Clean Air IN LONDON

Clerk of the Committee
Environmental Audit Committee
House of Commons
7 Millbank
London SW1P 3JA

By email and post: eacom@parliament.uk

13 December 2009

Dear Member of the Environmental Audit Committee

The AIR QUALITY INQUIRY MEMORANDUM by the CAMPAIGN FOR CLEAN AIR IN LONDON

One of the worst public health failings or 'cover-ups' in modern history with over 250,000 premature deaths due to poor air quality in the UK undisclosed over 10 years*

Introduction

1. I am writing on behalf of the cross-party Campaign for Clean Air in London (CCAL) to submit a memorandum to the Environment Audit Committee's (EAC's) inquiry into Air Quality which opened on 21 October and closes on 14 December 2009. Thank you for the opportunity for do so. The EAC's announcement of the inquiry can be seen at:

   http://www.publications.parliament.uk/pa/cm/cmenvaud.htm

2. The purpose of CCAL is to achieve urgently and sustainably at least World Health Organisation (WHO) recommended standards of air quality throughout London. CCAL operates under the auspices of The Knightsbridge Association, an amenity society. Further details of CCAL's mission and its supporters can be found at www.cleanairinlondon.org.

3. CCAL supports strongly all the comments made by ClientEarth and Environmental Protection UK in their responses to this inquiry (except if in conflict with this letter in which case this letter prevails).

4. Please acknowledge receipt of this letter to the email address provided separately.

* CCAL calculation for the UK using COMEAP 2009's 6% coefficient and methodology described in Appendix 3. In other words, the government seems to have decided not to disclose since 1998 an updated estimate of the number of premature deaths due to exposure to dangerous airborne particles ($PM_{2.5}$ or PM_{10}). There is a separate question as to whether the 250,000 figure is a substantial underestimate.

Summary

5. **No effective strategy**: In CCAL's carefully considered view, the UK does not have an effective strategy to comply fully with air quality laws and shows no sign of developing one. The EAC's inquiry is therefore timely.

6. At separate public meetings in November and December 2009, highly respected members of COMEAP (the Committee on the Medical Effects of Air Pollution) were referring still to 8,100 premature deaths per year due to PM_{10} in urban areas of Great Britain (Table 1.1 on page 3 of the COMEAP 1998 report). CCAL can find no other official number disclosed by the government for total premature deaths due to $PM_{2.5}$ or PM_{10} in the UK since 1998. The COMEAP 1998 report was titled 'Quantification of the Effects of Air Pollution on Health in the United Kingdom' and recommended a coefficient of 0.75% per 10 $\mu g/m^3$ PM_{10} (e.g. 1.07% $PM_{2.5}$) See also:

   http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4006323

7. CCAL estimates, using COMEAP's 2009 recommendation of a 6% coefficient per 10 $\mu g/m^3$ $PM_{2.5}$, there were around 35,000 premature deaths due to dangerous airborne particles ($PM_{2.5}$) (which would be the same for PM_{10} based on current government advice) in the UK in 2005 (and perhaps 51,537). See Appendix 2 and paragraph 25 below.

8. **Failings or 'cover-up' of the real health impact**: Assuming CCAL is correct, pending a better estimate from the government, it is not unreasonable to assume there have been some 350,000 premature deaths due to $PM_{2.5}$ and/or PM_{10} over the last 10 years compared to the 81,000 premature deaths one might have assumed from COMEAP or government published figures. In CCAL's view, this 'gap' of over 250,000 may represent one of the biggest public health failings or 'cover-ups' in modern history. Action: We need clarity now on the actual and Precautionary Principle figures.

9. **CCAL is concerned separately, based on a close reading of the Peer Review of the COMEAP 2009 report, that COMEAP may be substantially underestimating the health impact at 6% per 10 $\mu g/m^3$ $PM_{2.5}$. Higher coefficients of 12%, 15%, 16% and/or 17% are possible.**

10. **Modeling is not 'fit for purpose'**: The government's modeling of air quality concentrations over the last decade has not been 'fit for purpose'. It has pointed and continues to point to expected sharp reductions in concentrations of dangerous air pollutants. Each year, the government registers apparent 'surprise' when actual results show the opposite picture. What is more alarming is that the UK has justified less monitoring of air pollution than other countries on the back of its commitment to modeling. This is not acceptable and again endangers public health and the successful planning and delivery of an effective strategy to improve air quality. Action: Future strategy should assume no change in concentrations under business as usual until

modeling is proven to be reliable.

11. **No coherent delivery chain**: The almost total disjunction between the government's responsibility, on behalf of the Member State, and the 'work towards compliance' duty on local authorities has been a recipe for failure. In general, local authorities (and the Mayor of London) seem to have little appetite to take action they are not required to take. Action: The Environment Agency should be given national responsibility, authority, accountability and adequate resources to ensure full compliance everywhere with air quality laws (perhaps as in the USA; proposed at Heathrow; and/or in relation now to flooding). Alternatively or additionally, a very clear chain of delivery needs to be defined for each layer of government and others. See also Appendix 5.

12. **Next steps**: Many steps need to be taken to improve air quality in the UK and comply fully with air quality laws. These include: scrapping COMEAP and replacing it with a body more like the Health Effects Institute in the USA; giving the Mayor of London sole responsibility for complying immediately with EU limit values for PM_{10}; using everything including the 'kitchen sink' to ensure full compliance with EU limit values for nitrogen dioxide (NO_2); and launching a major campaign to build public understanding of the health risks of poor air quality and the actions needed to minimise them.

13. **The opportunity**: Protecting public health and complying with air quality laws also offers many co- benefits. The UK could show at the 2012 Olympics how air pollution and wider sustainability issues can be tackled successfully in major cities. Ridicule is in prospect if air quality is not tackled.

Health and environmental risks caused by poor air quality

Warning: CCAL has a lay understanding of epidemiology but has made every reasonable effort to ensure the accuracy of its statements on health risks.

Health risks - Dangerous airborne particles (see also Appendix 1)

14. Dangerous airborne particles are usually categorised by size: fine particles called $PM_{2.5}$ (less than 2.5 microns in diameter (μm)); coarse particles called $PM_{2.5-10}$; and PM_{10} (less than 10 μm in diameter). $PM_{2.5}$ arises largely from combustion and $PM_{2.5-10}$ arises largely from mechanical processes e.g. tyre and brake wear. A recent EEA/ETC report estimated that within Europe about 70% of PM_{10} concentrations comprise $PM_{2.5}$. i.e. 0.75% per 10 $\mu g/m^3$ PM_{10} = 1.07% per 10 $\mu g/m^3$ of $PM_{2.5}$.

15. Note: COMEAP's advice is that there is little risk in the coarse fraction so its health impacts are often not quantified i.e. all the risk for PM_{10} is contained in $PM_{2.5}$. Some scientists disagree and consider that toxicity appears across the PM fraction. CCAL has adopted COMEAP's stance for simplicity i.e. the number of premature deaths due to $PM_{2.5}$ and PM_{10} is the same.

16. CCAL's understanding of the timeline of knowledge about the health risks of $PM_{2.5}$ and PM_{10} is set out in Appendix 1 and more briefly below.

17. In 1998, in its report titled "Quantification of the Effects of Air Pollution on Health in the United Kingdom", COMEAP proposed in paragraph 9.18 on page 57 a hazard rate (or risk coefficient) for short term exposures of 0.75% per 10 $\mu g/m^3$ PM_{10} as a 24 hour mean for all ages. It felt there was insufficient data to allow acceptably accurate quantification of [long term] health effects.

18. In March 2001, in its report titled "Statement and Report on Long-Term Effects of Particles on Mortality", COMEAP proposed a hazard rate (or risk coefficient) for long term exposures of 0.1% per 1 $\mu g/m^3$ drop in annual mean $PM_{2.5}$ for those aged 30 years and over (i.e. 1.0% per 10 $\mu g/m^3$).

19. In June 2009, in its report titled "Long-Term Exposure to Air Pollution: Effect on Mortality", COMEAP proposed in paragraph xiii on page 3 a hazard rate (or risk coefficient) for long term exposures of 6.0% per 10 $\mu g/m^3$ increase in annual mean $PM_{2.5}$ for those aged 30 years and over.

20. CCAL urges the EAC to consider the Peer Review comments submitted on COMEAP's draft report (see Appendix 1 of COMEAP 2009) which include serious criticisms of COMEAP's choice of coefficients and of the elicitation process used by COMEAP to choose the recommended coefficient.

See: http://comeap.org.uk/documents/reports/63-long-term-exposure-to-air-pollution-effect-on-mortality.html

21. CCAL urges the EAC to consider Defra's report on the impact of delay in complying with air quality laws on race. It is titled 'UK notification to the European Commission to extend the compliance deadline for meeting PM_{10} limit values in ambient air to 2011, Race Equality Impact Assessment (England)'. See Appendix 6**.**

22. CCAL is not aware of any update on the total societal costs of poor air quality since Table 2.14 on page 90 of the Defra 2007 Air Quality Strategy (AQS):

    http://www.defra.gov.uk/publications/2011/03/26/air-quality-strategy-vol1-pb12654/

    While 6% remains the COMEAP 2009 recommendation, the range for 2005 societal costs is £8.582 bn to £20.165 bn. The 7 to 8 months average national impact in life expectancy appeared in the Foreword of the same 2007 AQS.

23. Applying COMEAP 2009 recommendations using the Precautionary Principle suggests a coefficient of 15%. Even however at a lower 12%, the societal costs were £16.238 bn to £38.115 bn in 2005 (per Table 2.14 in the 2007 AQS).

Government or COMEAP statements re premature deaths due to $PM_{2.5}$ in the UK in 2005

24. At separate public meetings in November and December 2009, highly respected members of COMEAP were referring still to a 1998 COMEAP figure of 8,100 premature deaths per year

due to PM_{10} in urban areas of Great Britain (Table 1.1 on page 3 of the COMEAP 1998 report). CCAL can find no other official number disclosed by the government for total premature deaths due to $PM_{2.5}$ or PM_{10} in the UK since 1998. The COMEAP 1998 report was titled 'Quantification of the Effects of Air Pollution on Health in the United Kingdom'. See also:

http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4006323

The public events were the Environmental Protection UK autumn conference on 12 November 2009 and the Royal Society of Chemistry's annual conference on 9 December 2009.

CCAL's lay calculation of premature deaths due to $PM_{2.5}$ in the UK in 2005

25. The European Topic Centre on Air and Climate Change estimated in its paper titled 'Health Impacts and Air Pollution – An exploration of factors influencing estimates of air pollution impact upon the health of European citizens' in December 2008 estimated that there were 51,537 premature deaths attributable to exposure to ambient PM_{10} concentrations in the UK in 2005 (Table 1.1 on page 8).

    See: http://acm.eionet.europa.eu/reports/ETCACC_TP_2008_13_HealthImpact_AirPoll

26. CCAL has calculated the number of premature deaths due to $PM_{2.5}$ in the UK in 2005 using three separate methods (see Appendix 2).

27. CCAL estimates that between 33,000 to 40,000 people died prematurely due to $PM_{2.5}$ (or PM_{10}) in the UK in 2005 assuming the COMEAP 2009 6% coefficient. The number may be as high as 51,537 (see paragraph 25 above). Note that levels of $PM_{2.5}$ have been broadly static over the last 10 years.

28. Assuming CCAL is correct, pending a better estimate from the government, it is not unreasonable to assume there have been some 350,000 premature deaths due to $PM_{2.5}$ and/or PM_{10} over the last 10 years compared to the 81,000 premature deaths one might have assumed from COMEAP or government published figures. In CCAL's view, this 'gap' of over 250,000 may represent one of the biggest public health failings or 'cover-ups' in modern history.

29. CCAL is concerned separately, based on a close reading of the Peer Review of the COMEAP 2009 report, that COMEAP may be substantially underestimating the health impact at 6% per 10 $\mu g/m^3$ $PM_{2.5}$. Higher coefficients of 12%, 15%, 16% and/or 17% are possible.

CCAL's lay calculation of premature deaths due to $PM_{2.5}$ in London boroughs in 2005

30. CCAL has similarly calculated the number of premature deaths due to $PM_{2.5}$ in London in 2005 for each London borough (Appendices 3 and 3A). CCAL estimates that there were between 3,500 (assuming a 6% coefficient) and 6,500 (assuming a plausible 12% coefficient) and 7,900 (using a wider 15% coefficient) premature deaths due to $PM_{2.5}$ in London in 2005. The actual numbers may be around 10% higher depending on average population-weighted exposures

in outer London. These numbers dwarf the 1,031 premature deaths due to PM_{10} in 2005 that the government told Mayor Livingstone which were based on a coefficient of 0.75% per 10 $\mu g/m^3$ increase in PM_{10} (per COMEAP's 1998 recommendation) (refer to CCAL letter to Mayor Johnson dated 20 September 2009).

Health risks - Nitrogen dioxide (NO_2) (see also Appendix 4)

31. At Environmental Protection UK's autumn conference on 12 November 2009, CCAL recollects Professor Jonathan Ayres, Chairman of COMEAP, making a personal comment (i.e. not official COMEAP policy) to the whole meeting that public exposure to ambient concentrations of nitrogen dioxide in the urban environment is 'irrelevant' for public health. CCAL recollects Professor Ayres went on to emphasise though that NO_2 has the advantage of being very easy to monitor and it is a reliable indicator of hazardous vehicle emissions. Despite these important clarifications, CCAL considers that Professor Ayres' personal comments could be a source of public confusion and therefore merit clarification from the government.

Environmental risks

32. CCAL draws the EAC's attention to the European Commission's press release dated 12 December 2007 which included estimates of the cost impact of air pollution on biodiversity. See:

    http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/07/571&format=HTML&aged=1&language=EN&guiLanguage=en

Summary health issues and the effective communication of them

33. A cynic might say that COMEAP in 2009 chose not to increase its coefficient of total mortality for $PM_{2.5,}$ despite significant new research published n 2005 and 2006, because: it did not wish to 'run' ahead' of WHO advice (2006); the European Commission's CAFÉ programme; and/or Defra's Air Quality Strategy (2007). A cynic might also suggest that COMEAP may have been concerned about presenting health impact coefficients much higher than those it had identified in 1998 and 2001.

34. CCAL's carefully considered view, influenced by comments in the Peer Review of COMEAP 2009, is that COMEAP is likely to have understated (perhaps very substantially) in 2009 the health impact of poor air quality.

35. Further, CCAL considers that the Precautionary Principle should be followed when public health is at risk. On this basis, COMEAP's 2009 recommendations point to coefficients of 12% or 15% per 10 $\mu g/m^3$ $PM_{2.5}$.

36. Irrespective of the correct coefficient for total mortality, CCAL considers it important to communicate the health impact of poor air quality appropriately (i.e. in a manner which is meaningful and most useful) to different audiences. There are four common metrics: premature or attributable deaths; total (e.g. national) years of life lost (YLL); average reduction in life expectancy across the whole UK population; and years lost per statistical victim. In CCAL's

experience, premature death and years of life lost per statistical victim are the most effective measures to use for communication with the general public. Clearly, as with all risks, it is important to explain the meaning of the metric carefully. YLL may be appropriate for economists *et al*.

37. Please note that CCAL has not mentioned the health impact of other forms of air pollution in this memorandum e.g. ozone (O_3) and sulphur dioxide (SO_2).

38. In CCAL's view, Londoners should be warned that up to one person in eight who died in Greater London in 2005 may have done so due to exposure to dangerous airborne particles (assuming only Average UK population-weighted exposures in London). Research published in 2001 by Professor Nino Kunzli suggests that those who die prematurely due to dangerous airborne particles may do so, on average, 9.8 years early. On this basis, the health impact of poor air quality in London is similar or greater to that for alcoholism, obesity and/or smoking.

Steps that need to be taken to ensure that air quality targets will be met in future

39. Many steps need to be taken to improve air quality in the UK and comply fully with air quality laws including those set out below.

40. The government must 'grip' the UK's serious air quality problem and deliver on its responsibilities.

41. The government must disclose as a matter of urgency its assessment of the number of premature deaths due to dangerous airborne particles ($PM_{2.5}$) in each region of the UK in 2005 (or preferably a more recent year) (using at a minimum COMEAP 2009's 6% coefficient) together with a Precautionary Principle number (e.g. the 15% coefficient). Also an estimate of the years of life lost per statistical victim. These metrics are provided for other health risks e.g. obesity and smoking.

42. The government should scrap COMEAP or revamp it to ensure its independence, effective governance and focus on highlighting multiple metrics and adopting explicitly a faster review of evidence and the use of the Precautionary Principle approach to protect public health. CCAL would favour replacing COMEAP with a body more like the Health Effects Institute in the USA with its Independent Board of Directors (with legal duties). See: http://www.healtheffects.org/index.html

43. The government must weigh benefits and costs against the need to meet air pollution deadlines whether for air quality or climate change.

44. The government should give the Mayor of London legal responsibility for ensuring full compliance with air quality laws for PM_{10} immediately.

45. The government needs to take a strong lead on ensuring compliance with air quality laws for NO_2. In CCAL's view this may require 'every measure available including the kitchen sink'. See Defra's write up of its NO_2 measures workshop dated 4 August 2009.

46. It is imperative that planning takes place now to ensure full compliance with air quality laws for $PM_{2.5}$ since these are likely to drive public health benefits once EU limit values for PM_{10} and NO_2 are met.

47. CCAL has proposed 65 recommendations to improve air quality in London (Appendix 7). Many are relevant nationally. These include 'The London Matrix', 'The London Principle' and 'The London Circles'.

48. The government must maximise economy of scale benefits by taking an active lead and giving directions on measures such as inner city low emission zones (to avoid national waste and chaos).

49. The government must drop its myopic focus on CO_2 to the exclusion of other air pollutants. In particular, its approach to diesel has been a significant cause of poor quality in our biggest cities.

50. A major public understanding campaign should be launched to warn people about the dangers of poor air quality and the measures individuals can take to reduce its impact.

51. Government should press the European Commission and the WHO to update urgently (and well before 2013) their recommendations for the health impact of poor air quality based on the most up to date scientific research referred to in this memorandum or otherwise.

52. Protecting public health and complying with air quality laws will show how air pollution and sustainability can be tackled successfully. The 2012 Olympics offers an opportunity to do so.

Close

53. CCAL would be pleased to clarify or provide further evidence and/or give verbal evidence to the EAC.

54. Please confirm that CCAL may publish this letter on its website and otherwise circulate it.

55. CCAL has copied this letter to the National Audit Office team investigating air quality for the EAC.

With best wishes.

Yours sincerely

Simon Birkett
Founder and Principal Contact

Campaign for Clean Air in London

Enclosures

Cc: National Audit Office

APPENDIX 1 Health risks - Dangerous airborne particles

56. Dangerous airborne particles are usually categorised by size: fine particles called $PM_{2.5}$ (less than 2.5 micrograms per cubic metre (μ/m^3)); coarse particles called $PM_{2.5-10}$; and PM_{10} (less than 10 μ/m^3). $PM_{2.5}$ arises largely from combustion and $PM_{2.5-10}$ arises largely from mechanical processes e.g. tyre and brake wear. A recent EEA/ETC report estimated that within Europe about 70% of PM_{10} comprises $PM_{2.5}$. i.e. 0.75% per 10 $\mu g/m^3$ PM_{10} = 1.07% per 10 $\mu g/m^3$ of $PM_{2.5}$

57. Note: COMEAP's advice is that there is little risk in the coarse fraction so its health impacts are often not quantified i.e. all the risk for PM_{10} is contained in $PM_{2.5}$. Some scientists disagree and consider that toxicity appears across the PM fraction. CCAL has adopted COMEAP's stance for simplicity i.e. the number of premature deaths due to $PM_{2.5}$ and PM_{10} is the same.

58. CCAL's understanding of the timeline of knowledge about the health risks of $PM_{2.5}$ and PM_{10} is set out below.

59. Initially, scientists considered that the health impacts of air pollution included respiratory problems and perhaps cancer. They used time series studies that analysed the rise in deaths around the time of air pollution 'episodes'. Subsequent research identified the dominance of cardiovascular disease as a cause of death. Long term, so-called cohort studies, undertaken over decades have tracked the health impact of $PM_{2.5}$ and found a lack of 'threshold' i.e. no safe level of exposure.

60. The two studies most widely cited in the literature are based on the American Cancer Society (ACS) and Harvard Six Cities cohorts (COMEAP 2009, page 174). The ACS cohort study followed several hundred thousand people in metropolitan areas across the USA.

61. In 1998, in its report titled "Quantification of the Effects of Air Pollution on Health in the United Kingdom", COMEAP stated in paragraph 9.18 on page 57:

"We have taken as a coefficient of effect an increase of 0.75% per 10 $\mu g/m^3$ PM_{10} as a 24 hour mean. On this basis, we estimate that PM_{10} contributes to the advancement of around 8,100 deaths in the urban population of Great Britain annually."

"In the view of this subgroup and COMEAP, in addition to the effects recorded here, it is likely that long-term exposure to air pollutants also damages health. At present there are insufficient data

to allow acceptably accurate quantification of these effects and the sub- group was not confident in applying UK estimates of exposure-response coefficients from long term studies undertaken elsewhere. However, if estimates made elsewhere, especially in the USA, do apply in the UK, they suggest that the overall impacts may be substantially greater than those we have as yet been able to quantify." Paragraph 1.14 on page 3.

See:http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4006323

It seems the full report can no longer be purchased or accessed online. CCAL has a copy.

62. In other words, based on time series studies, COMEAP 1998 proposed a hazard rate (or risk coefficient) for short term exposures of 0.75% per 10 $\mu g/m^3$ PM_{10} as a 24 hour mean for all ages. It felt there was insufficient data to allow acceptably accurate quantification of [long term] health effects.

63. In March 2001, in its report titled "Statement and Report on Long-Term Effects of Particles on Mortality", COMEAP stated in paragraph 59 (iv) on page 23:

"Although intended as only a rough comparison, this does suggest that the gain in life years from the cohort studies is at least 10 fold greater than estimates from the time series studies alone."

"For long term exposures it stated in the Table in paragraph 10 on page 3 "0.1% based on a 1 $\mu g/m^3$ drop in annual mean $PM_{2.5}$ [for those aged 30 years and over]. Estimate considered most likely to be around this size."

See: http://www.advisorybodies.doh.gov.uk/comeap/statementsreports/longtermeffects.pdf

64. In other words, based on cohort studies, COMEAP 2001 proposed a hazard rate (or risk coefficient) for long term exposures of 1.0% per 10 $\mu g/m^3$ drop in annual mean $PM_{2.5}$ for those aged 30 years and over.

65. Kunzli *et al* (2001) stated in 'Assessment of Deaths Attributable to Air Pollution: Should We Use Risk Estimates Based on Time Series of on Cohort Studies':

"In our impact assessment, we assumed that cases' deaths were due to cardiorespiratory disease and that these air pollution-related deaths had the same age distribution as all persons who died from cardiorespiratory diseases. Thus, the amount of time lost, per statististical victim, turned out to be 9.8 years, which corresponds to a change in life expectancy of approximately 0.6 years in the total population."

See: http://aje.oxfordjournals.org/cgi/reprint/153/11/1050

Note: Professor Kunzli's 0.6 years (i.e. 7.2 months) is very similar to the government's current 7-8 months (across 61 million people).

66. Pope *et al* (2002) proposed in 'Lung Cancer, Cardiopulmonary Mortality, and Long-Term exposure to Fine Particulate Air Pollution' an average adjusted mortality relative risk associated with a 10 μg/m^3 change in fine particles measuring less than 2.5 μm in diameter of 1.06 (95% CI 1.02-1.11).

See: http://jama.ama-assn.org/cgi/reprint/287/9/1132

67. Jerrett *et al* (2005) stated in 'Spatial analysis of air pollution and mortality in Los Angeles'. This study was based on data selected from the ACS cohort for the period 1982-2000:

"After controlling for 44 individual covariates, all cause mortality had a relative risk (RR) of 1.17 (95% confidence interval = 1.05-1.30) for an increase of 10 μg/m^3 $PM_{2.5}$ and a RR of 1.11 (0.99-1.25) with maximal control of both individual and contextual confounders."

See: http://www.ncbi.nlm.nih.gov/pubmed/16222161

68. COMEAP published an Interim Statement on 18 January 2006 recommending the use of coefficient based on the average exposure period reported by Pope *et al* 2002 as:

"*…our best, current, estimate of that linking $PM_{2.5}$ and all-cause mortality in the UK' (COMEAP 2009, page 60)"*

"Our interim conclusion is then that the effects on mortality of long-term exposure to a mixture of air pollutants, represented by $PM_{2.5}$, are best characterized by the following coefficient, expressed in terms of the percentage change in relative risk of all cause mortality per 10 μg/m^3 change in annual average $PM_{2.5}$: with 95% CI (1.02-1.11)

"We note this represents a change from that provided in our last report. This reflects the expansion of the evidence-base in this area and our deeper understanding of the effects of pollutants, and other factors, on health." COMEAP 2009, page 61

See:

http://comeap.org.uk/documents/reports/63-long-term-exposure-to-air-pollution-effect-on-mortality.html

69. In 2006, the World Health Organisation published updated global guidelines on air quality. This recommended a coefficient of 6% per 10 μg/m^3 increase in $PM_{2.5}$ which has been used by the European Commission and others in the CAFÉ (Clean Air for Europe) studies.

See: http://comeap.org.uk/documents/reports/63-long-term-exposure-to-air-pollution-effect-on-mortality.html

70. Laden *et al* (2006) stated in 'Reduction in Fine Particulate Air Pollution and Mortality, Extended Follow-up of the Harvard Six Cities Study':

"We found an increase in overall mortality associated with each 10 μg/m^3 increase modeled either as the overall mean (rate ratio [RR], 1.16; 95% confidence interval [CI], 1.07-1.22) or as exposure in the year of death (RR 1.14; 95% CI, 1.13-1.44)."

See: http://ajrccm.atsjournals.org/cgi/reprint/173/6/667

71. In 2007, Defra published its Air Quality Strategy which adopted the 6% coefficient per 10 μg/m^3 increase in $PM_{2.5}$.

72. Pope *et al* (January 2009) stated in 'Fine-Particulate Air Pollution and Life Expectancy in the United States' :

"A decrease of 10 μg per cubic meter in the concentration of fine particulate matter was associated with and estimated increase in mean (+/-SE) life expectancy of 0.61+/-0.20 year."

See: http://content.nejm.org/cgi/reprint/360/4/376.pdf

73. In June 2009, in its report titled "Long-Term Exposure to Air Pollution: Effect on Mortality", COMEAP stated in paragraph xiii on page 3:

"Best estimate of 1.06 with 95% confidence interval 1.02-1.11.

"Our representation of the uncertainty regarding the coefficient linking the relative risk of death from all-causes to long-term exposure to $PM_{2.5}$ is given in the figure.

"For the purposes of conducting impact assessments regarding all-cause mortality and assessing policy interventions designed to reduce levels of air pollutants, we have recommended that the full distribution of probabilities be used as an input into Monte Carlo analysis, the approach we favour. Alternatively, we suggest that the plausible 'low' and 'high' values of 1.01 and 1.12, respectively, based approximately on the 12.5% and 87.5% percentiles of the overall range of plausibility, could be used in sensitivity analyses.

"We also recommend that the wider interval of 0 to 15% (relative risk 1.00 and 1.15) be included in any report on quantification of risks from long-term exposure to particulate air pollution represented by $PM_{2.5}$."

See: http://comeap.org.uk/documents/reports/63-long-term-exposure-to-air-pollution-effect-on-mortality.html

COMEAP went on to state on page 60:

"We have chosen the coefficient based on the averaged exposure period reported by Pope et al (2002) as our best estimate, current, estimate of that linking $PM_{2.5}$ and all-cause mortality in the UK. This coefficient is based on the largest available cohort study."

74. Commenting on this and other criticism of it for excluding key scientific research, COMEAP

stated in paragraph 1 on page 179 "A cut-off date of early 2006 was adopted for published work which was considered in detail. We note that this, unfortunately, excludes an important and influential review by Pope and Dockery (2006) and recommend reading of that review to readers of this report."

75. In other words, based on cohort studies, COMEAP 2009 proposed a hazard rate (or risk coefficient) for long term exposures of 6.0% per 10 $\mu g/m^3$ increase in annual mean $PM_{2.5}$ for those aged 30 years and over.

76. CCAL urges the EAC to consider the Peer Review comments submitted on COMEAP's draft report (see Appendix 1 of COMEAP 2009) which include serious criticisms of its choice of coefficients and of the elicitation process used by COMEP.

See: http://comeap.org.uk/documents/reports/63-long-term-exposure-to-air-pollution-effect-on-mortality.html

77. CCAL urges the EAC to consider Defra's report on the impact of delay in comply with air quality laws on race. It is titled 'UK notification to the European Commission to extend the compliance deadline for meeting PM_{10} limit values in ambient air to 2011, Race Equality Impact Assessment (England)'.

78. CCAL is not aware of any update on total societal costs since that in Table 2.14 on page 90 of Defra's Air Quality Strategy 2007 (AQS):

http://www.defra.gov.uk/publications/2011/03/26/air-quality-strategy-vol1-pb12654/

While 6% remains the COMEAP 2009 recommendation, the range for 2005 societal costs is £8.582 bn to £20.165 bn. The 7 to 8 months appeared in the Foreword of the same Defra AQS.

79. Applying COMEAP 2009 recommendations using the Precautionary Principle suggests a coefficient of 15%. Even however at a lower 12%, the societal costs were £16.238 bn to £38.115 bn in 2005 (per Table 2.14 in the Defra AQS referred to above).

APPENDIX 2 CCAL's lay calculation of premature deaths due to $PM_{2.5}$ in the UK in 2005

80. The European Topic Centre on Air and Climate Change estimated in its paper titled 'Health Impacts and Air Pollution – An exploration of factors influencing estimates of air pollution impact upon the health of European citizens' in December 2008 that there were 51,537 premature deaths attributable to exposure to ambient PM_{10} concentrations in the UK in 2005 (Table 1.1 on page 8).

See: http://air-climate.eionet.europa.eu/reports/ETCACC_TP_2008_13_HealthImpact_AirPoll

81. CCAL has calculated the number of premature deaths due to $PM_{2.5}$ in the UK in 2005 using

three separate methods. **CCAL's first estimate** - The European Environment Agency's report titled 'Spatial assessment of PM_{10} and ozone concentrations in Europe (2005)' provides (in Figure 3.4 on page 20) an estimate of around 650 premature deaths per million i.e. 61 times 650 = 39,650 premature deaths due to PM_{10} (or $PM_{2.5}$) in the UK in 2005.

See: http://www.eea.europa.eu/publications/spatial-assessment-of-pm10-and-ozone-concentrations-in-europe-2005-1

82. **CCAL's second estimate** is based on the methodology in its letters to Mayor Johnson dated 20 September and 17 November 2009 respectively. The total number of UK deaths (all ages) in 2005 was 582,700 (Annex B, Table B1 on page 97 of the report via the link below)

    http://www.ons.gov.uk/ons/rel/kpvs/key-population-and-vital-statistics/no--32--2005-edition/key-population-and-vital-statistics.pdf

Less 1.9% to get deaths of people aged 30 and above (per CCAL letter to Mayor Johnson dated 17 November) = 571,629 deaths

Exposed to 10.144 $\mu g/m^3$ $PM_{2.5}$ as the UK population-weighted average for 2005 (see Appendix 3).

Gives for $PM_{2.5}$ and PM_{10} (i.e. assuming $PM_{2.5}$ and PM_{10} premature deaths are the same as seems to be current government policy):

6% adjusts to 5.74%	= 32,811 premature deaths
12% adjusts to 10.86%	= 62,079 premature deaths
15% adjusts to 13.22%	= 75,569 premature deaths

Therefore, assuming COMEAP's 6% coefficient (2009) gives 32,800 premature deaths for 2005 using the same 6% assumption and the same other parameters (ie 10.144 $\mu g/m^3$ of anthropogenic (i.e. man-made) $PM_{2.5}$) used in the Defra AQS 2007.

83. **CCAL's third estimate** uses the methodology indicated by Professor Kunzli *et al* (2001). A calculation of the equivalent to 7 to 8 months across 61 million people.

    Using (say) 7.5 months, as the average for 61 million people, CCAL calculates:

    (Premature deaths in 2005) x (105 x 9.8 x 12) = (7.5 months x 61m). Hence, premature deaths for 2005 constant levels of $PM_{2.5}$ is 37,050.

    Where 105 is the number of years for the whole cohort to die and 9.8 is the average life lost per victim and 12 converts it to months.

84. **CCAL therefore estimates that between 33,000 to 40,000 people died prematurely due to $PM_{2.5}$ (or PM_{10}) in the UK in 2005 assuming COMEAP 2009's 6% coefficient. The number may be as high as 51, 537.**

85. Assuming CCAL is correct, pending a better estimate from the government, it is not unreasonable to assume there have been some 350,000 premature deaths due to $PM_{2.5}$ and/or PM_{10} over the last 10 years compared to the 81,000 premature deaths one might have assumed from COMEAP or government published figures. In CCAL's view, this 'gap' of over 250,000 may represent one of the biggest public health failings or 'cover-ups' in modern history.

86. CCAL is concerned separately, based on a close reading of the Peer Review of the COMEAP 2009 report, that COMEAP may be substantially underestimating the health impact at 6% per 10 $\mu g/m^3$ $PM_{2.5}$. Higher coefficients of 12%, 15%, 16% and/or 17% are possible.

APPENDIX 3 Agreed calculation of Premature Deaths due to $PM_{2.5}$ in London in 2005

CCAL and the Health Protection Agency (HPA) have used national average annual $PM_{2.5}$ concentrations from Defra's Air Quality Strategy 2007 to calculate the Attributable Deaths in London in 2005 due to exposure to $PM_{2.5}$ and the following further assumptions:

i. London has the same anthropogenic $PM_{2.5}$ (i.e. man-made fine particles) annual average population-weighted mean as the whole UK of 10.144 $\mu g/m^3$ (gravimetric) (see Table 2.11 on page 87 of Volume 3 of Defra's Air Quality Strategy 2007) in 2005. See

ii. http://archive.defra.gov.uk/environment/quality/air/airquality/publications/stratreview-analysis/chap-2-icgb.pdf

iii. Note that Defra assumed (on page 87) the level of non-anthropogenic $PM_{2.5}$ to be constant and estimated it to be about 3.37 $\mu g/m^3$ annual average population-weighted mean.

iv. Dr Heather Walton of the Health Protection Agency confirmed in a presentation to the Air Quality Summit held on 30 November 2009 that Inner London is estimated to have exposure levels for $PM_{2.5}$ 50% higher than the UK national average i.e. 15.216 $\mu g/m^3$;

v. 52,995 total deaths in London in 2005 from Table 4.1b on page 57 of National Statistics: Key Population and Vital Statistics, Local and Health Authority Areas. These deaths comprised 17,650 in Inner London and 35,345 in Outer London. See: http://www.ons.gov.uk/ons/rel/kpvs/key-population-and-vital-statistics/no--32--2005-edition/key-population-and-vital-statistics.pdf

vi. the death rate of those dying before 30 years of age as 1.9% of total deaths from Table 6.1 on page 47 of National Statistics, Population Trends, No. 124, Summer 2006. See: http://www.ons.gov.uk/ons/rel/population-trends-rd/population-trends/no--124--summer-2006/population-trends.pdf

vii. calculated that there were 52,995 x (1 – 0.019) = 51,988 total deaths in London in 2005 of people aged 30 and above split between 17,315 in Inner London and 34,673 in Outer London; and

viii. applied the recommendations from COMEAP's 2009 Report to use a coefficient of 6% per 10

μg/m^3 of $PM_{2.5}$ as the best estimate of Attributable Deaths, with a sensitivity of 12% and a wider interval of 15% (which COMEAP said should be used in any report on quantification of risks from long-term exposure to air pollution represented by $PM_{2.5}$).

The calculation of premature deaths is explained in the footnote on page 46 of the COMEAP 2009 Report. It says:

"If the new concentration change in population-weighted mean for the policy interest is –x μg/m^3 (with a negative sign as the analysis usually concerns reductions), then the new RR [Relative Risk] for an x μg/m^3 reduction is calculated as $1.06^{-x/10}$ [assuming 1.06 is the RR for a 10 μg/m^3 increase in $PM_{2.5}$]. As the equation represents a curved relationship, concentration increments need to be identified as increases or decreases – the new RR will have a different value for a given concentration increment depending on whether it is for an increase or a decrease."

CCAL and the HPA have therefore used the above log-linear function to scale the results to ensure an accurate number and applied the resulting RR to the number deaths of people of 30 years of age and older.

The agreed calculations for London in 2005 using the different coefficients and assuming 1.5 times UK average population-weighted exposures for Inner London and 1.0 times for Outer London are:

6%: **Attributable Deaths = 17,315 x $(1 - 1.06^{-15.216/10.000})$ + 34,673 x $(1 - 1.06^{-10.144/10.000})$ = 3,459**

12%: **Attributable Deaths = 17,315 x $(1 - 1.12^{-15.216/10.000})$ + 34,673 x $(1 - 1.12^{-10.144/10.000})$ = 6,508**

15%: **Attributable Deaths = 17,315 x $(1 - 1.15^{-15.216/10.000})$ + 34,673 x $(1 - 1.15^{-10.144/10.000})$ = 7,900**

Previously CCAL had simply applied the RRs of 1.06, 1.12 and 1.15 figures for the 10.144 μg/m^3 reduction in $PM_{2.5}$ as indicated on page 46 of the COMEAP Report 2009 can be done as an approximation. The differences for a 15.216 μg/m^3 and 10.144 μg/m^3 reduction in $PM_{2.5}$ become:

Instead of 6%: $1 - 1.06^{-15.216/10.000} = 8.48\%$ $1 - 1.06^{-10.144/10.000} = 0.0574$ i.e. 5.74% Instead of 12%: $1 - 1.12^{-15.216/10.000} = 15.84\%$ $1 - 1.12^{-10.144/10.000} = 0.1086$ i.e. 10.86% Instead of 15%: $1 - 1.15^{-15.216/10.000} = 19.16\%$ $1 - 1.15^{-10.144/10.000} = 0.1322$ i.e. 13.22%

APPENDIX 4 Health risks - Nitrogen dioxide (NO_2)

87. At Environmental Protection UK's autumn conference on 12 November 2009, CCAL recollects Professor Jonathan Ayres, Chairman of COMEAP, making a personal comment (i.e. not official COMEAP policy) to the whole meeting that public exposure to ambient concentrations of nitrogen dioxide in the urban environment is 'irrelevant' for public health. CCAL recollects Professor Ayres went on to emphasise though that NO_2 has the advantage of being very easy to monitor and it is a reliable indicator of hazardous vehicle emissions. Despite these important clarifications, CCAL considers that Professor Ayres' personal comments could be a source of public confusion and therefore merit clarification from the government.

88. In a written question on 27 October 2009, Lord Berkeley asked:

    "To ask Her Majesty's Government what harmful air pollutants are likely to be present in ambient air when concentrations of nitrogen dioxide (NO_2) are high; and in what proportions."

89. Lord Davies of Oldham replied in a statement:

    "Nitrogen dioxide (NO_2) arises directly and indirectly from combustion processes. Concentrations are generally highest close to their emission sources, primarily road transport followed by the power generation industry and other industrial and commercial sector sources.

    "The nature of the combustion processes and fuel used will determine the presence of other pollutants, such as particulate matter, polycyclic aromatic hydrocarbons, benzene, carbon monoxide and sulphur dioxide. It is not possible to define the proportions that these pollutants may be present in at any particular location at any one time. Proportions will vary with time, the distance from sources, meteorology, and chemistry depending on the type of combustion processes and emissions released."

    See: http://www.theyworkforyou.com/wrans/?id=2009-10-27a.138.0

90. Please see COMEAP's statement on the quantification of the effects of long-term

exposure to nitrogen dioxide on respiratory morbidity in children (October 2009)

See: http://comeap.org.uk/documents/statements/44-statement-and-supporting-papers.html

91. Please note that WHO confirmed in 2006 its concerns about the health impact of exposure to NO2. In this respect, Dr Michal Krzyzanowski (who lead that report) expressed a personal view to CCAL that there has been much less research into the health effects of NO_2 than that for $PM_{2.5}$ and PM_{10}. He commented similarly to CCAL that NO_2 concentrations should not be made worse by measures to reduce other pollutants.

92. Please note that recent research by David Carslaw that indicates NO_2 levels may not fall as levels of oxides of nitrogen (NOx) fall e.g. with newer standards for European vehicle emissions.

APPENDIX 5

The delivery chain for air quality

93. The almost total disjunction between the government's responsibility, on behalf of the Member State, and the 'work towards compliance' duty on local authorities is a recipe for failure. In general, local authorities (and the Mayor of London) seem to have little appetite to take action they are not required to take. Action: The Environment Agency should be given national responsibility, authority, accountability and resources to ensure full compliance everywhere with air quality laws (perhaps as in the US, proposed at Heathrow and in relation now to flooding. Alternatively, a very clear chain of delivery needs to be defined for each layer of government.

94. Britain's Transport Infrastructure Adding Capacity at Heathrow: Decisions Following Consultation published by the Department for Transport in January 2009 paragraph 64 on page 24 stated:

"On air quality, the Environment Agency would be responsible for overseeing monitoring and analysing air quality data. Because background emissions, emissions from surface transport, both airport-related and non-airport-related, and aviation emissions are contributory factors to air quality around Heathrow, the Agency would report any breaches to both Secretaries of State. The CAA, in respect of noise, and the Environment Agency, in respect of air quality, will have the necessary powers to ensure that relevant parties take their share of the remedial action needed to comply with the respective legal limits. The Agency would take account of its duties and relevant guidance provided by the Secretary of State for Environment, Food and Rural Affairs, in agreement with the Secretary of State for Transport."

http://www.baa.com/static/BAA_Airports/Downloads/PDF/Capacity_at_Heathrow.pdf

95. Defra Air Quality Forum on 24 February 2009 minutes:

"CCAL were concerned that the Mayor for London and local authorities were only required to work towards the achievement of the air quality objectives. They suggested that the Secretary of State should issue a direction under the legislation, which stated that "at a minimum, the Mayor and the local authorities should commit to use their best efforts to implement successfully actions to improve air quality in London, when it exceeds limit values, which are meaningful when judged in the context of all their available powers and the deadlines applicable under UK and European law". CCAL considered this would allow the necessary actions to be enforceable by various people at local and national level."

Link no longer available