Appendix 2
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

Contents

Objectives to be included in regulations for the purposes of local air quality management			
Pollutant	**Objective**		**Date to be achieved by**
	Concentration	**Measured as**	
Benzene	16.25 $\mu g/m^3$ (5 ppb)	running annual mean	31 December 2003
1,3 Butadiene	11.6 mg/m^3 (1 ppb)	running annual mean	31 December 2003
Carbon monoxide	11.6 mg/m^3 (10 ppm)	running 8 hour mean	31 December 2003
Lead	0.5 $\mu g/m^3$ 0.25 $\mu g/m^3$	annual mean annual mean	31 December 2004 31 December 2008
Nitrogen dioxide	200 $\mu g/m^3$, (105 ppb) not to be exceeded more than 18 times a year 40 $\mu g/m^3$, (21 ppb)	1 hour mean annual mean	31 December 2005 31 December 2005
Particles (PM_{10})	50 $\mu g/m^3$, not to be exceeded more than 35 times a year 40 $\mu g/m^3$	24 hour mean annual mean	31 December 2004 31 December 2004
Sulphur dioxide	350 $\mu g/m^3$, (132 ppb) not to be exceeded more than 24 times a year 125 $\mu g/m^3$, (47 ppb) not to be exceeded more than 3 times a year 266 $\mu g/m^3$, (100 ppb) not to be exceeded more than 35 times a year	1 hour mean 24 hour mean 15 minute mean	31 December 2004 31 December 2004 31 December 2005

National objectives not to be included in regulations for the purposes of local air quality management			
Pollutant	**Objective**		**Date to be achieved by**
	Concentration	**Measured as**	
Objectives for the protection of human health			
Ozone	100 µg/m^3, (50 ppb) not to be exceeded more than 10 times a year	daily maximum of running 8 hour mean	31 December 2005
Objectives for the protection of vegetation and ecosystems			
Nitrogen oxides (assuming NO_X is taken as NO_2)	30 µg/m^3, (16 ppb)	annual mean	31 December 2000
Sulphur dioxide	20 µg/m^3, (8 ppb) 20 µg/m^3, (8 ppb)	annual mean winter average (1/10 to 31/3)	31 December 2000 31 December 2000

BRIEF DESCRIPTION OF THE 8 POLLUTANTS SPECIFIED IN THE NATIONAL AIR QUALITY STRATEGY

Each of the eight pollutants will now be briefly considered to give necessary background information, the proportion of the inventory arising from road transport generally and diesel fuelled vehicles specifically, the forecast of how this is expected to change in the future, and current performance against the Air Quality Strategy objectives. Together, this information provides a basis for determining the importance of each pollutant to this project.

Benzene –

Background information and sources

The primary source of this pollutant in the atmosphere is from gasoline fuelled vehicles. Whilst both evaporative losses and exhaust emissions contribute to levels, the latter is predominant. However, the complex chemistry within the combustion chamber of IC engines means that a reduction in the level of these pollutants in the fuel does not lead to a pro-rata reduction in exhaust emissions, rather some smaller reduction.

Current and future inventory levels

In 1998 road transport contributed 66.2% of the whole inventory (detailed figures are given in the second half of this appendix) with gasoline fuelled vehicles contributing 61.8% of the total. These are a reduction both in real terms and as a percentage of the whole relative to 1995 and 1990 caused primarily by the increasing number of gasoline fuelled vehicles fitted with closed loop fuel control and three way catalysts. Forecasts are for the urban road transport emissions of benzene to decrease by 79% between 1995 and 2005, with emissions from gasoline vehicles falling by 80% over this period as the number of vehicles fitted with closed loop fuel control and three way catalysts increases. However, this forecast is based on such vehicles being appropriately maintained and not emitting higher levels.

Current ambient concentrations relative to the Air Quality Strategy objectives

Currently automatic hourly data is collected on benzene at 13 sites across the UK. The sites are chosen to represent a variety of different site types from the kerbside of one of the busiest roads in London to a rural location. In 1998 the annual mean concentrations at these sites ranged from 1 to 5 $\mu g/m^3$ with the single outlier of 14 $\mu g/m^3$ for the Marylebone Road site. All of these values are less than the AQS Objective of 16.25 $\mu g/m^3$ by 31/12/03, and are in the context of a decreasing inventory.

Consequently benzene is an important pollutant to consider in the context of this project. Its levels are currently under the AQ standard, and provided that vehicle emissions do decline as predicted it should not be a major cause for concern. Therefore, an I&M regime could contribute to ensuring the AQ Standard continues to be met.

1,3 butadiene –
Background information and sources

As for benzene, the primary source of 1,3-butadiene in the atmosphere is from exhaust emissions from gasoline fuelled vehicles.

Current and future inventory levels

In 1998 road transport contributed 88.5% of the whole inventory (detailed figures are given in the second half of this appendix) with gasoline fuelled vehicles contributing 76% of the total. Forecasts are for the urban road transport emissions of 1,3-butadiene to decrease by 77% between 1995 and 2005, a decrease nearly wholly from gasoline vehicles as vehicles fitted with closed loop fuelling control and TWCs become an even larger proportion of the fleet. Reductions of the total inventory of 32% have already been realised between 1990 and 1996.

Current ambient concentrations relative to the Air Quality Strategy objectives

Currently automatic hourly data is collected on 1,3-butadiene at the same 13 sites across the UK as for benzene. In 1998 the annual mean concentrations at these sites ranged from 0.11 to 0.56 $\mu g/m^3$ with the single outlier of 2.34 $\mu g/m^3$ for the Marylebone Road site. All but the Marylebone Road site are less than the AQS Objective of 2.25 $\mu g/m^3$ by 31/12/03, and are in the context of a decreasing inventory.

Consequently, as for benzene, 1,3-butadiene is an important pollutant to consider in the context of this project. Its ambient concentrations are within the AQ Standard, and an I&M regime has the potential of ensuring this remains so.

Carbon monoxide –
Background information and sources

Carbon monoxide (CO) is a gas formed by the incomplete combustion of carbon-containing fuels. The main source of this pollutant in the UK is road transport, which in 1998 accounted for around 73% of the UK total. Within road transport the predominant source is gasoline fuelled vehicles which account for 96.4% of the emissions, the remaining 3.6% coming from diesel fuelled vehicles. This difference is because diesel fuelled vehicles virtually always operate with excess air relative to the quantity of fuel injected, and nearly complete combustion of carbon to carbon dioxide occurs.

Current and future inventory levels

Annual emissions of CO have been declining since 1990, falling by 33% between 1990 and 1997 (detailed figures are given in the second half of this appendix). This is caused primarily by the increasing number of gasoline fuelled vehicles fitted with closed loop fuel control and three way catalysts. Forecasts are for the urban road transport emissions of CO to decrease by a further 59% between 1995 and 2005, with emissions from diesel vehicles falling by 46% over this period.

Current ambient concentrations relative to the Air Quality Strategy objectives

CO is currently measured at 61 sites within the National Urban Network. During 1998 concentrations of CO were generally low, and the National Air Standard of 11.6 mg/m^3 as an 8 hr running mean was only exceeded at one of the sites where a maximum figure of 12.8 mg/m^3 was recorded. All other sites were below 82% of the standard.

Consequently carbon monoxide is a very important pollutant to consider in the context of this project. It will be seen later that the importance is enhanced by CO being a proxy for particulates.

Lead –
Background information and sources
The main source of UK airborne lead emissions is from anti-knock lead additives in petrol which in 1998 accounted for 57% of annual UK lead emissions. Industrial combustion forms another significant source, with the non-ferrous metals sector accounting for 18% of annual emissions in 1998.

Annual emissions have fallen significantly in recent years, declining by 65% between 1990 and 1998. The major source of emission reductions is from the transport sector, which fell by 73% over the same period. This is due to the reduction of the lead content of leaded petrol from around 0.34g/l to 0.143g/l in 1986 and, that since 1987, sales of unleaded petrol have increased, particularly as result of the increased use of cars fitted with catalytic converters. The sale of leaded petrol was banned from 1 January 2000 and will result in a further decline in annual emissions from transport to almost zero.

Because of the factors above lead is not an important pollutant to consider in the context of this project.

Nitrogen dioxide –
Background information and sources

All combustion processes in air produce oxides of nitrogen. Nitrogen dioxide (NO_2) and nitric oxide (NO) are both oxides of nitrogen and together are referred to as NO_X. At the high temperatures involved in the combustion chambers of vehicles very little nitrogen dioxide is produced, rather it is its chemically moderately reactive parent nitrogen monoxide that is formed in significant quantities and is emitted from the tail pipe. The rate of conversion of NO to NO_2 is typically 50% conversion in a few tens of minutes, and consequently in remote, unpolluted areas nitric oxide concentrations are only a small fraction of those of nitrogen dioxide. However, in polluted areas, such as heavily congested towns and cities, nitric oxide concentrations often exceed those of nitrogen dioxide. Therefore, in determining the contribution of vehicles to air quality, the combined emissions of both oxides, i.e. of NO_X is important.

Current and future inventory levels

In 1998 road transport accounted for about half (46%) of national annual emissions. This contribution is split between gasoline (28%) and diesel emissions (17.4%). This gap has been growing because of falling NO_X emissions from diesel vehicles. Significant contributions to the national annual emissions are emitted from the electricity supply industry (21%) and the industrial and commercial sectors (16%). UK annual emissions of NO_X have declined rapidly in recent years, with a 37% reduction between 1990 and 1998 in total emissions. This decline is largely due to emission reductions in the public power and road transport sectors, which together account for more than 90% of the reductions. Forecasts of emissions of NO_X from road transport in urban areas of the UK (given in part 2 of this appendix) predict a decrease by 59% between 1995 and 2005.

Current ambient concentrations relative to the Air Quality Strategy objectives

Concentrations of nitrogen dioxide and oxides of nitrogen are currently monitored using automatic instruments at 83 national network sites across the UK. These sites are located in a wide range of locations ranging from the remote site of Strath Vaich in the north of Scotland to the kerbside of Marylebone Road in central London. From the data annual means and the concentration which is exceeded 18 times during the year are calculated. Just under half of the sites exceeded an annual average nitrogen dioxide concentration of 40µg/m^3 (the Air Quality Standard for 31/12/2005) in 1998. Annual concentrations of nitrogen dioxide in urban areas were generally highest at roadside and kerbside sites. Fifteen of the eighteen roadside sites exceeded 40µg/ m^3 as an annual mean, which ranged from 32µg/ m^3 at Norwich roadside to 82µg/ m^3 at the London Cromwell Road roadside site. The highest annual mean concentration (92µg/ m^3) measured in 1998 was recorded at the Marylebone Road kerbside site in London, although this is not representative of annual average public exposure. However, these data fo show that of the eight species quoted in the air Quality Strategy, it is the one that probably is the most challenging for local authorities.

Ozone –

Background information and sources

The chemistry of the formation of ozone is a complex issue. It is not present in automotive exhausts, neither is any simple parent molecule emitted. Indeed it is not emitted from any man-made source in any significant quantities. It arises from chemical reactions in the atmosphere caused by sunlight. These chemical reactions do not take place instantaneously, but over several hours or even days depending on the volatile organic compounds (VOCs) in the atmosphere and their concentrations. Further, once ozone has been produced it may persist for several days. In consequence, ozone measured at a particular location may have arisen from VOC and NO_X emissions many hundreds, or even thousands, of kilometres away, and may then travel further for similar distances.

In the context of this project the understanding of atmospheric modellers is that **there is no direct relationship between ozone levels and automotive emissions**. Whilst there may be relationships and strong correlations, the control of other species on the list (hydrocarbons and NO_X) is as close as is currently practicable to influencing ozone levels. The fact that ozone concentrations are affected by pollutants produced well away from the area of measurement, often outside the UK, is recognised by the government not imposing the responsibility of controlling ozone levels on local authorities, whereas under local air management local authorities have the responsibility to work towards achieving the Air Quality Strategy objectives for the other seven pollutants.

Particles (PM_{10}) –

Background information and sources

PM_{10} are defined as the weight of particulate mass below 10 μm aerodynamic diameter. Particulate mass is currently the subject of intensive research, and the complexity o f the generic term is becoming apparent. Research indicates the effects on health of the various sources are not equal, and it is increasingly accepted that it is important to reduce the contribution from road transport. Further, there is increasing evidence to suggest that the health effects of particles are due to, primarily, fine particles ($PM_{2.5}$ or finer) and it can be anticipated that future legislation may specify an air quality standard for $PM_{2.5}$.

Atmospheric PM_{10} can be considered as being composed of three main categories of source. Primary particles are emitted directly by combustion processes, and are generally less than 2.5μm and often less than 1μm. Secondary particles are those which are formed in the atmosphere from chemical reaction and include sulphates and nitrates. These secondary particles are also generally less than 2.5μm. The third category is the so-called coarse particles which are formed from a variety of primarily non-combustion sources which include natural events such as wind-blown dusts and soils, forest and other natural fires, and man-influenced sources such as resuspended road dust and tyre debris, and construction and mining/quarrying activity. The particles generated by these sources mostly arise from mechanical attrition and are thus relatively large, i.e. generally greater than 2.5μm.

Current and future inventory levels

In 1998 road transport accounted for 24.5% of the UK annual PM_{10} emissions inventory. This was sub-divided into contributions from diesel vehicles (16.2%), petrol vehicles (5.4%) and brake and tyre wear (2.9%). This is predicted to fall by 53% between 1995 and 2005 and is in addition to the 16% reduction that occurred between 1990 and 1995. The fall is caused by the penetration into the fleet of new diesel vehicles meeting tighter particle emission regulations.

Current ambient concentrations relative to the Air Quality Strategy objectives

PM_{10} is currently measured at 50 national automatic sites within the National Automatic Urban and Rural Networks. During 1998, the 1997 Strategy objective was exceeded at 41 of the 48 measurement sites operating that year. Exceedences of the objective were recorded at all the kerbside and roadside sites, the majority of the urban background, urban centre and suburban sites and two of the three rural sites.

Given the above, the importance of vehicular contributions to PM10 is clear. However, it is likely that the emission factor currently used to calculate PM emissions from gasoline vehicles is too high. Further, neither current type approval standards and in-service testing include measurement of PM. The consideration of this, and the instrumentation/procedures that might be required, is part of the work schedules for Phase 2 of the project, i.e. is outside the scope of this report.

Sulphur dioxide –
Background information and sources

Emissions of sulphur dioxide are dominated by fossil-fuelled power stations, which accounted for two thirds of the national total in 1995. There are also significant emissions from the industrial sector. The contribution from transport is small, and with the introduction of low sulphur fuels, will diminish further. Therefore, in contrast to other pollutants, transport emissions of sulphur dioxide are relatively unimportant nationally, but the contribution of diesel fuel can make a significant contribution to background levels in urban areas.

Current and future inventory levels

In 1998 road transport accounted for only about 1.4% of the national annual emissions, with gasoline and diesel emissions being similar (approximately 0.7% each). This is predicted to fall further with the increasing use of ultra-low sulphur fuels.

Current ambient concentrations relative to the Air Quality Strategy objectives

Sulphur dioxide is currently measured at 64 national automatic sites within the National Automatic Urban and Rural Networks. 1998 was a year characterised by good dispersion of air pollutants. Concentrations of sulphur dioxide during 1998 were therefore generally low when compared to previous years. The most stringent of the Strategy objectives is the 15 minute objective of $266\mu g/m^3$, not to be exceeded more than 35 times a year. During 1998, this objective was only exceeded at 6 of the 62 sites, most of which are located in coal burning areas.

The EU Directive limit values were exceeded at fewer sites. The hourly limit value of 350μg/ m^3, not to be exceeded more than 24 times a year, was not exceeded at any of the national monitoring sites. The daily limit value of 125μg/ m^3, not to be exceeded more than 3 times a year, was exceeded at two sites.

Consequently, sulphur dioxide is not an important pollutant to consider in the context of this project.

ANNUAL EMISSIONS AND PREDICTED UK ANNUAL ROAD TRANSPORT EMISSIONS

UK Annual benzene emissions for 1990 – 1998 in k tonnes*

Source	1990	1995	1998	% of 1998
Processes in industry	6.41	5.57	4.48	19.2%
Road transport				
petrol combustion	35.55	27.11	19.09	57.7%
diesel combustion	2.64	1.82	1.47	4.4%
petrol evaporation	2.24	1.72	1.34	4.1%
Other transport	1.59	1.55	1.48	4.5%
Other	5.62	5.08	5.21	15.8%
Total	54.05	42.85	33.07	

Predicted UK Annual urban road transport emissions of benzene for 1995 – 2015 in k tonnes¶

		1995	2000	2005	2010	2015
Cars	Petrol	17.62	9.01	3.57	2.17	2.08
	DERV	0.04	0.05	0.04	0.02	0.02
	All Cars	17.66	9.06	3.61	2.20	2.10
LGV	Petrol	1.06	0.51	0.08	0.01	0.01
	DERV	0.07	0.07	0.06	0.04	0.03
	All LGV	1.13	0.58	0.14	0.05	0.04
HGV	Artic	0.08	0.04	0.02	0.01	0.01
	Rigid	0.53	0.31	0.17	0.11	0.09
	All HGV	0.61	0.35	0.19	0.12	0.10
Buses		0.22	0.14	0.08	0.05	0.04
Motorcycles		0.17	0.17	0.18	0.19	0.20
All DERV		0.94	0.62	0.36	0.23	0.20
All petrol		18.85	9.69	3.83	2.38	2.29
All vehicles		19.79	10.31	4.20	2.61	2.49

* Taken from "National Atmospheric Emissions Inventory – UK Emissions of air pollutants 1970 – 1998", ", Report to DETR AEQD by AEA Technology NETCEN, see web site http://www.aeat.co.uk/netcen/airqual/naei/annreport/annrep98

f Taken from "UK Road Transport Emission Projections", Report to DETR AEQD by AEA Technology NETCEN, TP Murrells, Jan 2000, ref AEAT-5953

UK Annual 1,3 butadiene emissions for 1990 – 1998 in k tonnes*

Source	1990	1995	1998	% of 1998
Chemical industry	0.36	0.29	0.27	3.9%
Road transport				
petrol combustion	10.93	7.92	5.29	76.3%
diesel combustion	0.90	1.06	0.84	12.1%
Other	0.59	0.57	0.53	7.6%
Total	12.78	9.84	6.93	

Predicted UK Annual urban road transport emissions of 1,3 butadiene for 1995 – 2015 in k tonnes¶

		1995	2000	2005	2010	2015
Cars	Petrol	4.87	2.4	0.87	0.52	0.51
	DERV	0.09	0.14	0.13	0.1	0.08
	All Cars	4.96	2.55	1	0.61	0.59
LGV	Petrol	0.3	0.15	0.02	0	0
	DERV	0.09	0.13	0.11	0.08	0.07
	All LGV	0.39	0.27	0.14	0.09	0.07
HGV	Artic	0.03	0.02	0.01	0.01	0.01
	Rigid	0.09	0.07	0.04	0.03	0.02
	All HGV	0.12	0.09	0.06	0.04	0.03
Buses		0.05	0.05	0.04	0.02	0.02
Motorcycles		0.06	0.07	0.07	0.07	0.08
All DERV		0.36	0.41	0.33	0.24	0.2
All petrol		5.23	2.61	0.96	0.59	0.58
All vehicles		5.59	3.03	1.29	0.83	0.79

* Taken from "National Atmospheric Emissions Inventory – UK Emissions of air pollutants 1970 – 1998", ", Report to DETR AEQD by AEA Technology NETCEN, see web site http://www.aeat.co.uk/netcen/airqual/naei/annreport/annrep98

f Taken from "UK Road Transport Emission Projections", Report to DETR AEQD by AEA Technology NETCEN, TP Murrells, Jan 2000, ref AEAT-5953

UK Annual carbon monoxide emissions for 1990 – 1998 in k tonnes*

Source	1990	1995	1998	% of 1998
Residential plant	358	260	234	4.9%
Processes in industry	412	397	414	8.7%
Road transport				
petrol	4,962	3,804	3,347	70.4%
diesel	185	165	132	2.8%
Other transport	370	348	339	7.1%
Other	651	346	292	6.1%
Total	6,938	5,320	4,758	

Predicted UK Annual urban road transport emissions of carbon monoxide for 1995 – 2015 in k tonnes¶

		1995	2000	2005	2010	2015
Cars	Petrol	1,860	1130	739	488	392
	DERV	9	11	10	8	7
	All Cars	1,869	1,141	750	496	399
LGV	Petrol	150	78	19	7	5
	DERV	11	12	11	8	7
	All LGV	161	91	30	15	12
HGV	Artic	5	3	3	3	3
	Rigid	29	18	13	12	12
	All HGV	34	21	15	14	15
Buses		38	20	12	8	8
Motorcycles		69	73	76	80	84
All DERV		91	66	49	39	37
All petrol		2,079	1,281	835	576	482
All vehicles		2,170	1,347	884	615	519

* Taken from "National Atmospheric Emissions Inventory – UK Emissions of air pollutants 1970 – 1998", ", Report to DETR AEQD by AEA Technology NETCEN, see web site http://www.aeat.co.uk/netcen/airqual/naei/annreport/annrep98

¶ Taken from "UK Road Transport Emission Projections", Report to DETR AEQD by AEA Technology NETCEN, TP Murrells, Jan 2000, ref AEAT-5953

UK Annual lead emissions for 1990 – 1998 in k tonnes*

Source	1990	1995	1998	% of 1998
Combustion for non-ferrous metals	213	181	189	18%
Processes in industry	96	82	89	9%
Road transport	2,177	1,067	592	57%
Other	478	318	163	16%
Total	2,964	1,648	1,033	

UK Annual NO_X emissions for 1990 – 1998 in k tonnes*

Source	1990	1995	1998	% of 1998
Public power generation	781	485	364	20.8%
Residential plant	64	66	71	4.1%
Other comb. in industry	195	169	155	8.8%
Road transport				
petrol combustion	805	620	494	28.2%
diesel combustion	523	408	305	17.4%
Other transport	226	203	195	11.1%
Other	193	172	169	9.6%
Total	2,787	2,123	1,753	

Predicted UK Annual urban road transport emissions of NO_X for 1995 – 2015 in k tonnes¶

		1995	2000	2005	2010	2015
Cars	Petrol	228	133	69	41	33
	DERV	9	11	11	8	6
	All Cars	237	144	80	49	39
LGV	Petrol	16	8	2	0	0
	DERV	11	9	8	5	4
	All LGV	27	17	9	5	4
HGV	Artic	22	15	11	10	11
	Rigid	63	44	30	25	25
	All HGV	84	60	41	35	36
Buses		44	39	31	27	25
Motorcycles		1	1	1	1	1
All DERV		149	118	91	75	71
All petrol		244	142	72	43	35
All vehicles		393	260	162	117	106

Predicted UK Annual road transport emissions of NO_X for 1995 – 2015 in k tonnes¶

		1995	2000	2005	2010	2015
Cars	Petrol	521	332	180	117	98
	DERV	15	19	18	14	13
	All Cars	536	351	198	131	111
LGV	Petrol	36	15	3	1	1
	DERV	25	21	16	11	10
	All LGV	60	36	19	12	11
HGV	Artic	163	112	84	59	41
	Rigid	181	111	69	46	30
	All HGV	345	223	153	105	71
Buses		63	51	40	28	20
Motorcycles		1	1	1	1	1
All DERV		448	314	227	158	114
All petrol		557	347	184	118	99
All vehicles		1,005	661	411	277	213

UK Annual PM_{10} emissions for 1990 – 1998 in k tonnes*

Source	1990	1995	1998	% of 1998
Public power generation	70	37	23	14%
Residential plant	48	28	26	16%
Other comb. in industry	24	21	16	10%
Processes in industry	11	11	11	7%
Quarrying and construction	34	29	27	17%
Road transport				
petrol combustion	18	12	9	5.5%
diesel combustion	45	38	26	16%
brake and tyre wear	4	4	5	3%
Other transport	5	4	4	2.5%
Other	17	16	16	10%
Total	276	200	163	

* Taken from "National Atmospheric Emissions Inventory – UK Emissions of air pollutants 1970 – 1998", ", Report to DETR AEQD by AEA Technology NETCEN, see web site http://www.aeat.co.uk/netcen/airqual/naei/annreport/annrep98

¶ Taken from "UK Road Transport Emission Projections", Report to DETR AEQD by AEA Technology NETCEN, TP Murrells, Jan 2000, ref AEAT-5953

Predicted UK Annual urban road transport emissions of PM_{10} for 1995 – 2015 in k tonnes[¶]

		1995	2000	2005	2010	2015
Cars	Petrol	4.9	2.0	1.7	1.8	1.9
	DERV	1.8	2.1	2.0	1.2	0.6
	All Cars	6.7	4.1	3.7	2.9	2.5
LGV	Petrol	0.4	0.1	0.1	0.1	0.1
	DERV	3.6	3.4	3.1	1.8	1.0
	All LGV	4.0	3.6	3.2	1.8	1.1
HGV	Artic	1.4	0.7	0.4	0.3	0.4
	Rigid	7.5	3.6	2.0	1.6	1.6
	All HGV	8.9	4.3	2.4	1.9	1.9
Buses		3.6	2.1	1.4	1.0	0.9
Motorcycles		0.4	0.4	0.4	0.4	0.5
All DERV		17.9	11.9	8.9	5.9	4.5
All petrol		5.6	2.6	2.2	2.2	2.4
All vehicles		23.5	14.5	11.1	8.1	6.8

Predicted UK Annual road transport emissions of PM_{10} for 1995 – 2015 in k tonnes[¶]

		1995	2000	2005	2010	2015
Cars	Petrol	10.6	4.5	3.9	4.0	4.3
	DERV	3.7	4.0	3.6	2.3	1.5
	All Cars	14.3	8.5	7.5	6.3	5.8
LGV	Petrol	0.8	0.3	0.1	0.1	0.1
	DERV	8.4	7.5	6.4	4.1	2.8
	All LGV	9.2	7.7	6.5	4.2	2.9
HGV	Artic	7.5	4.0	2.4	1.2	0.6
	Rigid	16.8	7.8	4.1	2.1	1.0
	All HGV	24.3	11.8	6.5	3.3	1.7
Buses		5.0	2.7	1.3	0.7	0.4
Motorcycles		0.4	0.4	0.4	0.4	0.4
All DERV		41.4	26.0	17.8	10.4	6.4
All petrol		11.8	5.1	4.4	4.5	4.8
All vehicles		53.2	31.1	22.2	14.9	11.2

[f] Taken from "UK Road Transport Emission Projections", Report to DETR AEQD by AEA Technology NETCEN, TP Murrells, Jan 2000, ref AEAT-5953

UK Annual SO_2 emissions for 1990 – 1998 in k tonnes*

Source	**1990**	**1995**	**1998**	**% of 1998**
Public power generation	2,723	1,591	1,072	66%
Petroleum refining plants	155	178	172	11%
Other comb. in industry	357	262	147	9%
Road transport				
petrol combustion	23	16	11	1%
diesel combustion	40	35	12	1%
Other transport – shipping	27	29	25	2%
Other	407	245	176	11%
Total	3,732	2,356	1,615	

* Taken from "National Atmospheric Emissions Inventory – UK Emissions of air pollutants 1970 – 1998", ", Report to DETR AEQD by AEA Technology NETCEN, see web site http://www.aeat.co.uk/netcen/airqual/naei/annreport/annrep98