

29 November 2014

**Mayor publishes health study revealing first estimates of deaths attributable to nitrogen dioxide**

‘Clean Air in London’ (CAL) estimates 5,061 deaths attributable to dangerous airborne particles (PM<sub>2.5</sub>) in London in 2020 and 5,159 in 2025. These compare with the Mayor’s estimate of 4,267 for PM<sub>2.5</sub> in 2008. CAL estimates 2,684 deaths attributable to nitrogen dioxide (NO<sub>2</sub>) in London in 2020 and 1,893 in 2025 with up to one-third overlap with PM<sub>2.5</sub> giving totals of 6,851 and 6,422 attributable deaths in 2020 and 2025 respectively. The new totals are significantly larger than previous estimates because they include the first estimates for NO<sub>2</sub> and population increases which more than offset projected reductions in PM<sub>2.5</sub>

CAL speculates that total annual deaths attributable to NO<sub>2</sub> and PM<sub>2.5</sub> currently may be around 7,500 in London and around 55,000 in the UK compared to 29,000 for anthropogenic PM<sub>2.5</sub> alone in 2010 (when NO<sub>2</sub> mortality was not identified). Ozone may be responsible for a further 5,000 to 10,000 attributable deaths in the UK. We await official estimates from COMEAP and Public Health England (PHE) next year

CAL asks Parliament’s Environmental Audit Committee to recommend the prioritisation of COMEAP and PHE’s work calculating NO<sub>2</sub> mortality estimates and their inclusion annually thereafter in the Public Health Indicators. Separately, CAL urges President Juncker to prioritise implementation of the Clean Air Policy Package in the European Commission’s 2015 Working Programme on 16 December not scrap it, as he has proposed, which would condemn hundreds of thousands of Europeans to an early death

CAL congratulates Mayor Johnson for publishing these new estimates for ‘Years of life lost’ attributable to air pollution. However, the new estimates confirm again that the Mayor’s so-called ULEZ in 2020 is too small, too weak and too late

The Mayor has published documents supporting the consultation on his proposed Ultra Low Emission Zone (ULEZ) including a Health Impact Assessment (HIA). The consultation runs until 9 January 2015.

<https://consultations.tfl.gov.uk/environment/ultra-low-emission-zone>

[http://cleanair.london/wp-content/uploads/CAL-294-ULEZ-HIA\\_Final\\_ULEZ-consultation\\_Reduced-size.pdf](http://cleanair.london/wp-content/uploads/CAL-294-ULEZ-HIA_Final_ULEZ-consultation_Reduced-size.pdf)

The HIA estimates the health impact of dangerous airborne particles (PM<sub>2.5</sub> and PM<sub>10</sub>) and nitrogen dioxide (NO<sub>2</sub>) on Londoners in 2020 and 2025. It then estimates the improvement expected from implementing the ULEZ. The Base Cases presented for 2020 and 2025 are the first updates produced by the Mayor since his ground breaking Health Study for 2008 was published on 29 June 2010.

<http://cleanair.london/health/mayor-johnson-publishes-health-study-estimating-4267-premature-deaths/>

<http://cleanair.london/wp-content/uploads/CAL-098-Mayors-health-study-report-June-2010.pdf>

As far as Clean Air in London (CAL) is aware, the HIA includes the world's first published estimates of mortality attributable to NO<sub>2</sub>. The HIA also includes estimates for hospital admissions, costs and other valuable information.

## **Dangerous airborne particles**

In June 2010, the Mayor estimated 4,267 deaths attributable to long-term exposure to PM<sub>2.5</sub> in London in 2008. His estimate assumed: the population of Greater London was 7.67 million; and a population-weighted annual mean concentration of PM<sub>2.5</sub> of 15.3 micrograms per cubic metre (µg/m<sup>3</sup>).

Since then the Committee on the Medical Effects of Air Pollutants (COMEAP) and Public Health England (PHE) have recommended using an average loss of life per attributable death of 12 years (Notes 4 and 5) for those dying aged 30 and older. The HIA estimates total years of life lost in 2020 and 2025. Therefore, using CAL's understanding of COMEAP and PHE methodology, it has calculated the number of deaths attributable to PM<sub>2.5</sub> for each of 2020 and 2025.

CAL estimates for PM<sub>2.5</sub>:

- 5,061 deaths attributable to long-term exposure to PM<sub>2.5</sub> in London in 2020. This estimate assumes: the population of Greater London will be 9.13 million; and a population-weighted annual mean concentration of PM<sub>2.5</sub> of 12.6 µg/m<sup>3</sup>.
- 5,159 deaths attributable to long-term exposure to PM<sub>2.5</sub> in London in 2025. This estimate assumes: the population of Greater London will be 9.48 million; and a population-weighted annual mean concentration of PM<sub>2.5</sub> of 12.2 µg/m<sup>3</sup>.

CAL assumes these are total concentrations of PM<sub>2.5</sub> i.e. anthropogenic and non-anthropogenic PM<sub>2.5</sub>.

Defra estimated total PM<sub>2.5</sub> in London in 2012 at 13.9 µg/m<sup>3</sup>. See the Clean Air in Cities app for details <http://cleanair.london/apps/>.

## **Nitrogen dioxide**

In 2013, the World Health Organisation (WHO) published 'state of the science' reports on the health impacts of air pollution titled 'Review of evidence on health aspects of air pollution' (REVIHAAP) and 'Health risks of air pollution in Europe' (HRAPIE).

The HRAPIE report included the first guidance for estimating the mortality impact of NO<sub>2</sub>. The HIA says NO<sub>2</sub> impacts should be reduced by (up to) 33% to account for possible overlap with effects from long-term PM<sub>2.5</sub> exposure and uses the lag profile recommended by COMEAP.

The HIA estimates total years of life lost in 2020 and 2025 assuming a threshold for the mortality impacts of NO<sub>2</sub> at an annual mean of 20 µg/m<sup>3</sup>. CAL has calculated estimates of total mortality assuming an average of 12 years of life lost per attributable death for NO<sub>2</sub> (i.e. the same as PM<sub>2.5</sub>) as

there is evidence of a long-term effect of NO<sub>2</sub> on mortality as great as that of PM<sub>2.5</sub>. Fewer ‘average years of life lost’ would mean more attributable deaths not fewer. We await confirmation from COMEAP, PHE or the WHO that this approach is correct.

CAL estimates for NO<sub>2</sub>:

- 2,684 deaths attributable to long-term exposure to NO<sub>2</sub> in London in 2020. This estimate assumes: the population of Greater London will be 9.13 million; and a population-weighted annual mean concentration of NO<sub>2</sub> of 31.0 µg/m<sup>3</sup> i.e. 11.0 µg/m<sup>3</sup> above the threshold.
- 1,893 deaths attributable to long-term exposure to NO<sub>2</sub> in London in 2025. This estimate assumes: the population of Greater London will be 9.48 million; and a population-weighted annual mean concentration of NO<sub>2</sub> of 27.3 µg/m<sup>3</sup> i.e. 7.3 µg/m<sup>3</sup> above the threshold.

CAL has heard suggestions that there may be no threshold for the mortality impact of NO<sub>2</sub> i.e. like PM<sub>2.5</sub>. If this were the case, the total mortality impact of NO<sub>2</sub> would approximately treble for 2020 and 2025 with many more deaths attributable to NO<sub>2</sub> than PM<sub>2.5</sub>. For the avoidance of doubt, CAL does not advocate such an approach as it would conflict with WHO advice in HRAPIE.

## **Total mortality**

CAL has estimated total mortality attributable to PM<sub>2.5</sub> and NO<sub>2</sub> by deducting one-third from the smaller NO<sub>2</sub> estimate as the HIA and HRAPIE recommend. On this basis, CAL estimates a Base Case of 6,851 deaths attributable to PM<sub>2.5</sub> and NO<sub>2</sub> in 2020; and 6,422 deaths attributable to PM<sub>2.5</sub> and NO<sub>2</sub> in 2025.

Nationally, if the attributable fraction for NO<sub>2</sub> and total PM<sub>2.5</sub> (plus ozone and short and long-term effects?) doubled from around 5 to 9% to around 10 to 18% this would be relevant for around 50,000 reported deaths in London and 550,000 reported deaths in the UK of people aged 30 and older. Air pollution levels in Greater London are about 50% higher than the UK average.

CAL speculates therefore that total deaths attributable to NO<sub>2</sub> and PM<sub>2.5</sub> currently may be around 7,500 in London and around 55,000 in the UK compared to 29,000 for anthropogenic PM<sub>2.5</sub> alone in 2010 (when NO<sub>2</sub> mortality was not identified). In CAL’s opinion, ozone may be responsible for a further 5,000 to 10,000 attributable deaths in the UK. We await official estimates from COMEAP and PHE next year.

## **Other information**

The HIA report also:

- i. estimates that 653,000 people will be exposed to NO<sub>2</sub> above the annual mean limit value in 2020 falling to 123,000 in 2025. Of these 300,000 and 58,000 respectively are estimated to live within the area covered by the Central London ULEZ.
- ii. shows the 20 boroughs with the highest number of people exposed to NO<sub>2</sub> exceeding the annual mean limit value in 2020 in descending order are: Westminster; Camden; Southwark;

- Kensington and Chelsea; Tower Hamlets; Lambeth; Islington; Brent; Hammersmith and Fulham; Wandsworth; Hackney; Newham; Barnet; Haringey; Lewisham; Waltham Forest; Hounslow; Ealing; Greenwich; and Redbridge. The City of London has a small population but appears next.
- iii. a Base Case of population-weighted annual mean concentrations of PM<sub>2.5</sub> by area in 2020: Central London 14.4 µg/m<sup>3</sup>; Inner London 13.1 µg/m<sup>3</sup>; Outer London 12.3 µg/m<sup>3</sup>; and London-wide 12.6 µg/m<sup>3</sup>.
  - iv. a Base Case of population-weighted annual mean concentrations of NO<sub>2</sub> by area in 2020: Central London 42.5 µg/m<sup>3</sup>; Inner London 34.7 µg/m<sup>3</sup>; Outer London 28.2 µg/m<sup>3</sup>; and London-wide 31.0 µg/m<sup>3</sup>.
  - v. total chronic mortality health values of £2,126 million for PM<sub>2.5</sub> and £1,123 million for NO<sub>2</sub> (2012 prices).
  - vi. the proportion of Care homes, Hospitals and Schools exceeding the NO<sub>2</sub> annual mean limit value in Central London falling from 20.0%, 50.9% and 34.2% respectively to 0.0%, 17.5% and 5.1% respectively as a result of the Central London ULEZ.

CAL notes that Transport for London estimated in November 2006 that Phase 3 of the Low Emission Zone, if implemented in October 2010, would reduce the number of people exposed to NO<sub>2</sub> exceeding the annual mean limit value in Greater London from 443,000 to 408,000 in 2015.

## Questions

Questions that arise include:

- i. How many deaths does the Mayor consider are currently attributable to NO<sub>2</sub> and PM<sub>2.5</sub> in London? What about O<sub>3</sub> and SO<sub>2</sub>?
- ii. Why did London report 47,580 deaths in London in 2013 compared to 458,110 in England outside London compared to populations of 8.42 million and 48.53 million respectively i.e. 0.56% compared to 0.94%? Oddly, there were 48,297 deaths in London in 2010 with a population of 7.82 million. It may be due in part to a 'warm' winter in 2013. The reported deaths number is used to estimate air pollution mortality.
- iii. Why did the HIA not follow Defra appraisal guidance that recommends that the impacts of other pollutants (notably SO<sub>2</sub> and O<sub>3</sub>) should be captured in an impact assessment? See page 13 in the 'ULEZ Health Impact Assessment'. There may be some or complete overlap between PM<sub>2.5</sub>, NO<sub>2</sub> and SO<sub>2</sub> and O<sub>3</sub> health impacts.

CAL considers the HIA statement on page 12 of the ULEZ Health Impact Assessment to be 'out of date':

*"There is also increasing evidence that chronic exposure to NO<sub>2</sub> may be important but the evidence for an association that is suitable for quantification of the impacts is less strong than for particles and not yet sufficiently convincing to be used widely."*

REVIHAAP states on page 73:

*“Both short- and long-term studies have found these associations with adverse effects at concentrations that were at or below the current EU limit values, which for NO<sub>2</sub> are equivalent to the values from the 2005 global update of the WHO air quality guidelines. Chamber and toxicological evidence provides some mechanistic support for a causal interpretation of the respiratory effects. Hence, the results of these new studies provide support for updating the 2005 global update of the WHO air quality guidelines (WHO Regional Office for Europe, 2006) for NO<sub>2</sub>, to give: (a) an epidemiologically based short-term guideline value; and (b) an annual average guideline value based on the newly accumulated evidence. In both instances, this could result in lower guideline values.”*

## Quotes

Simon Birkett, Founder and Director of Clean Air in London, said:

“Clean Air in London (CAL) congratulates Mayor Johnson for publishing these new estimates for the health impact of air pollution in London including the world’s first, as far as we know, published estimates of deaths attributable to nitrogen dioxide (NO<sub>2</sub>).

“These new estimates of NO<sub>2</sub> mortality are particularly significant for Londoners as many roads in central London will tend to have the highest NO<sub>2</sub> concentrations in the world. Earlier this year, Dr David Carslaw, a highly respected scientist, raised the possibility that measurements of NO<sub>2</sub> concentrations recorded at the Oxford Street roadside air pollution monitoring site were, to his knowledge, the highest in the world. NO<sub>2</sub> annual concentrations and hourly exceedances in Brixton Road may exceed those in Oxford Street in 2014.

“These new health estimates are shocking enough but they may still be underestimates. Factors which would increase them include: Euro 6 engine standards for diesel vehicles not delivering emission reduction as expected; more deaths being reported by the Office for National Statistics for Greater London; scientists determining there is no threshold for mortality impacts from NO<sub>2</sub>; more congestion as many hundreds of thousands of people visit and live and work in London and wish to drive cars; and climate change worsening London’s heat island effect.

“In 2009, CAL accused the previous Government of one of the biggest public health ‘cover-ups’ or failings in modern history for not publishing estimates of the number of people dying early from long-term exposure to PM<sub>2.5</sub>. Our claims were investigated by Parliament’s Environmental Audit Committee and subsequently confirmed with Public Health England now publishing estimates annually for every local authority in England. The current situation is very different. Similar estimates for NO<sub>2</sub> are being calculated just months after scientists and World Health Organisation issued new advice.

“The first NO<sub>2</sub> mortality estimates for London confirm the Mayor’s so-called Ultra Low Emission Zone (ULEZ) is too small, too weak and too late. The Mayor must ban all diesel exhaust (and biomass burning) from the most polluted places by 2020, with an intermediate step by 2018, as coal was banned so successfully 60 years ago. At least 10 boroughs should be included.

“At a European level, President Juncker must prioritise implementation of the Clean Air Policy Package (CAPP) in the European Commission’s 2015 Working Programme on 16 December not scrap it, as he has proposed, which would condemn hundreds of thousands of Europeans to an early death. The CAPP made financial sense even though NO<sub>2</sub> mortality costs were not incorporated in it.

“We must create a better city and Europe. London should be leading the world in fighting air pollution as we did 60 years ago.

ENDS

## Notes

### 1. Mayor’s Ultra Low Emission Zone consultation – closes 9 January 2014

<https://consultations.tfl.gov.uk/environment/ultra-low-emission-zone>

### 2. ULEZ Health Impact Assessment – October 2014

[http://cleanair.london/wp-content/uploads/CAL-294-ULEZ-HIA\\_Final\\_ULEZ-consultation\\_Reduced-size.pdf](http://cleanair.london/wp-content/uploads/CAL-294-ULEZ-HIA_Final_ULEZ-consultation_Reduced-size.pdf)

### 3. Mayor’s Health Impact Assessment 2008

<http://cleanair.london/health/mayor-johnson-publishes-health-study-estimating-4267-premature-deaths/>

<http://cleanair.london/wp-content/uploads/CAL-098-Mayors-health-study-report-June-2010.pdf>

### 4. COMEAP

19 June 2009

<https://www.gov.uk/government/publications/comeap-long-term-exposure-to-air-pollution-effect-on-mortality>

21 December 2010

<https://www.gov.uk/government/publications/comeap-mortality-effects-of-long-term-exposure-to-particulate-air-pollution-in-the-uk>

[http://webarchive.nationalarchives.gov.uk/20140505104658/http://www.comeap.org.uk/images/stories/Documents/Statements/FINAL\\_Local\\_mortality\\_burden\\_statement\\_August\\_2012.pdf](http://webarchive.nationalarchives.gov.uk/20140505104658/http://www.comeap.org.uk/images/stories/Documents/Statements/FINAL_Local_mortality_burden_statement_August_2012.pdf)

August 2012

[http://webarchive.nationalarchives.gov.uk/20140505104658/http://www.comeap.org.uk/images/stories/Documents/Statements/FINAL\\_Local\\_mortality\\_burden\\_statement\\_August\\_2012.pdf](http://webarchive.nationalarchives.gov.uk/20140505104658/http://www.comeap.org.uk/images/stories/Documents/Statements/FINAL_Local_mortality_burden_statement_August_2012.pdf)

## 5. Public Health England

<https://www.gov.uk/government/news/estimates-of-mortality-in-local-authority-areas-associated-with-air-pollution>

<https://www.gov.uk/government/publications/estimating-local-mortality-burdens-associated-with-particulate-air-pollution>

Public Health Indicators 2012

<http://www.phoutcomes.info/public-health-outcomes-framework#gid/1000043/par/E12000004/ati/102/page/3>

## 6. World Health Organisation reports

REVIHAAP

<http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications/2013/review-of-evidence-on-health-aspects-of-air-pollution-revihaap-project-final-technical-report>

HRAPIE

<http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications/2013/health-risks-of-air-pollution-in-europe-hrapie-project.-new-emerging-risks-to-health-from-air-pollution-results-from-the-survey-of-experts>

## 7. NO<sub>2</sub> meta analysis

<http://erj.ersjournals.com/content/early/2014/02/20/09031936.00114713.abstract>

## 8. Defra data

PM<sub>2.5</sub>

<http://uk-air.defra.gov.uk/data/pcm-data>

NO<sub>2</sub>

<http://uk-air.defra.gov.uk/data/gis-mapping>

## 9. NO<sub>2</sub> levels in London

Brixton Road 2014

[http://www.londonair.org.uk/london/asp/publicstats.asp?region=0&site=LB4&Maptype=Google&mapview=all&statyear=2014&la\\_id=&zoom=9&lat=51.475&lon=-0.11982399999999416&laEdge=N](http://www.londonair.org.uk/london/asp/publicstats.asp?region=0&site=LB4&Maptype=Google&mapview=all&statyear=2014&la_id=&zoom=9&lat=51.475&lon=-0.11982399999999416&laEdge=N)

Oxford Street 2014

[http://www.londonair.org.uk/london/asp/publicstats.asp?region=0&site=WM6&la\\_id=&network=All&postcode=&MapType=Google&VenueCode=](http://www.londonair.org.uk/london/asp/publicstats.asp?region=0&site=WM6&la_id=&network=All&postcode=&MapType=Google&VenueCode=)

Comment by King's College London on NO<sub>2</sub> levels in London

<http://www.londonair.org.uk/london/asp/news.asp?NewsId=OxfordStHighNO2&StartIndex=21>

## 10. Office for National Statistics data

<http://www.ons.gov.uk/ons/rel/pop-estimate/population-estimates-for-uk--england-and-wales--scotland-and-northern-ireland/2013/sty-population-estimates.html>

<http://www.ons.gov.uk/ons/rel/vsob1/mortality-statistics--deaths-registered-in-england-and-wales--series-dr-/2013/stb-deaths-registered-in-england-and-wales-in-2013-by-cause.html>

<http://www.ons.gov.uk/ons/rel/vsob1/deaths-registered-area-usual-residence/2012/index.html>

## 11. Clean Air Policy Package

[http://ec.europa.eu/environment/air/clean\\_air\\_policy.htm](http://ec.europa.eu/environment/air/clean_air_policy.htm)

See the 'Impact assessment' pages 111 and 185

[http://ec.europa.eu/environment/archives/air/pdf/Impact\\_assessment\\_en.pdf](http://ec.europa.eu/environment/archives/air/pdf/Impact_assessment_en.pdf)