Modelling Air Quality Scenarios in London

Are the EU limit values for NO$_2$ and PM$_{10}$ achievable?

by

David Carruthers, Kate Johnson, Amy Stidworthy, Jo Blair,
Cambridge Environmental Research Consultants

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Base Case Scenarios
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Model Introduction and Input Data

• ADMS-Urban

  ADMS dispersion model including street canyon effects, nested within an urban area trajectory model.

• Input data


  Meteorology – Hourly sequential Heathrow Airport 1999 (base year) and 1996 (worst case year)

  Background – Rural monitoring from monitoring sites around London. Future projections based on EMEP calculations. Constant coarse contribution.
Comparison of Measured and Calculated Annual Average, Percentile and Standard Deviation Data Pairs calculated using ADMS-Urban (a) NO$_2$, (b) PM$_{10}$
Calculated Annual Average NO$_2$ Concentrations
Annual Average PM$_{10}$ concentration calculated using ADMS-Urban

Greater London, 1999
Annual mean PM$_{10}$ concentration Modelled using ADMS-Urban

Greater London, 2004
Annual mean PM$_{10}$ concentration Modelled using ADMS-Urban

Greater London, 2010
Annual mean PM$_{10}$ concentration Modelled using ADMS-Urban

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Daily average PM$_{10}$ concentrations calculated using ADMS-Urban

(a) 35 exceedences

(b) 7 exceedences
Calculated pollutant concentrations corresponding to the EU limit values for 2005 and 2010; exceedence of the limit are shown in bold.

<table>
<thead>
<tr>
<th>Site</th>
<th>NO₂ 1999 Meteorology</th>
<th>PM₁₀ 1999 Meteorology</th>
<th>PM₁₀ 1996 Worst case meteorology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010 Annual Mean</td>
<td>2010 1 hour mean</td>
<td>2005 5 year average</td>
</tr>
<tr>
<td>A3</td>
<td>48</td>
<td>143</td>
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<td>Camden</td>
<td>55</td>
<td>178</td>
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<tr>
<td>Harringey</td>
<td>42</td>
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<td>25</td>
</tr>
<tr>
<td>Marylebone Road</td>
<td>71</td>
<td>191</td>
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<tr>
<td>Sutton roadside</td>
<td>29</td>
<td>128</td>
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<td>Bexley</td>
<td>31</td>
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<td>Bloomsbury</td>
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<td>Eltham suburban</td>
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<td>Hillingdon</td>
<td>48</td>
<td>168</td>
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<tr>
<td>North Kensington</td>
<td>40</td>
<td>151</td>
<td>24</td>
</tr>
</tbody>
</table>
Source apportioned PM$_{10}$ at Bloomsbury monitoring station

Total = 29µg/m$^3$

Secondary Europe 24%
Secondary UK 24%
Other B/ground 35%

Total = 21µg/m$^3$

Secondary Europe 21%
Secondary UK 21%
Other B/ground 48%

Cars
LGV
Other Road
Commercial Gas
Other B/ground
Taxis
Rigid HGV
Rail
Buses
Articulated HGV
Domestic Gas
Other Sources
Secondary UK
Secondary Europe

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Source apportioned PM$_{10}$ at Marylebone Road monitoring station

1999

- Secondary Europe: 13%
- Secondary UK: 13%
- Other B/ground: 21%
- Rigid HGV: 10%
- Buses: 6%
- Cars: 11%

Total = 49µg/m$^3$

2010

- Secondary Europe: 13%
- Secondary UK: 13%
- Other B/ground: 21%
- Rigid HGV: 10%
- Buses: 6%
- Cars: 11%

Total = 49µg/m$^3$
London 2005 Annual Mean NOx Concentrations by Traffic Category

(a) Major Roads

(b) Other Roads

(c) Car

(d) Van

(e) Bus and Coach

(f) LOV

(g) Rigid HGV

(h) Articulated HGV
Modelled contribution of major source groups to annual average NO$_x$ concentrations in the neighbourhood of Heathrow Airport (2005)
2010 LEZ 2 Reductions in PM$_{10}$
Effect of the proposed Euro V type scenarios on annual average NO$_2$ concentrations at a range of receptor points across London in 2020.

Comparison of results at 226 London receptor points in Euro V scenario tests, Feb 2004

Annual average NO$_2$, 2020
Effect of the proposed Euro V type scenarios on annual average PM$_{10}$ concentrations at a range of receptor points across London in 2020.

Comparison of results at 226 London receptor points in Euro V scenario tests, Feb 2004

Annual average PM$_{10}$, 2020
Conclusions

Without further action the following limits will be widely exceeded in London.

- NO$_2$ annual average in 2010 (40µg/m$^3$)
- PM$_{10}$ daily average limit value 35 exceedences of 50µg/m$^3$ in 2005 (adverse meteorology)
- PM$_{10}$ annual average in 2010 (40µg/m$^3$)

Source apportionment allows effective targeting of mitigation measures.

Mitigation measures
- LEZ – little impact
- Additional technological improvements – Euro V, Euro VI – more impact