

Emissions compliance proves a major challenge for the UK

Efforts to reduce emissions from vehicle exhausts is proving to be a tough ask as the UK struggles to meet European directives on air quality, says Dr Glyn Rhys-Tyler.

Introduction

Greater attention has been placed on the environmental impact of transport in recent years and the fact that poor air quality has a significant negative impact on human health.

The two main air pollutants of current concern from road transport in the UK are nitrogen oxides (NO_x) and particulate matter. This article focuses on NO_x from vehicle exhausts.

NO_x from vehicle exhausts primarily comprises two components: nitric oxide (NO) and nitrogen dioxide (NO₂). From a health perspective NO₂ is of most concern. However NO readily converts to NO₂ in the atmosphere, so to reduce ambient concentrations of NO₂ it is necessary to control emissions of total NO_x.

Road transport is responsible for about 46% of total NO_x emissions in England. However in locations with poor air quality, for example some parts of the highway network, the relative contribution of road transport to the NO₂ air quality problem can be up to 80%. NO and NO₂ emissions are particularly associated with diesel engines.

The legal context

Legal limit values for nitrogen dioxide in ambient air were defined and adopted in European legislation (Directive 99/30/EC) in April 1999.

These include a one hour mean limit value for the protection of human health of 200 µg/m³ not to be exceeded more than 18 times a calendar year and an annual mean limit value for the protection of human health of 40 µg/m³. Both limit values were to be met by member states by 1 January 2010.

However a review in 2005 had shown that compliance with the Directive would be difficult for a significant number of member states. A new Directive 2008/50/EC was adopted which, while keeping the limit values unchanged, introduced the



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possibility of extending the compliance date by up to five years (to 1 January 2015).

In addition the Directive imposed a general duty on member states to prepare 'air quality plans' for areas where the limit values were not met. Directive 2008/50/EC was made law in England through the Air Quality Standards Regulations 2010.

The problem

Despite the fact that air quality legislation was introduced in 1999 and that European governments have had 16 years (to date) to take remedial action the problem of NO₂ pollution in ambient air persists.

In September 2011 the UK Government produced projections for ambient NO₂ concentrations and published expected dates for compliance with the legislated annual mean limit values. For the purpose of air quality assessment and compliance reporting the UK is divided into 43 geographic zones. The September 2011 projections indicated 27 zones would be compliant by 2015, 42 compliant by 2020 and all 43 compliant by 2025.

However in July 2014 the UK Government published updated projections which indicated that only five

zones would be compliant by 2015, 15 compliant by 2020, 38 by 2025 and 40 by 2030. The remaining three zones (Greater London Urban Area, West Midlands Urban Area and West Yorkshire Urban Area) would not be compliant by 2030.

The UK Government has stated that one of the reasons for the worsening position is the failure of the European vehicle emission (Euro) standards to deliver the expected reductions in emissions of oxides of nitrogen from diesel vehicles.

The UK Supreme Court ruled in April 2015 that the Government had failed to meet its legal obligation to comply with the NO₂ air quality limit values contained in Directive 2008/50/EC and must submit new air quality plans to the European Commission no later than 31 December 2015.

Local air quality and road transport in practice

In 2012 surveys of real world vehicle emissions were carried out in the London Borough of Ealing using roadside remote sensing techniques. The surveys permitted the quantification of both NO and NO₂ emission rates from different groups



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of road vehicles by fuel type and Euro emissions standard.

Within the case study locations air quality (ambient NO₂ concentration) was also monitored during 2012, at 14 locations. The observed annual mean NO₂ concentrations ranged from a minimum of 40.7 µg/m³, to a maximum of 75.1 µg/m³.

In 2012 light vehicles (cars, vans and taxis) in Ealing were responsible for between 33% and 49% of total road transport NO_x emissions, depending on location. Heavy goods vehicles were responsible for between 16% and 58% depending on location and buses were responsible for between 2% and 51%.

This variability highlights the importance of targeting appropriate management interventions to achieve desired local reductions in air pollution within a local authority area.

The introduction of the Euro 6 emissions standard

The new Euro 6 emissions standard for light vehicles came into force on 1 September 2015 for the registration and sale of passenger cars in the EU. The new emissions standard reduced the type approval test limit for NO_x from diesel



Roadside remote sensing techniques are used to survey vehicle emissions

passenger cars and light vans from 180 mg/km at Euro 5, to 80 mg/km at Euro 6.

Earlier emissions control technologies (eg Euro 5) have largely failed to deliver the expected reductions in such emissions in the real world. However in May 2015 EU member states also agreed to adopt 'real world driving' emissions test procedures to address the inconsistency between current laboratory tests and real world emissions performance. The 'Real Driving Emission' test procedure is due to come into force from September 2017.

Euro 6 emissions limits for heavy goods vehicles are being introduced over a different timescale but are due to be fully implemented by 31 December 2016. The revised HGV emissions standard reduces the NO_x emissions limit from 2.0 g/kW.hr at Euro 5, to 0.46 g/kW.hr at Euro 6.

Looking to the future

Introduction of the new Euro 6 vehicle emissions standards alone will take a number of years to have a significant impact on local air quality, due to the rate of fleet renewal.

The average age of a passenger car in Ealing is around seven years. The commercial vehicle fleet tends to be younger, so the rate of renewal of commercial vehicles will be faster.

The 'legacy' problem of the existing vehicle fleet driving on the roads today will continue for many years to come unless interventions are made to improve their emissions performance, reduce their usage in locations with poor air quality, or remove the most polluting vehicles from the road.

"It remains to be seen whether the recent revelations of the use of emissions testing 'defeat devices' by Volkswagen will have a



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material influence on future developments in the market or regulations."

Recent analysis indicates that, even with a significant intervention such as an 'Ultra Low Emission Zone', a number of the Ealing air quality monitoring locations are still expected to have an annual mean NO₂ concentration of greater than the legal limit value of 40µg/m³ at 2017.

A small number of monitoring sites in Ealing, where current annual mean NO₂ concentrations are in excess of 60µg/m³, will possibly still be in breach of the legal limit value at 2020, even with significant management interventions, due to the volume and composition of local road traffic.

Conclusions

The Government is required by the UK Supreme Court to submit revised air quality plans to the European Commission by the end of 2015.

Road transport emissions are a significant part of the problem in locations where legal air quality limit values are breached and therefore reduction of road transport emissions will necessarily form part of the solution.

The Government is currently consulting on a draft plan to improve air quality by tackling nitrogen dioxide in towns and cities, which runs until 6 November 2015. (see <http://bit.ly/1VTcIMZ>)

The challenge is complex, involving issues of science, technology, economics, social equity and public health and will require cross disciplinary solutions. The UK and other European member states face a significant challenge if the desired outcome of clean air is to be achieved in the foreseeable future.

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