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Mr Simon Birkett  
Campaign for Clean Air in London

**CCU Ref: DWOE165739**

1 February 2010

Dear Mr Birkett,

### **Air quality**

Thank you for your letter of 8 January about air quality. I have been asked to reply.

In 1998 the Committee on the Medical Effects of Air Pollutants (COMEAP) published a report on the quantification of the effects of air pollution on health<sup>1</sup>. Estimates of the effects of short-term exposure to air pollutants were calculated. These calculations were based on 1995 and 1996 air pollution levels, which have since fallen. The committee considered it likely that long-term exposure to air pollutants could damage health but concluded that there was insufficient UK data to allow acceptably accurate quantification of these effects.

In the light of new evidence, COMEAP returned to this question in 2001. The committee published a statement and report on long-term effects of particles on mortality<sup>2</sup> in which they concluded that it was more likely than not that a causal association exists between long-term exposure to particles and mortality. In the report estimates of the health impacts of both long-term and short-term exposure to particles on a per  $\mu\text{g}/\text{m}^3$  basis were calculated. It was noted that the health impacts of long-term exposure were considerably greater than the short-term effects. The report also noted 'as a rough guide' that  $\text{PM}_{2.5}$  could be responsible for an average loss of life expectancy from birth of about 2-20 months.

Updated estimates on the impact of exposure to air pollution were published in the Air Quality Strategy<sup>3</sup> 2007 for England, Scotland, Wales and Northern Ireland. Average loss in life expectancy figures (a reduction of 7-8 months) and total life years lost were used to express the impact of long-term exposure to particles. Estimates of deaths brought

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<sup>1</sup>[http://www.dh.gov.uk/dr\\_consum\\_dh/groups/dh\\_digitalassets/@dh/@ab/documents/digitalasset/dh\\_108458.pdf](http://www.dh.gov.uk/dr_consum_dh/groups/dh_digitalassets/@dh/@ab/documents/digitalasset/dh_108458.pdf)

<sup>2</sup>[http://www.dh.gov.uk/ab/COMEAP/DH\\_108596](http://www.dh.gov.uk/ab/COMEAP/DH_108596)

<sup>3</sup><http://www.defra.gov.uk/environment/quality/air/airquality/strategy/index.htm>



forward as a result of the short-term effects of air pollutants were made for the analysis of the individual policies considered in the Air Quality Strategy.

Since 2001, when referring to the 1998 quantification report, we have emphasised, that the estimate of 8100 deaths brought forward for PM<sub>10</sub> was based on air pollution levels that have since declined and that additional health outcomes, including the effects of long-term exposure, have since been accepted (for example, see the 2003 PQ 09143). There has not been a cover-up; it is just that the larger health impact of long-term exposure to fine particles that has been acknowledged has been expressed in terms of loss of life-expectancy rather than numbers of deaths.

COMEAP has updated its recommendations regarding the coefficients linking long-term exposure to air pollution to the effect on mortality in its 2009 report<sup>4</sup>, confirming its interim statement in 2006<sup>5</sup>. Calculations of the total health impact of the long-term exposure to fine particles (PM<sub>2.5</sub>) will be done as part of a forthcoming supplement to this report. This will include a consideration of the different metrics that can be used to express the health effects.

The Government is often asked 'What is the impact of air pollution on health in the UK'? This question is not as simple as it sounds. If the question was a neutral question about the proportion of total deaths that may involve a contribution from air pollution and there were no plans to take any action to change levels of pollution, then an estimate per year might be appropriate. However, we believe that this is not usually the intention of the question. The intention comes from a concern that air pollution ought to be reduced and that lives would be saved as a result. To represent the effects of long-term exposure to PM<sub>2.5</sub> we have therefore approached this question by modelling a hypothetical removal of anthropogenic PM<sub>2.5</sub> in the year in question and in subsequent years.

It is important to realise that if PM<sub>2.5</sub> is reduced, then more people will survive into the following year. If the reduction is maintained into the following year, then there will again be a reduction in deaths but the net result will be a combination of three factors:

- (i) the reduction in fine particles (which will reduce numbers of deaths)
- (ii) the increased size of the population due to survivors from the previous year (larger populations give larger numbers of deaths)
- (iii) the increased age of the population due to the survivors from the previous year being one year older (populations with a higher proportion of older people give larger numbers of deaths).

Due to the counteracting effects of factors (ii) and (iii), the reduction in the number of deaths in the second year will be less than in the first. This counteracting effect due to changes in population size and age, accumulates over time so that the reduction in numbers of deaths becomes progressively smaller. Eventually, there will actually be more deaths in the reduced pollution scenario because those in the scenario where pollution was not reduced have already died. Without new births, the final outcome after about 100

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<sup>4</sup> [http://www.dh.gov.uk/ab/COMEAP/DH\\_108151](http://www.dh.gov.uk/ab/COMEAP/DH_108151)

<sup>5</sup> [http://www.dh.gov.uk/dr\\_consum\\_dh/groups/dh\\_digitalassets/@dh/@ab/documents/digitalasset/dh\\_096803.pdf](http://www.dh.gov.uk/dr_consum_dh/groups/dh_digitalassets/@dh/@ab/documents/digitalasset/dh_096803.pdf)

years is that everyone in both scenarios will have died and the net difference in numbers of deaths will be zero.

The complex nature of the change in the pattern of deaths over time, and the fact that, in the long-term, everyone will die, leads us to prefer total life years and average gain or loss of life-expectancy as the appropriate metric. These metrics represent the fact that PM<sub>2.5</sub> affects the timing of people's deaths not whether they die (nobody is immortal!). While the criticism that total life years is difficult for the public to grasp is understandable, we do believe that the general public understands the concept of life-expectancy reasonably well.

Time-series studies, which examine associations between daily levels of air pollution and percentage increase in mortality, are used to estimate the effect of air pollution on deaths in the UK population. Death is affected by bringing forward the date of death and it is not possible to estimate by how long. In the UK, calculations of the numbers of deaths affected per year by exposure to PM<sub>10</sub>, SO<sub>2</sub> or O<sub>3</sub> is expressed in terms of 'deaths brought forward'<sup>1</sup>.

We do not generally support the use of coefficients from cohort studies (which examine effects of long-term exposure) in calculating numbers of deaths. In the UK, the estimated health impact of long-term exposure to fine particulate air pollution is expressed in terms of 'loss of life expectancy'. The reasoning behind our preference for this metric, i.e. 'loss of life expectancy', instead of deaths is explained above. Therefore, any comparison with alcoholism, obesity and smoking would be most appropriate on the basis of total life-years lost or average loss of life-expectancy. It also worth noting that some of the deaths due to alcoholism and obesity can be clinically identified. The relevant contributing disease can be listed as an underlying cause of death by ONS<sup>6</sup>. This is not possible for deaths where air pollution is a contributing cause.

I hope that this letter addresses your concerns.

Yours sincerely,

Defra - Customer Contact Unit

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<sup>6</sup> See Lords PQs 505 and 506 (2009)  
<http://services.parliament.uk/hansard/Lords/ByDate/20091022/writtenanswers/part009.html>