications/m5-health-impact.pdf>

FIGURE 5.6 Modelled contribution of stack emissions to annual average NO_x ground-level concentrations around the M5 East tunnel stack, February 2002 – January 2003

Modelled contribution of stack emissions to annual average NO_x ground-level concentration ($\mu\text{g m}^{-3}$)



CBMS, T1, T3, U, X1 and X2 are pollutant monitoring stations.

Source: Hibberd (2003)

This study indicated that the maximum ground-level concentrations of PM_{10} , NO_x and NMVOC were found 600–1200 m downwind of the stack during daytime. The spatial pattern reflected the trends in prevailing winds (Figure 5.4). Most importantly, the highest concentrations

This study indicated that the maximum ground-level concentrations of $\text{PM}_{2.5}$ from Nitrogen Oxide and NMVOC were found 600 to 1200 m downwind of the ventilation shaft during daytime. The spatial pattern reflected the trends in prevailing winds

- Increased traffic around tunnel access routes and local streets
- Portal emissions potentially worse than stack emissions
- Poor public health practise to improve air quality in one area in exchange for worsening air quality elsewhere.
- Dispersion problems in urban areas
- Particles have mass and are subjected to gravity
- Sydney basin geography “collects” pollution over entire city
- Cowie study showed no improved health in people living near now bypassed roads.
- Tunnels concentrate pollution and offer an opportunity to mostly remove that pollution from the atmosphere through filtration

You will get some pollution coming back, but it’s so small that you can’t see it, can’t smell it; these air pollution molecules do have mass, so they will be subject to gravity. They don’t just disappear into thin air and are gone, they are not biodegradable.

When there are tunnels, there must be on ramps and off ramps, and they attract traffic.

It’s not good public policy practice to say that air quality will be improved for one group of people, but punish another group of people. That’s not how public health works. Governments and developers should adopt a cautionary principle: when there is doubt about the safety of something, you don’t go ahead with it.

Road Traffic Tunnel: A Planned Evaluation

Christine T. Cowie^{1,2*}, Nectarios Rose^{1,2}, Wafaa Ezz^{1,2}, Wei Xuan^{1,2}, Adriana Cortes-Waterman^{1,2}, Elena Belousova¹, Brett G. Toelle¹, Vicky Sheppeard⁴, Guy B. Marks^{1,2}

1 Woolcock Institute of Medical Research, Sydney, Australia, **2** Cooperative Research Centre for Asthma and Airways, Sydney, Australia, **3** NSW Health Department, Sydney, Australia, **4** Western Sydney and Nepean Blue Mountains Public Health Unit, Sydney, Australia

Abstract

Objective: The construction of a new road tunnel in Sydney, Australia, and concomitant reduction in traffic on a major road presented the opportunity to study the effects of this traffic intervention on respiratory health.

Methods: We made measurements in a cohort of residents in the year before the tunnel opened (2006) and in each of two years afterwards (2007–2008). Cohort members resided in one of four exposure zones, including a control zone. Each year, a respiratory questionnaire was administered ($n=2,978$) and a panel sub-cohort ($n=380$) performed spirometry once and recorded peak expiratory flow and symptoms twice daily for nine weeks.

Results: There was no consistent evidence of improvement in respiratory health in residents living along the bypassed main road, despite a reduction in traffic from 90,000 to 45,000 vpd. Residents living near tunnel feeder roads reported more upper respiratory symptoms in the survey but not in the panel sub-cohort. Residents living around the tunnel ventilation stack reported more upper and lower respiratory symptoms and had lower spirometric volumes after the tunnel opened. Air pollutant levels measured near the stack did not increase over the study period.

Conclusion: The finding of adverse health effects among residents living around the stack is unexpected and difficult to explain, but might be due to unmeasured pollutants or risk factors or an unrecognized pollutant source nearby. The lack of improvement in respiratory health among people living along the bypassed main road probably reflects a minimal change in exposure due to distance of residence from the road.

Citation: Cowie CT, Rose N, Ezz W, Xuan W, Cortes-Waterman A, et al. (2012) Respiratory Health before and after the Opening of a Road Traffic Tunnel: A Planned Evaluation. PLoS ONE 7(11): e48921. doi:10.1371/journal.pone.0048921

Editor: Stephanie Ann Cornier, Louisiana State University Health Sciences Center, United States of America

This slide shows a study done on the Lane Cove tunnel which shows that there is no improvement in the health of people that were now living on a by-passed road after the tunnel opened, and there were respiratory problems in people who lived near the stacks, and they couldn't explain it.

Northconnex EIS

- Tunnel users will be exposed to very high levels of pollution

For those of you who are looking forward to these tunnels: tunnel users will be exposed to very high levels of pollution.

Table 2-47: Calculated in-tunnel air quality for forecast traffic volumes (2019 and 2029) (project contribution) – main alignment tunnels during peak hours

– design as presented in the EIS
 – design including updates to fuel mix and no change to ratio of NO₂ to NO_x (16%)
 – design including updates to fuel mix and ratio of NO₂ to NO_x (16%)

Pollutant concentrations (mg/m ³) (peak hour)									
Approximate distance along main alignment tunnels									
Start	1 km	2 km	3 km	4 km	5 km	6 km	7 km	8 km	9 km
Inbound main alignment tunnel at 9 am (2019)									
PM _{2.5}	0.331	0.772	1.06	1.34	1.62	1.90	2.17	2.56	3.45
PM ₁₀	0.346	0.812	1.12	1.41	1.70	2.00	2.28	2.71	3.63
NO ₂	0.039	0.099	0.124	0.144	0.165	0.186	0.206	0.250	0.374
NO _x	0.044	0.111	0.140	0.162	0.186	0.210	0.232	0.282	0.432
CO	0.070	0.177	0.224	0.260	0.298	0.336	0.372	0.451	0.675
PM ₁₀	0.039	0.084	0.122	0.158	0.193	0.229	0.265	0.307	0.377
PM _{2.5}	0.040	0.087	0.127	0.164	0.200	0.238	0.275	0.318	0.391
NO ₂	0.037	0.090	0.115	0.149	0.183	0.217	0.251	0.290	0.347
NO _x	0.039	0.095	0.122	0.156	0.195	0.231	0.267	0.306	0.369
Inbound main alignment tunnel at 9 am (2029)									
PM _{2.5}	0.411	0.996	1.32	1.67	2.01	2.35	2.70	3.20	4.29
PM ₁₀	0.415	0.999	1.33	1.69	2.03	2.37	2.73	3.23	4.33
NO ₂	0.043	0.108	0.138	0.159	0.182	0.204	0.227	0.278	0.411
NO _x	0.049	0.124	0.156	0.183	0.209	0.235	0.261	0.317	0.473
CO	0.079	0.199	0.250	0.292	0.335	0.375	0.415	0.506	0.798
PM ₁₀	0.047	0.101	0.145	0.189	0.232	0.275	0.319	0.369	0.439
PM _{2.5}	0.061	0.109	0.156	0.203	0.249	0.296	0.343	0.397	0.472
NO ₂	0.046	0.095	0.137	0.178	0.219	0.260	0.301	0.348	0.414
NO _x	0.050	0.102	0.145	0.192	0.236	0.280	0.324	0.375	0.446
Inbound main alignment tunnel at 6 pm (2019)									
PM _{2.5}	0.156	0.911	1.76	2.62	3.47	4.32	5.12	5.59	6.26
PM ₁₀	0.152	0.890	1.71	2.55	3.38	4.20	4.98	5.44	6.09

NorthConnex
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The NorthConnex EIS shows the predicted levels of pollution for the North bound and South bound tunnels in 2019 and 2029, with PM_{2.5} at 0.477 and 0.487 in one tunnel and 0.553 and 0.576 milligrams per cubic metre in the other tunnel. After conversion from milligrams to micrograms per cubic metre these measurements equate to 477 and 487 micrograms per cubic metre in one tunnel and 553 and 576 micrograms per cubic metre in the other tunnel, where we've talked about safe levels of PM_{2.5} of less than 25 micrograms per cubic metre.

NO ₂	0.005	0.110	0.231	0.352	0.473	0.594	0.707	0.771	0.890
PM ₁₀	0.005	0.112	0.235	0.358	0.481	0.604	0.719	0.794	0.915
PM _{2.5}	0.006	0.179	0.376	0.573	0.770	0.97	1.15	1.26	1.40
NO ₂	0.032	0.090	0.153	0.215	0.278	0.340	0.401	0.450	0.504
PM ₁₀	0.033	0.092	0.156	0.220	0.284	0.347	0.410	0.460	0.515
PM _{2.5}	0.030	0.085	0.144	0.203	0.263	0.322	0.379	0.425	0.472
PM ₁₀	0.031	0.087	0.147	0.207	0.269	0.329	0.387	0.434	0.487
Northbound main alignment tunnel at 6 pm (2029)									
CO	0.195	1.13	2.19	3.25	4.31	5.37	6.35	6.94	7.76
NO ₂	0.183	1.06	2.05	3.04	4.04	5.03	5.95	6.50	7.27
PM ₁₀	0.005	0.119	0.250	0.381	0.512	0.643	0.765	0.834	0.932
PM _{2.5}	0.005	0.123	0.258	0.393	0.529	0.664	0.790	0.861	0.963
NO ₂	0.008	0.197	0.413	0.630	0.846	1.06	1.26	1.38	1.54
PM ₁₀	0.039	0.106	0.178	0.250	0.323	0.395	0.464	0.521	0.585
PM _{2.5}	0.041	0.111	0.186	0.261	0.337	0.412	0.484	0.543	0.61
NO ₂	0.037	0.100	0.169	0.237	0.305	0.373	0.439	0.497	0.553
PM ₁₀	0.039	0.104	0.176	0.247	0.318	0.389	0.457	0.518	0.576

1 milligram / cubic metre =

1000 micrograms / cubic metre

Mass / Volume

0.487

Milligram / Cubic metre

Microgram / Cubic metre

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NO ₂	0.005	0.110	0.231	0.352	0.473	0.594	0.707	0.771	0.890
	0.005	0.112	0.235	0.358	0.481	0.604	0.719	0.794	0.919
	0.008	0.179	0.376	0.573	0.770	0.97	1.15	1.26	1.407
PM ₁₀	0.032	0.090	0.153	0.215	0.278	0.340	0.401	0.450	0.504
	0.033	0.092	0.156	0.220	0.284	0.347	0.410	0.460	0.515
	0.030	0.085	0.144	0.203	0.263	0.322	0.379	0.425	0.477
PM _{2.5}	0.031	0.087	0.147	0.207	0.269	0.329	0.387	0.434	0.487
Northbound main alignment tunnel at 6 pm (2029)									
CO	0.195	1.13	2.19	3.25	4.31	5.37	6.35	6.94	7.76
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PM 2.5 Guidelines Reminder

- Australian NEPM guideline:
 - 25mcg/m³
- USA EPA air quality standard
 - 12mcg/m³
- WHO air quality guideline
 - 10mcg/m³
- Northconnex last km each way inside tunnel:
 - 500mcg/m³

(Note: error on slide. WHO air quality guideline for 24 hours should read 25mcg/m³ and USA EPA should read 35mcg/m³)

Australia recommends 25 micrograms per cubic metre of PM_{2.5}, the USA recommends 12 micrograms per cubic metre of PM_{2.5}, the World Health Organisation (WHO) recommends 25 micrograms per cubic metre of PM_{2.5}, so if you're sitting in a traffic jam in the NorthConnex tunnel, you're breathing in almost 20 times the level of particulate matter recommended by the WHO.

In conclusion, I would like to reemphasise the fact that medical and scientific evidence is showing, without a doubt, that air pollution from motor vehicle traffic is responsible for major adverse health effects.

These health effects can occur from short term as well as long term exposure to air pollution.

Research is finding that a large proportion of adverse health event occur with exposure to what is considered "safe" levels which fall within current guidelines. This has prompted the statement that there is no safe level of exposure.

Air pollution is a major public health issue in many developed countries and governments are facing great challenges in reversing and correcting the causes of urban pollution.

Projects, such as road tunnels, encourage motor vehicle traffic and lead to an overall increase in traffic related pollution. Tunnels concentrate pollutants within them and around the ventilation facilities and portals. These projects lead to an overall increase in urban pollution and pose health risks to their users as well as surrounding communities.

Tunnel projects pose a unique opportunity to remove many of these pollutants entirely from the urban environment by the use of adequate filtration systems.

15:08

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Air pollution is linked to an increase in diabetes, according to these studies

Cristina Fernández Esteban, Business Insider EspañaJul 11, 2018, 8:02 AM

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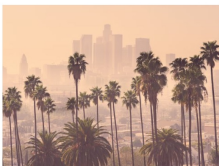
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- **Poor air quality can increase the risk of stroke, heart disease, lung cancer, and respiratory diseases – both chronic and acute.**
- **A new study shows a direct link between air pollution – even at 'safe' levels – and a higher risk of**



A haze of smog over Los Angeles. Shutterstock/J Dennis

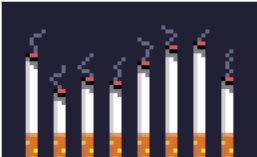
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NEWS HOME

Chart of the day: In these cities, breathing air is like smoking cigarettes



Doc's dire warning

People need to wake up... this is the new asbestos and it's coming out of a stack

Dr Ray Hansen

There is no evidence to prove to us that it is safe to get asphyxiated in a tunnel.

Dr Hansen explained that knowledge is gathering in the medical world about the health impacts of air pollution, and that the pollutants have been shown to be carcinogenic, alongside causing an increased risk of asthma and diabetes. He is particularly concerned about the concentrated exhaust fumes coming out of asphyxiated stacks.

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Air pollution linked to third of Bradford child asthma cases

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The evil you cannot see

Their research is the most sophisticated, but depends on death statistics that are often incomplete or of poor quality, meaning that all estimates are provisional. But research 1999 done by Doug Dockery and his team at research group in an major US cities where health and pollution data are less problematic demonstrated the level of asphyxiated concentration small particles.

They found no level of small particle pollution that was entirely without risk. So the WHO 'safe' standards are pragmatic, rather than our safe driving, levels of alcohol consumption do not mean that even small amounts of alcohol are free of health effects. The American Heart Association, the AHA, has taken a deep interest in small particle pollution, partly because the majority of deaths attributed to it are deaths from heart disease. After looking at all the studies the AHA concludes that larger particles are not associated with an increased risk of death, just the very tiny ones that you cannot see.

Don't jog - walk more

What can we do? The measures that have successfully cut our levels from large particle pollution - clouds of black smoke and high levels of sulphur dioxide - will only reduce the levels of small particle pollution. Moving from diesel to natural gas for large motor vehicles in the long term would be a welcome move. Renewable energy may reduce the production of small particles - you would need to take some care.

In the meantime, by following air pollution indexes, patients with existing lung or heart disease should be warned not to exercise vigorously or unnecessarily on days when the small particle levels are high.

The researchers is not indifferent to our fuel-burning activities. Small particle pollution is yet another example of how important it is to demand our activities to use what could be more important to our environment.



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Articles

Effects of long-term exposure to air pollution on natural-cause mortality: an analysis of 22 European cohorts within the ESCAPE project

Ole Raaschou-Nielsen, PhD, Massimo Stafoggia, MSc, Zorana Jovanovic Andersen, PhD, Prof Barbara Hoffmann, MD, Kathrin Wolf, PhD, Evangelia Samoli, PhD, Paul Fischer, MSc, Mark H, Prof Paolo Vineis, MD, Wei W Xun, MSc, Prof Klea Katsouyanni, PhD, Konstantina Dimakopoulou, PhD, Prof Bertil Forsberg, PhD, Lars Modig, PhD, Aki S Havulinna, DSc [tech], Timo Lanki, PhD, Anu

Climate change to worsen urban air quality, lifting death toll

By Peter Hansen
16 July 2018 - 12:05am



Days of severe pollution in Australia's biggest cities will worsen in coming decades as a warming climate triggers more intense temperature inversion events, exacerbating health issues, according to new research.

With more than 3000 premature deaths a year in Australia already linked to urban air pollution, worsening low-level air quality could increase the toll, said Jason Evans, a professor at the ARC Centre of Excellence for Climate Extremes and a co-author of the report published recently in the *Climate Dynamics* journal.



