The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

Volume 1

Department for Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

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The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1)

Presented to Parliament by the Secretary of State for Environment, Food and Rural Affairs
By Command of Her Majesty:
Laid before the Scottish Parliament by the Scottish Ministers
Laid before the National Assembly for Wales by Welsh Ministers
Laid before the Northern Ireland Assembly by the Minister of the Environment
July 2007

Cm 7169 NIA 61/06-07

£40.00
Two volumes
Not to be sold separately

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Ministerial Foreword

The quality of our air in the United Kingdom has improved considerably over the last decade. Overall, the air we breathe is cleaner today than at any time since before the industrial revolution. We have achieved this through tighter controls on emissions of pollutants from industry, transport and domestic sources. In recent years, our policies have help cut concentrations of harmful pollutants and reduced the annual numbers of premature deaths and hospital admissions by many thousands. The long term trend is of general improvement.

Despite this positive picture, air pollution still harms health and the environment. Recent research has shown that some pollutants are more dangerous than previously thought. For some pollutants there is no absolute safe threshold. Air pollution is currently estimated to reduce the life expectancy of every person in the UK by an average of 7-8 months with estimated equivalent health costs of up to £20 billion each year. Air pollution also has a detrimental effect on our ecosystems and vegetation. Clearly there are significant benefits to be gained from further improvements.

We are committed to keeping our policies under review and the review of the strategy has been one of the most comprehensive environmental studies carried out by the UK Government and the devolved administrations. The review proposed potential new policy measures to improve air quality, and examined their costs and benefits, impact on exceedences of the strategy's air quality objectives, effect on ecosystems and qualitative impacts. This new Air Quality Strategy identifies the key measures we plan to consider and those where further work is needed to develop their future potential. We estimate that, together with measures already agreed, the new measures proposed for consideration in this strategy will improve the effect on life expectancy in the UK, to a reduction of only 5 months.

The case for retaining the current objectives is clear, and we are determined to maintain the highest justifiable level of health protection. These objectives remain in the new strategy together with a national level policy framework for exposure reduction for fine particles to improve public health across the UK, and a new objective for ecosystems.

This new strategy also sets an agenda for the longer term. In particular, we need to find out more about how air pollution impacts on people's health and the environment to help inform options and future policy decisions. In the very long term, policies which address both air pollution and climate change could deliver very large reductions in air pollution along with carbon dioxide, between now and 2050.

This strategy sets out a framework to achieve cleaner air that will bring health and social benefits to us all. As individuals and businesses, we can all play a part in delivering cleaner air.

Jonathan Shaw
Parliamentary Under Secretary of State and Minister for the South East

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1)

Contents

Volume 1 of the Air Quality Strategy is accompanied by Volume 2: Evidence Base to Support the Air Quality Strategy for England, Scotland, Wales and Northern Ireland and An Economic Analysis to Inform the Air Quality Strategy – Updated Third Report of the Interdepartmental Group on Costs and Benefits.

Executive Summary

Aim: This Air Quality Strategy sets out air quality objectives and policy options to further improve air quality in the UK from today into the long term. As well as direct benefits to public health, these options are intended to provide important benefits to quality of life and help to protect our environment.

Our air is cleaner in overall terms than at any time since the industrial revolution, but it still causes serious adverse effects and there are significant benefits to be gained from improving air quality further. Recent research has shown that some pollutants are more dangerous than previously thought and we need to act faster and take further measures to move us closer to meeting our objectives. Pollutants from sources such as our cars, ships and industrial plants lead to levels of pollution which are still having a marked affect on our health and natural environment.

Air pollution is currently estimated to reduce the life expectancy of every person in the UK by an average of 7-8 months. The measures outlined in the strategy could help to reduce the impact on average life expectancy to five months by 2020, and provide a significant step forward in protecting our environment.

The current situation is positive in several respects. Over the past ten years the quality of our air has improved and we are meeting our current objectives for all air pollutants in over 99 per cent of the UK. From 1990 to 2001 the improvements have helped avoid an estimated 4,200 premature deaths per annum and 3,500 hospital admissions per annum.

However, there is still more to do. We are projected to miss objectives on three of our nine pollutants (particles, ozone and nitrogen dioxide). The areas of exceedence are relatively small, although significant numbers of people are likely to be exposed as the exceedences tend to be in highly populated areas. Critical loads for acidity and/or the fertilising effects of nitrogen[1] are exceeded in over half the UK's natural and semi-natural habitats.

This updated strategy provides a clear, long-term vision for improving air quality in the UK and offers options for further consideration to reduce the risk to health and the environment from air pollution.

[1] See definition of critical loads in box 1 on page 14.

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1)

Vision

1. The UK Government and devolved administrations are committed to delivering clean air for a good quality of life. We have come a long way since the smogs of the 1950s. We have achieved cleaner air through regulating emissions from industrial processes, progressively tightening emissions and fuel standards for road vehicles and controlling smoke from domestic premises. But there are still sometimes levels of pollution that can significantly harm human health and the environment. In line with the Government's aim of sustainable development we can all play a part to help deliver cleaner air to ensure a less polluted environment both now and for future generations, whether as businesses or as individuals. There are important co-benefits to also considering reductions in carbon dioxide emissions at the same time as tackling air pollutants in order to meet our obligations and targets for both climate change and air quality.

Scope

2. This document provides an overview and outline of the UK Government and devolved administrations' ambient (outdoor) air quality policy. It sets out a way forward for work and planning on air quality issues, details objectives to be achieved, and proposes measures to be considered further to help reach them. The strategy is based on a thorough and detailed analysis of estimating reductions in emissions and concentrations from existing policies and proposed new policy measures, and quantification and valuation of benefits and estimated costs (the analysis is set out in more detail in Volume 2 of the strategy and the updated Third Report by the Interdepartmental Group on Costs and Benefits (IGCB)). It should however be noted that each new policy measure taken forward for further consideration will be subject to the full policy scrutiny process, including formal Impact Assessments. It is not the UK Government and devolved administrations' intention that the measures assessed in this strategy will receive funding beyond that which has already been or will be provided.

History of the Air Quality Strategy

3. The Environment Act 1995 requires the UK Government and the devolved administrations for Scotland and Wales to produce a national air quality strategy containing standards, objectives and measures for improving ambient air quality and to keep these policies under review. There is equivalent legislation in Northern Ireland.

4. Air quality in the UK has generally continued to improve since 1997 when the first Air Quality Strategy was adopted[2]. This was replaced by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland[3] published in January 2000. It established the framework for achieving further improvements in ambient air quality in the UK to 2003 and beyond. The strategy identified actions at local, national and international level to improve air quality. It was followed by an Addendum[4] in February 2003 which tightened several of the objectives and introduced a new one.

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[2] The United Kingdom National Air Quality Strategy, March 1997 (Cm 3587)

[3] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Working Together for Clean Air, January 2000 (Cm 4548, SE2000/3, NIA 7).

[4] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Addendum, February 2003.

5. Both in the strategy and addendum, the UK Government and the devolved administrations indicated that a future review would focus more on progress towards meeting the objectives themselves and the policy measures needed to deliver them. Within that approach, individual objectives could be revised or new ones considered in light of policy, scientific and technological developments.

Review of the Strategy and Consultation

6. The Air Quality Forum of stakeholders was closely involved from the outset in developing the review of the 2000 Air Quality Strategy. A workshop in May 2005, organised by Defra, the devolved administrations and the National Society for Clean Air and Environmental Protection, enabled stakeholders to comment on the policy development process before formal consultation took place.

7. Formal consultation on the review of the strategy took place between April and July 2006[5]. Over 150 formal responses were received from a wide range of interested parties, including industry and transport sectors, local authorities, environmental and health groups, research organisations and members of the public. A second stakeholder workshop was held in June 2006 to help to clarify the proposals and provide stakeholders with the opportunity to discuss views.

8. Since then we have carried out further work to underpin the case for the retention of those strategy objectives not prescribed by EU Directives. We have also carried out additional sensitivity work on the baseline and some key measures, taking account of more recent developments, such as more recent energy projections, and consultation responses. Further details of this additional evidence are contained in the supporting volumes to the strategy (Volume 2: Evidence base to support the Air Quality Strategy and the updated IGCB Third Report).

Geographical coverage and devolution

9. The UK Government and the devolved administrations in Scotland, Wales and Northern Ireland are responsible for policy and legislative issues affecting the environment, including air quality. However, due to the transboundary nature of air pollutants it is appropriate to have an Air Quality Strategy presented in a document with common aims covering all parts of the UK. The 2000 Air Quality Strategy and 2003 Addendum were produced on that basis and this latest strategy is also presented as a UK Government and devolved administrations document.

Structure of the strategy

10. This strategy sets out the UK Government and devolved administrations' air quality objectives and the measures selected to achieve the desired improvements in air quality. It does not contain updated evidence on measures we have chosen not to pursue in the immediate future (details of which were set out in the 2006 consultation documents and ICGB Third Report).

11. The strategy's supporting scientific, economic and regulatory evidence and analysis is contained in Volume 2 of the strategy and the updated ICGB Third Report.

[5] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, A consultation document on options for further improvements in air quality. (April 2006) Defra http://www.defra.gov.uk/corporate/consult/airqualstrat-review/consultation-vol1.pdf

12. **Volume 2** sets out the scientific and economic evidence base: further evidence on the objectives; the content of the baseline modelling; details of pollutant emissions; full assessment of policy measures; and plans for further development of the evidence base. It also contains the Regulatory Impact Assessment (RIA).

13. **Volume 3** is a fully updated Third Report by the IGCB. This updates the analysis contained in the IGCB's Third Report, published alongside the strategy review consultation in 2006. This takes account of recent developments and new information from consultation responses, and takes the opportunity to present new analysis, such as the assessment of uncertainties through techniques such as Monte Carlo analysis, to better inform this strategy. Following its publication in 2006, the Third Report of IGCB was the subject of peer review in the form of an academic panel, focusing on the methodological and economic issues. At this panel this work was praised as being "well-designed analysis and represented a significant progress in evaluating such policies". This work was also praised by both the Organisation for Economic Co-operation and Development (OECD) on improving the co-ordination between environmental and health policies and the Environment Research Funders Forum study on the use of evidence in government policy (not yet published).

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1)

Air quality standards and objectives

14. Air pollution can have a serious effect on people's health. Exposure to air pollution can have a long-term effect on health, associated in particular with premature mortality due to cardiopulmonary (heart and lung) effects. In the short-term, high pollution episodes can trigger increased admissions to hospital and contribute to the premature death of those people that are more vulnerable to daily changes in levels of air pollutants. Air pollution also has negative impacts on our environment, both in terms of direct effects of pollutants on vegetation, and indirectly through effects on the acid and nutrient status of soils and waters.

15. The UK Government's and devolved administrations' primary objective is to ensure that all citizens should have access to outdoor air without significant risk to their health, where this is economically and technically feasible. This strategy is based on standards from expert recommendations representing levels at which no significant health effects would be expected in the population as a whole and on the standards and principles of better regulation. The objectives in this strategy aim to move air quality as close to these standards as possible.

16. There are a wide range of terms and concepts in national and international initiatives, for example, standards, objectives, target values and limit values. Several of these terms feature in this strategy, and are defined below, but two key concepts provide the central structure. These are standards and objectives. The Environment Act 1995 requires this strategy to include statements on "standards relating to the quality of air", and "objectives for the restriction of the levels at which particular substances are present in the air". Standards have been used as benchmarks or reference points for the setting of objectives.

17. For the purposes of the strategy

- **standards** are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups or on ecosystems
- **objectives** are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedences, within a specified timescale.

18. Standards, as the benchmarks for setting objectives, are set purely with regard to scientific and medical evidence on the effects of the particular pollutant on health, or, in the appropriate context, on the wider environment, as minimum or zero risk levels. In the area of the effects on human health this is the approach adopted by the World Health Organisation (WHO) in the formulation of their air quality guidelines published in 1987 and their subsequent revision in 1994/95 (published in 2000 and 2005), and by Expert Panel on Air Quality Standards (EPAQS) in the UK who last reported on pollutants of national importance in 2002.

19. A similar approach is utilised for the development of policies and measures to reduce ecosystem damage. Standards expressed in terms of critical loads and levels (see Box 1 below for this and other definitions) are derived for habitats and exceedence of this value is used as an indication of the potential for harmful effects to systems at steady state thus giving an indication of risk to the system.

The long term goal of European policy[6], shared by the UK Government and devolved administrations, is ultimately to remove all critical levels and loads exceedences.

20. In setting objectives derived from the health and ecosystem advice, the UK Government and the devolved administrations have also taken account of economic efficiency, practicability, technical feasibility and timescale. Objectives do not have direct legal force, but their existence and attainment needs to be borne in mind in designing and executing all measures (see paragraphs 21 – 23 below).

Box 1: Other useful related definitions

EU Limit values are legally binding EU parameters that must not be exceeded. Limit values are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedences allowed per year, if any, and a date by which it must be achieved. Some pollutants have more than one limit value covering different endpoints or averaging times.

Target values – are used in some EU Directives and are set out in the same way as limit values. They are to be attained where possible by taking all necessary measures not entailing disproportionate costs.

Critical loads – are usually defined as "a quantitative estimate of an exposure to one or more pollutants below which significant effects on specific sensitive elements of the environment do not occur according to present knowledge" and where pollutants are deposited to land or water. Exceedence of critical load is used as an indication of the potential for harmful effects to ecosystems.

Critical levels – refer to gaseous concentrations of pollutants above which direct adverse effects on vegetation or ecosystems may occur according to present knowledge. Therefore, when pollutant concentrations exceed the critical level it is considered that there is risk of harmful effects.

Measures are the methods of achieving the objectives. No single measure on its own will realise the full attainment of the air quality objectives and so packages of measures will need to be deployed. Measures can be technological (eg fitting pollution abatement technologies to road vehicles and industrial processes) as well as measures designed to change behaviours (eg smarter choices, traffic management measures, incentives for cleaner vehicles and road pricing). Some measures require international agreement. Others are determined at national or local level.

Implementation of air quality objectives

21. The UK Government and devolved administrations set Air Quality Strategy objectives to reflect the importance they attach to public health and the environment. However in determining the appropriate level for these objectives, these considerations have been balanced against – amongst other things – social implications and economic goals including growth. The

[6] Thematic Strategy on Air Pollution under the **Sixth Environmental Action Programme** was adopted on 21 September 2005 (see http://ec.europa.eu/environment/air/cafe/index.htm). The objectives of the Thematic Strategy are achieving "*levels of air quality that do not give rise to significant negative impacts on, and risks to human health and the environment*". For the natural environment, this means no exceedence of critical loads and levels.

Environment Act 1995 requires that the Environment Agency and the Scottish Environment Protection Agency (SEPA) have regard to the Air Quality Strategy in exercising their pollution control functions, particularly under the Environmental Protection Act 1990 and under the Pollution Prevention and Control Regulations 2000 (PPC) and the Pollution Prevention and Control (Scotland) Regulations 2000. Local authorities are also required to work towards the Strategy's objectives prescribed in regulations for that purpose. Similar requirements exist in Northern Ireland under the Environment (Northern Ireland) Order 2002 and the Pollution Prevention and Control Regulations (Northern Ireland) 2003.

22. The air quality objectives in the Air Quality Strategy are a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except in as far as these mirror any equivalent legally binding limit values in EU legislation. Where UK standards or objectives are the sole consideration, there is no legal obligation upon regulators, to set Emission Limit Values (ELVs)[7] any more stringent than the emission levels associated with the use of Best Available Techniques (BAT) in issuing permits under the PPC Regulations[8]. This aspect is dealt with fully in the PPC Practical Guides.

23. Our aim is a steady decrease in ambient levels of pollutants towards the objectives over the period of implementation. Some areas of the country will find it easier than others to achieve the objectives. If it is practicable and efficient to reach objectives before the target date, or to achieve a quality of air which exceeds the objectives, we should do so. The aim is then to sustain the improvement.

Details of pollutants and objectives

24. Table 1 below summarises the main UK sources of each pollutant and the health and environmental hazards associated with it (these are described in more detail in Volume 2 of the strategy). It is worth noting that the largest emission sources are not necessarily the greatest contributors to poor air quality – exposure depends on several other factors as well, such as proximity of source to receptor and the efficiency of dispersion in the atmosphere.

25. Table 2 sets out for each pollutant, the strategy's objectives and European Directive limit or target values. The final column of the table indicates whether the objective is new or has changed from the previous 2000 Strategy and its 2003 Addendum. There are currently no EU limit or target values for ammonia[9] (ammonia is discussed in more detail in paragraphs 36 – 40 below).

[7] Emission Limit Value – the mass, concentration or level of an emission which may not be exceeded over a given period.

[8] BAT is a term defined in the IPPC Directive and applied at sector and installation level by the regulator.

[9] The total quantity of ammonia emissions is captured through the National Emission Ceilings Directive 2000/81/EC and a proportion is regulated through the Integrated Pollution and Prevention Control Directive 96/61/EC.

Table 1

Pollutant	Description and main UK sources	Potential effects on health/ environment
Particulate Matter (PM-PM_{10} and $PM_{2.5}$)	Particulate Matter is generally categorised on the basis of the size of the particles (for example $PM_{2.5}$ is particles with a diameter of less than 2.5µm). PM is made up of a wide range of materials and arise from a variety of sources. Concentrations of PM comprise primary particles emitted directly into the atmosphere from combustion sources and secondary particles formed by chemical reactions in the air. PM derives from both human-made and natural sources (such as sea spray and Saharan dust). In the UK the biggest human-made sources are stationary fuel combustion and transport. Road transport gives rise to primary particles from engine emissions, tyre and brake wear and other non-exhaust emissions. Other primary sources include quarrying, construction and non-road mobile sources. Secondary PM is formed from emissions of ammonia, sulphur dioxide and oxides of nitrogen as well as from emissions of organic compounds from both combustion sources and vegetation.	Both short-term and long-term exposure to ambient levels of PM are consistently associated with respiratory and cardiovascular illness and mortality as well as other ill-health effects. The associations are believed to be causal. It is not currently possible to discern a threshold concentration below which there are no effects on the whole population's health. PM_{10} roughly equates to the mass of particles less than 10 micrometres in diameter that are likely to be inhaled into the thoracic region of the respiratory tract. Recent reviews by WHO and Committee on the Medical Effects of Air Pollutants (COMEAP) have suggested exposure to a finer fraction of particles ($PM_{2.5}$, which typically make up around two thirds of PM_{10} emissions and concentrations) give a stronger association with the observed ill-health effects, but also warn that there is evidence that the coarse fraction between (PM_{10} – $PM_{2.5}$) also has some effects on health.

Pollutant	Description and main UK sources	Potential effects on health/ environment
Oxides of nitrogen (NO_X)	All combustion processes in air produce oxides of nitrogen (NO_X). Nitrogen dioxide (NO_2) and nitric oxide (NO) are both oxides of nitrogen and together are referred to as NO_X. Road transport is the main source, followed by the electricity supply industry and other industrial and commercial sectors.	NO_2 is associated with adverse effects on human health. At high levels NO_2 causes inflammation of the airways. Long term exposure may affect lung function and respiratory symptoms. NO_2 also enhances the response to allergens in sensitive individuals. High levels of NO_X can have an adverse effect on vegetation, including leaf or needle damage and reduced growth. Deposition of pollutants derived from NO_X emissions contribute to acidification and/or eutrophication of sensitive habitats leading to loss of biodiversity, often at locations far removed from the original emissions. NO_X also contributes to the formation of secondary particles and ground level ozone, both of which are associated with ill-health effects. Ozone also damages vegetation.
Ozone (O_3)	Ozone is not emitted directly from any human-made source. It arises from chemical reactions between various air pollutants, primarily NO_X and Volatile Organic Compounds (VOCs), initiated by strong sunlight. Formation can take place over several hours or days and may have arisen from emissions many hundreds, or even thousands of kilometres away.	Exposure to high concentrations may cause irritation to eyes and nose. Very high levels can damage airways leading to inflammatory reactions. Ozone reduces lung function and increases incidence of respiratory symptoms, respiratory hospital admissions and mortality. Ground level ozone can also cause damage to many plant species leading to loss of yield and quality of crops, damage to forests and impacts on biodiversity.

Pollutant	Description and main UK sources	Potential effects on health/ environment
Sulphur dioxide (SO_2)	UK emissions are dominated by combustion of fuels containing sulphur, such as coal and heavy oils by power stations and refineries. In some parts of the UK, notably Northern Ireland, coal for domestic use is a significant source.	Causes constriction of the airways of the lung. This effect is particularly likely to occur in people suffering from asthma and chronic lung disease. Precursor to secondary PM and therefore contributes to the ill-health effects caused by PM_{10} and $PM_{2.5}$. Potential damage to ecosystems at high levels, including degradation of chlorophyll, reduced photosynthesis, raised respiration rates and changes in protein metabolism. Deposition of pollution derived from SO_2 emissions contribute to acidification of soils and waters and subsequent loss of biodiversity, often at locations far removed from the original emissions.
Polycyclic aromatic hydrocarbons (PAHs)	There are many different PAHs emanating from a variety of sources. This strategy uses benzo[a]pyrene (B[a]P) as a marker for the most hazardous PAHs. The main sources of B[a]P in the UK are domestic coal and wood burning, fires (eg accidental fires, bonfires, forest fires, etc), and industrial processes such as coke production. Road transport is the largest source for total PAHs, but this source is dominated by species thought to be less hazardous than B[a]P.	Studies of occupational exposure to PAHs have shown an increased incidence of tumours of the lung, skin and possibly bladder and other sites. Lung cancer is most obviously linked to exposure to PAHs through inhaled air. Individual PAHs vary in their ability to induce tumours in animals or humans. The carcinogenic potency of some PAHs is unknown or uncertain. Individual PAHs have been classified by the International Agency for Research on Cancer, with three classified as "probably carcinogenic to humans", including B[a]P, and three classified as "possibly carcinogenic to humans".
Benzene	Has a variety of sources, but primarily arises from domestic and industrial combustion and road transport.	Benzene is a recognised human carcinogen which attacks the genetic material and, as such, no absolutely safe level can be specified in ambient air. Studies in workers exposed to high levels have shown an excessive risk of leukaemia.
1,3-butadiene	Mainly from combustion of petrol. Motor vehicles and other machinery are the dominant sources, but it is also emitted from some processes, such as production of synthetic rubber for tyres.	1,3-butadiene is also a recognised genotoxic human carcinogen, as such, no absolutely safe level can be specified in ambient air. The health effect of most concern is the induction of cancer of the lymphoid system and blood–forming tissues, lymphoma and leukaemia.

Pollutant	Description and main UK sources	Potential effects on health/ environment
Carbon monoxide (CO)	Formed from incomplete combustion of carbon-containing fuels. The largest source is road transport, with residential and industrial combustion making significant contributions.	Substantially reduces capacity of the blood to carry oxygen to the body's tissues and blocks important biochemical reactions in cells. People with existing diseases which affect delivery of oxygen to the heart or brain, such as angina, are at particular risk.
Lead (Pb)	Emitted from the combustion of coal and also the iron and steel combustion and non-ferrous metals.	Exposure to high levels in air may result in toxic biochemical effects which have adverse effects on the kidneys, gastrointestinal tract, the joints and reproductive systems, and acute or chronic damage to the nervous system. Affects intellectual development in young children.
Ammonia	Mainly derived from agriculture, primarily livestock manure/ slurry management and fertilisers. Small proportion derived from variety of sources including transport and waste disposal.	Ammonia can lead to damage of terrestrial and aquatic ecosystems through deposition of eutrophying pollutants and through acidifying pollutants. Precursor to secondary PM and therefore contributes to the ill-health effects caused by PM_{10} and $PM_{2.5}$.

Table 2

National air quality objectives and European Directive limit and target values for the protection of human health

Pollutant	Applies	Objective	Concentration measured as[10]	Date to be achieved by and maintained thereafter	European obligations	Date to be achieved by and maintained thereafter	New or existing
Particles (PM_{10})	UK	50µg.m^{-3} not to be exceeded more than 35 times a year	24 hour mean	31 December 2004	50µg.m^{-3} not to be exceeded more than 35 times a year	1 January 2005	Retain existing
	UK	40µg.m^{-3}	annual mean	31 December 2004	40µg.m^{-3}	1 January 2005	
	Indicative 2010 objectives for PM_{10} (from the 2000 Strategy and 2003 Addendum) have been replaced by an exposure reduction approach for $PM_{2.5}$ (except in Scotland – see below)						
	Scotland	50µg.m^{-3} not to be exceeded more than 7 times a year	24 hour mean	31 December 2010			Retain existing
	Scotland	18µg.m^{-3}	annual mean	31 December 2010			
Particles ($PM_{2.5}$) Exposure Reduction	UK (except Scotland)	25µg.m^{-3}	annual mean	2020	Target value 25µg.m^{-3} [12]	2010	New (European obligations still under negotiation)
	Scotland	12µg.m^{-3}		2020	Limit value 25µg.m^{-3}	2015	
	UK urban areas	Target of 15% reduction in concentrations at urban background[11]		Between 2010 and 2020	Target of 20% reduction in concentrations at urban background	Between 2010 and 2020	
Nitrogen dioxide	UK	200µg.m^{-3} not to be exceeded more than 18 times a year	1 hour mean	31 December 2005	200µg.m^{-3} not to be exceeded more than 18 times a year	1 January 2010	Retain existing
	UK	40µg.m^{-3}	annual mean	31 December 2005	40µg.m^{-3}	1 January 2010	
Ozone	UK	100µg.m^{-3} not to be exceeded more than 10 times a year	8 hour mean	31 December 2005	Target of 120µg.m^{-3} not to be exceeded more than 25 times a year averaged over 3 years	31 December 2010	Retain existing

Table 2

National air quality objectives and European Directive limit and target values for the protection of human health							
Pollutant	**Applies**	**Objective**	**Concentration measured as**	**Date to be achieved by and maintained thereafter**	**European obligations**	**Date to be achieved by and maintained thereafter**	**New or existing**
Sulphur dioxide	UK	266µg.m^{-3} not to be exceeded more than 35 times a year	15 minute mean	31 December 2005			Retain existing
	UK	350µg.m^{-3} not to be exceeded more than 24 times a year	1 hour mean	31 December 2004	350µg.m^{-3} not to be exceeded more than 24 times a year	1 January 2005	
	UK	125µg.m^{-3} not to be exceeded more than 3 times a year	24 hour mean	31 December 2004	125µg.m^{-3} not to be exceeded more than 3 times a year	1 January 2005	
Polycyclic aromatic hydrocarbons	UK	0.25ng.m^{-3} B[a]P	as annual average	31 December 2010	Target of 1ng.m^{-3}	31 December 2012	Retain existing
Benzene	UK	16.25µg.m^{-3}	running annual mean	31 December 2003			Retain existing
	England and Wales	5µg.m^{-3}	annual average	31 December 2010	5µg.m^{-3}	1 January 2010	
	Scotland, Northern Ireland	3.25µg.m^{-3}	running annual mean	31 December 2010			
1,3- butadiene	UK	2.25µg.m^{-3}	running annual mean	31 December 2003			Retain existing
Carbon monoxide	UK	10mg.m^{-3}	maximum daily running 8 hour mean/in Scotland as running 8 hour mean	31 December 2003	10mg.m^{-3}	1 January 2005	Retain existing
Lead	UK	0.5µg.m^{-3}	annual mean	31 December 2004	0.5µg.m^{-3}	1 January 2005	Retain existing
		0.25µg.m^{-3}	annual mean	31 December 2008			

Table 2

National air quality objectives and European Directive limit and target values for the protection of human health							
Pollutant	**Applies**	**Objective**	**Concentration measured as**	**Date to be achieved by and maintained thereafter**	**European obligations**	**Date to be achieved by and maintained thereafter**	**New or existing**
National air quality objectives and European Directive limit and target values for the protection of vegetation and ecosystems							
Nitrogen oxides	UK	30µg.m^{-3}	annual mean	31 December 2000	30µg.m^{-3}	19 July 2001	Retain existing in accordance with 1st Daughter Directive
Sulphur dioxide	UK	20µg.m^{-3}	annual mean	31 December 2000	20µg.m^{-3}	19 July 2001	Retain existing in accordance with 1st Daughter Directive
	UK	20µg.m^{-3}	winter average	31 December 2000	20µg.m^{-3}	19 July 2001	
Ozone: protection of vegetation & ecosystems	UK	Target value of 18,000µg m^{-3} based on AOT40 to be calculated from 1 hour values from May to July, and to be achieved, so far as possible, by 2010	Average over 5 years	1 January 2010	Target value of 18,000µg m^{-3} based on AOT40 to be calculated from 1 hour values from May to July, and to be achieved, so far as possible, by 2010	1 January 2010	New EU target

[10] An explanation of the different concentration measurements is provided in Volume 2 of the strategy.

[11] 25µg.m^{-3} is a cap to be seen in conjunction with 15% reduction. See paragraphs 29 – 32 below for explanation of exposure reduction.

[12] The European directive with proposals for $PM_{2.5}$ concentrations in air is currently subject to negotiation and final adoption.

Developments since 2000 Air Quality Strategy

26. Defra and the devolved administrations published 'An Evaluation of the Air Quality Strategy'[13] in January 2005. It evaluated selected air quality policies in the road transport and electricity generation sectors to assess their effectiveness in achieving air quality improvements. The report looked at policies between 1990-2001. However, due to the fact that the benefits of these policies extend far beyond this period, the analysis was also extended over a projected period between 2002-2010.

27. It is clear from the evaluation report that policies in the road transport sector and the electricity generating sector have had a major impact in reducing air pollutant emissions and were shown to be very cost beneficial, with benefits estimated to have exceeded costs by up to a factor of 24. Of particular importance was the fitting of catalytic converters to motor vehicles and the increased use of gas to generate electricity. These had a major impact on improving air quality and ensuring progress towards the UK's air quality objectives and European air quality limit values. They have also resulted in extremely large benefits to society by reducing the health and environmental impacts of air pollution, with road transport policies achieving benefits worth £2.9 to £18.4 billion and policies in the electricity generating sector achieving benefits worth £10.8 to £50.6 billion between 1990 and 2001. (The variation in these figures is largely the result of the uncertainty surrounding health impacts. Recent advances in the quantification of health benefits suggest that even the high end of this range of estimated of benefits is likely to underestimate the true benefit). The majority of these benefits were as a result of improvements in human health.

Objectives

28. This latest strategy does not remove any of the objectives set out in the previous strategy or its addendum, apart from replacing the provisional 2010 PM_{10} objective in England, Wales and Northern Ireland with the exposure reduction approach (discussed in paragraphs 29 – 32 below). Scotland is retaining its PM_{10} 2010 objective alongside exposure reduction. We have reviewed the case for retaining the PAH and 15 minute SO_2 objectives and the supporting evidence is set out in the accompanying volumes. The analysis shows that there is sound evidence that the existing objectives are still justified and the UK Government and the devolved administrations do not want to take any retrograde steps in safeguarding human health and environmental protection, and so propose to retain them. The strategy introduces a new ozone objective to protect ecosystems, in line with the EU target value set out in the Third Daughter Directive.

New air quality objectives: the exposure reduction framework for particles

29. The current policy framework and the legislative requirement to meet EU air quality limit values everywhere in the UK tends to direct our attention to localised hotspot areas of pollution (where the objectives are not met). There is clear and unequivocal health advice that there is no

[13] An Evaluation of the Air Quality Strategy, Defra, January 2005. Copies available on www.defra.gov.uk/environment/airquality/strategy/evaluation/index.htm

accepted threshold effect, i.e. no recognised safe level for exposure to fine particles ($PM_{2.5}$)[14] [15]. For this pollutant, the current policy framework is therefore not going to generate the maximum improvement in public health for the investment made, because it focuses attention on hotspots only, despite much more widespread adverse effects on health being likely.

30. We have therefore adopted an '*exposure reduction*' approach for $PM_{2.5}$ to seek a more efficient way of achieving further reductions in the health effects of air pollution by providing a driver to improve air quality everywhere in the UK rather than just in a small number of localised hotspot areas, where the costs of reducing concentrations are likely to be exceedingly high. This will act to make policy measures more cost-effective and is more likely to maximise public health improvements across the general population.

31. The exposure reduction approach is based on the principle that for pollutants with a low or zero threshold for adverse effects, it will generally be more beneficial to public health, and potentially more cost-effective to reduce pollutant levels across the whole population of an urban area or region rather than in a small area or "hotspot". The framework of delivering this approach contains two inseparable parts:

- air quality objectives/limit values (often called "backstop objective" or "concentration cap") to ensure some basic level or quality of air which all citizens should experience, embodying the "environmental justice" concept
- an objective based on reducing average exposures across the most heavily populated areas of the country (often called "percentage reduction" or "exposure reduction" objective), in order to generate further cost effective public health improvements over and above the basic level of protection generated by the objective above.

32. While the percentage reduction objective is a relative measure of improvement (in this case 15 per cent reduction in average concentrations in urban background areas across the UK between 2010 and 2020), the backstop objective (or concentration cap) is designed to deliver a **minimum level of protection applicable to all areas in a country** ($25\mu g.m^{-3}$). In Scotland, where background levels of pollution are generally lower, the Scottish Executive has decided to retain the strategy's 2010 PM_{10} objective in addition to introducing the exposure reduction approach.

Potential objectives to be kept under review

Ecosystems

33. The 2000 Air Quality Strategy did not address the impact of air pollution on ecosystems to any significant extent, as it was primarily concerned with the improvement of air quality for the protection of human health. Since then, the UK Government and the devolved administrations consider that the scope of the strategy should be progressively extended to address key ecosystem impacts. Therefore options for extending the 2000 Strategy's objectives for SO_2 and NO_X for protection of vegetation and ecosystems, beyond those specified under the First Daughter Directive were included within the consultation which fed into this update of the strategy.

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[14] WHO air quality guidelines. Global update 2005. Report on a Working Group meeting , Bonn, Germany, October 2005. http://www.euro.who.int/Document/E87950.pdf

[15] "Department of Health (2007) Committee on the Medical Effects of Air Pollutants 'Long-term Exposure to Air Pollution: Effect on Mortality' Draft report for technical comment. http://www.advisorybodies.doh.gov.uk/comeap/statementsreports/longtermeffectsmort2007.pdf

34. These options raised a number of concerns amongst respondents to consultation on the review and the UK Government and devolved administrations have taken account of comments received on the options proposed. This strategy retains the previous strategy's ecosystem objectives for sulphur dioxide and oxides of nitrogen, in line with the requirements of the First Daughter Directive, but we consider that it would be inappropriate to implement the further options proposed during the consultation at the present time. We will instead, take forward additional analysis and consider how best to ensure protection of ecosystems against air pollution in the medium to the long term. In addition to the requirements under the First Daughter Directive which sets objectives for protection of vegetation and ecosystems, there are a number of international and national agreements which identify and seek to protect ecosystems of high conservation site value[16]. Consideration will be given to whether additional objectives would afford the level of protection we are seeking. A range of options will be analysed, and stakeholders will be fully involved in the development process.

Critical loads and critical levels

35. The UK Government and the devolved administrations are committed to the long term goal expressed in the EU's 6th Environmental Action Plan to "reach the long term objective of no-exceedence of critical loads and levels"[17]. Due to the transboundary nature of these pollutants, the best means of moving further towards this goal is through concerted action across Europe to reduce acidifying and eutrophying emissions, such as through the EU National Emission Ceilings Directive (NECD) and the United Nations Economic Commission for Europe (UNECE) Convention on Long Range Transboundary Air Pollution and the review of the Gothenburg Protocol. Both are currently under review. The UK Government and devolved administrations will continue to support the development of cost effective policies aimed at reducing critical load exceedence at UNECE and EU levels and further research and development to improve our understanding of these effects.

Ammonia

36. This pollutant is not currently covered under the Air Quality Strategy. In recent decades, as levels of sulphur and NO_X have reduced, so has their contribution to detrimental impacts on sensitive ecosystems. As a result ammonia is becoming of increasing significance. Emission projections show that there has been a small but steady decline in ammonia emissions over the last 15 years. Our emission projections indicate that although we are likely to meet our NECD limit for ammonia in 2010 and subsequent years, it is likely to be by a narrow margin (a few kilotonnes). We will keep this under review to ensure we meet our statutory target.

37. The nature of ammonia emissions and their diffuse sources make analysis of control measures and policies particularly challenging. An additional complexity is the potential for interaction between losses of nitrogen compounds to air and water, so called "pollution swapping", where for example, techniques to reduce ammonia emissions from the soil to air could potentially lead to the nitrogen emerging as nitrates in water courses to the detriment of the aquatic environment.

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[16] These include: Special Protection Areas (SPAs) and Special Areas of Conservation (SACs), established under the EC Habitats and Birds Directive and jointly included in EU wide network of protected areas called Natura 2000 sites. The Habitats Directive commits Member States to protecting SACs and SPAs and endeavouring to use their land use planning and development policies "with a view to improving the ecological coherence of Natura 2000 sites". The Convention on Wetlands of International Importance establishes Ramsar Sites; and the 1981 Wildlife and Countryside Act establishes Areas and Sites of Special Scientific Interest (SSSI).

[17] http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_242/l_24220020910en00010015.pdf

38. Current regulatory controls on ammonia are primarily through IPPC which, through a permitting process, controls emission to air, water and land from a range of industrial sources, including fertiliser production, intensive indoor rearing of pigs and poultry (although these cover only a small proportion of total ammonia emissions). Permit conditions require the use of BAT in relation to all significant emissions (which, for intensive livestock rearing, includes ammonia).

39. There are, however, a number of current, and forthcoming, policy levers and controls which will and do have impacts on ammonia losses. Of most significance are: Common Agricultural Programme reform, where production is now decoupled from subsidies; the review and likely tightening of the action programme under the Nitrates Directive; and the Catchment Sensitive Farming programme under the Water Framework Directive. There is at present, however, little data quantifying the level of reduction in ammonia emissions likely to result from these policies. The Government has commissioned work to attempt to assess the effects of these changes on our projections.

40. In light of this, we do not consider it appropriate at this time to set objectives for ammonia without consideration of wider environmental issues and regulatory frameworks. A holistic and strategic approach will be taken to tackling nitrogen emissions through nutrient management in a wider context of losses to water, air and impacts on climate change. Work has started to identify what policy mechanisms, targets and objectives are required to meet our commitments in relation to ammonia and to bring about desirable outcomes more generally from the adoption of a holistic nutrient management approach.

Current air quality policies

41. The UK Government and the devolved administrations' role in delivering cleaner air is to provide a clear policy framework to include, where appropriate, legislation and/or non-regulatory measures such as financial incentives. Mechanisms have been introduced to control emissions from the significant sources of air pollution, in particular from the transport and industry sectors and from domestic premises. We will continue to maintain and implement existing controls so that current standards do not deteriorate. The main controls are set out below.

International

42. The Air Quality Strategy also takes into account the European and wider international context in which the UK's domestic policies are set. As a Member of the European Union, the UK is required to achieve its obligations under European legislation. The UK is also a Party to the UNECE Convention on Long Range Transboundary Air Pollution, which provides the forum for addressing long range transboundary air pollution issues over an area wider than the EU.

43. Since September 2005, both the European Parliament and the Council have been considering a proposal for a new ambient air quality framework directive. Both adopted a preliminary position in June 2006; the revised directive is expected to be adopted in the second half of 2007 or early 2008.

44. The proposed Directive:

- streamlines four existing air quality directives and a Decision in line with better regulation principles
- confirms many of the existing directive's obligations, but introduces some flexibilities in meeting those obligations under some circumstances:
  - the possibility to postpone the attainment deadlines for some limit values
  - the ability to disregard contributions to air pollution from natural sources for the purposes of determining compliance with obligations
  - greater clarity on where to assess air quality so that the focus is on areas where members of the public could be exposed
- introduces controls on fine particles. The European Commission has proposed controls on $PM_{2.5}$ in line with the most recent advice from the WHO. There is also a new approach proposed – "exposure reduction" (see paragraphs 29 – 32 above) – for this pollutant that would focus policy on improving air quality in the places where the greatest number of people are likely to be exposed, and not just in pollution hotspots.[18]

Road Transport

45. The Government continues to implement its strategy for transport contained in The Future of Transport White Paper, published in July 2004[19]. This stated that vehicles must continue to get cleaner, quieter and less harmful to the environment, and that progress made over the last decade needs to continue in the future. We will ensure that technological progress goes hand

[18] The directive is still in draft, and at the time of publication of this strategy, proposes the following controls on fine particles ($PM_{2.5}$): (i) target value of 25 $\mu g.m^{-3}$ by 2010; (ii) limit value of 25 $\mu g.m^{-3}$ by 2015; (iii) exposure reduction target of up to 20% reduction of urban background particulate matter levels from a reference year of 2010, to be achieved by 2020."

[19] The Future of Transport White Paper (Cm 6234). July 2004. The Stationery Office.

in hand with better planning, better management and smarter ways of using our transport network.

46. The Future of Transport White Paper also stated that good quality transport infrastructure should complement or enhance the character of its local area. Therefore transport schemes, such as bypasses round towns and villages, should improve the quality of life for local communities but need to be designed in ways that offer environmental gains, reduce community severance and improve air quality wherever possible.

47. Road transport is a key source of many air pollutants, particularly in urban areas. There are two main trends in the transport sector working in opposite directions: new vehicles are becoming individually cleaner in response to European emission standards legislation, but total vehicle kilometres are increasing. Overall emissions of key air pollutants from road transport have fallen by about 50% over the last decade, despite increases in traffic, and are expected to reduce by a further 25% or so over the next decade. This is mainly a result of progressively tighter vehicle emission and fuel standards agreed at European level and set in UK regulations.

48. There are systems in place to ensure compliance with vehicle emission standards. Through its Type Approval work, the Vehicle Certification Agency ensures that all new models of cars coming onto our roads meet EU emissions standards. Almost all types of vehicles must go through an emission check as part of the annual MOT testing procedures. In service testing is one of several measures designed to reduce pollution from vehicle emissions. The MOT tests are kept under review in response to developments in vehicle technology to ensure an appropriate framework. Regulations were introduced in 1997 in England and Wales to allow local authorities to check vehicle emissions by the roadside and issue fixed penalties if vehicles do not meet the legal limits.

49. In Scotland, the 2003 Regulations allow any local authority to apply to the Scottish Ministers for designation to undertake roadside emissions testing and to instruct drivers of parked idling vehicles to switch off their engines. Currently around a third of Scottish authorities make use of either or both of these powers. The Scottish Executive provides annual grant support to help fund these activities and issued guidance in 2003.

50. The Government also has an excellent record of incentivising cleaner fuels and vehicles through duty differentials – for example, duty incentives for fuels such as ultra low sulphur petrol/diesel. These mechanisms help to encourage the use and uptake of cleaner fuels and vehicles, rewarding those who choose to buy clean, fuel-efficient vehicles through lower vehicle excise duty and company car tax rates.

51. In England and Wales, the Highways Agency's purpose is to operate, maintain and improve the strategic trunk road network with one of its objectives being to respect the environment. The agency can influence its effect on air quality through: contributing to strategic planning; road improvements; integrating transport and encouraging sustainable travel; providing better information for improved operation; and working with local authorities to deliver the Air Quality Strategy.

Emissions from larger industrial sources

52. The Environmental Protection Act 1990 (EPA 1990), which established the main mechanisms for minimising air pollution from industrial sources, has helped to improve air quality considerably, but it remains very important that there is continuing regulatory effort in order to maintain the improvements. These mechanisms are now being replaced by systems introduced under the Pollution Prevention and Control Act 1999 which incorporate implementation of the EU IPPC Directive (96/61/EC). A phased approach is underway to apply the controls sector by sector and is due for completion by October 2007.

53. IPPC covers some 4,300 installations in England and Wales. These include large-scale installations, such as oil refineries, power stations and chemical plants. Large food and drink processing plants are also covered, as are large intensive units for rearing pigs or poultry. Some 90% of these installations are regulated by the Environment Agency, with the remainder regulated by the local authority. In Scotland, all IPPC installations (some 650 Part A installations) are regulated by SEPA. In Northern Ireland, the 400 IPPC installations are regulated by the Environment and Heritage Service.

54. Where an air quality objective derived from a legally binding limit value set in EU legislation can only be met by imposing emission limits on an industrial installation or sector more stringent than those associated with the use of BAT, then the more stringent emission limits will have to be imposed by the regulator. However, if the UK has chosen to adopt the standard or objective as a matter of national policy which is more demanding than any EU requirement, regulators should generally not require emission limits more stringent than those associated with the use of BAT.

Role of Local Authorities

55. The UK Government and devolved administrations fully recognise the important role that local authorities have to play in helping deliver the strategy's air quality objectives and the mandatory European air quality limit values. Action taken at the local level can be an effective way of tackling localised air quality problems, leading to an overall improvement of air quality across the UK.

Local Air Quality Management

56. The Environment Act 1995 and the Environment (Northern Ireland) Order 2002 introduced the system of local air quality management (LAQM). Since then, local authorities have had to periodically review and assess the current, and likely future, air quality in their areas against national air quality objectives for seven air pollutants included in regulations for that purpose. Where any objective is unlikely to be met by the relevant deadline, local authorities must designate those areas as air quality management areas (AQMAs) and take action, along with others, to work towards meeting the objectives.

57. This system has considerably improved our knowledge and understanding of local air quality in the UK over the last ten years. The information gathered by local authorities about local levels of pollutant concentrations has greatly helped the UK Government and devolved administrations in evaluating how much more effort is required to achieve the most challenging objectives. Government's guidance to local authorities on the system[20] [21] will be reviewed later this year.

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[20] Local Air Quality Management: Policy Guidance LAQM.PG(03). Defra 2003

[21] Technical Guidance LAQM. TG (03) Defra 2003.

58. To date around 200 local authorities in the UK have designated parts or the whole of their district as an AQMA. The majority of these have been declared for exceedences of the NO_2 and PM_{10} objectives mainly due to road transport emissions. The sources of emissions are either local authority roads, or the strategic road network regulated by the Highways Agency in England and Wales, Transport Scotland in Scotland and the Department of Regional Development Roads Service in Northern Ireland. A few AQMAs (mainly in Northern Ireland) have been declared for exceedences of the PM_{10} objectives due to emissions from burning solid fuel in domestic premises. There are also a handful of AQMAs in the UK which have been designated for the SO_2 objectives due to emissions from nearby industrial plants.

59. The UK Government and the devolved administrations strongly believe that air quality issues should be dealt with in a holistic and multi-disciplinary way. In drawing up action plans, local authority environmental health/pollution teams are expected to engage local authority officers across different departments, particularly, land-use and transport planners to ensure the actions are supported by all parts of the authority. In addition engagement with the wider panorama of relevant stakeholders, including the public, is required to ensure action plans are fit-for-purpose in addressing air quality issues. It is vital that all those organisations, groups and individuals that have an impact upon local air quality, buy-in and work towards the objectives of an adopted action plan.

60. At publication of this strategy, around 120 air quality action plans[22] have been submitted. The content of action plans can vary from one authority to another and depends on the main sources of pollutants of concern. Local authorities know what will work best in their area, but there are some common elements to many of the action plans received, especially since the majority of the action plans produced so far focus on measures dealing with road traffic.

61. The UK Government and the devolved administrations welcome the fact that the majority of local authorities have been working and are continuing to work in close partnership with their neighbours through regional air quality steering groups/fora. For example, a number of English local authorities have established a "Low Emissions Strategies Group", to help scope and develop practical knowledge on the implementation of low emissions zones and measures. Such groups play an important role to share information, resources and good practice between local authorities to support their air quality duties. Many local authorities have also set up air quality stakeholder partnerships which provide a useful mechanism for engaging and working with other agencies, such as the Environment Agency, SEPA, Highways Agency, and local business and community groups in delivering cleaner air.

62. Effective consultation and interaction with the local community is also extremely important and the vast majority of local authorities have successfully disseminated local air quality information through a variety of media, such as websites, public campaigns, leaflets, and local press. Some have also used innovative methods of engaging local businesses and community groups in order to build trust and gain support for their work. Local authorities should continue to ensure that they engage and interact with agencies and local community groups at the earliest opportunity within the LAQM process.

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[22] The Environment Act 1995 sets out a duty for those authorities that have designated air quality management areas to produce an air quality action plan. In England, under the Government's "freedoms and flexibilities" agenda, those local authorities classified as "excellent" are no longer required to produce an action plan; however they still have a duty to take action to work towards meeting the national air quality objectives. This freedom and flexibility will shortly be extended to local authorities classified as 4 star, equivalent to "excellent" under the new rating system.

63. The Government's Beacon Scheme 'Delivering Cleaner Air' theme for England recognises local authority excellence in managing air quality at the local level. Four authorities were awarded Beacon status in March 2007[23] and will share their best practice with other authorities, which we hope will continue to improve local authorities' performance in this policy area.

64. The UK Government's annual air quality grant programme also supports local authorities with their LAQM air quality monitoring and action plan activities. Similar support systems operate in the devolved administrations.

65. Local measures in action plans include:

- corporate commitment to putting air quality at the heart of the decision making process, particularly in other policy areas such as planning decisions or including air quality in regional spatial strategies/local development frameworks
- commitment to working closely with relevant authorities responsible for highways and/or environmental regulation on possible emissions reduction measures where trunk roads and/or industrial sources are major local sources of pollutants
- local traffic management measures to limit access to, or re-route traffic away from, problem areas. Low emission zones are a possible solution that some authorities have been looking at in this context
- commitment to developing or promoting green travel plans and/or to using cleaner-fuelled vehicles in the authority's own fleet
- strategy for informing members of the public about air quality issues, perhaps via local newsletters or other media
- quality partnerships with bus or fleet operators to deliver cleaner, quieter vehicles in return for the provision of better bus lanes or more flexible delivery arrangements
- in the longer term, perhaps, congestion charging schemes and/or workplace parking levies.

66. The UK Government and devolved administrations consider that these measures continue to be very important in improving local air quality and quality of life in the UK.

67. Under the UK Government's "freedoms and flexibilities"[24] agenda, local authorities in England were encouraged to integrate their air quality action plans into their Local Transport Plan (LTP), where local road transport was a primary factor in the AQMAs.

68. Most English local authorities have now either integrated their action plans or included air quality information in their LTP. Including air quality measures in the LTP should increase the capacity to deliver cleaner air by tackling the local road sources of pollutant emissions. In Scotland, air quality action plans currently remain separate from Local and Regional Transport Strategies, which are the equivalent to the English LTPs, although local authorities and Regional Transport Partnerships are strongly encouraged to ensure that plans and Strategies are properly co-ordinated.

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[23] London Borough of Croydon, London Borough of Greenwich, Sefton Metropolitan Borough Council and Sheffield City Council.

[24] One of the main aims of the Government's "freedoms and flexibilities" agenda is to reduce the burden on local authorities of having to produce too many plans/strategies.

69. Local authorities with local road transport related AQMAs were able to secure funding through LTP resources, which were issued in December 2006. A formula was used to allocate funds to cover expenditure on capital projects up to 2010/2011 which will deliver cleaner air. The formula used for 2007/08 includes those AQMAs designated up to mid-October 2005, and in 2008/09 to 2010/2011, it also includes areas designated between mid-October 2005 and mid-October 2006. No more changes will be made to the funding formula so authorities with emerging AQMAs will have to make use of existing LTP resources.

70. Following this, and the successful evaluation of the LAQM system concluded in 2003, the UK Government and the devolved administrations remain committed to LAQM as a tool to deliver improved air quality. The third round under the system started in April 2006 and the UK Government and the devolved administrations will re-evaluate the role of the LAQM system by 2010.

71. The following are some other examples of legislative controls which local government can implement to improve air quality:

Emissions from transport sources

72. Traffic management can make a significant contribution to help reduce emissions of pollutants from road vehicles, for example, schemes which restrict or exclude less clean vehicles from certain roads or areas, such as low emission zones, or reduce road congestion. The UK Government and the devolved administrations' transport policies depend to a large extent on local actions. LTPs in England and Wales and Local and Regional Transport Strategies in Scotland are the main mechanisms for implementing transport policies at the local level. One of the key criteria against which these plans are judged for central funding is the extent these take account of air quality considerations.

Emissions from industrial sources

73. The local authority pollution, prevention and control (LAPPC) regime, covers installations known as Part B installations (and Part C installations in Northern Ireland), such as smaller foundries, many solvent-using processes, timber activities, crematoria, car refinishing establishments and service stations, except in Scotland where SEPA is the responsible authority. These installations have been regulated largely since 1991, predating the IPPC Directive but essentially following the same procedures albeit only in relation to the control of air emissions, and in England and Wales regulated by local authorities. Some 2,500 Part B installations are regulated by SEPA in Scotland. In Northern Ireland regulation occurs under the Pollution Prevention and Control Regulations (Northern Ireland) 2003. These installation are regulated only in relation to their emissions to air. As with the other control systems, the transfer to the LAPPC regime was undertaken over a phased timetable and is nearing completion. Local authorities also regulate Part A(2)s under PPC Regulations.

74. An independent performance review of the local authority pollution control regimes in 2003/4[25] concluded that the vast majority of the 17,000 regulated processes had been upgraded in response to statutory guidance on BAT which the consultants considered a significant achievement.

[25] Review by Atkins consultants: http://www.defra.gov.uk/environment/ppc/localauth/pubs/reports/index.htm

Planning

75. The planning systems across the UK for land use and transport planning are also an important part of an integrated approach to air quality improvements. The UK Government and the devolved administrations provide planning authorities with guidance when considering new developments with emphasis on accessibility for public transport, park and ride schemes, walking and cycling. These can all help reduce the number of journeys made by car and the emissions to air. In England, Regional Spatial Strategies are being drawn up which should include policies on air quality. In turn, Local Development Frameworks should also contain air quality policies to set a strategic framework to deal with air quality in the local planning system.

76. In England, Regional Spatial Strategies (RSS) set out a broad development strategy for a fifteen to twenty year period for each region. The RSS informs the development of Local Development Frameworks whose local development documents must be in general conformity with the RSS. When preparing a regional spatial strategy or a local development document both regional planning bodies and local planning authorities must have regard to national policy and advice issued in guidance. This includes Planning Policy 23 (PPS23) which covers systems for pollution control, air quality, water quality and development on land affected by contamination, and Planning Policy Guidance Note 13 (PPG 13) Transport which sets out guidance on reducing the need to travel, especially by private car, and promoting more sustainable transport choices for people and moving freight. In addition, the draft PPS Planning and Climate Change sets out how planning should shape places with lower carbon emissions and that are resilient to climate change now accepted as inevitable, with an expectation to deliver patterns of urban growth that help secure the fullest possible use of sustainable transport for moving freight, public transport, cycling and walking.

77. The RSS and Development Plan Document constitute the statutory Development Plan. Local planning authorities must determine planning applications in accordance with the statutory Development Plan, unless material considerations indicate otherwise. Where there are other material considerations, the Development Plan should be the starting point, and other material considerations should be taken into account in reaching a decision. Government's statements of planning policy (PPSs) are material considerations which must be taken into account, where relevant, in decisions on planning applications.

78. Scotland has similar guidance on air quality in Planning Advice Note 51, Planning and Environmental Protection which was revised in 2006 and for transport in Scottish Planning Policy 17 Planning for Transport. In Wales, the Planning Policy Wales sets out the guidance for air quality and Technical Advice Note 18 provides advice on transport planning. In Northern Ireland PPS 13 Transportation and Land Use has been prepared to guide the integration of transportation and land use.

79. Local authorities have also worked together through the National Society for Clean Air and Environmental Protection to produce more detailed guidance on how air quality should be taken into account in the development planning process.

Emissions from domestic premises

80. As well as controlling emissions of dark smoke from industrial premises, the Clean Air Acts also provide local authorities with powers to declare and enforce smoke control areas in which emissions of smoke from chimneys and use of unauthorised fuels is generally prohibited. Most of the UK's major towns and cities are now covered by smoke control orders. Regulations have been introduced in Northern Ireland which also limit the sulphur content of solid fuels for general use. Outside smoke control areas, local authorities have powers under the Environmental Protection Act 1990 to deal with emissions of smoke which constitute a statutory nuisance. Equivalent powers exist in Northern Ireland under the Clean Air (Northern Ireland) Order 1981.

Other Government policies that affect air quality

Better regulation

81. The better regulation agenda is about finding effective ways to deliver the desired outcomes without placing unnecessary costs on those who are regulated. It is not about eroding environmental outcomes, rather it is about implementing the most efficient ways to achieve them.

82. The three key commitments that underlie this agenda[26] are

- regulate only when necessary and doing so in a light-touch way that is proportionate to risk
- achieve exacting targets to reduce the cost of administering regulations
- rationalise the inspection and enforcement arrangements for both business and the public sector.

83. In December 2004 Defra committed in its Five Year Strategy to cutting administrative costs for the industries it regulates by 25 per cent by 2010. This was followed in March 2005 by the Better Regulation Task Force report 'Regulation – Less is More' and the Hampton Report that among other things advocated the use of the standard cost model for measuring administrative burdens. These reports were accepted in full by the Government and Defra has published its progress in its second Simplification Plan 'Maximising Outcomes, Minimising Burdens'[27], in December 2006.

84. The paragraphs below explain how the new Air Quality Strategy looks to deliver on the three key commitments, set out above, that underpin the better regulation agenda. This simplification analysis is provided in more detail in the Regulatory Impact Assessment published in Volume 2 of the strategy.

Light touch proportionate interventions

85. The main change to the current policy framework is the move to an "exposure reduction" approach for setting objectives for particulate matter and away from long term objectives based on limits. This is a substantial move towards the risk based policy framework, focusing on delivering improved public health, in line with the vision of the Hampton Review[28]. Allowing

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[26] Further information is available from the Better Regulation Executive at http://www.cabinetoffice.gov.uk/regulation/

[27] Maximising Outcomes, Minimising Burdens. Defra (2006). http://www.defra.gov.uk/corporate/regulat/regulat.asp

[28] Reducing Administrative burdens: effective inspection and enforcement. Phillip Hampton. HM Treasury (March 2005).

interventions to be focused on areas where significant health improvements can be achieved, it will also reduce the pressure to act where little benefit can be accrued even by resorting to disproportionate measures.

86. Our analysis shows that a focus on exposure reduction rather than targeting limit values resulted in around twice the health benefits and was expected to result in substantially lower costs.[29]

87. We are also committed to continuing to ensure that any new regulation, both from domestic and EU legislation, will be proportionate, consistent, transparent and well targeted.

88. We will achieve this through influencing EU legislation, including the new EU air quality directive, and the proposed revisions of the National Emissions Ceilings Directive, the Integrated Pollution Prevention and Control Directive and the UNECE Convention on Long Range Transboundary Air Pollution's Gothenburg Protocol.

89. We will also use, where appropriate, alternatives to classic regulation such as market approaches or soft measures. One such example is in the implementation of the Large Combustion Plants Directive where the UK has provided operators with the option of participating in the National Emission Reduction Plan[30] which features a provision for transfer of emission allowances between operators.

Reducing administrative costs

90. Air quality regulations are estimated to account for approximately £10.8m per annum[31] in administrative cost, or around 3.5 per cent of Defra's total estimated cost. Close inspection of this estimate shows how effective the application of this legislation has been in avoiding imposing unnecessary administrative costs. Five air quality interventions were identified as imposing an administrative burden on business. Within these two government interventions, the Pollution Prevention and Control Regulations 2000 (PPC) and the Defra Code of Good Agricultural Practice for the protection of air, together account for almost 99.7 per cent of the cost.

91. Simplification of the PPC regulations is already being considered both under the Environmental Permitting Programme (EPP) and the Better Regulation Review of Part B activities. Proposals under the current EPP consultation identify potential savings of £90m over ten years. In addition, a Better Regulation Review is underway on the 4,000 processes regulated by local authorities in England and Wales. The substantive analysis of the sectors involved is now in progress, and a second consultation with detailed proposals and a regulatory impact assessment will be issued probably in the second half of 2007.

92. We are also undertaking a holistic review of the Codes of Good Agricultural Practice in respect to air, water and soil.

Rationalising inspection and enforcement

93. We continue to focus on ensuring that the inspection and enforcement arrangements associated with air quality are as proportionate and efficient as practicable.

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[29] The comparison between limit values and the exposure reduction approach is provided in Volume 2 of the strategy.

[30] See http://www.defra.gov.uk/corporate/consult/emission-reductionplan/index.htm

[31] Estimated from the Admin Burdens Measurement Exercise. Available from www.cabinet-office.gov.uk/regulation/

94. To achieve this aim we are:

- looking to ensure that as far as practicable a single regulator would visit a regulated operator. A key example of this is the PPC review discussed above. In this instance a new flexibility to be introduced is the opportunity for operators to consolidate regulation by a single body where specific overlaps exist. We are considering extending this option to further areas of legislation
- removing administrative costs on regulators so that any unnecessary duplication of work is minimised. This can be seen in the support that we have provided for the integration of local authorities' Air Quality Action Plans into Local Transport Plans in England. In Wales Air Quality Action Planning will be subsumed within the Health, Social Care and Wellbeing Strategies produced by local authorities from April 2008
- continuing to implement the Hampton principles. Significant progress has been undertaken to ensure that regulation of installations under the Local Authority Pollution and Prevention Controls is an example of best practice. For example, risk-based regulation was introduced three years ago and is being linked to the annual fees and charges, with an incentive for business to reduce their risks. This will result in reduced numbers of inspections as a result of better environmental performance.

Climate change

95. The importance of climate change as an environmental issue of global significance has increased enormously in the past few years. The Stern Report[32] and the Energy White Paper[33] highlighted the importance of the need to reduce global carbon emissions. The Government's environmental policies will be developed with a consideration of their impact on climate change and greenhouse gas emissions, and this is particularly true of air quality. Where practicable and sensible, synergistic policies beneficial to both air quality and climate change will be pursued. A good example here is energy efficiency. Where there are antagonisms, (some are discussed below), the trade-offs will be quantified and optimal approaches will be adopted. In the case of this strategy, we have taken account of the range of measures at our disposal to achieve the reductions needed, and their associated costs and benefits (see accompanying volumes for further discussion). Similarly, the Climate Change Programme review[34] also quantified the impact on air pollution emissions of further possible measures to reduce greenhouse gas emissions.

96. The EU Emissions Trading Scheme (ETS) is a key policy instrument that aims to reduce emissions of carbon dioxide (CO_2) at least cost. In October 2006 the Government published its vision for emission trading. The European Climate Change Programme is currently undertaking a review with a goal of providing long term certainty about the future of the scheme. It is also considering options for expanding the scheme to include new sectors and gases. In a parallel track to this work, the Commission published in December 2006 a proposal to include aviation in the EU ETS from 2011. The UK Government supports the inclusion of this sector and looks forward to progress on this proposal. There will be co-benefits for air quality and climate change if reduced carbon dioxide emissions are achieved by decreasing the use of energy generated by fossil fuel combustion.

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[32] Stern Review on the Economics of Climate Change October 2006; Available from HM Treasury website http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

[33] Energy White Paper: Meeting the Energy Challenge. May 2007.The Stationery Office.

[34] Climate Change The UK Programme 2006 : Tomorrow's Climate- Today's Challenge. (Cm 6764/SE2006/43). The Stationery Office http://www.defra.gov.uk/environment/climatechange/uk/ukccp/pdf/ukccp06-all.pdf

97. "Changing Our Ways: Scotland's Climate Change Programme" was published in 2006 and strengthens the original programme published in 2000. A key requirement of Scotland's National Transport Strategy will be to demonstrate how the transport sector will contribute to reducing carbon emissions in Scotland.

98. The Air Quality Expert Group (AQEG) has provided advice to the UK Government and devolved administrations on the links between air quality and climate change[35]. AQEG's report examines the scientific background to these interactions and identifies synergies, where measures to improve air quality can help to ameliorate climate change, and trade-offs where policy measures in the two areas pull in different directions. The report's conclusions are already helping to shape the evidence underpinning policy development. The report also contains a number of recommendations on the ways in which more sophisticated assessments of air quality and climate change impacts could be integrated into future policy decisions (see Chapter 6 of AQEG report). The Group's main recommendations are set out in Box 2 below. We are considering these points and will respond in due course.

Box 2: AQEG main recommendations

1. Impact analysis of policies or specific developments, whether for industry, transport, housing etc, should take account of the interlinkages of emissions of air quality and climate change pollutants. In particular measures at the national level designed to improve local air quality or to abate greenhouse warming should not be implemented without prior consideration of all types of impact on the atmosphere and other environmental media.

2. Detailed consideration should be given to appropriate policy drivers and legislation that could be introduced to ensure that the reduction of greenhouse gas emissions is properly incorporated into regional and local government planning decisions.

3. Detailed consideration should be given to developing better means of expressing the influence of air quality pollutants on climate, and for inter-comparing the benefits of abatement strategies in respect of air quality and of climate change.

4. The relationship between local radiative forcing and local temperature response has not been sufficiently investigated. This may be particularly important for spatially inhomogeneous radiative forcing agents such as aerosol (direct and indirect effects) and tropospheric ozone and needs further research.

5. Research is needed on the extent to which policies for large-scale tree planting within the United Kingdom and elsewhere within Europe would influence air quality in high temperature summer pollution episodes. Wider impacts of land use change upon both air quality and global pollutants also need to be considered.

[35] AQEG (2007). Air quality and climate change: a UK perspective. Report by the Air Quality Expert Group. http://www.defra.gov.uk/environment/airquality/publications/airqual-climatechange/index.htm

Box 2: AQEG main recommendations *(continued)*

6. Consideration should be given to promoting measures which result in benefits both for air quality and climate. These might include incentives for domestic energy conservation, improved industrial process efficiency and measures designed to modify the behaviour of individuals so as to reduce the impact of their activities on the atmosphere. Given the significant influence of transport emissions, measures which reduced the use of road vehicles, shipping and aircraft would be highly beneficial.

7. A comprehensive life cycle analysis should be conducted comparing the environmental implications of electric and hybrid vehicles with each other and with conventionally-fuelled vehicles, to inform policy on incentivising their use. A detailed fuel-cycle analysis is required to consider the air quality and greenhouse gas emission implications for the production, supply and consumption of biofuels for transport.

8. The full fuel cycle environmental implications of non-fossil fuel means of electricity generation (ie wind, tidal, nuclear, etc) should be evaluated, as part of the development of future energy supply policies. This should include the implications of large-scale biofuel and bioenergy production for land-surface exchange of both air pollutants and greenhouse gases.

9. The development of well informed European policy on ozone precursors would benefit greatly from a more global view of emissions, trends and abatement issues.

10. Future climate change policy should consider extending the basket of radiative forcing agents included in the development of climate change policies.

99. Trade-offs between air quality and climate change are often minor. For example, flue gas desulphurisation (FGD) fitted to reduce SO_2 may increase CO_2 emissions by 2-3 per cent but can reduce SO_2 emissions from an industrial plant by as much as 90 per cent or more. The use of large scale FGD started in the UK in the early 1990s, and between 1990 and 2005, SO_2 emissions, the main cause of acid rain, reduced by 81 per cent. Whilst other measures have contributed to this trend, including a lower sulphur content in liquid fuels, the reduction is dominated by power station emissions abatement.

100. For some measures the interactions between climate change and air quality are less straightforward. For instance, in practice, reducing the toxic emissions from diesel vehicles will reduce the trade-offs between petrol and diesel vehicles, and will help to pave the way for reductions in air pollutants and in greenhouse gases. The up-take of cleaner diesel vehicles at the Euro 5 and 6 vehicle emission standards level will not only help to improve greenhouse gas emissions but could also help to realise the co-benefits from air quality and climate change policies discussed by Stern the earlier this is done, the earlier these benefits will be realised. It is worth noting here that black carbon, the main form of the particle emissions from diesel vehicles, itself exerts a warming effect on climate, as well as being potentially toxic so there are both climate change and public health reasons to remove these emissions from diesel exhausts[36].

[36] The extent of the climate warming due to black carbon is a subject of ongoing research within Defra and the Hadley Centre.

101. Generating heat and power from biomass combustion is another area that allows carbon savings to be made, although careful analysis of the energy inputs required to produce, process and transport the fuel is needed in order to accurately quantify such savings. There is also a need to balance any carbon savings against air quality effects such as the potentially increased emission of particulates or PAH. The choice of fuel, appliance and location will be crucial in achieving this balance.

102. The government has published a UK biomass strategy[37] which will attempt to address all of these factors. A report for the Scottish Executive, produced in 2006, made a comparative analysis of the greenhouse gas and air pollution emissions from biomass production and consumption[38].

103. The package of policy measures proposed in this strategy have potential carbon benefits of around 380,000 tonnes of carbon saved per annum by 2020 driven by reduced levels of carbon emitted from more fuel efficient low emission vehicles.

Local links to climate change

104. In many ways, local authorities are well placed to pursue measures which improve air quality and reduce greenhouse gas emissions. For example, policies designed to reduce the impact that transport has on air quality by tackling congestion and encouraging a shift to public transport, walking and cycling should also reduce carbon dioxide emissions. Measures to improve energy efficiency and cut energy demand should also reduce air pollutants that are produced during electricity generation. In developing Air Quality Action Plans and where appropriate, LTPs, local authorities should bear in mind the synergies between air quality and climate change, and the added benefits to the local, regional and global environment of having an integrated approach to tackling both climate change and air quality goals.

Transport issues

105. The Department for Transport is taking forward implementation of the UK Government's strategy set out in the Future of Transport White Paper, published in 2004[39], and is also working with European partners to develop tighter standards for both vehicles and fuels. With regard to road transport, no decisions have been taken on whether to establish a national system of road pricing, however the government is working with interested local authorities who are exploring the scope for developing local schemes, as part of a wider package of transport measures, to tackle local congestion. It is only on the evidence we get from established schemes that any decision on national road pricing would be made.

106. The government is also reviewing its strategy, processes and delivery on transport in the light of the Eddington Study[40] and the Stern Review. While the Eddington Study focused on how transport can better support the economy, it fully recognised the need to ensure that environmental and other external costs from transport are taken into account in decision-making, and that users pay the full cost of their journeys. This is entirely consistent with Sir Nicholas Stern's report on the economics of climate change, and includes accounting for transport's impacts on air quality, congestion, climate change and quality of life in general.

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[37] UK Biomass Strategy. May 2007. Defra. http://www.defra.gov.uk/environment/climatechange/uk/energy/renewablefuel/pdf/ukbiomassstrategy-0507.pdf

[38] Review of Greenhouse Gas Life Cycle Emissions, Air Pollution Impacts and Economics of Biomass Production and Consumption in Scotland; Scottish Executive Environment and Rural Affairs Department 2006 http://www.scotland.gov.uk/Publications/2006/09/22094104/0

[39] The Future of Transport White Paper (Cm 6234) July 2004. The Stationery Office.

[40] The Eddington Transport Study – The Case for Action. December 2006. The Stationery Office.

There are many examples of transport schemes and policies offering benefits both for the environment and the economy, including walking and cycling, smarter choices, and public transport. The government has pledged to publish a more detailed response to the Eddington Study and the Stern Review, taking into account all of transport's objectives.

107. The Government already uses transport taxation to incentivise the uptake of low emission vehicles, in particular through Vehicle Excise Duty and Company Car Tax. The King Review of Low Carbon Cars will examine the vehicle and fuel technologies which over the next 25 years could help to decarbonise road transport, particularly cars. This will include consideration of where co-benefits in improving air quality can be realised. The Reduced Pollution Certificate scheme has provided incentives for the early uptake of clean lorries and buses, and in Budget 2007 the Government announced that a renewed scheme of Reduced Pollution Certificates for lorries and buses that meet the Euro V standard before it becomes mandatory in 2009 will come into force from October 2007. The scheme will provide reductions of up to £500 in Vehicle Excise Duty for eligible vehicles. The aim of the scheme is to bring forward the emission reduction benefits of the Euro V standard by incentivising early purchase of these vehicles.

108. The Future of Air Transport White Paper, published in 2003, noted that local air quality is an issue around airports, particularly NO_2 and PM_{10}. It confirmed that major new airport development could not proceed if there was evidence that it would be likely to result in breaches of the EU limits. Addressing this would require a combination of measures, including technology improvements, tighter standards, better operational practices and incentives through the use of economic instruments. The primary concern is around Heathrow. Expansion at Stansted and (if it were to be agreed) at Gatwick could produce isolated air pollution hotspots, but these are considered capable of being managed by mitigation measures.

109. At Heathrow, the annual average EU limit for NO_2 is currently being exceeded in a number of places, mainly in the north and north east close to the airfield, and around major roads including the M4. Source concentrations are a mix of aircraft and other aviation emissions, and vehicles on the surrounding road network. The *Project for the Sustainable Development of Heathrow*[41] is currently assessing the likely position in the event of further development, and how NO_2 concentrations in the area might be effectively reduced. Proposals will be the subject of a public consultation exercise later in 2007.

110. Ships release a significant fraction of the total emissions of man-made air pollutants. These include NO_X, sulphur oxides (SO_X), particulate matter (PM), and volatile organic compounds (VOC), which all affect local air quality. The global nature of shipping makes the International Maritime Organisation (IMO) a natural forum through which to agree a global policy response to air pollution from ships. This is covered by Annex VI of the Convention on Marine Pollution (MARPOL), which is being revised during 2007. Technical options for NO_X and SO_X emissions reduction are under development by the Sub-Committee on Bulk Liquid and Gases of IMO. The Maritime and Coastguard Agency represents the UK which is a strong proponent within the IMO of tough targets for atmospheric emissions from ships.

111. The Mayor of London is responsible for air quality and transport in London and announced in May 2007 that a London Low Emission Zone will commence in February 2008 initially for HGVs, buses and coaches. These vehicles will be required to meet certain Euro emission standards operating within Greater London. Vehicles that do not comply will be required to pay a daily rate, the proceeds of which (if any) will be spent on a number of measures related to air quality and transport. Analysis shows the scheme will generate health benefits for Londoners

[41] See Department for Transport website http://www.dft.gov.uk/pgr/aviation/environmentalissues/heathrow/

and reduce areas of exceedence of air quality objectives and move towards meeting EU air quality limit values.

112. Scotland's National Transport Strategy will set a context within which Regional Transport Strategies in Scotland will be developed, as well as providing the framework for the Scottish Strategic Transport Projects Review. This will identify, appraise and prioritise the key strategic projects across all modes of transport.

Local issues

113. The quality of the local environment, which includes air quality, has been identified as one of the government's priorities. Public opinion polls regularly show the importance that citizens place on the state of the environment on their doorstep. Such things as littered streets, cars abandoned in residential areas, graffiti strewn street furniture, poor street lighting and neglected parks can all contribute to a decreased sense of well being. The UK Government's vision is to create cleaner, safer, greener communities for all as part of its drive to deliver sustainable communities. This vision is supported by Welsh Assembly Government's Environment Strategy, which has the quality of the local environment as a key theme. The Scottish Executive's policies also emphasise the importance of local environmental equality to the quality of life.

114. The UK Government published its "Strong and Prosperous Communities"[42] Local Government White Paper in 2006. The aim of the White Paper is to give local people and local communities more influence and power and delivering better public services through a rebalancing of the relationship between central and local government and local people.

115. The Government published a research report in 2006 into links between "Air Quality and Social Deprivation in the UK: an environmental inequalities analysis"[43] which found that, in a number of urban areas, the least affluent members of society tend to be exposed to the highest levels of air pollution. This is particularly the case in England, where AQMAs declared for NO_2 are often in the most socially deprived areas, although this is less marked in Wales and Scotland. The report concluded that measures to improve air quality can have a more pronounced effect in deprived areas and could help to reduce this social inequality.

The need for new air quality measures

116. Air quality in the UK has generally improved since 1997 when the first Air Quality Strategy was adopted. The Evaluation of the Air Quality Strategy[44], published in 2005, indicated that, between 1990 and 2001, policies have resulted in a marked decline in concentrations of air pollutants, with an estimated reduction of more than 4,200 premature deaths and 3,500 hospital admissions per annum. It also suggests that these policies reduced life years lost by between 39,000 and 117,000 life years in 2001. Furthermore, the evaluation shows that these policies have been cost beneficial with an estimated £68billion benefits generated across the UK, set against costs of £6billion during the 1990 to 2001 period.

117. The current policies in our baseline scenario are policies or commitments already in place, or where agreement has been reached, that provide a baseline or starting point, from which to assess the current situation, and to act as a comparison for proposed future policies.

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[42] http://www.communities.gov.uk/index.asp?id=1503999

[43] Air Quality and Social Deprivation in the UK: an environmental inequalities analysis; Defra 2006; http://www.airquality.co.uk/archive/reports/reports.php?report_id=424;

[44] See footnote 12 for details.

118. It is clear that all the strategy objectives are or will be met on time in most parts of the UK with the exception of ozone. However, for some pollutants and at certain locations, levels are not declining as fast as expected and trends are flattening or even reversing. Even though further emission reductions are expected (eg as new vehicles and fuels become cleaner and older more polluting vehicles are replaced), projections show that there will still be exceedences of the objectives for PM, NO_2 and PAHs well after their target achievement dates of end of 2005 and by 2010 in some of our major urban areas and alongside busy roads.

119. Ozone will also remain an issue, and although it is more prevalent in rural areas, average levels are gradually increasing in urban areas. The production of ozone is strongly influenced by the weather, more being created on sunny days. There is a small upward trend in background ozone levels in the UK, in common with rising hemispheric ozone levels. There is a more marked increase in average levels in urban areas, due to the reduction in urban emissions of NO_X, which tend to destroy ozone close to their emission source. Short term peak (hourly to 8-hourly mean) levels of ozone in "summer smog" episodes have decreased in response to policy measures over the last twenty years or so, but there is some indication that this has levelled off in recent years and may even be reversed if climate change effects result in increased frequencies of hot summers like those of 2003 and 2006.

120. Urban concentrations of NO_2 have not been declining as fast as those of nitric oxide (NO), so that the NO_2/NO_x ratio has increased. The AQEG has suggested the most likely explanation of the observed trend is a change in the percentage of road traffic NO_x emissions directly emitted as NO_2. This in turn can be linked to the increasing number of light-duty diesel vehicles, especially cars meeting Euro 3 emission standards fitted with oxidation catalysts, and the fitting of catalytically regenerative particle traps to heavy-duty vehicles. Exceedences of the strategy's hourly and annual mean NO_2 objectives are still expected to fall in the future, but not as fast as had previously been expected. The UK Government and devolved administrations will take this effect into account in future policy development affecting transport emissions.

121. Furthermore, for pollutants for which no threshold for adverse health effects has been identified, such as PM, air pollution continues to have a significant negative impact on people's health even in areas that have already achieved the objectives. The assessment carried out for the review of the strategy estimates that the level of man-made particulate air pollution experienced in the UK in 2005 would be expected to reduce life expectancy averaged over the whole population of the UK by up to about 7-8 months[45]. This health impact in 2005 is estimated to cost up to £8.5-20.2 billion per annum[46]. Our assessment estimates that if no further measures in addition to those already agreed are implemented, man-made particulate air pollution in the UK will continue to reduce average life expectancy by up to about 5.5 months even by 2020. This health impact in 2020 is estimated to cost up to £6.2-14.7 billion per annum.

[45] Based on coefficients from the latest independent health advice from the Committee on the Medical Effects of Air Pollutants (COMEAP). See http://www.advisorybodies.doh.gov.uk/comeap/pdfs/interimlongtermeffects2006.pdf

[46] Calculated using the updated Third Report methodology of the Interdepartmental Group on Costs and Benefits (IGCB). See http://www.defra.gov.uk/environment/airquality/panels/igcb/index.htm

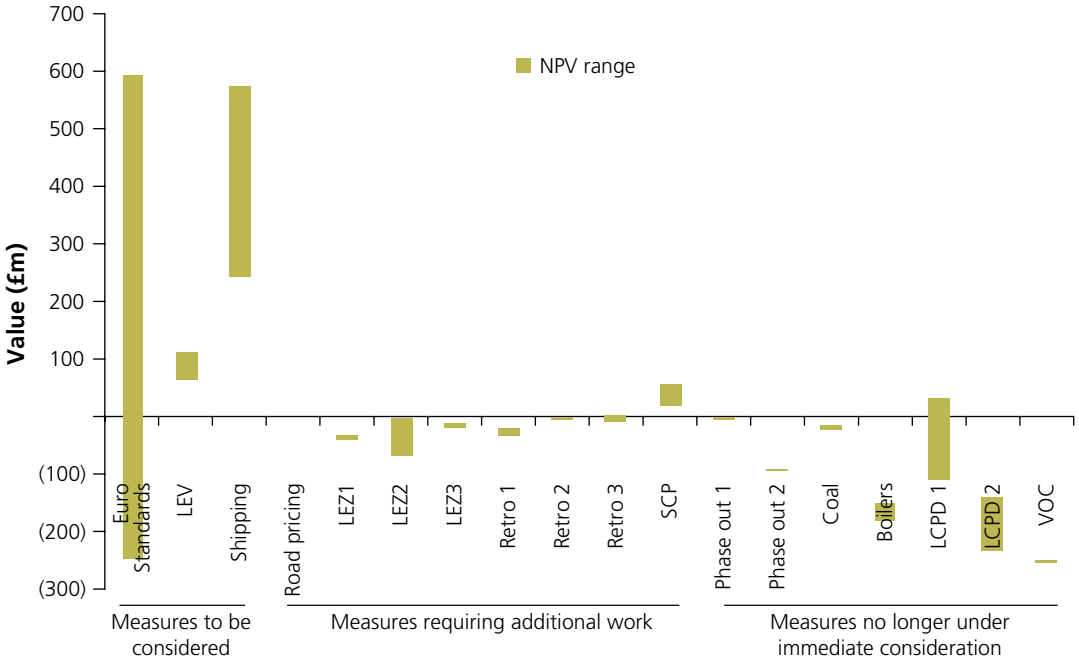
New policies to be considered

122. The following summary indicates that there are additional policy measures which the modelling suggests could, if implemented, generate significant net benefits to society (after taking costs into account), significant improvement to our ecosystems and habitats, and help the UK Government and the devolved administrations move closer to the air quality objectives by eliminating a significant number of areas of exceedence. A detailed assessment of the new modelled policy measures set out below and the associated cost and benefits is provided in Volume 2 of the strategy and the updated Third Report of the IGCB[47].

123. Local measures are considered in principle at the end of this section, although cannot be specified exactly in this strategy which is concerned primarily with specific national measures. Nevertheless, local measures are likely to play a significant role in the achievement of the strategy's objectives and we advocate the continuation of such important initiatives.

124. The diagram below sets out the results of the cost benefit analysis that has been undertaken for the potential areas considered for the Air Quality Strategy. This diagram presents the annual net present value of each of the areas, that is the monetised benefits less the monetised costs, at today's prices.

Net present value of measures assessed within the Air Quality Strategy



[47] Note on modelling: The new analysis undertaken for the strategy is based on the latest scientific and economic evidence. A key change underlying the new analysis is the assumption relating to the formation of secondary particulate matter (PM). The analysis in the review of the Air Quality Strategy 2000 assumed that a 100 per cent change in emissions of SO_2 and NO_x was reflected in secondary PM concentrations (sulphate and nitrate). More recent evidence suggests that this overestimate the change in secondary PM and hence a 50 per cent change has now been assumed. Further details are in the accompanying IGCB document.

New measures to be considered

125. We will consider more fully the measures below as soon as possible (for consistency, the letters in brackets following each measure refer to the letters assigned to each measure in the consultation documents on the review of the Air Quality Strategy):

- Incentivising the early uptake of new tighter European vehicle emissions standards (Euro-standards) (a revised Measure C)
- Increased uptake of low emission vehicles (Measure E)
- Reducing emissions from ships (Measure N)

126. Our modelling shows that this package of additional measures could generate significant benefits to the UK net of the associated costs in the region of £0.033bn – £1.211bn per annum (creating a return on costs of between 4 per cent and 138 per cent[48]) from a gain of between 2.0 and 3.8 million life years.

Measures requiring additional development work

127. We are keeping the following measures under review as they either require additional development work prior to implementation and/or coordination with other policy measures which are yet to be implemented. As the measures have been modelled, these measures are unlikely to generate positive net benefits at the present time (see accompanying volumes of the strategy for supporting analysis) , however they may have potential to produce significant health benefits to society and reductions in exceedences of critical loads for ecosystems and vegetation. We may therefore recommend introducing these measures if and when the situation changes and/or more detailed and fuller assessments indicate that the measures become cost beneficial and/or more feasible. We may also implement alternative measures in these general areas that are shown to have positive net benefits:

- A national road pricing scheme (Measure F)[49]
- London and other low emission zones (Measure G)
- Retrofitting catalyst-based diesel particulate filters to HGVs (Measure H)
- Reducing emissions from small combustion plants (Measure L)

[48] Based on health benefits of between 2.0m and 3.8m life years saved over 100 years and costs of between £878 – £885m per annum.

Measures no longer under immediate consideration

128. The following measures may also generate some health and environmental benefits, but are unlikely to generate benefits outweighing costs at present, or are not currently feasible or otherwise are superseded by other measures being taken forward. As a result these measures are not being kept under immediate review but we shall continue to explore opportunities to reduce air pollution in these areas based on future developments:

- A programme of incentives to phase out most polluting vehicles (Measures D1, D2)
- Switch away from coal to gas and oil for domestic combustion (Measure I)
- Product standards for domestic boilers (Measure J)
- Bringing forward the implementation of selective catalytic reduction (SCR) on coal-fired power stations (Measure K1)
- Fitting SCR on gas-fired power stations, iron and steel plants and petrol refineries (Measure K2)
- Reducing VOC emissions (Measure M)

Further detail on additional measures to be considered

Incentivising the early uptake of new Euro standards (revised Measure C)

129. This Government has consistently encouraged the use of cleaner fuels, technologies and vehicles, for example through graduated vehicle excise duty, the reformed company car tax structure and fuel duty differentials. The Government announced in Budget 2007 that it would consider the case for incentivising the early uptake of Euro 5 and subsequently Euro 6 technology through Company Car Tax and other instruments. An incentive for Euro 6 take up cannot be provided until Euro 5 is mandatory.

130. This measure relates to new European emission standards that passenger cars, light duty vehicles and heavy duty vehicles are required to achieve before they are allowed to be placed on the market. It is modelled on a UK wide basis aimed at motorists who choose to buy such cleaner vehicles ahead of the date the vehicles are legally required to enter the market. Cleaner vehicles are defined as vehicles that emit the Euro agreed standards for low quantities of NO_X and PM_{10}.

131. Incentivising the earlier up-take of cleaner diesel vehicles at the Euro 5 and 6 level could improve greenhouse gas emissions and also help to realise the co-benefits from air quality and climate change policies discussed by Stern. The modelling of this measure estimates likely benefits to the UK net of the associated costs in the region of -£246 to £595m per annum, although a full impact assessment of the implementation options is yet to be undertaken.

Increased uptake of low emission vehicles (Measure E)

132. Our modelling defines low emission vehicles as vehicles that emit low quantities of NO_X, PM_{10} and carbon dioxide (CO_2). The modelling therefore demonstrates positive air quality and climate change impacts. This has been modelled as a UK wide policy measure. This measure would be likely to generate significant benefits to the UK net of the associated costs, in the region of £63m to £112m per annum, although a full impact assessment of the implementation options is yet to be undertaken.

Reducing emissions from ships (Measure N)

133. This measure models the effects of reducing emissions of NO_x and SO_2 from ships, using one of the potential scenarios under consideration at the IMO. Emissions from ships have been found to contribute significantly to secondary particles formation and therefore background levels of PM_{10} across the whole of the UK. This measure focuses on reducing the sulphur content of marine fuel and reducing emissions of NO_X from ships' engines.

134. In order to have a significant effect on air quality this measure would need to be extended to all shipping in seas around the UK and is likely to be best implemented through the IMO where consideration is being given to substantial reduction of both NO_x and SO_2, with a two tier approach starting in 2010 with a view to completion in either 2015 or 2017. There are a number of proposals being floated within the IMO Sub-Committee on Bulk Liquid and Gases with respect to NO_x and SO_x reduction. These include: doing nothing; re-defining maximum levels of sulphur in marine fuels; defining and fixing emission limits of SO_x and NO_x for environmentally sensitive zones (including the current Sulphur Emission Control Areas of the Baltic and North Sea); pollutant emissions trading; encouraging the use of new engine design and of exhaust gas cleaning systems; even switching worldwide shipping to diesel fuel, which is cleaner burning then the heavy fuel oils used globally today. It is not currently known which of these measures the IMO will favour, although the UK will push for challenging targets in reducing emissions.

135. This measure is likely to generate significant benefits to the UK net of the associated costs in the region of £245m to £576m per annum.

Local "soft measures": Smarter Choices

136. Research published in 2004 entitled *'Smarter Choices – Changing the Way We Travel'*[49] provided us with robust evidence of the impact of 'soft' measures (also known as Smarter Choices) where they have been promoted vigorously and identifying the differences such measures could make upon local traffic and congestion levels.

137. Smarter Choice measures include workplace and school travel plans, personalised travel planning, public transport information and marketing, travel awareness campaigns, car sharing, car clubs, teleworking and teleconferencing, cycling and walking. Provided that Smarter Choice measures are implemented within a supportive policy context, they can be sufficiently effective in facilitating choices to reduce car use and offer good value for money.

138. Smarter Choices can complement, rather than substitute for other policies. If they are implemented in isolation then as road traffic levels are reduced the extra road space created may encourage other motorists onto the roads, thereby offsetting some of the initial benefits.

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[49] Department for Transport, July 2004. *'Smarter Choices: Changing the Way We Travel'*. http://www.dft.gov.uk/stellent/groups/dft_susttravel/documents/page/dft_susttravel_029721.hcsp

Although soft factors have the potential to generate reductions in traffic around specific sites, they must be locked in alongside other policies to maximise the benefits.

139. The Smarter Choices report estimated that significant reductions in road journeys could be achieved by implementing Smarter Choice policies at an average cost for implementation of 1.5p per car km saved. The report also estimates the benefits to be 10 times this, at 15p per car km saved and more than three times this level in congested urban conditions. Thus the report argues that every £1 spent on well designed soft measures could bring about £10 of benefits in reduced congestion alone – more in the most congested conditions.

140. From the results of the assessment carried out (see Volume 2 of the strategy for further details) it is clear that there are significant benefits to be gained by increasing the take-up of Smarter Choice measures. However, the appraisal indicates that the air quality benefits (up to £27m) represent only a small proportion (3 per cent) of the total benefits that are dominated by the reductions in congestion.

141. The Department for Transport encouraged local authorities to include Smarter Choice measures in their new local transport plans that came into effect in April 2006. This was both through direct engagement with local authorities and guidance – Making Smarter Choices Work – on how they might include them in their strategies.

142. The Department for Transport continues to promote the mainstreaming of Smarter Choices both through engagement with local authorities and a substantial package of other measures, including:

- spending over £100m in support of the Travelling to School Initiative to 2008
- £15m to support the development of 'walking buses' for children going to school and other walking schemes
- a 5 year programme costing £10m to develop three showcase sustainable travel towns (Darlington, Peterborough and Worcester) and test the impact of applying sustained and intensive implementation of smarter choices on a town-wide basis
- spending £10m a year to promote cycling through Cycling England, which was set up in March 2005
- the new National Business Travel Network, launched in February 2007, to provide a forum to develop shared ideas and best practice on business travel planning
- an on-going programme of best practice guidance. Those currently in preparation include 'The essential guide to travel planning', 'Using the planning system to secure travel plans' and 'Making personalised travel planning work'.

Further details of measures requiring additional development work

A national road pricing scheme (Measure F)

143. This potential additional measure looks at the impact of a hypothetical national road pricing scheme on air quality in the UK. The measure is being kept under review because no decisions have been taken on national road pricing, let alone what form it would take, or how it might operate, if this measure were to be introduced.

144. The analysis suggests that this additional policy measure could generate some health benefits and significant benefits to society. The analysis suggests that this measure would probably have an insignificant impact on our ecosystems. Focussing on the qualitative assessment, this measure could have positive impacts on noise and social impacts.

London and other low emission zones (Measure G)

145. This measure looked at the implementation of theoretical low emissions zones in London and in seven other large urban areas of the UK. Low emission zones (as with other air quality management schemes) are developed, implemented and managed by local authorities. Following public consultation, the Mayor of London announced in May 2007 implementation of a London-wide Low Emission Zone (LEZ) in February 2008. The actual London LEZ aims to reduce the amount of air pollutants produced by HGVs, buses and coaches using London's roads, generating health benefits for Londoners and helping to move closer toward meeting the 2010 air quality objectives and EU air quality limit values. Our analysis shows that the theoretical form of this measure could provide important potential health benefits and significant reductions in the numbers of areas of exceedence of the air quality objectives. It should be noted that the actual London LEZ to be implemented by the Mayor differs from the modelled theoretical low emission zones.

Retrofitting catalyst-based diesel particulate filters to Heavy Goods Vehicles (Measure H)

146. This measure looks at the retrofitting of catalyst-based diesel particulate filters to HGVs and the captive fleet (coaches and buses). This measure is not concerned with new vehicle purchase but rather with vehicles that are already in the fleet but that are not currently meeting Euro 5 standards.

147. As result of revised assumptions, following the consultation and discussions with the Department for Transport and stakeholders, cost-benefit analysis results for this measure have improved and, as such, this measure will be kept under review.

Reducing emissions from small combustion plants (Measure L)

148. This potential additional policy measure requires the reduction of harmful pollutants emitted by small combustion plants (between 20 and 50MW). It is UK wide.

149. The analysis shows that emissions reductions from this sector can potentially generate significant health benefits. However, abatement policies are being kept under review because we will need to assess specific individual measures. We will also need to assess the impact on reducing the areas of exceedences of our air quality objectives and also the costs and benefits, in particular the effect on competitiveness and economic performance of small businesses. The European Commission is currently considering whether to propose the extension of the IPPC Directive to small combustion plants. The UK will decide whether to support such a proposal in the light of the outcome of the consultancy study conducted on behalf of the Commission (expected 2007) and its own further consideration.

150. The process for further consideration of the new objectives and measures contained within this strategy will start immediately. We will continue to consider those measures listed for further development from now until the next review of the strategy, although if in the interim it was agreed that any of those measures should be taken forward, implementation could be considered at that time. The date of the next review of the strategy will depend upon significant related developments, such as in the EU or internationally, or new scientific or health-based evidence, and we will monitor such events closely.

151. With regard to other developments, the new EU Air Quality Directive is likely to be adopted towards the end of 2007. The European Commission, as part of the continuing Clean Air for Europe (CAFE) programme, is expected to propose in late 2007 a revision of the National Emission Ceilings Directive setting new ceilings for 2020.

152. The European Commission is also expected to propose revisions to the IPPC Directive around the end of 2007. However, the Commission does not envisage a revised Directive taking effect until 2012 at the earliest. The UK's view is that the current Directive is generally sound and not in need of major changes in scope or process, although some clarifications and simplifications should be made. A more detailed UK position will be developed during 2007.

153. The Gothenburg Protocol under the UNECE Convention on Long Range Transboundary Air Pollution is being reviewed during 2007. Once the review is complete a decision will be taken on what type of instrument, if any, the Convention Parties wish to develop a revision or replacement of the existing Protocol. The UK will consider its position in the light of the review and developments in the EU and elsewhere.

Development of the evidence base

154. The UK air quality Evidence and Innovation programme, managed by Defra on behalf of the UK Government and the devolved administrations, has a budget of around £11m per annum. All of the projects within this programme have relevance to the development of air quality policy, covering all the pollutants and effects discussed in this strategy. Over the foreseeable future the programme will continue to:

- quantify the exposure of human populations and/or ecosystems to pollutants through measurement and modelling
- assess the relative contributions to these exposures from source sectors both in the UK and elsewhere
- assess the impact of air pollution
- assess policy options and their delivery
- produce effective strategies and communication to positively impact behaviour to improve air quality.

155. The major challenges facing the air quality Evidence and Innovation programme over the next few years will be:

- the optimisation of the statutory monitoring networks to incorporate the additional requirements of new EU Air Quality Directives
- developing a more sophisticated understanding of the source attribution of the effects associated with particle and ozone exposure

- investigating further the links between air pollution and climate change
- developing a better understanding of the temporal and spatial consequences of changing deposition trends on ecosystems
- incorporating social science research into the evidence base to allow the development of better targeted policies to reduce air pollution.

Longer term view

156. This strategy aims to improve air quality in the UK over the short to medium-term, but there remains potential for further improvements in future. Looking ahead to 2050, policies to address both climate change and air pollutant emissions can potentially deliver significant improvements in air quality and public health. These improvements would go beyond the measures discussed earlier in this strategy.

157. The Energy White Paper published in 2003[50] included a long term aim of reducing carbon dioxide emissions by 60 per cent by 2050. The recent draft Climate Change Bill proposed to put this target into statutory legislation. In order to achieve reductions of this size, significant changes to all sectors of the economy, including the energy and transport sectors, are likely to be necessary. If these changes result in increased energy efficiency and in a significant contribution of zero or low-carbon intensity renewables (ie other than biomass or biofuels) and very low emitting vehicles, then considerable improvements in air quality and hence public health could result.

158. Our analysis[51] attempts to make an assessment of the potential air quality and public health benefits in the UK if these large reductions in greenhouse gas emissions were achieved. The difficulties in attempting to look further forward to the policy environment in which the UK could find itself in 2050 include the possibility that the socio-economic climate could be very different then from what we might be able to envisage now. Moreover, while some allowance has been made in the analysis for the effects of climate change, these effects could be significantly greater.

159. What is clear is that over these timescales, air quality improvements are intimately connected with energy futures and the mix of sources used for energy generation and transport, and that policies for the improvement of air quality and combating climate change will become increasingly linked. What is also evident, is that the geographical coverage of the policy debate on air quality should broaden in scope, and that a wider range of source sectors will become important. The increasingly large scale transboundary nature of air quality problems – particularly ozone and to some extent particulate matter – is becoming clearer with increasing evidence and research, as are the links with climate change.

160. These developments will enlarge the fora for debate on future control strategies for air pollutants to cover not only North America and the rest of Europe, but also other countries in the northern hemisphere. This widening debate and the different atmospheric processes that are necessarily involved in determining pollution levels on these scales will mean that other sources and pollutants – notably those from agriculture and shipping – will play an important role in determining future air quality in the northern hemisphere.

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[50] Energy White Paper: our energy future – creating a low carbon economy (Cm 5761) 2003. The Stationery Office.

[51] UK Air quality in 2050 – synergies with climate change policies. Environmental Science & Policy, Volume 10 (2007) 169-175.

161. In estimating potential future air pollution levels in central London around 2050, our analysis has shown that there are still potentially large reductions that are achievable, with consequently similar improvements in public health from air pollution. Current levels of fine particles ($PM_{2.5}$) in London could potentially be reduced by up to 55 per cent compared with current levels at urban background locations and 63 per cent beside the most polluted roads. Current levels of nitrogen dioxide could be reduced by approximately 55 per cent and approximately 70 per cent at background and roadside locations respectively in London. Both scenarios assume improvements in emissions of toxic pollutants and greenhouse gases from energy generation and from the road transport sector such as fitting particle filters, a much larger proportion of low emission vehicles, and no significant traffic growth in London.

162. There will inevitably be debate over the feasibility of such improvements, and the costs which society will be prepared to devote to them, but it seems clear that significant reductions are still possible and that such air pollution levels could represent substantial reductions in adverse effects on public health and ecosystems in the UK.

Abbreviations and glossary

$\mu g.m^{-3}$	micrograms per cubic metre
µm	1µm = 1 micron = 1 millionth of a metre
acidification	the decrease in pH of surface waters and soils
AQEG	Air Quality Expert Group
AQMA	Air Quality Management Area
B[a]P	benzo[a]pyrene
BAT	best available techniques
CAFE	European Commission's Clean Air for Europe programme
CO	carbon monoxide
CO_2	carbon dioxide
COMEAP	Committee on the Medical Effects of Air Pollutants, reporting to Department of Health
Defra	Department for Environment, Food and Rural Affairs
DTI	Department of Trade and Industry
EA	Environment Agency
EC	European Commission
ELV	Emission Limit Values
EPAQS	Expert Panel on Air Quality Standards
EPA	Environmental Protection Act
ETS	Emission Trading Scheme
EU	European Union
eutrophication	excess nutrient fertilisation of ecosystems
FGD	flue gas desulphurisation
IGCB	Interdepartmental Group on Costs and Benefits, reporting to Defra
IMO	International Maritime Organization
IPC	Integrated Pollution Control regime
IPPC	Integrated Pollution Prevention and Control Directive
LAPC	Local Air Pollution Control
LAQM	Local Air Quality Management
LEZ	Low Emission Zones
LTPs	Local Transport Plans (in England and Wales)
MARPOL	International Maritime Organisation Marine Pollution Convention

MOT	annual vehicle roadworthiness test
NECD	National Emission Ceilings Directive
$ng.m^{-3}$	nanograms per cubic metre
NO	nitric oxide
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen, the sum of NO and NO_2
OECD	Organisation for Economic Co-operation and Development
O_3	ozone
PAHs	polycyclic aromatic hydrocarbons
Pb	lead
pH	a measure of the acidity or alkalinity of a solution
PM_1	particulate matter which passes through a size-selective inlet with a 50% efficiency cut-off at 1µm aerodynamic diameter
PM_{10}	particulate matter which passes through a size-selective inlet with a 50% efficiency cut-off at 10µm aerodynamic diameter
$PM_{2.5}$	particulate matter which passes through a size-selective inlet with a 50% efficiency cut-off at 2.5µm aerodynamic diameter
ppb	parts per billion (parts per 1000 million)
PPS	Planning Policy Statement
real-time monitors	automatic monitors giving continuous updates of data, as opposed to filters or diffusion tubes which provide data at a later stage, after laboratory chemical analysis has been carried out.
RIA	Regulatory Impact Assessment
RSS	Regional Space Strategies
SAC	Special Areas of Conservation
SCR	selective catalytic reduction
SEPA	Scottish Environment Protection Agency
SO_2	sulphur dioxide
SO_x	oxides of sulphur, in emissions, predominantly SO_2
SPA	Special Protection Areas
SSSIs	Sites of special scientific interest
UNECE	United Nations Economic Commission for Europe
VOCs	volatile organic compounds

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1)

WHO	World Health Organisation

Printed in the UK for The Stationery Office Limited
on behalf of the Controller of Her Majesty's Stationery Office
ID 5611194 07/07

Printed on Paper containing 75% fibre content minimum.

Published by TSO (The Stationery Office) and available from:

Online

www.tsoshop.co.uk

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ISBN 978-0-10-171692-5

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