The UK National Air Quality Strategy: the effects of the proposed changes on Local Air Quality Management

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Abstract

The UK has implemented a system of Local Air Quality Management (LAQM) to tackle the many contemporary sources of air pollution, notably transport, industry and domestic fuel burning, in a holistic manner. The current legislation stems from the Environment Act 1995, which required a National Air Quality Strategy (NAQS) to be published outlining the Governments policies with respect to the assessment and management of air quality. The NAQS, originally published in March 1997, is on a rolling programme of reviews in order to reflect developments in European legislation, technological and scientific advances, improved air pollution modelling techniques and an increasingly better understanding of the economic and social issues involved. Following the first review (currently at consultation stage), this paper will

comment on how the proposed changes may affect the LAQM process. The proposed changes will also be summarised and discussed in the context of European Union air quality objectives and the economic analysis of NAQS.

1. Introduction

Air pollution is of significant public concern. The UK has addressed this concern by implementing a system of air pollution control arguably one of the most advanced in Europe. This new system of Local Air Quality Management (LAQM) has been introduced to keep pace with many contemporary sources of air pollution, notably transport, industry and domestic fuel burning. For the first time, air pollution control legislation is carried out by a human health *effects-based* approach.

2. Legislative Background

The current legislation stems from the Environment Act 1995, Part IV (HM Government[1]) which required the Secretary of State to prepare and publish a statement containing policies with respect to the assessment and management of air quality 'as soon as possible'. This was duly published as the National Air Quality Strategy (NAQS) in March 1997 (DoE[2]). The core of NAQS was the setting of health based standards for a series of eight pollutants. These were set following a review by a government commissioned Expert Panel on Air Quality Standards. The Air Quality Regulations 1997 (HM Government[3]) subsequently gave legal weight to standards and objectives for seven pollutants, which are to be achieved by 2005.

The emphasis of the legislative changes was about action at a local level, by giving local authorities new powers, and obligations, to reach the air quality objectives (Longhurst *et al*, 1996[4]). The control of air pollution is not an entirely new responsibility for local authorities. Since the Environmental Protection Act 1990 (HM Government[5]) they have been responsible for emissions to air from Part 'B' processes, which are those smaller industrial processes identified by the Act as significant. However, this is the first time that local authorities have been required to take a holistic overview of air pollution from a variety of sources, over differing spatial and temporal scales and attempt to integrate solutions into existing policy requirements, particularly through the use of transport plans, land use plans and economic development plans. This represents a significant management challenge.

The first and key step in the LAQM regime is a *review and assessment* of air quality in the local authority's area. The Government has recommended a three-stage approach, whereby each stage increases in detail and complexity. The complexity and detail of the review should be consistent with the risk of failing to achieve the air quality objectives by the end of 2005. On completion of a third stage, in areas where it appears that objectives are not likely to be reached by 2005, an Air Quality Management Area (AQMA) must be designated. Where AQMAs have been designated, local authorities are required to prepare a

written action plan setting out how they will attempt to achieve air quality standards and objectives in the designated area (DETR[6]).

UK legislation is under revision with respect to European Commission requirements. The Ambient Air Quality Directive (96/62/EC[7]) provides member states with a basis for LAQM. Daughter directives will set standards for specified pollutants. The first covering sulphur dioxide, nitrogen dioxide, particulates (PM_{10}) and lead has now reached a common position and is expected to be enacted in the near future. This will be followed by a Directive on ozone, benzene and carbon monoxide in 1999, and a Directive on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel, and mercury by the end of 1999 (Elsom[8]). Other European initiatives include the Auto Oil process that involves the oil and car industry in partnership with the European Commission to set a framework for the reduction of exhaust emissions.

3. Government Guidance

For the ease of implementation of the LAQM process, the Government has published a set of eight guidance documents relating particularly to the technical aspects of air quality management, such as modelling, monitoring and emissions inventories. Local authorities are only required to *have regard* to the guidance that is in addition to the many other guidance documents produced for land-use planners, transport planners and economic development officials.

The NAQS was always proposed as an evolutionary document and when published in March 1997 was due to be reviewed at the end of 1999. The Labour Government which came to power in May 1997, promised 'a right to clean air' and a speedy implementation of the strategy (ENDS[9]). As part of this pre-election promise, the review of NAQS was brought forward from the end of 1999 to the end of 1998.

4. Review of the UK National Air Quality Strategy

The review of the National Air Quality Strategy (DETR[10]) has now been published in draft form and it should be noted that all comments in this paper relate to the draft review document published in January 1999. Following consultation on the proposals set out in the review, the Government intends to produce a revised version of NAQS, which itself will be subject to consultation during 1999, before it is finalised at the end of the year. This is the first in a rolling programme of reviews, by which it is intended to maintain the currency of the Strategy to reflect developments in European legislation, technological and scientific advances, improved air pollution modelling techniques and an increasingly better understanding of the economic and social issues involved. This is consistent with the theoretical approach to LAQM proposed by Longhurst *et al*[4]. The proposals set out in this review will not affect the review and assessments currently being undertaken by local authorities, but if implemented, will shape the continuing local authority review and assessment processes.

The review (DETR[10]) has taken account of a wide range of developments since publication of the original strategy. These have included the publication of the first EU ambient Air Quality daughter directive setting out standards for sulphur dioxide, nitrogen dioxide, particulates and lead. Also last years transport White Paper which sets out proposed measures to give local authorities new powers, for example road user charging, also needed consideration. The review acknowledges 'some uncertainty' over the full implications of many of these measures with respect to air quality. Agreements have also been reached on tougher EC standards for vehicle emissions and fuel quality, emissions from heavy duty diesels and sulphur levels in heavy fuel oil through the Auto Oil process. These measures together with constantly improving science, monitoring data and modelling precision have increased official confidence that many of the strategies objectives can comfortably be tightened (ENDS[11]).

The first review of the Strategy (DETR[10]) has covered a wide range of issues and looked at every aspect of air quality policy. It has taken account of new scientific and technical evidence and in particular, evidence from the Interdepartmental Group on Costs and Benefits (IGCB) which was set up specifically to assist this review. In many areas this cost - benefit analysis highlighted the difficulties in applying monetary valuation techniques to uncertain and complex areas of environmental policy.

4.1 Benzene

The review recommends that the existing objective should be replaced with a new objective to reach the 5 ppb standard recommended by EPAQS in all areas by 2003. The longer-term target level of 1 ppb recommended by EPAQS should become an indicative level to be achieved as far as practicable in all locations by 2005. However, modelling work undertaken by the government suggests that benzene levels near many busy roads will be above this level in 2005. Therefore this indicative figure will not be included in the regulations for LAQM and will be reviewed in the light of work on the impact of traffic management measures on air quality.

4.2 1,3-butadiene

The existing objective of 1ppb should be maintained, but achieved by 2003 as recommended by EPAQS. Full compliance is expected at all roadside locations by 2003 with no further measures.

4.3 Carbon monoxide

The existing objective of 10ppm should be maintained, but achieved by 2003, earlier than first intended. Again, full compliance is expected at all roadside locations by 2003 with no further measures.

4.4 Lead

The review recommends that the existing objective should be replaced with a new objective to achieve the 0.5 $\mu g/m^3$ standard by 2004 in order to achieve the Air Quality Daughter Directive (AQDD) limit value by 1 January 2005. In addition, the air quality standard recommended by EPAQS of 0.25 $\mu g/m^3$ as an annual mean should become a new objective to be achieved by 2008. Ambient lead concentrations are forecast to fall faster than was previously thought due to the sales of leaded petrol being banned from 2000. The Government expects to achieve compliance with the 0.5 $\mu g/m^3$ objective by the end of 2004, except for minor exceedences in the immediate vicinity of some industrial sources.

4.5 Nitrogen dioxide

The review recommends that the AQDD 1 hour limit of 104.6 ppb not to be exceeded more than 18 times per year (to be achieved by beginning of 2010) should be adopted as a provisional objective in place of the current hourly objective to be achieved by 2005. The existing annual mean objective of 21 ppb should be retained as a provisional objective to be achieved by 2005 and reviewed in two years time. In addition, to comply with the AQDD, the Government proposes to introduce a national objective to protect vegetation of 15.7 ppb as an annual mean to be achieved by 2000.

The DETR's modelling suggests that the 21 ppb concentration will be 'extremely testing', especially in London (DETR[10]). On current policies the objective would be breached at background sites in inner London and at roadside sites in other major cities. The IGCB concluded that the measures necessary to meet the objective 'could have major transport implications and cannot be justified in cost and benefit terms'. In taking a final decision in the next review, it will ensure that local authorities do not feel forced to take extreme measures which would lead to serious disruption or damage to their local economies' (ENDS[11]).

4.6 Ozone

Considerable uncertainties remain about the extent to which national objectives can be achieved until the outcome of the forthcoming European negotiations on proposals affecting ozone. Until then, the existing provisional objective of 50 ppb measured as the 97th percentile of daily maximum 8-hour running means to be attained by 2005 should be retained as an indicative level. Recent modelling work suggests that the objective will be exceeded across most of southern Britain in both 2005 and 2010. However, an EC strategy on ozone is due. Discussions are focussing on a less stringent, non mandatory standard of 60 ppb for 2010, with the number of permitted exceedences still to be agreed (ENDS[11]). The Government's IGCB concluded that measures to meet the UK objective 'cannot be justified in economic terms by the relatively small reduction in quantifiable health and non-health effects'.

4.7 Particles (PM_{10})

The review recommends that the equivalent of the AQDD Stage 1 annual limit value of 40 $\mu g/m^3$ and 24 hour limit value of 50 $\mu g/m^3$not to be exceeded on more than 35 days by the start of 2005, should be adopted as new objectives for 2004. The existing provisional objective for 2005 is to be retained as an indicative level. The equivalent of the AQDD Stage 2 annual limit value of 20 $\mu g/m^3$ and 24 hour limit value of 50 $\mu g/m^3$ not to be exceeded on more than seven days, by 2010 has been recommended as indicative levels for 2009.

The relative importance of source categories of PM_{10} (primary, secondary and other particles) are now much better understood. There is growing evidence that the transboundary (secondary) component of PM_{10} is more significant than was earlier thought and that it has strong parallels with ground level ozone, particularly indicating the need to develop an international approach to its control. The current Environment minister, Micheal Meacher has said that he intends to 'press for concerted EU action' on PM_{10} at the next Environment Council. The growing research in this area is also pointing increasingly to the smaller fractions of particles ($PM_{2.5}$) as the most likely source of health effects. EPAQS are shortly due to issue a statement on the case for setting a new objective for $PM_{2.5}$. Traffic is a relatively important source of smaller particles, suggesting that $PM_{2.5}$ may be more amenable to management at the local level.

4.8 Sulphur dioxide

The existing objective should be adopted as a firm objective to be achieved by 2005. A new 1 hour objective of 131 ppb (not to be exceeded more than three times per year) to be adopted as objectives to be achieved by 2004. This will ensure compliance with the limit values in the Directive by that date. In addition, also to comply with the AQDD, the Government proposes to introduce two national objectives to protect ecosystems; 7 ppb as an annual average and 7 ppb as a winter average (1 October to 31 March) to be achieved by 2000.

The government expects the Strategy's objective to be achieved in most of the UK by 2005 except in certain hotpots in the immediate vicinity of some boilers burning coal and oil and in a few areas where coal is still used for domestic heating. Nevertheless, the Government intends to retain the existing objective for sulphur dioxide despite being considerably more stringent than the EC standards. Sulphur dioxide should be reduced as far as possible not only to reduce health effects directly as a result of exposure, but also to reduce its contribution to secondary particle formation and acidification.

Summary Table of existing and proposed air quality objectives:

Pollutant	Existing objective for end of 2005	Measured as	Proposed new objective	Proposed EC limit value
Benzene	5ppb	Annual mean	5ppb by 2003, 1ppb* by 2005	1.66ppb by 2010
1,3-butadiene	1ppb	Annual mean	1ppb by 2003	
Carbon monoxide	10ppm	8-hour mean	10ppm by 2003	8.5ppm by 2005
Lead	0.5μg/m^3	Annual mean	0.5μg/m^3 by 2004, 0.25μg/m^3 by 2008	0.5μg/m^3 by 2005 (2010 near industrial sources)
Nitrogen dioxide	150ppb	Hourly mean	104.6ppb by 2005 (18 exceedences allowed)**	104.6ppb by 2010, (18 exceedences allowed)
	21ppb	Annual mean	Unchanged**	21ppb by 2010
Ozone	50ppb	8-hour mean (8 exceedences allowed)	Unchanged*	
Particulates (PM_{10})	50μg/m^3	24-hour mean (4 exceedences allowed)	50μg/m^3 (7-20 exceedences allowed) by 2004. Also annual limit of 31μg/m^3	50μg/m^3 (35 exceedences allowed by 2005, 7 exceedences by 2010)
Sulphur dioxide	100ppb	15-min mean (35 exceedences allowed)	unchanged	131ppb 1-hour limit (24 exceedences allowed). 46.8ppb 24-hour limit (3 exceedences allowed)

Note: UK deadlines refer to the end of the year in question, while EC deadlines refer to the start of the year
* indicative level
** provisional objective only

5. Local versus National action

Ozone was included in the National Air Quality Strategy, but then deemed unsuitable for local management and hence omitted from the Air Quality Regulations 1997[3]. At the time there was a general agreement that the remaining seven pollutants could all be tackled through the LAQM process. However, it is becoming apparent that PM_{10} remains an intractable problem. There is growing evidence from the research community that secondary particles are a more important component than was previously thought (APEG[12]).

The review of NAQS coincided with the publication of the report on Source Apportionment of Particulate matter in the UK[12] by the Airborne Particulates Expert Group (APEG) set up specifically to look at this issue. APEG concluded that the current PM_{10} objective is unachievable. Bonfire night (November 5th) alone brings large parts of the UK close to breaching the limit of four exceedences a year. In addition, during times of adverse meteorology, secondary particles transported from continental Europe can cause exceedences in the south east on their own, regardless of any local primary contribution. For this reason there is a growing consensus that PM_{10} should be tackled nationally as is the case with ozone. However, the Government has advised that review and assessments by local authorities should not regard the proposed changes until the revised NAQS is published. At the present time local authorities are waiting for guidance on how to proceed with PM_{10}. This leaves local authorities in an extremely difficult position. There are likely to be widespread exceedences for PM_{10} over the UK, with transboundary secondary particles being cited as a major cause. It is unknown how local authorities can therefore treat PM_{10} in their management plans.

The review of NAQS, although still emphasising that local management should predominate, is gradually introducing more national measures. This includes the new (indicative) objectives for nitrogen dioxide and sulphur dioxide for the protection of ecosystems. It is envisaged that national policy instruments alone will tackle these objectives.

6. Discussion

Of the eight pollutants included in the original NAQS, five objectives have been tightened, two have stayed static and one has been relaxed.

The above changes proposed in the review of the UK National Air Quality Strategy[10] have come about due to three main issues: political pressure, the publication of EU objectives for the four pollutants outlined and the cost benefit analysis carried out by the Interdeparmental Group on Costs and Benefits (IGCB). The Government does not wish to be seen to be watering down its own environmental targets. Whilst the relaxation of the particulate objective is a pragmatic response to uncertainty, where it can speed up compliance, the Government has acted as in the case of benzene, nitrogen dioxide (hourly

mean), 1,3-butadiene and carbon monoxide, although for 1,3-butadiene and carbon monoxide this has only involved changing the target date to 2003.

The publication of EU objectives for sulphur dioxide, nitrogen dioxide, PM_{10} and lead (and proposed limits for benzene and carbon monoxide) has a direct effect on the setting of objectives in the member states. The EU objectives have an array of target dates, some being the beginning of 2005 whereas the UK NAQS was originally targeted for the end of 2005. The UK review has therefore altered the dates for benzene, 1,3-butadiene, carbon monoxide and lead to take account of this temporal difference. Other EU objectives such as nitrogen dioxide have a target date of 2010, leaving the UK in advance of other member states.

A commitment was given in the first NAQS to undertake a formal economic analysis aimed specifically at deriving comparable cost and benefit estimates of the additional measures required to meet the strategy objectives. The IGCB has been given the responsibility to fulfil this commitment. A significant amount of work is still in progress and there are many uncertainties in the methodology used. For example, putting a price on increased fatalities due to air pollution has encountered ethical difficulties and the uncertainty over the degree to which life expectancy is reduced by exposure to air pollutants. One problem was the lack of direct 'willingness to pay' studies for air pollution mortality risks (ENDS[11]), themselves subject to methodological criticism. Nonetheless, despite the difficulties, the Government still feels the need to demonstrate that any further measures taken to control air pollution are efficient in terms of the potential improvement in health and non-health effects and cost effective in terms of the measures which are adopted. The analysis currently being undertaken by the IGCB will therefore continue.

For the first time the strategy is also moving away from being a purely human health effects based approach to include the introduction of vegetation objectives. This places more emphasis on national measures than in the original strategy.

For local authorities, the changes will involve the detail of the review rather than the overall approach. For the current review and assessment process little change will be apparent. However, from the end of 1999, the goal posts for certain pollutants are likely to be altered. This is likely to involve a relaxation for particulates and tightening (particularly in time scale) for benzene, 1,3 butadiene, carbon monoxide, lead and nitrogen dioxide. The Government is due to review the situation for nitrogen dioxide in two years time, when it is thought that a relaxation of the annual mean objective will occur. For the second wave of review and assessments, which local authorities are obliged to undertake before 2005, the proposals set out in this review of the National Air Quality Strategy are very likely to have been implemented. This will involve a shorter time scale to reach certain objectives (benzene, 1,3-butadiene, carbon monoxide, lead) and if the EU objectives are adopted for PM_{10}, this will be significantly easier to obtain for many authorities who have identified concerns regarding PM_{10} in the current review and assessment.

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