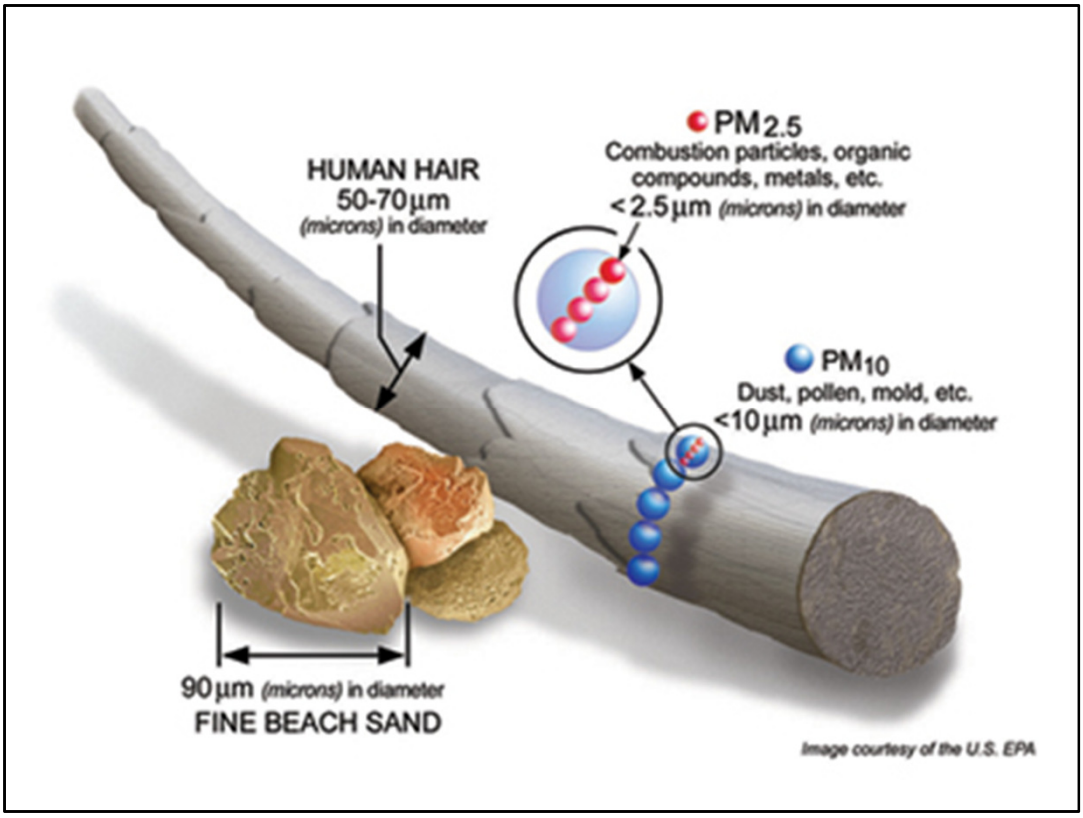
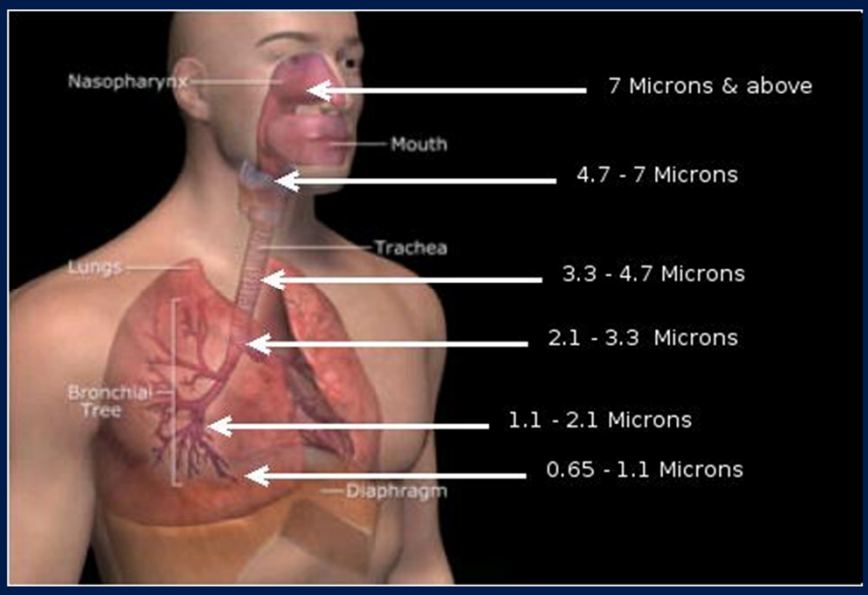


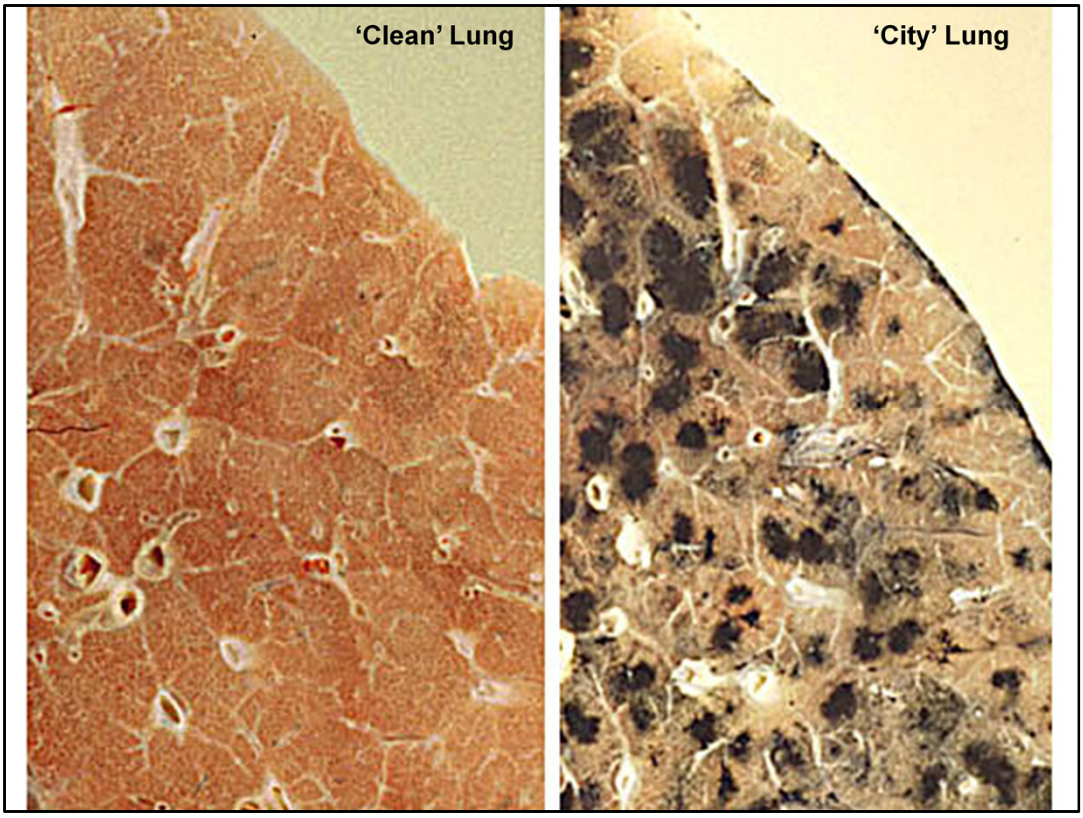
This is a public talk I gave in Newcastle about the health effects of air pollution on 7th March 2013, and I hope this format is acceptable to the senate committee. Submission from Dr Ben Ewald (Senior Lecturer in Epidemiology at the University of Newcastle, and general practitioner)

First slide: In air pollution, size matters, due to selective deposition at different places in the respiratory tract, as illustrated n slide2. However, chemical composition also matters, but has generally not been analysed in the original epidemiologic work establishing the health risks of air particulates. Pm 2.5 that is diesel exhaust is probably much more toxic than pm2.5 that is silica, but the analysis has not been done in these terms.

Particle size



Source: http://en.wikipedia.org/wiki/Respiratory_system


'Clean' Lung
'City' Lung

Current Australian standards

Table 2-1 Ambient Air Quality NEPM Standards and Goals

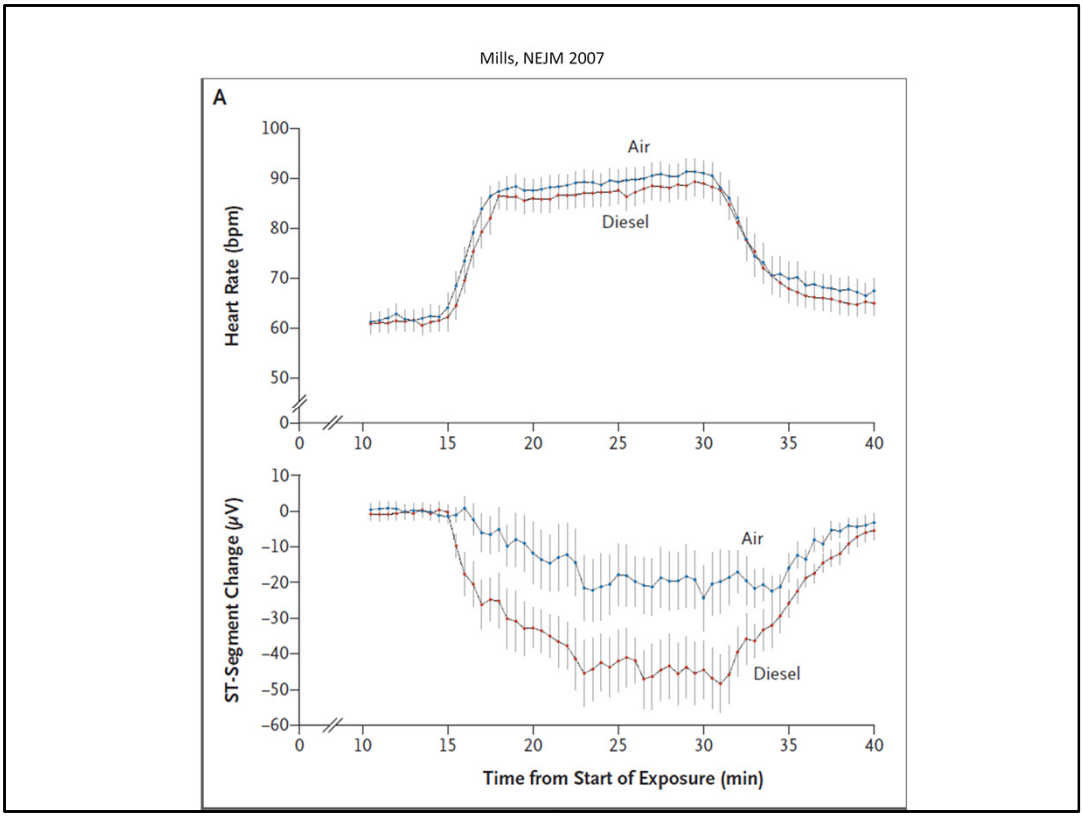
Pollutant	Averaging period	Maximum concentration	Goal within 10 years maximum allowable exceedences
Nitrogen dioxide	1 hour 1 year	0.12 ppm 0.03 ppm	1 day a year none
Sulfur dioxide	1 hour 1 day 1 year	0.20 ppm 0.08 ppm 0.02 ppm	1 day a year 1 day a year none
Particles as PM_{10}	1 day	50 $\mu g/m^3$	5 days a year
Particles as $PM_{2.5}$	1 day 1 year	25 $\mu g/m^3$ 8 $\mu g/m^3$	Goal is to gather sufficient data nationally to facilitate a review of the Advisory Reporting Standards.

Absolute safety, or acceptable risk?
Air Quality Guidelines for Europe, 2nd Ed, 2000

Table 25. Estimated number of people (in a population of 1 million) experiencing health effects over a period of 3 days characterized by a mean PM_{10} concentration of 50 or 100 µg/m³

Health effect indicator	No. of people affected by a three-day episode of PM_{10} at:	
	50 µg/m³	100 µg/m³
No. of deaths	4	8
No. of hospital admissions due to respiratory problems	3	6
Person-days of bronchodilator use	4 863	10 514
Person-days of symptom exacerbation	5 185	11 267

The WHO publication on air quality guidelines for Europe makes it clear that the standards are not set at a level that ensures absolute safety, rather at a level that is seen as posing acceptable risk. The acceptability was determined by a small number of experts involved in writing the guideline, not by a process of community consultation. Table 25 from that document is shown here. When I explain this to community members, many do not think this is acceptable risk.

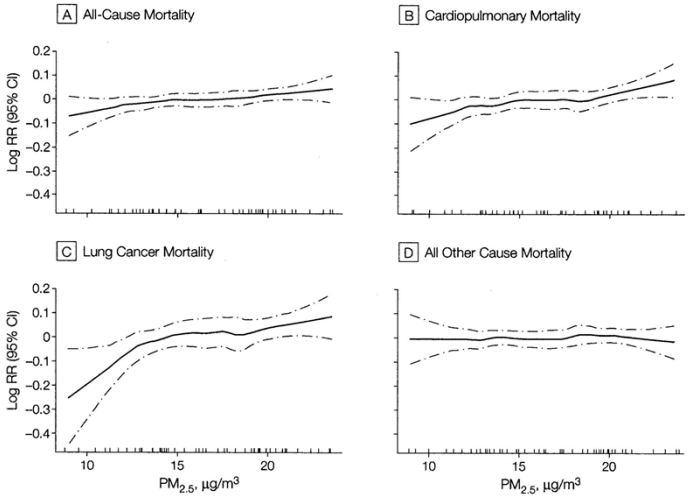


This study by Mills published in New England Journal of Medicine 2007 used a group of men with stable ischaemic heart disease, who exercised on an ergometer in a controlled atmosphere chamber for 15 minutes, while breathing either clean air or air contaminated with diesel exhaust at levels that can occur at street level for brief periods. (300 ug/m3). The top trace is their heart rate, which rises from 60 at baseline to about 90 while exercising. The bottom trace is the changes in the ST segment on their ecg trace. The ST segment is the component watched during a diagnostic stress test. It falls during exercise in those with ischaemic heart disease, and the greater fall when exposed to exhaust fumes shows that the heart muscle is suffering greater stress on its oxygen supply. This direct experimental evidence backs up the epidemiologic evidence of increased heart attacks on bad air days.
It also points to the special toxicity of diesel exhaust, which is a worry as there are increasing numbers of diesel powered vehicles.

Cancer and mortality effects occur right down to 8ug/m3

Pope, JAMA 2002,

Figure 2. Nonparametric Smoothed Exposure Response Relationship



Vertical lines along x-axes indicate rug or frequency plot of mean fine particulate pollution; $PM_{2.5}$, mean fine particles measuring less than 2.5 µm in diameter; RR, relative risk; and CI, confidence interval.

American cancer society cohort study of 1.2 million people, of whom 500,000 could be located to a metropolitan area with good air quality data. Enrolled 1982, followed to 1998. Adjusted for age, sex, race, education, smoking, BMI. Coarse particles and Total Suspended Particulates did not show the same relationship.

How does pm2.5 exposure compare to smoking?

- Relative risk for all cause mortality from smoking 22 cigarettes a day was 2.58, from 10ug/m3 PM2.5 was 1.06, ie 16 times smaller.
- For all cause mortality, PM 2.5 exposure at 25ug/m3 equates to smoking 3 cigarettes a day.

- Based on Pope, JAMA, 2002

How was that done? 1.06 to the power of 16.5 = 2.58 , so the risk of 10ug pm2.5 equals 22/16 cigarettes= 1.37, and assuming the effect is linear, 25ug/m3 equates to 3.4 cigarettes.
Relative risks must be compared exponentially. A relative risk of 2.58 is equal to the effect of 16.5 exposures with relative risk 1.06.

Current disease burden, air pollution

APPENDIX 2: ADDITIONAL HEALTH OUTCOMES DUE TO AIR POLLUTION

Table A.2: Annual number of additional health outcomes at mean ambient pollution level (effects of PM_{10} *with* threshold of 7.5 µg/m^3)

Health impacts	Sydney low–high (base incidence)	Hunter low–high (base incidence)	Illawarra low–high (base incidence)	Total low–high (base incidence)
Mortality (long-term effects) — >30 years	643 to 1 446 (19 825)	210 to 473 (6 433)	75 to 170 (2 573)	929 to 2 089 (28 831)
Respiratory hospital admissions	359 to 784 (56 064)	90 to 197 (13 998)	39 to 85 (6 775)	489 to 1 067 (76 837)
Cardiovascular hospital admissions	561 to 1 206 (73 102)	167 to 358 (21 542)	73 to 156 (10 517)	801 to 1 720 (105 161)
Acute bronchitis (<15 years)	7 149 to 18 945 (48 200)	1 933 to 5 112 (12 944)	724 to 1 969 (5 349)	9 806 to 26 025 (66 493)
Asthma attacks (<15 years)	1 184 to 2 605 (35 182)	344 to 758 (10 159)	97 to 215 (3 201)	1 626 to 3 578 (48 542)
Asthma attacks (>15 years)	0 to 1 027 (100 507)	0 to 275 (26 757)	0 to 74 (8 022)	0 to 1 376 (135 286)
Restricted activity days (>19 years)	14 517 to 19 350 (156 966)	3 558 to 4 741 (38 203)	1 282 to 1 714 (15 270)	19 357 to 25 806 (210 439)
Chronic bronchitis (adults)	237 to 4 126 (20 611)	58 to 1 010 (5 016)	21 to 368 (2 005)	315 to 5 504 (27 632)

This is from the work of Geoff Morgan, for the NSW health dept in 2003, available on the NSW dept environment web site. The current health burden from air pollution is large and under appreciated. Annual deaths attributable to air pollution in greater Sydney is in the range from 929 to 2089. To put this in perspective the annual road toll for the whole of NSW averages 367.

Cost of health impacts of air pollution

- Morgan 2003

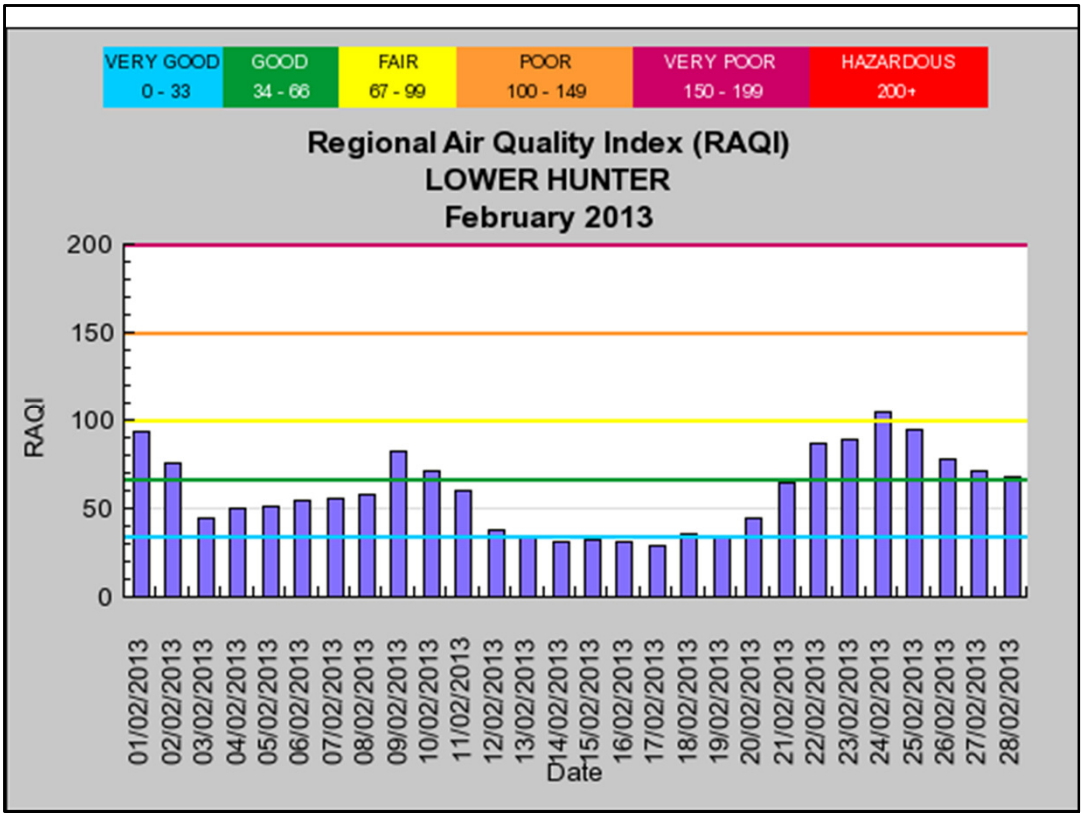
Table 6.3.1: Annual health costs of air pollution in the GMR (2003$)

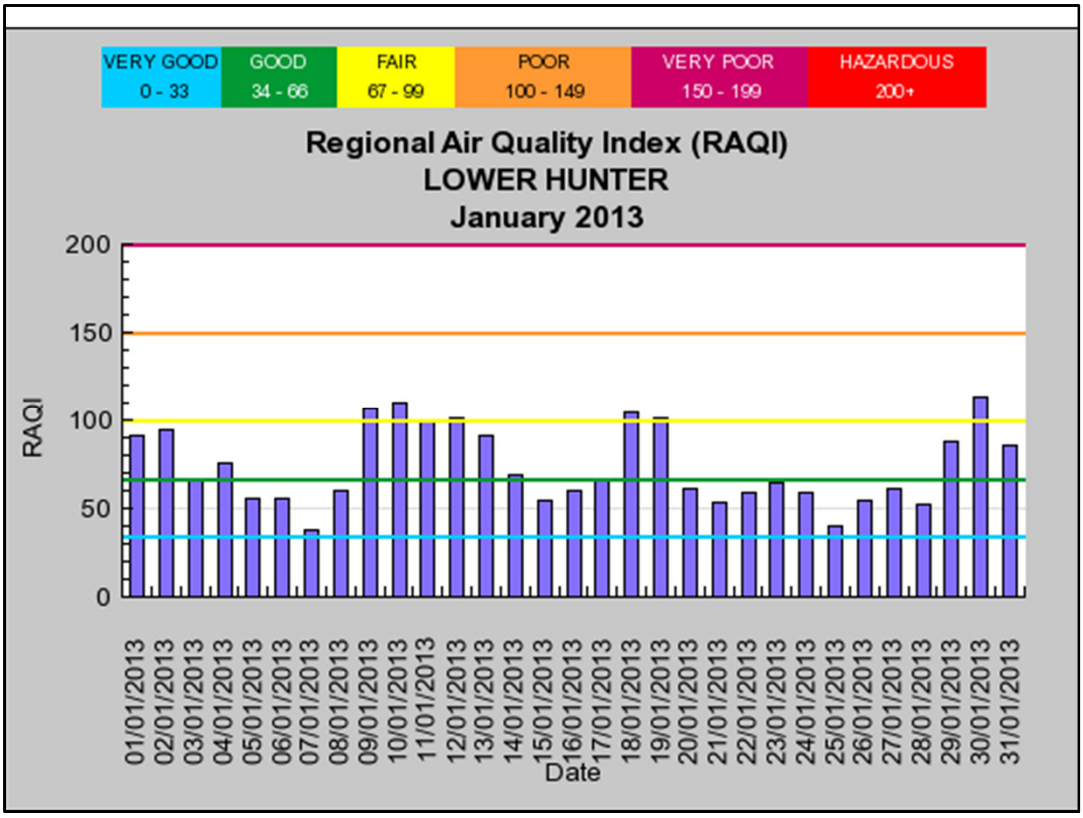
Region	Low	High	Midpoint
	Total cost at mean ambient level ($ million)		
Sydney	706	5,994	3,350
Hunter	226	1,765	996
Illawarra	81	638	360
GMR	1,013	8,397	4,705
	Cost per tonne of PM_{10} ($ thousand)		
Sydney	28	235	132
Hunter	8	63	35
Illawarra	6	46	26

These are the dollar values attributed to the health outcomes in the last slide. This 3.3 billion dollars is a huge and hidden cost, in the range of 0.4 to 3.4% of GDP. 2003 dollars.

Proposed 4th coal loader in Newcastle would pose additional health costs

- Applying G. Morgan's calculations of health cost burden of PM10 in the Hunter to the expected extra 363 t of pm10 per year as noted in the T4 EIS gives the conservative estimate of an additional $29 million per year health costs in 2011 dollars.


VERY GOOD
0 - 33
GOOD
34 - 66
FAIR
67 - 99
POOR
100 - 149
VERY POOR
150 - 199
HAZARDOUS
200+
Regional Air Quality Index (RAQI)
LOWER HUNTER
February 2013
RAQI
200
150
100
50
0
01/02/2013
02/02/2013
03/02/2013
04/02/2013
05/02/2013
06/02/2013
07/02/2013
08/02/2013
09/02/2013
10/02/2013
11/02/2013
12/02/2013
13/02/2013
14/02/2013
15/02/2013
16/02/2013
17/02/2013
18/02/2013
19/02/2013
20/02/2013
21/02/2013
22/02/2013
23/02/2013
24/02/2013
25/02/2013
26/02/2013
27/02/2013
28/02/2013
Date



The last 2 months air quality for Newcastle in not reassuring. There have been quite a few excedences, and as shown by the evidence from Pope, health effects from PM 2.5 occur at much lower levels than the current standards.

Summary

- Air pollution has significant health effects at current levels, even below the standards. It is a small individual risk falling on a very large number of people.

My calculations based on the study by Pope show that breathing air containing PM2.5 at 25ug/m3 has a similar health burden to smoking 3 cigarettes a day.

I think the evidence points to setting the 24 hour pm2.5 standard at less than 25ug/m3.

- New industry that increases particulate pollution is a threat to public health.