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# Air Quality Plans for the achievement of EU air quality limit values for nitrogen dioxide (NO<sub>2</sub>) in the UK

## UK Overview Document

September 2011



Llywodraeth Cymru  
Welsh Government



The Scottish  
Government



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**This document is also available on the UK-AIR website at:**

<http://uk-air.defra.gov.uk/library/no2ten>

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# AIR QUALITY PLANS FOR THE ACHIEVEMENT OF EU NITROGEN DIOXIDE (NO<sub>2</sub>) LIMIT VALUES IN THE UK: UK OVERVIEW DOCUMENT

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# AIR QUALITY PLANS FOR THE ACHIEVEMENT OF EU NITROGEN DIOXIDE (NO<sub>2</sub>) LIMIT VALUES IN THE UK: UK OVERVIEW DOCUMENT

## Introduction

- I. This document gives an overview of UK air quality in the 40 zones where the nitrogen dioxide (NO<sub>2</sub>) limit values in the Ambient Air Quality Directive (2008/50/EC)<sup>1</sup> are not expected to have been met in full by the attainment date of 2010<sup>2</sup>.
- II. It supports and should be read alongside the list of UK and National measures, the air quality plans for each of the 40 UK zones and technical report detailing the assessment methodology for the plans. These documents can be viewed on the UK-AIR website<sup>3</sup>. Together they form the basis of the UK's submission to the European Commission in September 2011 setting out how the UK will meet the NO<sub>2</sub> limit values in the shortest time possible.
- III. This UK overview document includes the following information listed in Annex XV of the directive:
  - information on responsible authorities for the development of air quality plans (section A3 of Annex XV).
  - general information on UK climate and topography (section A2 of Annex XV)
  - details of the overall UK compliance situation and the national measures either in place, soon to be in place or being considered to help meet the NO<sub>2</sub> limit values as soon as possible (sections A4-A10 and B2-B3 of Annex XV).
  - details of work underway to investigate the feasibility of a national framework for Low Emission Zones (LEZs) as an additional measure under consideration to hasten compliance in some zones.
- IV. The air quality plans for each zone contain the local information required in sections A1-A2, A4-5, A7-A8 of Annex XV. The UK and National Measures document includes further information required in sections A7-9 and B3 of Annex XV. The technical report includes the information required in section A4c.

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<sup>1</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF>

<sup>2</sup> 2010 data will be finalised for submission to the Commission in September 2011, so this assessment is based largely on projections from a 2008 baseline.

<sup>3</sup> <http://uk-air.defra.gov.uk/library/no2ten>

## Policy Background

- V. The EU Ambient Air Quality Directive (2008/50/EC) and the 4th Air Quality Daughter Directive (2004/107/EC)<sup>4</sup> set the air quality standards against which national and local ambient air quality policies are formulated. The directives set limit values and target values for various pollutants in ambient air including nitrogen dioxide (NO<sub>2</sub>) and require EU member states to assess and report compliance and take action to rectify any exceedences of those values.
- VI. The 2008 directive consolidated the requirements of the Air Quality Framework Directive (1996/62/EC) and its daughter directives (1999/30/EC, 2000/69/EC, and 2002/3/EC) which are now largely repealed. The fourth daughter directive is expected to be consolidated at a later date. The 2008 directive was transposed into national legislation in England<sup>5</sup>, Scotland<sup>6</sup>, Wales<sup>7</sup> and Northern Ireland<sup>8</sup> by the June 2010 deadline.
- VII. UK assessments for compliance with the EU limit and target values in the directive are based on national monitoring and modelling via the Automatic Urban and Rural Network (AURN)<sup>9</sup> and the Pollution Climate Mapping (PCM) model described in the accompanying technical report. The national monitoring network and model are set up to ensure compliance with, amongst other aspects, siting criteria and data quality requirements of the directive.
- VIII. Pollutant levels are assessed according to the directive requirements, and results are published on the UK's Air Information Resource (UK Air)<sup>10</sup>. For NO<sub>2</sub>, there are two limit values in the directive for the protection of human health to be met by 1 January 2010:
- An annual NO<sub>2</sub> mean concentration of no more than 40 µg/m<sup>3</sup>.
  - An hourly NO<sub>2</sub> mean concentration of 200 µg/m<sup>3</sup> not to be exceeded more than 18 times in a calendar year.
- IX. In the period leading up to 2010, margins of tolerance (MOT) have applied. These are pollutant levels set at a percentage margin above the limit value which decrease annually until the attainment date. The directive requires that where a zone exceeds or is at risk of exceeding the limit values plus any relevant margin of tolerance, Member States must draw up and implement air quality plans that set out the measures to be put in place to meet the limit values by 2010. These must be submitted to the Commission no later than two years after the exceedences was first reported. The UK plans for zones in exceedence of the NO<sub>2</sub> limit value prior to 2008 are available on the EU Central

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<sup>4</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:023:0003:0016:EN:PDF>

<sup>5</sup> [http://www.legislation.gov.uk/ukxi/2010/1001/pdfs/ukxi\\_20101001\\_en.pdf](http://www.legislation.gov.uk/ukxi/2010/1001/pdfs/ukxi_20101001_en.pdf)

<sup>6</sup> [http://www.legislation.gov.uk/ssi/2010/204/pdfs/ssi\\_20100204\\_en.pdf](http://www.legislation.gov.uk/ssi/2010/204/pdfs/ssi_20100204_en.pdf)

<sup>7</sup> [http://www.legislation.gov.uk/wsi/2010/1433/pdfs/wsi\\_20101433\\_mi.pdf](http://www.legislation.gov.uk/wsi/2010/1433/pdfs/wsi_20101433_mi.pdf)

<sup>8</sup> [http://www.legislation.gov.uk/nisr/2010/188/pdfs/nisr\\_20100188\\_en.pdf](http://www.legislation.gov.uk/nisr/2010/188/pdfs/nisr_20100188_en.pdf)

<sup>9</sup> There are separate networks for monitoring hydrocarbons, polycyclic aromatic hydrocarbons (PAHs) and metals

<sup>10</sup> <http://uk-air.defra.gov.uk/>

Data Repository<sup>11</sup>. In the event of exceedences of limit values where the attainment date has passed, air quality plans shall aim to keep the exceedence period as short as possible.

- X. The Commission's 2005 Thematic Strategy on Air Pollution and Council conclusions recognised that many EU member states envisaged difficulties in achieving full compliance with the limit values for NO<sub>2</sub>, especially close to roadsides in densely populated urban areas. Accordingly, Article 22 of the 2008 directive allows Member States to apply to postpone the attainment date for the NO<sub>2</sub> limit values from 2010 up to 2015, subject to submission to the Commission of air quality plans setting out how the limits will be met by the extended deadline. At a Commission workshop in April 2010 it became evident that, despite all reasonable efforts, the limit values were not expected to be achieved by 2015 in many major cities and towns across the EU. The Commission nevertheless advised that air quality plans should also be submitted for these zones and that these should indicate when the limits are expected to be achieved. This will enable the Commission to assess the efforts being made to improve air quality and meet the limits as quickly as possible.
- XI. Member States have until the end of September 2011 to submit these air quality plans to the Commission. The Commission then has nine months to assess the plans and their conclusions will be transmitted via a Commission Decision.
- XII. A 2008 Communication from the Commission was adopted to provide guidance to Member States on the information required in the plans. Member States have also been strongly recommended to use the reporting forms set out in the Staff Working Paper<sup>12</sup> accompanying the Communication. These forms summarise the content of the plans.

## **Responsible Authorities in the UK**

- XIII. In the UK, responsibility for meeting air quality limit values is devolved to the national administrations in Scotland, Wales and Northern Ireland. The Secretary of State for Environment, Food and Rural Affairs has responsibility for meeting the limit values in England and the Department for Environment, Food and Rural Affairs (Defra) co-ordinates assessment and air quality plans for the UK as a whole.
- XIV. The UK Government and the devolved administrations are required under the Environment Act 1995 to produce a national air quality strategy. This was last reviewed and published in 2007<sup>13</sup>. The strategy sets out how responsibilities for meeting EU limits are effectively shared between Government and local authorities and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem.

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<sup>11</sup> <http://cdr.eionet.europa.eu/gb/eu/aqpp>

<sup>12</sup> [http://ec.europa.eu/environment/air/quality/legislation/pdf/sec\\_2008\\_2132\\_en.pdf](http://ec.europa.eu/environment/air/quality/legislation/pdf/sec_2008_2132_en.pdf)

<sup>13</sup> <http://archive.defra.gov.uk/environment/quality/air/airquality/strategy/documents/air-qualitystrategy-vol1.pdf>

- XV. Within the UK there are over 400 local authorities, including 33 London Boroughs in Greater London. Part IV of the Environment Act 1995 and Part II of the Environment (Northern Ireland) Order 2002 require local authorities in the UK to assess air quality in their area and designate air quality management areas if improvements are necessary for the purposes of Local Air Quality Management (LAQM)<sup>14</sup>.
- XVI. Where an air quality management area is designated, local authorities must produce an air quality action plan describing the pollution reduction measures to be put in place in pursuance of air quality standards and objectives (generally the same as limit values). Around half of UK local authorities have had to put in place local air quality plans where this has been necessary in pursuance of the national objectives for NO<sub>2</sub>. Further information on these local plans is provided in the relevant plans for each zone. These local plans have been subject to separate consultation by the local authorities responsible.
- XVII. In Greater London, the Mayor of London is required under the Greater London Authority Act 1999 to produce an air quality strategy to achieve air quality standards and objectives in London. An updated version of the Mayor's Air Quality Strategy for London was published in December 2010<sup>15</sup> and includes details of measures to be deployed in the Greater London area to ensure air quality limits including those for NO<sub>2</sub> are achieved as soon as possible.
- XVIII. The directive sets out detailed requirements for air quality plans. For the purposes of reporting air quality plans under the EU directives, local authority plans and information on specific industrial installations where appropriate are collated by the national administration and submitted to the European Commission by the UK Government.

## **UK Climate and Topography**

- XIX. The United Kingdom has a temperate, maritime climate with typical annual average wind speeds around five metres per second. The topography of the UK is relatively flat with the dispersion conditions in most large urban areas not significantly influenced by large scale topography such as mountain valleys.
- XX. Within the UK, England has mostly lowland terrain; the highest point is 978 metres above sea level. In Scotland, the main population centres are in the lowlands, which lie to the south and east and, in particular, the central belt between Glasgow and Edinburgh. The highest point is 1344 metres above sea level in the sparsely populated Highland region to the north and west of the country. Likewise in Wales, the main population centres including Cardiff and Swansea are in the south, away from the more mountainous regions of north and mid-Wales. The highest point is 1085 metres above sea level. Northern Ireland is best described as hilly, rather than mountainous. The highest point is 852 metres above sea level.

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<sup>14</sup> <http://www.defra.gov.uk/environment/quality/air/air-quality/laqm/>

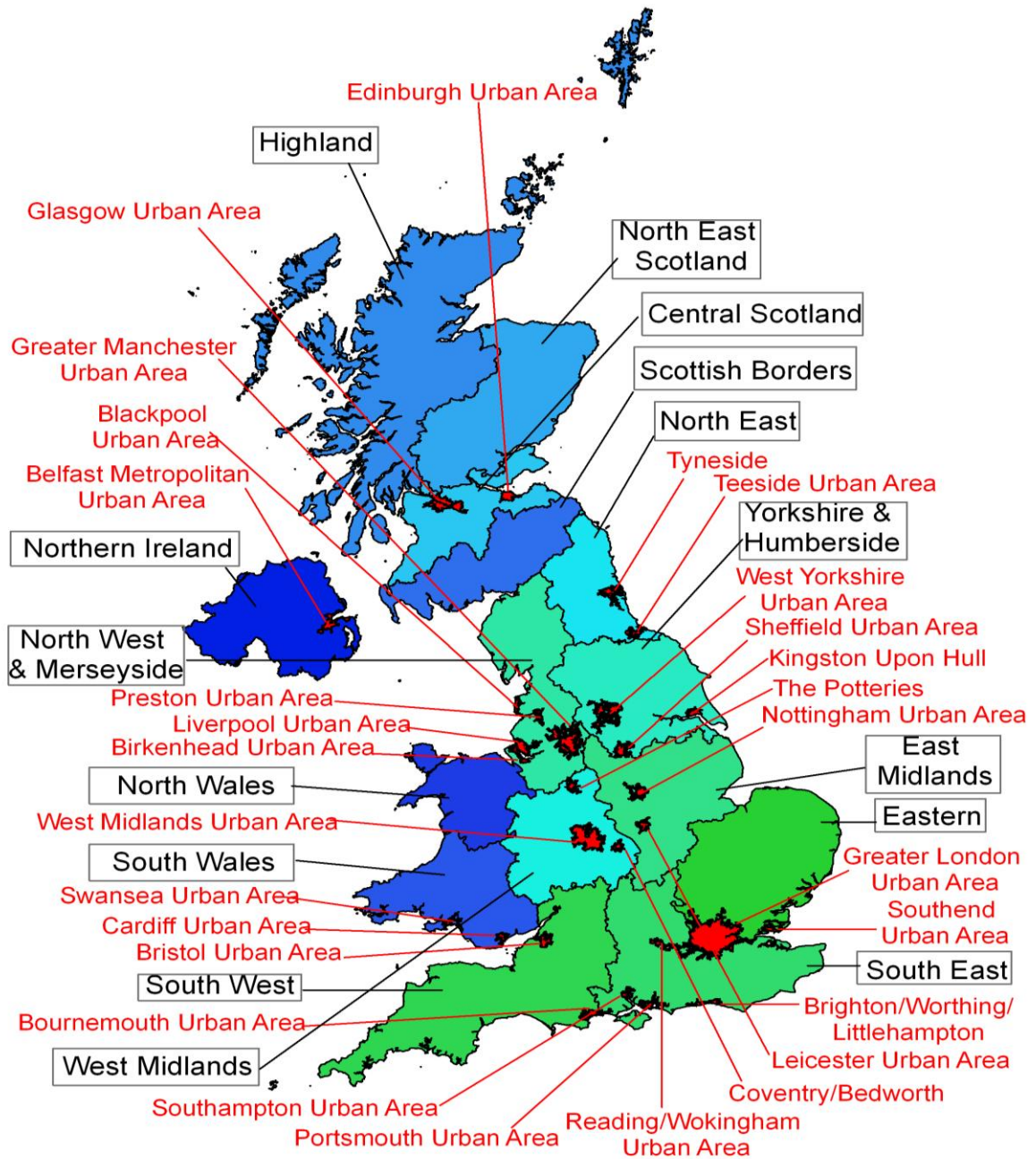
<sup>15</sup> <http://www.london.gov.uk/air-quality>



## UK Zones for Air Quality Assessment

XXI. UK zones do not generally comprise a single administrative authority. Rather they comprise a number of local authorities, each of which may have local air quality management plans. For the purposes of air quality assessment the UK comprises 43 zones. The zones are shown in **Figure 1** below.

**Figure 1: UK zones for Air Quality Assessment.**



**Agglomeration zones (red)**

**Non-agglomeration zones (blue/green)**

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# 1. Summary of UK zones requiring extra time to meet the NO<sub>2</sub> limit values

- 1.1 Air quality limit values for NO<sub>2</sub> are already met across 99% of the UK land area and 97% of the population and further improvements are expected in coming years. However, parts of 40 of the 43 UK zones have not achieved full compliance with the annual NO<sub>2</sub> limit value in 2010. Parts of three of the 40 zones are also non-compliant with the hourly limit value in 2010. The UK is therefore submitting to the European Commission air quality plans with a view to postponement of the compliance date to 2015 where attainment by this date is projected.
- 1.2 Monitored and modelled air quality data from the reference year of 2008 have been used to define a baseline assessment of NO<sub>2</sub> concentrations in the UK because this is the most recent year for which a full dataset was available at the time of assessment. These baseline data have been projected to determine the compliance picture for 2010, the year the limit values came into force. 2010 projections have been used because a full assessment of monitored and modelled air quality data for 2010 will not be completed until the end of September 2011. Early indications from the 2010 assessment indicate good correlation overall between the 2010 projections contained within the air quality plans and the 2010 assessment data.
- 1.3 **Table 1** summarises compliance in the baseline reference year of 2008, the projections to 2010 and the estimated compliance date for each zone. The table shows that of the 40 zones with exceedences in 2010, compliance may be achieved by 2015 in 23 zones, 16 zones are expected to achieve compliance between 2015 and 2020 and that compliance in the London zone is currently expected to be achieved before 2025.
- 1.4 The three zones which exceeded the hourly mean limit value in the 2008 assessment are Greater London, Glasgow and North East Scotland. Forecasts for the hourly mean are less certain than for the annual mean. The same compliance assessment has been applied.
- 1.5 **Air quality plans are therefore being submitted for each of the 40 zones. The plans set out how the NO<sub>2</sub> annual limit value and, in the case of three zones, the hourly limit value will be achieved in the shortest possible time after 2010.**

**Table 1: Summary of exceedence of NO<sub>2</sub> limit values and date of expected compliance by zone.**

Zone/Agglomeration	Annual mean limit value exceedence				Hourly Limit value exceedence	Postponement of the compliance date required? (Yes/No)	Compliance with NO <sub>2</sub> limits projected by	Current and planned baseline measures will achieve compliance by 2015?	LEZ scenario measure projected to achieve compliance in 2015?
	2008 baseline	Km of road exceeding annual limit value	2010 projection	Projected Km of road exceeding annual limit value in 2010	2008 baseline				
Greater London Urban Area	Yes	1287	Yes	947	Yes	Yes	<2025	✗	✗
West Midlands Urban Area	Yes	265	Yes	161	No	Yes	2020	✗	✗
Greater Manchester Urban Area	Yes	261	Yes	114	No	Yes	2020	✗	✗
West Yorkshire Urban Area	Yes	110	Yes	54	No	Yes	2020	✗	✗
Tyneside	Yes	56	Yes	30	No	Yes	2015	✗	✓
Liverpool Urban Area	Yes	72	Yes	37	No	Yes	2015	✗	✓
Sheffield Urban Area	Yes	58	Yes	39	No	Yes	2015	✗	✓
Nottingham Urban Area	Yes	45	Yes	18	No	Yes	2015	✓	n/a
Bristol Urban Area	Yes	32	Yes	16	No	Yes	2015	✗	✓
Brighton/Worthing/Littlehampton	Yes	3	Yes*	0-3	No	Yes	≤2015	✓	n/a
Leicester Urban Area	Yes	24	Yes	8	No	Yes	2015	✓	n/a

Portsmouth Urban Area	Yes	14	Yes	10	No	Yes	2015	✓	n/a
Teesside Urban Area	Yes	16	Yes	14	No	Yes	2020	✗	✗
The Potteries	Yes	23	Yes	18	No	Yes	2020	✗	✗
Bournemouth Urban Area	Yes	12	Yes	5	No	Yes	≤2015	✓	n/a
Reading/Wokingham Urban Area	Yes	9	Yes	1	No	Yes	≤2015	✓	n/a
Coventry/Bedworth	Yes	11	Yes	2	No	Yes	≤2015	✓	n/a
Kingston upon Hull	Yes	32	Yes	23	No	Yes	2020	✗	✗
Southampton Urban Area	Yes	21	Yes	15	No	Yes	2020	✗	✗
Birkenhead Urban Area	Yes	13	Yes*	0-13	No	Yes	≤2015	✓	n/a
Southend Urban Area	Yes	9	Yes	3	No	Yes	≤2015	✓	n/a
Blackpool Urban Area	No	0	No	0	No	No		-	-
Preston Urban Area	Yes	3	Yes	1	No	Yes	≤2015	✓	n/a
Glasgow Urban Area	Yes	76	Yes	46	Yes	Yes	2020	✗	✗
Edinburgh Urban Area	Yes	14	Yes	9	No	Yes	2015	✓	n/a
Cardiff Urban Area	Yes	18	Yes	10	No	Yes	2015	✓	n/a
Swansea Urban Area	Yes	3	Yes*	0-3	No	Yes	≤2015	✓	n/a
Belfast Metropolitan Urban Area	Yes	36	Yes	25	No	Yes	2015	✓	n/a
Eastern	Yes	111	Yes	80	No	Yes	2020	✗	✗
South West	Yes	62	Yes	29	No	Yes	2015	✓	n/a
South East	Yes	163	Yes	106	No	Yes	2020	✗	✗
East Midlands	Yes	82	Yes	36	No	Yes	2020	✗	✗

North West & Merseyside	Yes	210	Yes	136	No	Yes	2020	✗	✗
Yorkshire & Humberside	Yes	230	Yes	182	No	Yes	2020	✗	✗
West Midlands	Yes	76	Yes	49	No	Yes	2020	✗	✗
North East	Yes	53	Yes	30	No	Yes	2020	✗	✗
Central Scotland	Yes	24	Yes	10	No	Yes	2015	✓	n/a
North East Scotland	Yes	18	Yes	7	Yes	Yes	≤2015	✓	n/a
Highland	No	0	No	0	No	No		-	-
Scottish Borders	No	0	No	0	No	No		-	-
South Wales	Yes	32	Yes	19	No	Yes	2020	✗	✗
North Wales	Yes	11	Yes	10	No	Yes	2015	✓	n/a
Northern Ireland	Yes	27	Yes	3	No	Yes	≤2015	✓	n/a
<b>TOTAL</b>	<b>40</b>	<b>3600</b>	<b>40</b>	<b>2303</b>	<b>3</b>	<b>40</b>	<b>-</b>	<b>19</b>	<b>4</b>

n/a refers to the fact that the LEZ scenario has not been applied in the zone.

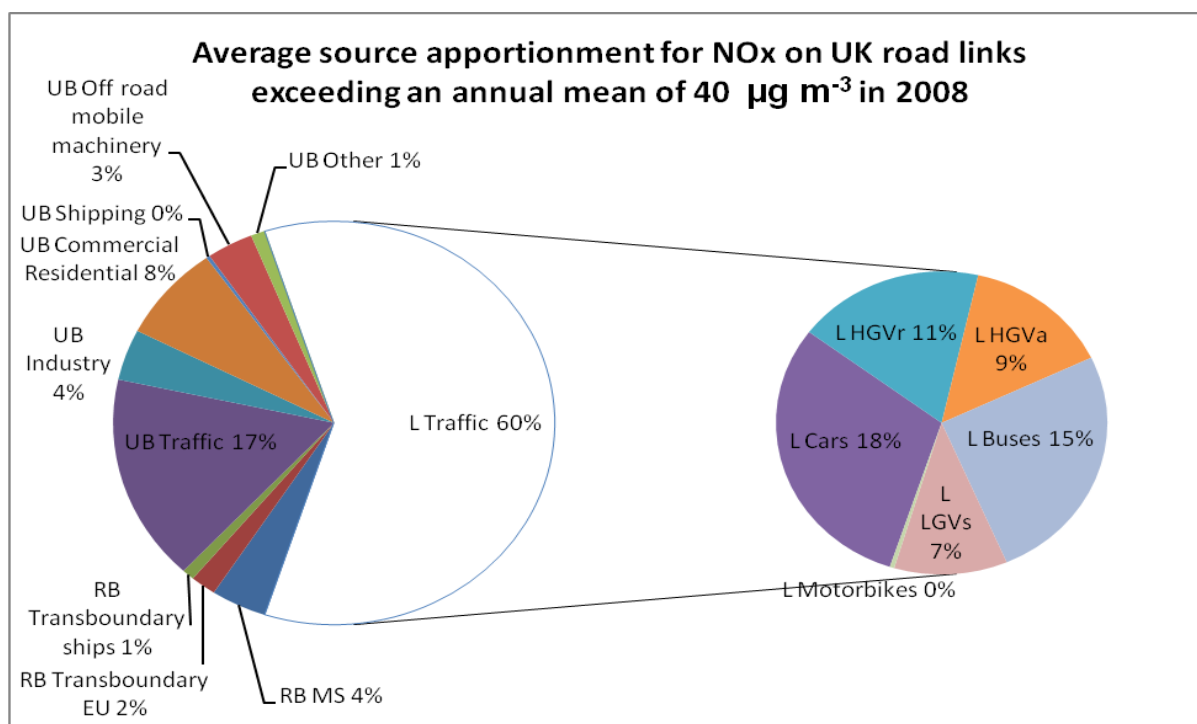
\*Projections show a chance of compliance by 2010 but projection uncertainties mean the confidence is low. Early indication from the 2010 assessment of air quality for the UK supports this judgement for all these zones.

≤2015 means by 2015 or possibly before

## 2. UK source apportionment

2.1 Road transport is the dominant source of pollution in areas exceeding the NO<sub>2</sub> limit values in the UK. This is illustrated in **Figure 2**. On average, local traffic contributes 60% of total UK NO<sub>x</sub> concentrations, though urban background contributions from traffic, domestic and industry sources are also relevant. The variance on different road types across the UK can be significant and generally speaking source apportionment is unique for each road. This is shown in individual zone plans which are provided separately from this document.

**Figure 2: Average NO<sub>x</sub> source apportionment on UK road link exceeding an annual mean NO<sub>2</sub> concentration of 40µg/m<sup>3</sup> in 2008.**



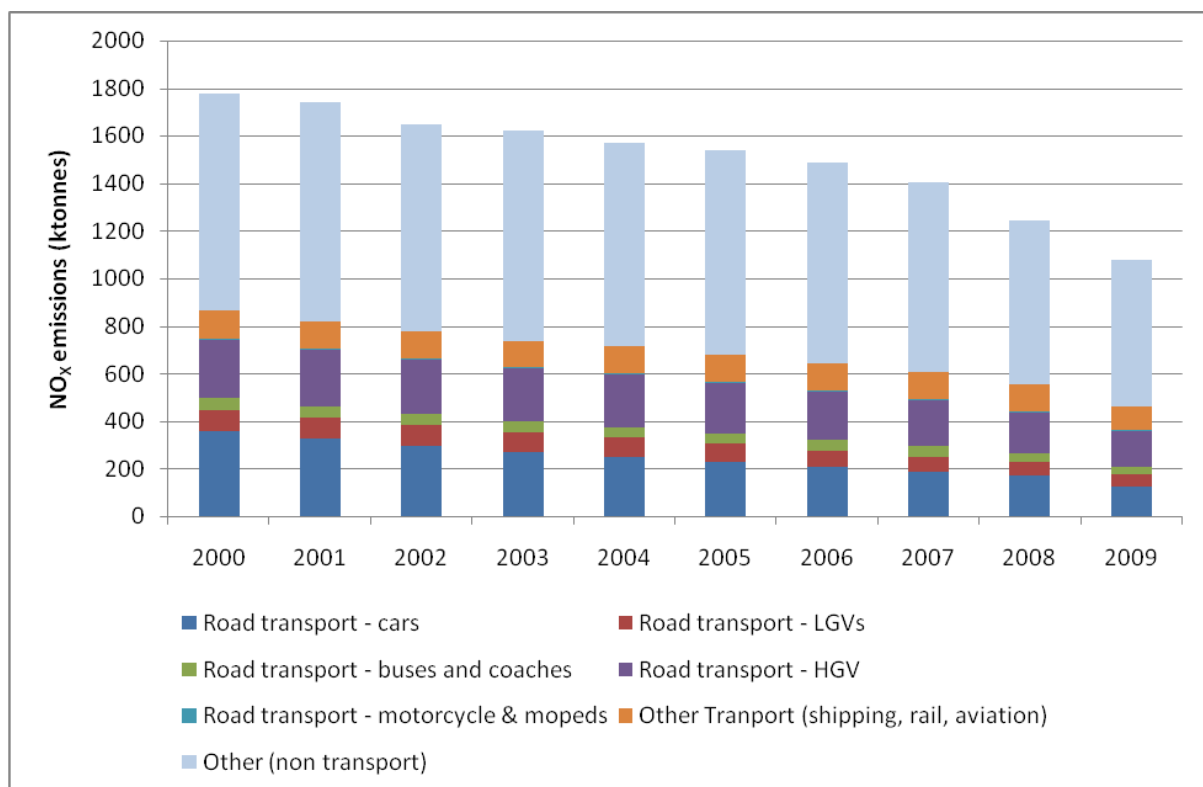
**Key: UB = urban background, RB = regional background, L = local, MS = Member State**

2.2 Emissions to air are regulated in terms of oxides of nitrogen (NO<sub>x</sub>), which is the term used to describe the sum of nitrogen oxide (NO) and nitrogen dioxide (NO<sub>2</sub>). The limit values for the protection of human health relate to NO<sub>2</sub>. Source apportionment information is often presented for NO<sub>x</sub>, rather than NO<sub>2</sub>, because the complexities of the atmospheric chemistry mean that a fully robust and unambiguous source apportionment is not possible for NO<sub>2</sub>. Further information on source apportionment is provided in the technical report detailing the assessment methodology for the plans.

### 3. Evaluation of progress towards meeting the NO<sub>2</sub> limit values

- 3.1 Since the NO<sub>2</sub> limit values came into force in 1999, the UK has introduced many pollution abatement measures that have resulted in compliance with the NO<sub>2</sub> limit values over large parts of the country. Approximately 83% of UK road links assessed are forecast to be compliant with annual mean limit value in 2010.
- 3.2 Between 2000 and 2009, total UK emissions of NO<sub>x</sub> have fallen by 39% (see **Figure 3**) and the UK is currently expected to meet its national emission ceiling for NO<sub>x</sub> under the National Emissions Ceilings Directive (2001/81/EC) in 2010<sup>16</sup>.

**Figure 3: Annual UK Emissions of Nitrogen Oxides (NO<sub>x</sub>) since 2000.**



- 3.3 Despite this significant decrease in NO<sub>x</sub> emissions, overall concentrations of NO<sub>2</sub> have declined at a slower rate and in many urban areas concentrations have remained relatively static over the last six to eight years. Consequently, the length of road exceeding the NO<sub>2</sub> limit values has fallen in recent years but urban hotspots remain. This is reflected in **Table 2**, which shows that the length of road exceeding the limit values has declined but the number of zones in which there are some exceedences of the limit values has remained relatively constant. There is ongoing research aiming to better understand the

<sup>16</sup> UK NO<sub>x</sub> emissions data for 2010 will be published in December 2011.



complexities and disparities between the emissions and concentrations of NO<sub>x</sub> and to reduce uncertainty in assessment results.

**Table 2: Trend Data: Number of zones and km of road exceeding the limit values (LV).**

	Year									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 Projections (from 2008) <sup>B</sup>
Number of zones exceeding NO <sub>2</sub> annual mean LV	38	36	42	39	38	39	41	40	40	37
Km in exceedence of NO <sub>2</sub> annual mean LV <sup>A</sup>	5521	3346	7382	4908	5025	4727	4788	3600	3254	2303
% of UK modelled road length exceeding	35%	21%	53%	35%	36%	34%	34%	26%	25%	17%
Number of zones exceeding NO <sub>2</sub> hourly mean LV	4	1	3	1	2	1	2	3	2	2

<sup>A</sup>We do not have Km in exceedence of NO<sub>2</sub> hourly mean LV as we have not modelled this

<sup>B</sup> Air quality plans are being submitted for more zones than are projected to exceed the limit values in 2010 in light of uncertainties within the projections. See **Table 1**.

## The compliance challenge

- 3.4 As stated in paragraph 1.1, compliance with the NO<sub>2</sub> limit values has been achieved over large parts of the UK. However, delivering the necessary improvements in urban areas has proved considerably more challenging than originally anticipated. There are a number of reasons for the slower than anticipated decline in NO<sub>2</sub> concentrations, some of which are historic and relatively well defined and others that are only just emerging and are yet to be addressed. The key reasons are EU wide.
- 3.5 In 2009, the UK updated its road transport emissions inventory to reflect new knowledge about real world emissions of NO<sub>x</sub> from a range of vehicle classes. Within the UK market, vehicles are tested over a regulatory cycle and type approved according to defined emission limits before sale. The updating process revealed that NO<sub>x</sub> emissions from vehicles had not decreased by the amounts expected in the literature for the type approval tests.
- 3.6 The most significant changes to the inventory were for emissions from Euro 3 and 4 diesel cars and Euro III Heavy Goods Vehicles (HGVs), introduced in 2000 and 2005. The underperformance of vehicle abatement technologies has meant that the decline in NO<sub>x</sub> emissions was 56 kilotonnes less than expected for road transport between 1998 and 2010.
- 3.7 This has been compounded by the increase in the fraction of NO<sub>x</sub> directly emitted as NO<sub>2</sub> from diesel vehicle exhausts due to the fitting of oxidation

catalysts and certain types of diesel particulate filters aimed at reducing other pollutant emissions from vehicles manufactured to Euro 3 and 4 and Euro III and IV standards. This leads to higher NO<sub>2</sub> concentrations close to emission sources such as urban roads.

- 3.8 Other unanticipated changes in the in the UK road transport fleet over the last 10 years have also meant that emissions of NO<sub>x</sub> have not fallen as much as expected. In particular, there has been growth in diesel vehicle activity with a switch from petrol to diesel in the UK car population with a concurrent increase in NO<sub>x</sub> emissions per vehicle. In 2000, only 14% of new cars sold in the UK were diesel but by 2010 this had risen to 46%<sup>17</sup>. There have also been increases in van and local bus activity in some urban areas.
- 3.9 Despite the underperformance of a number of diesel Euro Standards and increases in the fraction of NO<sub>x</sub> emitted as NO<sub>2</sub>, ambient concentrations of NO<sub>2</sub> were still expected to continue to fall from 2004 onwards. However, this has not been the case and investigations are now underway to try and understand why. Evidence suggests a number of reasons including:
- emissions from aging Euro 1 and 2 petrol cars are higher than our inventory currently suggests;
  - real world emissions of NO<sub>x</sub> from diesel cars and Light Goods Vehicles (LGVs) have reduced even less over the past 15 years than was thought despite the introduction of increasingly stringent Euro standards;
  - selective catalytic reduction (SCR) used on HGVs is ineffective at reducing NO<sub>x</sub> emissions under urban-type (slow speed and low engine temperature) driving conditions.
- 3.10 In conclusion, the main reason why the UK has not been able to achieve full compliance with the NO<sub>2</sub> limit value is that despite the introduction of vehicles meeting increasingly stringent Euro standards, real world emissions of NO<sub>x</sub> from many vehicle classes have been considerably higher than anticipated. This, combined with an increase in the fraction of NO<sub>x</sub> emitted as NO<sub>2</sub>, has led to trends in NO<sub>2</sub> concentrations over the last five years that are, at best, only weakly downwards.
- 3.11 The reasons outlined above are complex and underline the difficulties in both predicting the impacts of existing road transport abatement measures and in identifying additional measures that we can have confidence will bring about further emission reductions. Knowledge and understanding of NO<sub>2</sub> road transport emission sources continues to develop and with it our understanding of the achievability of meeting NO<sub>2</sub> limits.

## Assessment of compliance by 2015

- 3.12 The data in **Table 3** show the forecasted compliance picture for 2015. Air quality improvement measures have been modelled in two stages and are included in the projections. The first stage comprises committed measures

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<sup>17</sup> SMMT New Car CO<sub>2</sub> Report 2011: <https://www.smmt.co.uk/shop/new-car-co2-report-mar-2011/>

which are contained within the baseline (business as usual or BAU) projections for 2015 because they have either already been implemented or Government funding is confirmed for implementation in the near future. See Chapter 4 for more information on these measures.

- 3.13 Additional measures beyond those included in the baseline have been appraised as described in Chapter 5 and a second stage of modelling has been carried out looking at the possible impacts of a LEZ scenario. Further information on the modelling scenarios is set out in the accompanying technical report.
- 3.14 Decisions about which zones require additional time to meet the limit value have been made on the basis of the 2010 projections and more recent monitoring data. Whilst the projections indicate that compliance may be achieved in some zones prior to 2015, the uncertainties associated with these mean it is likely that the full period until 2015 will be required. Progress towards compliance as indicated by numbers of zone in exceedence is shown in **Table 3** below. Note that although 40 zones currently contain road links in exceedence, the vast majority of road links assessed in the UK are compliant.

**Table 3: Assessment of compliance beyond 2010**

	Number of zones in exceedence of NO <sub>2</sub> annual mean Limit Value	% of UK roadlinks assessed that are compliant with the NO <sub>2</sub> annual mean Limit Value
2010 Projections	40	83%
2015 – with measures modelled in a baseline scenario	21	95%
2015 – including the LEZ scenario	17	96%
2025 Assessment	0	100%

## Vehicle emission factors

- 3.15 Projections have been made using existing vehicle emissions factors from the UK National Atmospheric Emissions Inventory<sup>18</sup> as these represented the best available evidence. However, emerging evidence from different sources including an independent review of trends in NO<sub>x</sub> and NO<sub>2</sub> in the UK<sup>19</sup> suggests that there are still uncertainties in emission estimates used for some current vehicle types and Euro standards as described in paragraph 3.9.

<sup>18</sup> <http://naei.defra.gov.uk/>

<sup>19</sup> [http://uk-air.defra.gov.uk/reports/cat05/1108251149\\_110718\\_AQ0724\\_Final\\_report.pdf](http://uk-air.defra.gov.uk/reports/cat05/1108251149_110718_AQ0724_Final_report.pdf)

However, understanding of the issues is not yet sufficiently advanced to allow a comprehensive update of our road transport emissions inventory based on the emerging evidence. This is an issue for all EU Member States.

- 3.16 Before an improved emission inventory calculation methodology can be developed with confidence, further information is necessary. This includes: more sophisticated information on the extent of SCR use in the UK HGV fleet; better information on the changing emissions performance of petrol vehicles over time and more accurate information on the vehicle stock age profile and distance travelled.
- 3.17 During 2011 the UK is carrying out work to improve our understanding of the deficiencies of the road transport emissions inventory and to collect information to fill data gaps. We will continue to follow the advice in the EMEP emission inventory guidebook<sup>20</sup> on best practice in the use of methods and emission factors for inventory compilation and will look to update our road transport inventory when robust alternative methodologies have been developed.

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<sup>20</sup> <http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009>

## 4. Past, present and future measures towards compliance with NO<sub>2</sub> limit values

- 4.1 The many measures that have been implemented in all or part of the UK to help tackle NO<sub>2</sub> pollution are set out in successive UK Air Quality Strategies and the Air Quality Plans that have been submitted to the European Commission annually. These plans are available on the European Environment Agency's Central Data Repository<sup>21</sup>. Over 90 national measures are included in the list of UK and National measures accompanying this UK overview. The list also indicates which of the national measures have been included in the baseline modelling work underpinning production of the air quality plans.
- 4.2 The measures of the most direct relevance to tackling NO<sub>2</sub> exceedences have targeted road transport and have taken the form of regulatory requirements, fiscal incentives or behavioural measures aimed at promoting sustainable transport choices such as cycling, walking or public transport. This has included publication of guides or toolkits but also funding to support infrastructure improvements to achieve behavioural change.
- 4.3 UK measures have targeted all forms of transport – road, rail, air and shipping – and at both the national and local scales as necessary. They have contributed to improvements in ambient air quality as exemplified by the decline in the number roads exceeding NO<sub>2</sub> limit values and have also left the UK in a good position to meet its national emission ceilings for all four air pollutants under directive 2001/81/EC. Where it has been possible to quantify the impacts of these measures, these have been included in the baseline for the assessment of compliance with the NO<sub>2</sub> limit value.
- 4.4 The UK Government has also ensured that air quality is taken into account in the appraisal of national policy proposals and in local planning and development. National guidance<sup>22</sup> has been published on the interaction between planning policy and pollution control to ensure that through sustainable development we achieve the best balance of social, economic and environmental considerations and minimise adverse effects either on air quality specifically or the wider environment. The UK's Department for Transport has also recently implemented changes to the treatment of air quality in webTAG - its transport appraisal guidance<sup>23</sup>.
- 4.5 Reductions in air pollutant emissions also result from climate change mitigation. The UK Government has introduced significant commitments and measures to reduce CO<sub>2</sub> emissions and where possible is aiming to optimise the air quality co-benefits. The UK 2010 Publication 'Air Pollution: Action in a

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<sup>21</sup> <http://cdr.eionet.europa.eu/gb/eu/aqpp>

<sup>22</sup> An example guidance document is available here:

<http://www.communities.gov.uk/publications/planningandbuilding/planningpolicystatement23>

<sup>23</sup> <http://www.dft.gov.uk/webtag/>

Changing Climate<sup>24</sup> sets out the main domestic legal commitments to reduce CO<sub>2</sub> emissions and highlights the air quality/climate change benefits that can be achieved through actions such as promoting ultra-low carbon vehicles, renewable sources of energy not involving combustion and energy efficiency measures.

## **Implementation of EU Directives**

- 4.6 The UK has implemented all of the EU legislation set out in section B2 of Annex XV of the Ambient Air Quality Directive that is aimed at driving down emissions of air pollutants and improving air quality. The Annex to this document summarises the UK implementing legislation. The impact of all relevant EU legislation has been included in the baseline modelling work underpinning production of the air quality plans.

## **National transport measures**

- 4.7 It is the UK Department of Transport's vision to develop and maintain a transport system that is an engine for economic growth but one that is also greener and safer and improves the quality of life in our communities. Strategies for the reduction of air pollutant emissions from transport have been developed within this context, mindful of the long term priority of the UK to move towards a sustainable low carbon economy.
- 4.8 Successive UK Governments have introduced a number of measures at a total cost of £billions to encourage more sustainable forms of transport that have provided benefits for both air quality and climate change, as well as helping to reduce congestion in towns and cities in the UK and supporting economic growth and development. Implementation of these measures has taken place at a national, sub-national and local level according to which is most appropriate in order to achieve the optimum impact – the most significant of these measures are summarised in the following paragraphs.

## **Incentivising cleaner vehicles**

- 4.9 Over the last decade, a number of measures have been implemented which incentivise the uptake of cleaner vehicle technologies. More recently in 2010, the current UK Government has underlined its own commitment to improving air quality, in line with wider carbon benefits, by making provision of over £400m for measures designed to promote the uptake of ultra-low carbon vehicle technologies. This will include supporting consumer incentives for electric and other low emission cars until at least 2015, with regular reviews of the scheme and the level of subsidy to ensure continued value for money. It will also include continued investment in electric vehicle recharging infrastructure (Plugged In Places) and further research and development.

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<sup>24</sup> <http://www.defra.gov.uk/publications/files/pb13378-air-pollution.pdf>



- 4.10 Other measures which will improve existing vehicle emissions include a new Reduced Pollution Certificate scheme which will provide HGV operators with annual VED discounts of up to £500 for early compliance with the Euro VI air quality standard. This scheme has helped over 80,000 HGVs and buses achieve early compliance with the latest Euro Standards since the certificate was launched in 1999. The Green Bus Fund has also seen £45million allocated to 38 local authorities and transport companies to encourage the uptake of low-emission buses.
- 4.11 Examples of measures which have in the past 10 years significantly contributed to the accelerated uptake of cleaner vehicle technologies include: the CleanUp Programme, which provided grants to businesses for the purpose of encouraging the retrofit of emission reduction technologies or the conversion to alternative, less polluting, fuels; and the PowerShift programme, which provided grants for individuals and businesses to encourage the purchase of LPG, natural gas, hybrid and electric vehicles, and the conversion of conventional internal combustion engines to run on LPG or natural gas.

### **Freight distribution and modal shift**

- 4.12 Moving both freight and passengers away from road transport towards less polluting forms of transport, such as rail, waterway, cycling and walking, is an important part of addressing the UK's air quality problem. The UK Government has committed over £140 million to support cycling and walking between 2008 and 2011, and this work will continue through the funding provided by, for example, the £560m Local Sustainable Transport Fund in England. This fund will challenge local transport authorities<sup>25</sup> to develop packages of measures that support economic growth and reduce emissions in their communities as well as delivering cleaner environments, improved safety and increased levels of physical activity. Other measures are likely to include encouraging better public transport and improved traffic management schemes.
- 4.13 The UK Government heavily subsidises rail travel, helping to keep fare prices and freight costs down, and thereby encouraging modal shift to rail. In addition, the Government has committed to a number of mode shift grants, designed to encourage freight transport by rail, inland waterway, or sea. The grants have a confirmed combined budget of £20m for 2010/11, and £20m for 2011/12 and the UK Government expects they will help to remove around 1.5 million lorry journeys in that time.

### **Tackling traffic congestion**

- 4.14 Various measures have been implemented to tackle traffic congestion and the resulting emissions, including NO<sub>x</sub>, over the last decade. The Controlled Motorways scheme has introduced variable speed limits to smooth traffic over

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<sup>25</sup> Applies to local authorities outside of London

some of the busiest stretches of motorway. The Managed Motorways scheme has gone even further by directing traffic to use the motorway hard shoulder during times of peak traffic flow to ease congestion.

- 4.15 Research trials have also taken place to reduce traffic emissions and their impacts over motorway stretches with mixed results. These studies have included painting noise barriers with Titanium Dioxide to remove NO<sub>x</sub> from certain stretches of motorway.

### **Reducing emissions from shipping, aviation and rail**

- 4.16 The UK is committed to reducing NO<sub>x</sub> emissions from the shipping sector. The Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008<sup>26</sup> introduced NO<sub>x</sub> emission limits for marine diesel engines and the UK played a prominent role in securing revisions to Annex VI of the MARPOL Convention on pollution from ships, which introduces more stringent air pollution requirements. These requirements include staged (Tier 2 and Tier 3) reductions in new engine NO<sub>x</sub> limits by 2015. The UK is now funding work with Dutch and Norwegian colleagues to explore the feasibility of a NO<sub>x</sub> Emissions Control Area for the North Sea.
- 4.17 The UK has been working through the International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP) to drive NO<sub>x</sub> emission reductions from aviation. UK involvement in ICAO costs about £2m per year. A 'CAEP 6' NO<sub>x</sub> emissions standard for newly certified aircraft jet engines was agreed by ICAO in 2004 and introduced in 2008, which is 12% more stringent than the previous standard. In 2010, the UK helped ensure ICAO agreement of a new 'CAEP 8' NO<sub>x</sub> emissions standard, which upon introduction in 2014 will be a further 15% more stringent than the CAEP 6 standard for new large jet engines.
- 4.18 The UK is also embarking on further railway electrification work over the next 5-10 years, which will reduce reliance on diesel trains on key sections of the UK rail network. The largest rail electrification project is the £704million upgrade of the Great Western mainline from London to Cardiff, which will enable the replacement of older diesel locomotives with modern electric trains that emit no air pollutants at trackside. This will have a positive impact on air quality in and around the major urban train stations along the route.

### **Funding and guidance to local authorities**

- 4.19 Defra and the devolved administrations provide guidance to all local authorities on measures to improve air quality including guidance on LEZs, low emission vehicles, abatement equipment for reducing air pollution and guidance for implementing low emission strategies and managing air quality for land use planning. It is not possible to quantify the impact of all measures that local authorities take to improve air quality but we have used the

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<sup>26</sup> <http://www.legislation.gov.uk/ukSI/2008/2924/made>

information available to us to quantify as many measures as possible. This information is included in our baseline assessment of air quality.

- 4.20 The UK Government has in the past provided funding to local transport authorities in the form of capital grants (not in Scotland), the extent of which were weighted by a variety of criteria, including local air quality. The current UK Government's commitment to localism in England is likely to bring changes to this process, with a focus on de-ring-fencing, to enable local authorities to prioritise the most urgent problems. This will allow those local authorities with the worst air quality exceedences to assign funds as necessary to tackle the problem. The UK Government has recently made available an air quality grant of £2m to support local air quality improvement projects in England. This grant is focused on local authority led projects to tackle exceedences of NO<sub>2</sub>.

### **National non-transport measures**

- 4.21 The UK has introduced a wide variety of non-transport measures to tackle air pollution over the past decade. In 2009, overall UK emissions of NO<sub>x</sub> had fallen by 39% since 2000 in part due to measures tackling NO<sub>x</sub> pollution from industrial and domestic sources with further reductions expected before 2015 and beyond.

### **Measures for industry**

- 4.22 The industrial pollution permitting regime in the UK embodies the requirements of the Integrated Pollution Prevention and Control (IPPC) Directive (2008/1/EC) and the Large Combustion Plants Directive (2001/80/EC). Operating permits for industrial installations contain emission limit values and other requirements based upon the application of best available techniques (BAT). Between 2000 and 2009, NO<sub>x</sub> emissions from the power sector reduced by 27% and from other industrial combustion by 34%.
- 4.23 Since 2007, the introduction of low-NO<sub>x</sub> burners at many UK fossil fuel power stations has contributed to a sharp drop in NO<sub>x</sub> emissions from the power sector. Between now and 2015, further NO<sub>x</sub> emission reductions from the power sector are expected as older fossil fuel power stations are run down and closed under the opt-out provisions of the Large Combustion Plants Directive.

### **Measures for businesses and the home**

- 4.24 Over the last decade, the UK has introduced energy efficiency measures for homes and buildings that, although primarily targeted at reducing carbon dioxide (CO<sub>2</sub>) emissions to help tackle climate change, can also reduce NO<sub>x</sub> emissions. These measures have included domestic boiler scrappage

schemes<sup>27</sup> and the Warm Front scheme<sup>28</sup>. Looking ahead, key measures include:

- The Carbon Emissions Reduction Target (CERT), which is the principal existing household energy efficiency scheme. Introduced in April 2008, it is an obligation on larger domestic energy suppliers to reduce carbon emissions from British households. Suppliers can achieve their targets through the promotion of measures (typically with subsidy) which increase energy efficiency, reduce energy consumption or through Micro generation. Insulation measures together with more efficient lighting and heating measures make up the large proportion of savings. CERT was extended last summer to December 2012 setting a new higher target of 293 million lifetime tonnes of CO<sub>2</sub>, and significantly refocusing the scheme around measures which improve the fabric of the property. Over the CERT extension phase it is estimated that 3.5 million households will receive an insulation measure whilst the full suite of measures will see £989 million of air quality benefits realised.<sup>29</sup>
- The Green Deal<sup>30</sup>, which will establish a new market for energy efficiency measures from 2012, at the heart of which will be a new financing mechanism. Green Deal finance will promote a cost-effective response to our aims on energy efficiency and place the emphasis for paying for energy efficiency measures with the beneficiary – with the energy bill savings offsetting any costs. It will be supported by a new obligation on larger energy suppliers (which will supersede CERT) focused on the needs of the lower income and most vulnerable as well as hard to treat (e.g. solid wall) housing where energy saving solutions are more costly. Consultations on the detailed design of these mechanisms will be launched in autumn 2011.
- The Renewable Heat Incentive (RHI)<sup>31</sup>. From October 2012, incentivisation of renewable heat will be accompanied by NO<sub>x</sub> and particulate matter (PM<sub>10</sub>) emission limits for biomass-burning appliances below 20MW thermal capacity.
- The UK Carbon Plan<sup>32</sup>, which was published in March 2011, sets out the steps that the UK Government will be taking to deliver a low carbon economy and meet the UK's statutory carbon targets.

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<sup>27</sup> <http://www.energysavingtrust.org.uk/Home-improvements-and-products/Heating-and-hot-water/Boiler-Scrappage-Scheme>

<sup>28</sup> [http://www.direct.gov.uk/en/Environmentandgreenerliving/Energyandwatersaving/Energygrants/DG\\_10018661](http://www.direct.gov.uk/en/Environmentandgreenerliving/Energyandwatersaving/Energygrants/DG_10018661)

<sup>29</sup> [http://www.decc.gov.uk/en/content/cms/consultations/cert\\_ext/cert\\_ext.aspx](http://www.decc.gov.uk/en/content/cms/consultations/cert_ext/cert_ext.aspx)

<sup>30</sup> [http://www.decc.gov.uk/en/content/cms/what\\_we\\_do/consumers/green\\_deal/green\\_deal.aspx](http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/green_deal/green_deal.aspx)

<sup>31</sup> [http://www.decc.gov.uk/en/content/cms/what\\_we\\_do/uk\\_supply/energy\\_mix/renewable/policy/incentive/incentive.aspx](http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/policy/incentive/incentive.aspx)

<sup>32</sup> <http://www.decc.gov.uk/assets/decc/What%20we%20do/A%20low%20carbon%20UK/1358-the-carbon-plan.pdf>

4.25 In the period to 2020, further NO<sub>x</sub> emissions reductions will be achieved with the introduction of smart energy meters which are expected to reduce electricity consumption in homes and smaller non-domestic sites. 10% of transport energy is also expected to come from renewable sources and the power sector will be cutting NO<sub>x</sub> emissions even further to meet the requirements of the new Industrial Emissions Directive (2010/75/EU).

## 5. Consideration of scope for additional action to achieve the NO<sub>2</sub> limit value

- 5.1 Given that our projections suggest that a number of zones will not achieve full compliance by 2015, we are exploring all possibilities for additional action to hasten progress towards full compliance. This is extremely challenging.
- 5.2 Since 2008, the UK Government has reviewed a large number of different options for further action at national, regional and local levels. These have been considered against criteria of cost feasibility and effectiveness in delivery of improvements and included:
- review of UK Air Quality Strategy measures;
  - review of other measures implemented by Department for Transport, the Highways Agency and local authorities (through their air quality action plans);
  - review of measures being considered in the Mayor of London's Air Quality Strategy;
  - discussion with technical experts and local authority air quality practitioners;
  - consideration of measures set out in the Ambient Air Quality Directive (2008/50/EC).
- 5.3 The options for action have included:
- technology options including retro-fitment, low emission vehicles, buildings efficiency etc;
  - behavioural options including – encouraging modal shift, traffic management, eco-driving techniques;
  - local measures including, parking controls bus management arrangements, and measures for local transport planning;
  - strategic options such as national action to support LEZs.

### Appraising additional measures

- 5.4 The UK Government works to common guidance<sup>33</sup> on the assessment of new policy measures. This includes cost-benefit analysis, and the assessment of cost effectiveness.
- 5.5 In order to assess the most cost-effective technology measures to meet the NO<sub>2</sub> limit values, a Marginal Abatement Cost Curve (MACC) approach has been developed. This involves a consideration of the capital, operating and maintenance costs of the technology and the emission savings the technology is expected to deliver.
- 5.6 This assessment tool has allowed the assessment and ranking of a range of

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<sup>33</sup> [http://www.hm-treasury.gov.uk/d/green\\_book\\_complete.pdf](http://www.hm-treasury.gov.uk/d/green_book_complete.pdf)



theoretical technology shifts for their cost-effectiveness and NO<sub>2</sub> abatement potential. Additionally the tool allows us to translate emission reductions into potential impact upon projected concentrations of NO<sub>2</sub> at roadside locations in UK zones. Measures that the process suggests may be cost effective are then screened for their feasibility and acceptability before being progressed further for consideration of implementation costs and other issues and, given the necessarily uncertain assumptions, upon which the modelling is based, more sophisticated consideration of their NO<sub>2</sub> abatement potential.

- 5.7 The MACC analysis, presented in **Table 4**, shows that abatement from heavy duty vehicles may be the most effective approach to deliver additional reductions in NO<sub>x</sub> emissions: the abatement cost per tonne is lower than other measures. Abatement of heavy goods vehicles also has the potential to reduce NO<sub>x</sub> emissions significantly as these sources are large emitters.
- 5.8 The measures were not examined in isolation, rather packages of measures were analysed. Taking an illustrative package of requirements where SCR is fitted to all buses and HGVs, this package would have an abatement potential of 7,595 tonnes in 2015 at an average abatement cost of £6,316 per tonne.

**Table 4: Marginal abatement cost curve, below £80,000 per tonne (2015)**

Abatement option	Abatement cost (£/t 2015)	Abatement potential (t/NO <sub>x</sub> )
Euro I Buses replaced by Hybrid	£684	21
Euro II Buses replaced by Hybrid	£1,860	274
Euro III Buses replaced by Hybrid	£2,454	1017
Euro II HGVs being retrofitted with SCR*	£5,099	155
Euro III HGVs being retrofitted with SCR*	£5,380	2353
Euro IV Buses replaced by Hybrid	£5,604	481
Euro II Buses being retrofitted with SCR*	£6,251	498
Euro I Buses being retrofitted with SCR*	£6,625	37
Euro III Buses being retrofitted with SCR*	£7,257	1977
Euro IV HGVs being retrofitted with SCR*	£8,053	1524
Euro IV Buses being retrofitted with SCR*	£11,889	1048
Euro V Articulated HGVs replaced by Euro VI	£20,457	5224
Euro V Buses replaced by Hydrogen	£21,365	281
New Euro V Buses replaced by Euro VI	£26,452	1433
Euro V Rigid HGVs replaced by Euro VI	£32,300	3394
Boiler replacement in Commercial-Buildings	£37,470	384
Euro 1 Diesel LGVs replaced by Electric	£76,795	1

\* SCR = Selective Catalytic Reduction

- 5.9 Other options were considered which are not presented in the table above e.g. downsizing petrol cars, electrification of certain parts of the fleet and fitting SCR to power stations. These measures have not been singled out for further consideration due to constraints in feasibility of implementation. The table also does not show measures which had an abatement cost per tonne greater than £80,000. A full list of measures is available in an initial Impact Assessment (see paragraph 5.16).

- 5.10 The MACC tool analysis showed that measures to improve pre Euro IV vehicle standards especially for heavy good vehicles (HGVs) and buses either through retro-fitting with NO<sub>x</sub> abatement equipment or through new vehicle purchase may be amongst the most cost effective measures available to achieve the NO<sub>2</sub> limit values as quickly as possible. This initial assessment did not however take into account the underperformance noted for these later Euro standards under certain conditions and other issues affecting recent trends.

### **Investigating a national framework for Low Emission Zones (LEZs)**

- 5.11 Our analysis suggests that additional LEZs in some key towns and cities may be cost effective in helping to reduce NO<sub>x</sub> emissions (and hence concentrations of NO<sub>2</sub>), and in hastening progress towards compliance with NO<sub>2</sub> limit values. Whilst there are some significant uncertainties around their practical feasibility and effectiveness, we are therefore investigating the potential for LEZs in large urban areas especially and whether UK Government action (such as a national framework) might be appropriate to support or encourage their introduction by local authorities.
- 5.12 LEZs are geographic areas aimed at improving air quality through controlling entry for more polluting vehicles. In 2009 there were around 200 LEZs in operation, or being planned, in 11 European countries<sup>34</sup>. There is some evidence to suggest LEZs may have reduced transport particulate matter emissions where they have been implemented, though determining their impact on overall air quality is more difficult. Very few towns and cities have implemented LEZs targeted at reducing NO<sub>x</sub> emissions. In the UK, a LEZ has been in operation across Greater London since 2008 to encourage the uptake of cleaner vehicles in the city. In 2012 the emissions standards will tighten and it will apply to a wider range of vehicles.
- 5.13 Defra published best practice guidance for local authorities on LEZs in 2009<sup>35</sup>. However, with the notable exception of London where the Mayor already has in place the world's largest LEZ only a small number of LEZs have been implemented. For example, Oxford and Norwich have introduced LEZs to encourage cleaner bus fleets. The UK Government has been investigating the reasons for this with a view to addressing where possible the key barriers to uptake.
- 5.14 Several stakeholders including local authorities, the Greater London Authority, the Local Government Association, and the Environmental Industries Commission have suggested that a national framework for LEZs, which, for example, sets minimum Euro standards to be applied in operation and/or standards for certification of abatement equipment to reduce NO<sub>x</sub> emissions, would help encourage greater uptake. However the current uncertainties around vehicle emissions raise questions around the effectiveness of such

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<sup>34</sup> <http://www.dft.gov.uk/pgr/scienceresearch/orresearch/lez/pdf/lowemissionzones.pdf>

<sup>35</sup> <http://archive.defra.gov.uk/environment/quality/air/airquality/local/guidance/documents/practice-guidance2.pdf>

measures. There are also issues around feasibility and costs of implementation including enforcement. These issues are essential to resolve given that facilitating and implementing further LEZs would involve costs for both central and local government and they would impose compliance burdens on vehicle operators and others affected.

- 5.15 To better understand the feasibility and effectiveness of a national framework to support LEZs, further work is being urgently undertaken to investigate:
- the likely effectiveness of any LEZs in controlling air pollutant emissions within the necessary timescales;
  - the reliability and effectiveness of available NO<sub>x</sub> abatement equipment, taking into account evidence on the performance of Euro standards;
  - the cost and resource implications;
  - the likely take-up of LEZs by local authorities and;
  - how any scheme would relate to ongoing work at EU and UNECE level relating to certification of equipment for NO<sub>x</sub> abatement.
- 5.16 To reflect this work in progress we have published a study commissioned by Defra to investigate the feasibility of developing a certification scheme for retrofit HDV NO<sub>x</sub> abatement technology<sup>36</sup>. We have also included in our air quality plans a modelled scenario for additional LEZs for key urban areas to illustrate the possible benefits for air quality. An initial Impact Assessment<sup>37</sup> has informed our investigation of LEZs. This will be reviewed and updated as the work progresses and additional evidence becomes available.
- 5.17 Subject to the outcome of this development work, decisions will be made as to the next steps, recognising that further consultation would be necessary and that decisions on whether or not to introduce an LEZ in a particular area are for the relevant local authorities.
- 5.18 The LEZ work is being progressed in consultation with local authorities who have responsibility for putting in place measures in pursuance of air quality objectives at local level. In the case of London, the UK Government will continue to work with the Mayor and with London Boroughs to identify further measures to support the achievement of the NO<sub>2</sub> limit value as quickly as possible. Whilst measures to improve bus and HGV fleets would be beneficial in London, the significant additional contribution from non-heavy duty vehicle (HDV)<sup>38</sup> traffic means that a wider range of measures targeting different vehicle fleets are necessary.
- 5.19 In some zones the modelling shows that measures to support the LEZ scenario would have to be supported by further targeted local actions in order

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<sup>36</sup> [http://uk-air.defra.gov.uk/library/reports?report\\_id=668](http://uk-air.defra.gov.uk/library/reports?report_id=668)

<sup>37</sup> For link to Impact Assessment see:  
<http://www.archive.defra.gov.uk/environment/quality/air/airquality/docs/ia-no2.pdf>

<sup>38</sup> Heavy duty vehicles (HDVs) constitute buses and heavy goods vehicles

to achieve compliance by 2015. Details of local measures are set out in the relevant air quality plans and we will continue to discuss with local authorities what further actions are available to hasten compliance or to target these measures more effectively in these areas.

### **Modelling an illustrative LEZ scenario**

- 5.20 An illustrative “LEZ Scenario” has been modelled to assist in understanding the potential impacts of introducing further LEZs to reduce NO<sub>x</sub> emissions. In this scenario all HGVs and buses would be required to meet at least Euro IV emission standards for NO<sub>x</sub> and PM<sub>10</sub> in 2015 in order to travel on roads within selected local authorities. It would not be practicable or reasonable to apply an LEZ to individual stretches of the main long distance routes that connect different parts of the country and therefore it has been assumed that the restrictions do not apply to these roads. Initial screening work was undertaken to indicate where application of the measure would be effective at either reducing the gap to or achieving compliance with the NO<sub>2</sub> annual limit value.
- 5.21 Further information on the zones identified is shown in **Table 1** and is set out in the relevant air quality plans and the technical report. The technical report also gives details on the assumptions made relating to the behaviour of vehicle owners and the effectiveness of emission reduction measures resulting from the LEZ scenario. Projections to 2015 and 2020 including the LEZ scenario are shown in the relevant zone plans.

## Annex: Status of implementation of EU legislation in the UK as set out in Part 2 of Annex XV of the ambient air quality directive (2008/50/EC).

Starred directives are explicitly included in the baseline modelling analysis for NO<sub>2</sub> plans

Directive	Implemented	UK Implementing legislation
70/220/EEC emissions from motor vehicles*	Yes	The Motor Vehicles (EC Type Approval) (Amendment) Regulations 2003
1994/63/EC – petrol vapour recovery stage 1.	Yes	The Carriage of Dangerous Goods by Road Regulations 1996 Pollution Prevention and Control (Scotland) Regulations 2000 SSI 2000/323 (Part B of section 1.2, Chapter 1, Part I of Schedule1) The Control of Volatile Organic Compounds (Petrol Vapour Recovery) (Scotland) Regulations 2004 The Pollution Prevention and Control (Amendment) Regulations (Northern Ireland) 2004 The Pollution Prevention and Control (Amendment) (No. 3) Regulations (Northern Ireland) 2005 The Environmental Permitting (England and Wales) Regulations 2010
2008/1/EC – integrated pollution prevention and control (IPPC)*	Yes	The Pollution Prevention and Control (Scotland) Regulations 2000 The Offshore Combustion Installations (Prevention and Control of Pollution) Regulations 2001 The Pollution Prevention and Control Regulations (Northern Ireland) 2003 The Pollution Prevention and Control (Amendment) and Connected Provisions Regulations (Northern Ireland) 2005 The Pollution Prevention and Control (Amendment) and Connected Provisions (No. 2) Regulations (Northern Ireland) 2005 The Pollution Prevention and Control (Miscellaneous Amendments) Regulations (Northern Ireland) 2006 The Pollution Prevention and Control (Amendment) Regulations (Northern Ireland) 2007 The Environmental Permitting (England and Wales) Regulations 2010

1997/68/EC – non-road mobile machinery*	Yes	The Non-Road Mobile Machinery (Emission of Gaseous and Particulate Pollutants) Regulations 1999 The Non-Road Mobile Machinery (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2002 The Non-Road Mobile Machinery (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2004
98/70/EC quality of petrol and diesel fuels*	Yes	The Motor Fuel (Composition and Content) Regulations 1999 The Motor Fuel (Composition and Content) (Amendment) Regulations 2001
1999/13/EC – solvent emissions	Yes	The Environmental Permitting (England and Wales) Regulations 2010 The Solvent Emissions (Scotland) Regulations 2004 Solvent Emissions Regulations (Northern Ireland) 2004 Solvent Emissions (Amendment) Regulations (Northern Ireland) 2010
1999/32/EC – sulphur content of liquid fuels* 2005/33/EC – sulphur content of marine fuels*	Yes	The Sulphur Content of Liquid Fuels (England and Wales) Regulations 2007; The Sulphur Content of Liquid Fuels (Scotland) Regulations 2007; The Sulphur Content of Liquid Fuels Regulations (Northern Ireland) 2007; The Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2010
2000/76/EC – waste incineration*	Yes	The Environmental Permitting (England and Wales) Regulations 2010 Waste Incineration (Scotland) Regulations 2003 Waste Incineration Regulations (Northern Ireland) 2003
2001/80/EC - large combustion plants*	Yes	The Environmental Permitting (England and Wales) Regulations 2007 The Large Combustion Plants (Scotland) Regulations 2002; The Large Combustion Plants (National Emission Reduction Plan) Regulations 2007
2001/81/EC – national emission ceilings*	Yes	The National Emission Ceilings Regulations 2002
2004/42/EC - paint products	Yes	The Volatile Organic Compounds in Paints, Varnishes and Vehicle

		Refinishing Products Regulations 2005 as amended by The Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products (Amendment) Regulations 2010
2005/55/EC – emissions of vehicles*	Yes	The Road Vehicles (Construction and Use) and Motor Vehicles (Type Approval for Goods Vehicles) (Great Britain) (Amendment) Regulations 2006; The Motor Vehicles (EC Type Approval) (Amendment No. 4) Regulations 2006
2006/32/EC – energy efficiency*	Yes	Implemented through voluntary agreements