Was 2003 an Exceptional Pollution Year?

UK Trends in Nitrogen Dioxide, Nitrogen Oxides and PM_{10} Concentrations.

Report by

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On behalf of

Defra

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1 Introduction

1.1 Some unusual weather conditions, including a particularly hot summer, were experienced during 2003. Nitrogen dioxide and PM_{10} concentrations measured at many locations during 2003 were noticeably higher than those measured during 2002 and this has led to some uncertainty about how the data should be treated for Review and Assessment purposes. Should 2003 be treated as exceptional in terms of local air quality or should it be treated in the same way as any other year? More specifically, was 2003 outside of the normal year to year variation that might reasonably be expected in pollution concentrations? This report attempts to answer these questions by analysing long-term trends in the concentrations of these pollutants.

1.2 Annual mean concentrations of nitrogen oxides (NOx), nitrogen dioxide (NO_2) and PM_{10} measured at every Automatic Urban and Rural Network (AURN) monitoring site between 1992 and 2003 (inclusive) have been collated from the air quality website operated by AEA Technology (www.airquality.co.uk). The number of exceedences of 50 $\mu g/m^3$ as a 24-hour PM_{10} concentration and 200 $\mu g/m^3$ as a 1-hour mean NO_2 concentration have been taken from the same source. AEA Technology has also provided data capture rates for each site, for each year. The annual mean data were excluded from this analysis if data capture was less than 75%. The 24-hour and 1-hour exceedence data were excluded if data capture was less than 90%. All sites yielding more than 1 year of data (following screening for data capture) have been included. The data for 2003 were not fully ratified, but typically, the provisional data made up less than 25% of the year. Data from each site are reported in Appendices 2 to 6, but it should be noted that it is not possible to draw any conclusions on trends from data sets less than about 5 years. Details of the sites included in this report and how the data have been treated are given in Appendix 1.

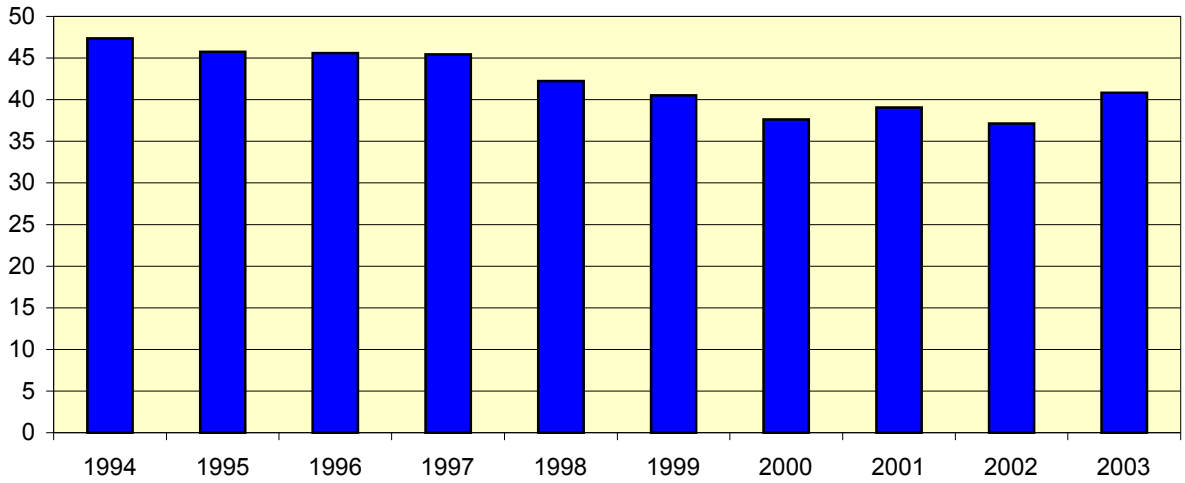
2 Annual Mean Nitrogen Dioxide Concentrations

2.1 Appendix 2 (Figures A2.1-A2.12) sets out the annual mean NO_2 concentration at each monitoring site, grouped according to region[1]. Most, but far from all, sites show a gradual reduction in measured concentrations throughout their operational lifetimes, with a small increase in 2003. There are no distinct regional patterns.

2.2 All sites with a full set of data over the six-year period 1998 to 2003 have been grouped according to site type. The average concentrations for five groupings of site types are plotted in Appendix 2 (Figures A2.13-A2.17). The average concentrations at both the Kerbside and

Roadside group of sites (Figure A2.13), and the Urban Background and Suburban group (Figure A2.16), show no trend over the six year period. For all other groups of site types, there is a slight downward trend. In all cases, other than for the two rural sites, the 2003 values are slightly higher than those for 2002. Figure 2.1 presents results for a longer run of monitoring, using data from 1994 to 2003 for sites with complete data sets over this period. In none of these data plots does 2003 stand out from the year to year variation.

Figure 2.1 Average Annual Mean Nitrogen Dioxide Concentrations Measured at 12 Long-Running Sites.



The sites included are: Leicester Centre; West London; Newcastle Centre; Belfast Centre; Manchester Town Hall; Glasgow City Chambers; Bristol Centre; Cardiff Centre; Birmingham East; Walsall Alumwell; Leeds Centre; and Sheffield Tinsley.

2.3 As discussed in Appendix 1, only a limited number of sites can be used in the analysis described above. By normalising the data to the concentration measured in 2001[2], almost all site-years with sufficient data capture can be included. Figure 2.2 shows the normalised[3] annual mean NO_2 concentration averaged across all sites[4]. This represents a much larger data set than Figure 2.1, but patterns are very similar. This figure shows that there has always been year to year variation in annual mean concentrations, and that the variation between 2002 and 2003 is not very much greater than the variation between 2000 and 2001.

2.4 The final 3 figures in Appendix 2 (Figures A2.18-A2.20) split the data in Figure 2.2 by site-type and by region. They indicate that roughly the same temporal pattern has been followed at all types of site and in all regions.

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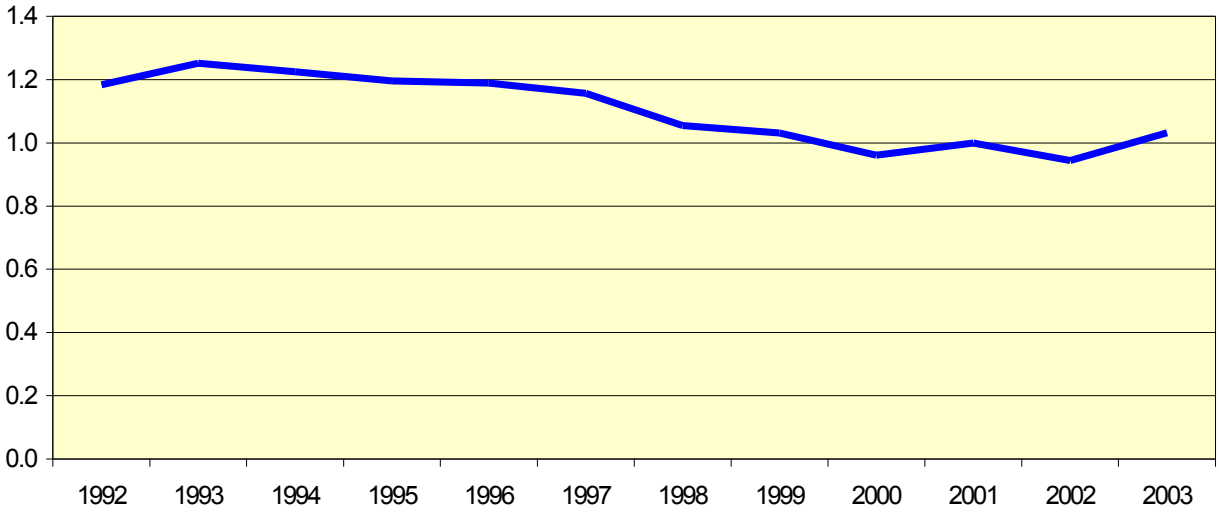
1 These regions are defined on www.airquality.co.uk
2 2001 was selected as it is the year with the greatest number of valid data points for NO_2 and PM_{10}.
3 The values presented are the averages of the ratio of the concentration in year xxxx to that in 2001 at each individual site.
4 All sites with data for 2001.

Figure 2.2 Average Normalised[a] Annual Mean Nitrogen Dioxide Concentrations Measured at all Operational Sites.



[a] Normalised to 1.0 in 2001.

3 1-hour Mean Nitrogen Dioxide Exceedences

3.1 Appendix 3 sets out the number of exceedences of 200 μg/m^3 as a 1-hour NO_2 concentration at each operational site during each year with at least 90% data capture. The data are not presented graphically, as the number of exceedences at most sites is very low, frequently being zero. However, as shown in Appendix 3, of those sites with sufficient data capture in 2003 and at least 1 of the 2 preceding years, 13 sites reported a deterioration, 10 sites reported an Improvement, and 40 sites reported no net change in air quality with regard to the 1-hour NO_2 standard during the period 2001 to 2003 (inclusive). Despite a small number of sites showing large increases in the number of 1-hour exceedences, on the whole, there has been no significant net worsening of air quality in 2003 with regard to the 1-hour NO_2 standard.

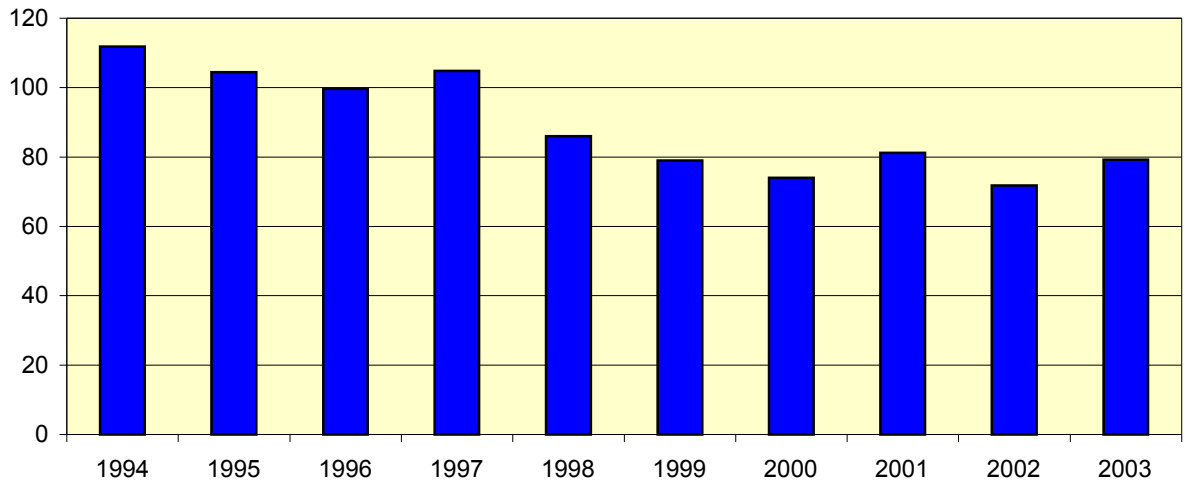
4 Annual Mean NOx Concentrations

4.1 Nitrogen oxides concentrations are included in the analysis, as they represent a primary pollutant. Annual mean NO_x concentrations are set out in Appendix 4 (Figures A4.1-A4.12), grouped according to region. Trends are broadly similar to those for NO_2. Figure 4.1 shows the data averaged across the 12 sites for which data are available in every year since 1994. The pattern is similar to that shown in Figure 2.1, although the decline over the 10-year period is

more noticeable. The pattern over the 6-year period 1998 to 2003 according to groupings of site types is shown in Figures A4.13-A4.17 (Appendix 4). There are some differences to the nitrogen dioxide patterns, but it is not the job of this report to explore these.

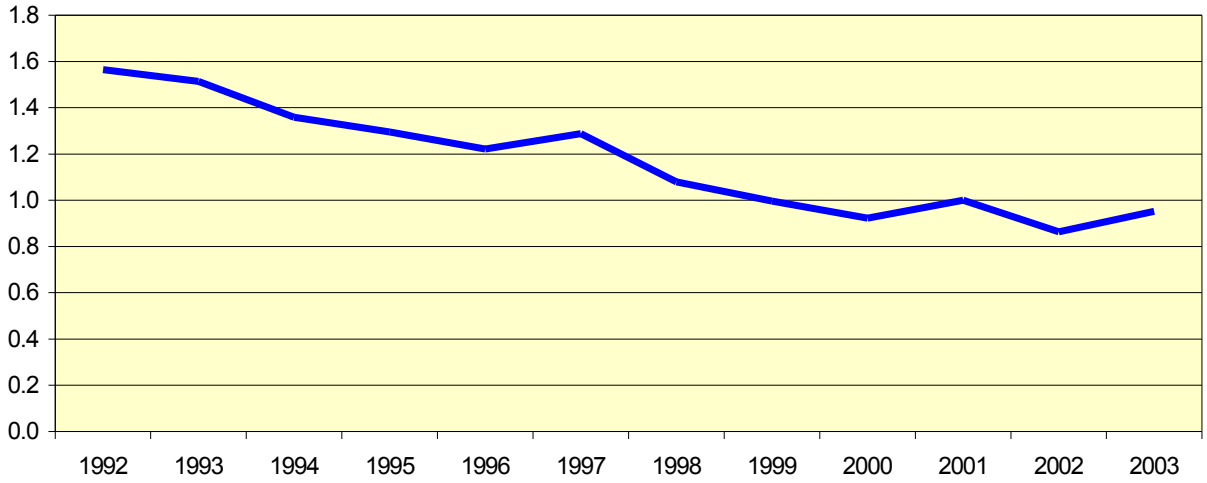
4.2 The normalised data (Figure 4.2), which combine a larger number of data points, show a very similar pattern to that shown in Figure 4.1. It appears from these data that the nation-wide increase in ambient NOx concentrations recorded between 2002 and 2003 was not significantly greater than that recorded between 2000 and 2001. The site-type and region specific normalised plots shown in Appendix 4 (Figures A.18-A.20) indicate that the patterns over the years are broadly consistent across all site types and regions.

Figure 4.1 Average Annual Mean NOx Concentrations Measured at 12 Long-Running Sites.



The sites included are: Leicester Centre; West London; Newcastle Centre; Belfast Centre; Manchester Town Hall; Glasgow City Chambers; Bristol Centre; Cardiff Centre; Birmingham East; Walsall Alumwell; Leeds Centre; and Sheffield Tinsley.

Figure 4.2 Average Normalised[a] Annual Mean Nitrogen Dioxide Concentrations Measured at all Operational Sites.



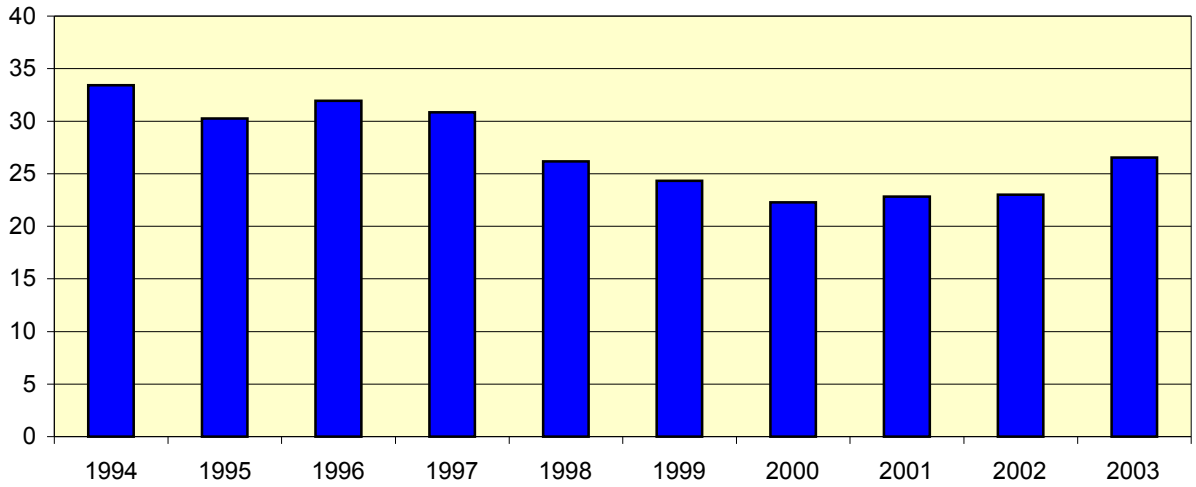
[a] Normalised to 1.0 in 2001.

5 Annual Mean PM_{10} Concentrations

5.1 Appendix 5 sets out the annual mean PM_{10} concentration at each monitoring site (Figures A5.1-A5.13). There are a large number of different temporal trends evident, with no clear delineation by region. Figure 5.1 shows the data averaged across the 7 sites that produced usable data every year since 1994. Average concentrations at these sites were greater in 2003 than during any of the 5 preceding years, but smaller than those prior to 1998. The average concentrations over the six year period 1998 to 2003 are shown by groupings of site types in Appendix 5 (Figures A5.14-18). They indicate that the general trends shown in Figure 5.1 were experienced at all different types of site.

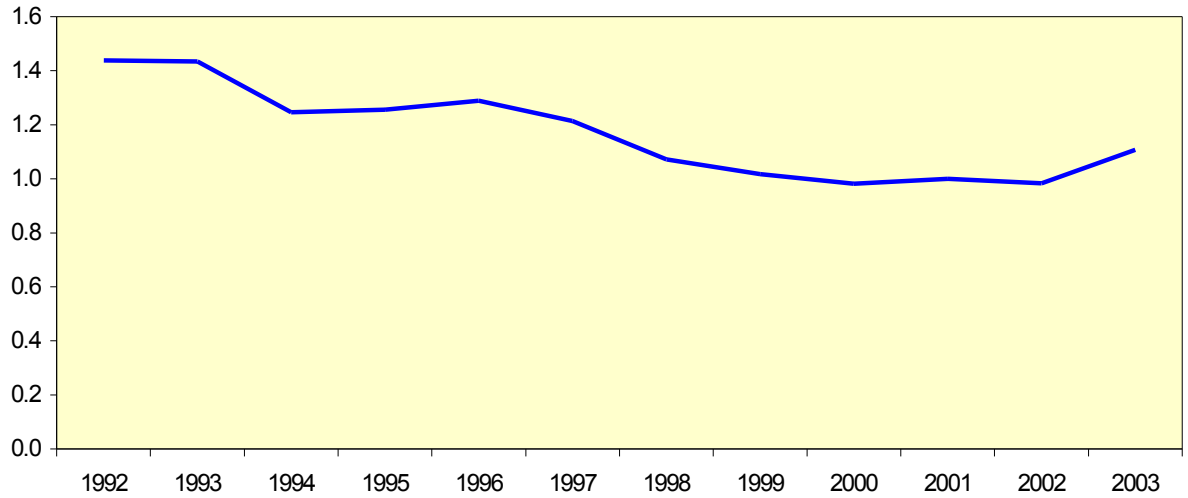
5.2 Figure 5.2 incorporates data from a great many more sites than Figure 5.1, and shows the concentrations relative to those in 2001. The pattern is very similar to that shown by the 7 long-running sites. The values for 2003 in all the above analyses do not appear to be outside the normal year to year variation.

Figure 5.1 Average Annual Mean PM_{10} Concentrations Measured at 7 Long-Running Sites



The sites included are: Leicester Centre; Newcastle Centre; Belfast Centre; Bristol Centre; Cardiff Centre; Birmingham Centre; Leeds Centre

Figure 5.2 Average Normalised[a] Annual Mean PM_{10} Concentrations Measured at all Operational Sites.



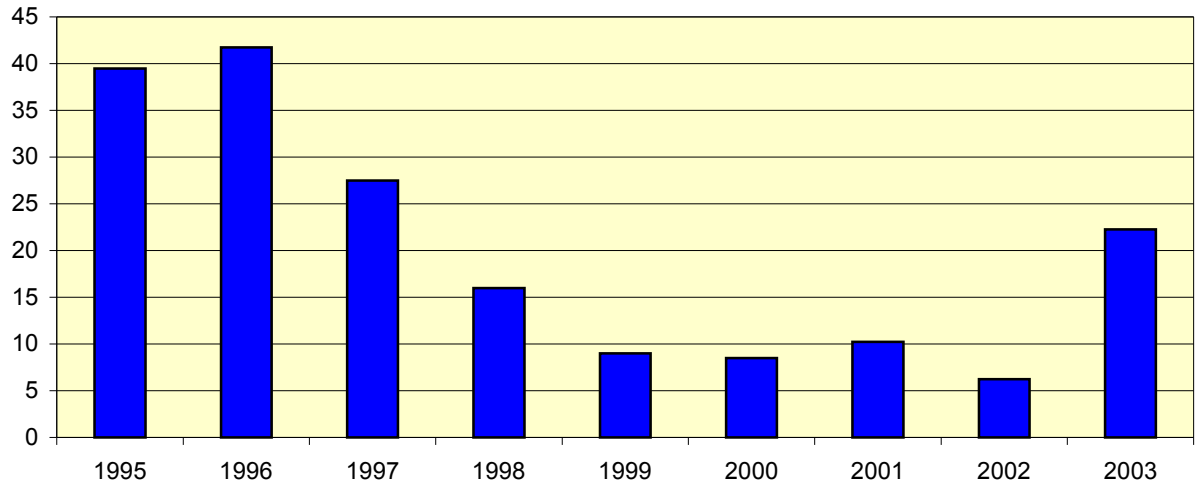
[a] Normalised to 1.0 in 2001.

6 24-hour PM_{10} Exceedences

6.1 Appendix 6 sets out the number of exceedences of 50μg/m^3 as a 24-hour PM_{10} concentration, at each monitoring site (Figures A6.1-A6.13). Figure 6.1 shows the average number of exceedences for the 4 sites with more than 90% data capture for every year since 1995. Figure 6.2 incorporates data from a great many more sites than Figure 6.1, but shows the same overall pattern.

6.2 The year to year variation seen for 24-hour exceedences is clearly much greater than for the annual mean concentration data. This is due to the sensitivity of this measure (number of days >50μg/m^3) to relatively small changes in concentration. For instance, an increase in annual mean PM_{10} from 22 to 25 μg/m^3 (a 9% increase) leads to a doubling of the number of days above 50 μg/m^3, from 6 to 12 days[5]. Thus, even though the number of 24-hour exceedences of 50 μg/m^3 was greater in 2003 than in the previous 5 years, 2003 is still not considered exceptional within the overall pattern over the last 10 years.

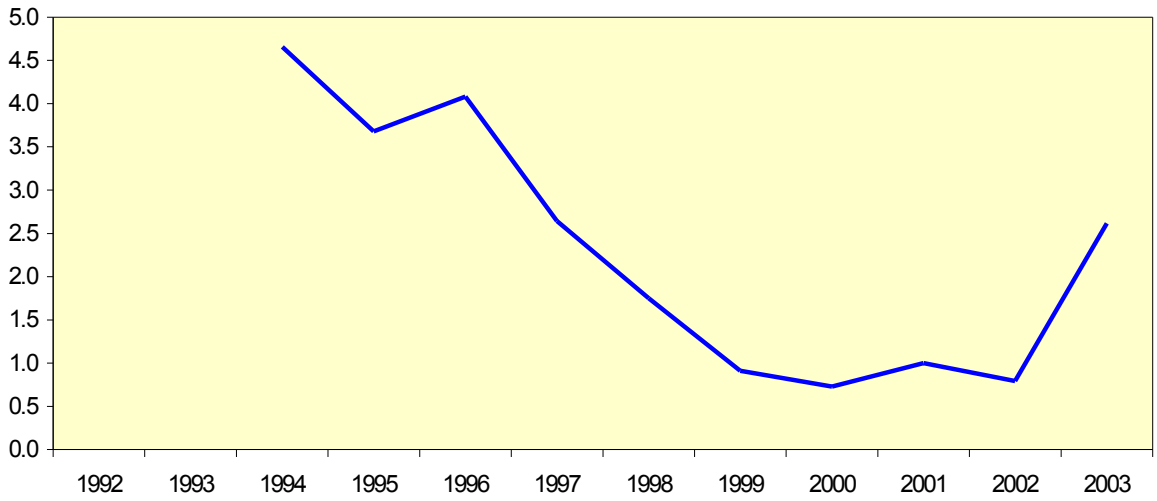
Figure 6.1 Average Number of 24-hour PM_{10} Exceedences of 50 μg/m^3 at 4 Long-Running Sites



The sites included are: London Bexley; Newcastle Centre; Bristol Centre; Swansea

[5] Based on the relationship from the national dataset shown in Figure 8.1 in Technical Guidance LAQM.TG(03).

Figure 4.2 Average Normalised[a] Number of 24-hour PM_{10} Exceedences of 50 μg/m^3 at all Operational Sites.



[a] Normalised to 1.0 in 2001.

7 Conclusions

7.1 The year to year variation over the last eleven years of NO_2, NO_x, and PM_{10} concentrations at AURN monitoring sites throughout the UK has been examined. While levels were generally higher in 2003 than in both 2001 and 2002, the increases were not outside the normal year to year variation seen in the data over a long period. The values in 2003 are thus not considered exceptional and authorities should include them in the Review & Assessment decision making process.

Appendix 1

A1.1 Annual mean concentrations of nitrogen oxides (NO_x), nitrogen dioxide (NO_2) and PM_{10} measured at every Automatic Urban and Rural Network (AURN) monitoring site between 1992 and 2003 (inclusive) have been collated from the air quality website operated by AEA Technology (www.airquality.co.uk). The number of exceedences of 50 $\mu g/m^3$ as a 24-hour PM_{10} concentration and 200 $\mu g/m^3$ as a 1-hour mean NO_2 concentration have been taken from the same source. AEA Technology has also provided data capture rates for each site, for each year. The annual mean data were excluded from this analysis if data capture was less than 75%. The 24-hour and 1-hour exceedence data were excluded if data capture was less than 90%. All sites yielding more than 1 year of data (following screening for data capture) have been included in the raw data plots. The data for 2003 were not fully ratified, but typically, the provisional data made up less than 25% of the year. Tables A1.1 and A2.2 list the sites that have provided data for this analysis.

A1.2 In order to simplify the raw data, all sites with a full set of data since 1998 have been grouped according to site type. This has enabled the annual mean and 24-hour exceedence data to be averaged across a number of sites. Because these cross-site averages must include the same sites each year, the number of sites included is limited. The sites included in these site-type specific cross-site averages are listed in Tables A1.3 to A1.5.

A1.3 Following on from the site-type-specific cross-site averages, in order to identify trends over a longer time-span, all sites with a full set of data since 1994 have been grouped and averaged. These plots are shown in the main text of the report and the sites included are listed with them.

Table A1.1 AURN Sites Reporting NO_2 and NOx Data and the Data Capture Rates for Each Site-Year.

Region	Site	Type	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
E	CambridgeRoadside	Roadside								30	93	97	94	89
E	NorwichRoadside	Roadside						51	99	88	99	94	98	98
E	StOsyth	Rural											62	95
E	WickenFen	Rural						13	91	87	85	88	85	64
E	Stevenage	Suburban	98	97	32									
E	Southend-on-Sea	Urban background									39	96	96	83
E	Thurrock	Urban background					21	88	87	98	93	96	94	94
E	NorwichCentre	Urban centre						42	93	97	97	94	95	94
EM	LincolnRoadside	Roadside						61	95	95				
EM	Ladybower	Rural	95	75	87	74	74	88	95	88	95	88	97	98
EM	MarketHarborough	Rural												5
EM	Northampton	Urban background										59	99	99
EM	LeicesterCentre	Urban centre			96	96	96	96	94	97	96	98	95	93
EM	NottinghamCentre	Urban centre					25	58	94	98	98	85	98	98
E	CamdenKerbside	Kerbside					62	95	97	97	96	99	97	94
L	LondonCromwellRoad	Kerbside	99	100	96	92	68							
L	LondonMaryleboneRoad	Kerbside						39	98	93	96	94	99	94
L	BrentfordRoadside	Roadside												42
L	BromleyRoadside	Roadside						24	38					
L	HaringeyRoadside	Roadside					62	99	99	98	88	98	98	88
L	HounslowRoadside	Roadside						15	85	92	97	95	82	
L	LondonA3Roadside	Roadside						63	93	98	97	97	88	81
L	LondonBromley	Roadside							23	95	82	89	97	97
L	LondonCromwellRoad2	Roadside							60	98	94	97	95	93
L	SouthwarkRoadside	Roadside						46	75	50	90	92	87	91
L	SuttonRoadside	Roadside					70	97	98	96	88	99	31	
L	TowerHamletsRoadside	Roadside					71	97	96	97	91	88	99	98
L	LondonBexley	Suburban			59	96	95	93	96	98	97	94	90	94
L	LondonEltham	Suburban					75	99	86	96	97	97	99	98
L	LondonHillingdon	Suburban					24	97	75	45	98	96	97	83
L	LondonSutton	Suburban					74	98	99	91	91	93	33	
L	LondonBrent	Urban background					89	91	96	98	98	89	98	96
L	LondonBridgePlace	Urban background	99	99	99	97	98	96	98	86				
L	LondonN.Kensington	Urban background					72	99	99	97	96	96	99	94
L	LondonTeddington	Urban background					37	95	96	98	99	94	98	96
L	LondonWestminster	Urban background										35	97	78
L	WestLondon	Urban background	100	100	100	100	100	100	100	98	98	95	97	96
L	LondonBloomsbury	Urban centre	78	94	96	93	96	96	95	92	96	87	9	68
L	LondonHackney	Urban centre						95	98	93	91	95	88	91
L	LondonLewisham	Urban centre						47	94	95	43		94	100
L	LondonSouthwark	Urban centre						66	94	93	96	97	84	73
L	LondonWandsworth	Urban centre					66	97	99	96	97	99	98	91
NE	Stockton-on-TeesYarm	Roadside										99	97	89
NE	Redcar	Suburban						51	96	96	98	83	94	96
NE	NewcastleCentre	Urban centre	73	96	94	93	97	97	94	80	98	86	95	93
NE	Billingham	Urban industrial	98	94	98	71	90	77	98	98	99	95	98	97
NE	Middlesbrough	Urban industrial				68	98	95	95	98	85	96	82	94
NI	Derry	Urban background						25	79	87	96	93	95	95
NI	BelfastCentre	Urban centre	61	97	95	95	97	96	93	97	81	86	95	96
NW	BuryRoadside	Roadside						73	96	93	97	98	94	90
NW	ManchesterSouth	Suburban					7	95	98	71	81	96	89	99
NW	Blackpool	Urban background									39	90	96	94
NW	Bolton	Urban background						85	95	94	97	98	98	98
NW	LiverpoolSpeke	Urban background												57
NW	ManchesterTownHall	Urban background	97	99	99	94	97	96	97	99	96	99	99	99
NW	Preston	Urban background									56	98	98	94
NW	Stockport	Urban background					7	94	98	98	98	99	68	
NW	StockportShawHeath	Urban background											22	98
NW	WiganLeigh	Urban background										97	98	92
NW	WirralTranmere	Urban background									61	98	94	96
NW	LiverpoolCentre	Urban centre		46	97	94	98	95	96	91	96	93	68	
NW	ManchesterPiccadilly	Urban centre					92	91	96	95	97	73	90	98
NW	SalfordEccles	Urban industrial						65	96	96	97	97	97	96
Scot	GlasgowKerbside	Kerbside						73	97	96	98	99	97	99
Scot	StrathVaich	Remote	85	42	68	86	85	17						
Scot	Dumfries	Roadside										79	95	98
Scot	Inverness	Roadside										42	98	98
Scot	BushEstate	Rural												23
Scot	Aberdeen	Urban background								27	94	95	97	88
Scot	EdinburghStLeonards	Urban background												10
Scot	GlasgowCityChambers	Urban background	99	89	98	97	97	98	98	98	99	99	95	96
Scot	EdinburghCentre	Urban centre	24	95	96	92	96	90	97	94	95	98	86	46
Scot	GlasgowCentre	Urban centre					42	98	67	85	68	86	95	43
Scot	Grangemouth	Urban industrial										97	57	99

E = Eastern; EM = East Midlands; L = London; NE = Northeast; NI = Northern Ireland; NW = Northwest; Scot = Scotland.
Site-years with less than 75% data capture (shaded) have been excluded from all analyses. Site-years with less than 90% data capture have been excluded from the analysis of 1-hour mean NO_2 exceedences.

Table A1.1 (continued) AURN Sites Reporting NO_2 and NOx Data and the Data Capture Rates for Each Site-Year.

Region	Site	Type	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
SE	BrightonRoadside	Roadside							69	2	55	93	95	87
SE	HoveRoadside	Roadside						25	98	13	89	93	94	96
SE	OxfordCentre	Roadside					11	17	71	99	99	100	99	98
SE	Harwell	Rural				12	84	72	79	54	86	84	98	88
SE	LullingtonHeath	Rural	85	89	69	95	86	79	79	65	91	94	91	89
SE	Rochester	Rural					86	91	90	96	83	95	98	98
SE	Canterbury	Urban background										91	98	99
SE	Portsmouth	Urban background										97	98	95
SE	Reading	Urban background						30	95	96	95	97	95	9
SE	ReadingNewTown	Urban background												15
SE	SouthamptonCentre	Urban centre			96	73	96	95	98	97	95	97	90	95
SW	BathRoadside	Roadside						90	98	82	76	84	98	95
SW	BristolOldMarket	Roadside					49	96	96	78	78	57		64
SW	ExeterRoadside	Roadside					49	96	98	98	98	90	93	96
SW	Somerton	Rural												41
SW	YarnerWood	Rural												29
SW	Bournemouth	Urban background										69	91	94
SW	BristolCentre	Urban centre		71	97	97	97	89	98	96	96	96	96	89
SW	PlymouthCentre	Urban centre						18	39	90	85	96	97	92
Wales	Wrexham	Roadside											78	98
Wales	AstonHill	Rural												20
Wales	Narberth	Rural						71	76	64	71	64	86	80
Wales	Cwmbran	Urban background										43	90	88
Wales	PortTalbot	Urban background						85	97	94	87	96	97	97
Wales	CardiffCentre	Urban centre	62	95	96	94	94	96	98	95	97	93	94	88
Wales	Swansea	Urban centre			8	96	96	96	97	98	98	95	98	98
WM	WalsallWillenhall	Suburban						38	92	86	84	92	94	97
WM	BirminghamEast	Urban background		8	97	97	90	96	97	98	97	94	91	93
WM	CoventryMemorialPark	Urban background										64	88	87
WM	LeamingtonSpa	Urban background					43	60	98	97	99	91	96	68
WM	SandwellOldbury	Urban background						30	69					
WM	SandwellWestBromwich	Urban background							16	96	89	95	94	86
WM	WalsallAlumwell	Urban background	97	95	100	78	99	97	78	91	94	96	98	96
WM	BirminghamCentre	Urban centre	35	94	96	97	97	92	72	95	97	92	93	88
WM	CoventryCentre	Urban centre						55	91	34	45			
WM	Stoke-on-TrentCentre	Urban centre						16	77	83	97	97	96	96
WM	WolverhamptonCentre	Urban centre				4	100	100	100	95	96	91	97	96
Y	HighMuffles	Rural												20
Y	BarnsleyGawber	Urban background						28	53	84	94	83	86	97
Y	BradfordCentre	Urban centre						8	96	97	96	90	97	94
Y	HullCentre	Urban centre			97	98	94	91	98	98	96	98	4	
Y	HullFreetown	Urban centre										15	94	
Y	LeedsCentre	Urban centre		77	96	97	97	97	93	98	97	91	87	86
Y	RotherhamCentre	Urban centre						52	82	26	97	95	95	97
Y	SheffieldCentre	Urban centre					95	96	93	98	97	97	98	97
Y	SheffieldTinsley	Urban industrial	98	99	97	83	94	98	98	95	97	99	97	97

SE = Southeast; SW = Southwest; WM = West Midlands; Y = Yorkshire and Humberside
Site-years with less than 75% data capture (shaded) have been excluded from all analyses. Site-years with less than 90% data capture have been excluded from the analysis of 1-hour mean NO_2 exceedences.

Table A1.2 AURN Sites Reporting PM_{10} Data and the Data Capture Rates for Each Site-Year.

Region	Site	Type	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
E	Southend-on-Sea	Urban background									43.2	97.6	97.2	83.6
E	Thurrock	Urban background					26.3	92.5	92.2	95.1	93.6	75.9	82	98.1
E	NorwichCentre	Urban centre						42.9	94.9	87.5	97.4	95.7	96.5	96.9
EM	Northampton	Urban background										94.6	99.2	99.5
EM	LeicesterCentre	Urban centre			93	96.6	96	96.5	94.8	96.1	97.1	96.6	79.3	88.9
EM	NottinghamCentre	Urban centre					30.5	96.7	98.3	97.1	98.5	97.6	88.9	91
L	CamdenKerbside	Kerbside					48.9	98.7	81.6	94.4	97.9	98.8	99.2	99
L	LondonMarylebone Road	Kerbside						45.4	98.5	94.8	98.6	89.1	98.1	98.7
L	HaringeyRoadside	Roadside					58.6	96.8	93.1	97.2	93.7	98.8	98.7	97.9
L	LondonA3Roadside	Roadside						49.9	96.8	97.5	98.2	97.6	96.7	96.5
L	SuttonRoadside	Roadside					74.6	99.1	98.4	98.3	91.5	86.2	32.5	
L	LondonBexley	Suburban			59.2	94.8	93.8	92.7	97.2	98.2	97.3	96	97.8	96.5
L	LondonEltham	Suburban					65.8	90.5	85.8	98.4	92.9	97.4	94.6	99.1
L	LondonHillingdon	Suburban					40.5	97.8	93.2	97.6	98.1	96.8	97.7	88.9
L	LondonBrent	Urban background					73	95.2	96.1	98.2	98.4	98.7	98.3	95.8
L	LondonN.Kensington	Urban background					74.7	97.5	98.1	98.6	95.5	95.9	98.5	98.4
L	LondonBloomsbury	Urban centre	77.7	97.4	97.7	93	91.7	96.1	94.4	96.1	97.1	97.7	35.5	58.3
NE	Stockton-on-TeesYarm	Roadside										58.3	96.9	96.1
NE	Redcar	Suburban						49.7	98	97.9	96.1	98	97.5	97.9
NE	NewcastleCentre	Urban centre	66.1	63.1	95.1	95.7	98.3	96.7	95.6	98	97.6	98.1	98.2	96.2
NE	Middlesbrough	Urban industrial				68.8	97	94.8	95.8	97.2	95.8	97.9	79.1	85.7
NE	Scunthorpe	Urban industrial						4.7	99.7	98.8	89.5	93	84.4	98.9
NI	LoughNavar	Remote					22.6	95.9	97.5	96.4	98.5	96.4	95.7	98.5
NI	BelfastClaraSt	Suburban					71.8	24.6	53.3	95	94.2	92.1	93.8	94.7
NI	Derry	Urban background						60.4	96.3	95.7	96.3	96.6	96.4	97.2
NI	BelfastCentre	Urban centre	79.2	96.1	94.7	95	94.7	96.2	94.1	96.5	81.3	80.8	97.6	97.3
NW	BuryRoadside	Roadside						85.8	94.9	95.7	92	94.4	95.8	97.5
NW	Blackpool	Urban background									39.4	97.1	98	96.4
NW	Bolton	Urban background						83.3	95.7	93.9	96.9	97.6	98.6	98.1
NW	Preston	Urban background									56.3	95.7	97.7	96.7
NW	Stockport	Urban background					8.7	84.3	98.6	97.7	97	99.1	70.5	
NW	StockportShawHeath	Urban background											22	98.8
NW	WiganLeigh	Urban background										97.2	98.5	97.9
NW	WirralTranmere	Urban background									61.3	97.8	97.2	97
NW	LiverpoolCentre	Urban centre		54.3	84	94	97	96	97.8	97.3	91.1	98	69.3	
NW	ManchesterPiccadilly	Urban centre				3.5	98.3	94.3	97.4	98.3	97.5	97	94.9	98
NW	SalfordEccles	Urban industrial						69.7	91.8	92.6	98.1	97.3	96.2	96.3
Scot	Aberdeen	Urban background								26.6	93.8	96.6	72.3	98.4
Scot	GlasgowKerbside	Kerbside						72.1	96.8	96.6	97.7	98.1	97	93.2
Scot	EdinburghCentre	Urban centre	17.3	82.4	89.3	92	96.9	93.9	98	92.4	96.3	97.3	82.1	44.1
Scot	GlasgowCentre	Urban centre					41.7	96.9	97.6	98.1	97.1	98.5	97.9	96.2
Scot	Grangemouth	Urban industrial										74.9	57.3	98.2
SE	Harwell	Rural							70.5	97.8	97.1	96.9	98.9	97.4
SE	Rochester	Rural					69.1	91.1	79.7	94	87.7	90.8	60.7	76.4
SE	Canterbury	Urban background										97.8	99.3	99.4
SE	Portsmouth	Urban background										97	97.2	97.1
SE	Reading	Urban background						30.1	97.6	90.9	94.6	95.8	98.3	9.2
SE	SouthamptonCentre	Urban centre			87.5	73.3	97.6	93.3	97.7	91.3	96.5	98.3	88.4	91.4
SW	BristolCentre	Urban centre		86.7	95.4	96.8	96.6	95.5	91.9	95.4	93.3	95.4	95.6	93.2
SW	PlymouthCentre	Urban centre						22.2	97.8	96.8	95.3	97	98.1	97.7
Wales	Narberth	Rural						75.8	88.7	80.6	80.9	92.6	90.5	87.5
Wales	Cwmbran	Urban background										43.5	97.3	99.2
Wales	PortTalbot	Urban background						88.1	97.6	97	95.7	97	97.7	98.4
Wales	CardiffCentre	Urban centre	47.5	55.5	96.2	96.6	95.4	96.3	98.1	98.2	97.8	98.3	96.9	89.6
Wales	Swansea	Urban centre			5.9	95.6	97.2	97.5	96.7	96.3	96.9	94.6	98.2	97.8
WM	BirminghamEast	Urban background		8.3	97	95.2	95	95.9	97.9	97.8	97	98	96.6	29
WM	CoventryMemorialPark	Urban background										81.3	97.8	81.6
WM	LeamingtonSpa	Urban background					43	86.5	98.3	97.6	98.1	98.5	98.3	85.8
WM	BirminghamCentre	Urban centre	75.1	83.6	93	97.9	94.9	95.2	94.9	95.3	98.1	97.7	97	85.7
WM	Stoke-on-TrentCentre	Urban centre						48.2	97.8	97.9	97.5	97.7	96.5	98.2
WM	WolverhamptonCentre	Urban centre				3.5	70.8	98.6	98.2	98.1	97.7	95.8	98.3	98.2
Y	BradfordCentre	Urban centre						9.3	97.2	97.9	96.6	93.5	98	96.6
Y	HullCentre	Urban centre			89.9	97.9	95.5	93.9	93.7	98.4	94.7	98.1	4.4	
Y	HullFreetown	Urban centre											13.9	88.7
Y	LeedsCentre	Urban centre		76.8	92	97.7	97.6	86.1	96.7	97.2	96.5	94.7	97.9	97.1
Y	SheffieldCentre	Urban centre				2.7	97.8	88.9	84.7	98.2	97	95.7	94	97.6

E = Eastern; EM = East Midlands; L = London; NE = Northeast; NI = Northern Ireland; NW = Northwest; Scot = Scotland; SE = Southeast; SW = Southwest; WM = West Midlands; Y = Yorkshire and Humberside

Site-years with less than 75% data capture (shaded dark grey) have been excluded from all analyses. Site-years with less than 90% data capture (shaded light grey) have been excluded from the analysis of 24-hour exceedences.

Table A1.3 Sites Used to Calculate Cross-Site Average Annual Mean NO_2 and NOx Concentrations 1998-2003

Urban Background and Suburban	Urban Centre	Kerbside and Roadside	Urban Industrial	Rural
Thurrock	NorwichCentre	NorwichRoadside	Billingham	Ladybower
LondonBexley	LeicesterCentre	CamdenKerbside	Middlesbrough	Rochester
LondonEltham	NottinghamCentre	LondonMaryleboneRoad	SalfordEccles	
LondonBrent	LondonHackney	HaringeyRoadside	SheffieldTinsley	
LondonN.Kensington	LondonWandsworth	LondonA3Roadside		
LondonTeddington	NewcastleCentre	TowerHamletsRoadside		
WestLondon	BelfastCentre	BuryRoadside		
Redcar	SouthamptonCentre	GlasgowKerbside		
Derry	BristolCentre	BathRoadside		
Bolton	CardiffCentre	ExeterRoadside		
ManchesterTownHall	Swansea			
GlasgowCityChambers	Stoke-on-TrentCentre			
PortTalbot	WolverhamptonCentre			
WalsallWillenhall	BradfordCentre			
BirminghamEast	LeedsCentre			
WalsallAlumwell	SheffieldCentre			

Table A1.4 Sites Used to Calculate Cross-Site Average Annual Mean PM_{10} Concentrations 1998-2003

Urban Centre	Urban Background and Suburban	Roadside and Kebside	Urban Industrial	Rural
NorwichCentre	Thurrock	CamdenKerbside	Middlesbrough	LoughNavar
LeicesterCentre	LondonBexley	LondonMaryleboneRoad	Scunthorpe	Narberth
NottinghamCentre	LondonEltham	HaringeyRoadside	SalfordEccles	
NewcastleCentre	LondonHillingdon	LondonA3Roadside		
BelfastCentre	LondonBrent	BuryRoadside		
ManchesterPiccadilly	LondonN.Kensington	GlasgowKerbside		
GlasgowCentre	Redcar			
SouthamptonCentre	Derry			
BristolCentre	Bolton			
PlymouthCentre	PortTalbot			
CardiffCentre	LeamingtonSpa			
Swansea				
BirminghamCentre				
Stoke-on-TrentCentre				
WolverhamptonCentre				
BradfordCentre				
LeedsCentre				
SheffieldCentre				

Table A1.5 Sites Used to Calculate Cross-Site Average 24-hour PM_{10} Exceedences 1998-2003

Urban Centre	Urban Background and Suburban	Roadside and Kebside
NewcastleCentre	LondonBexley	HaringeyRoadside
ManchesterPiccadilly	LondonBrent	LondonA3Roadside
GlasgowCentre	LondonN.Kensington	BuryRoadside
BristolCentre	Redcar	GlasgowKerbside
PlymouthCentre	Derry	
Swansea	Bolton	
Stoke-on-TrentCentre	PortTalbot	
WolverhamptonCentre		
BradfordCentre		
LeedsCentre		

There were insufficient data to include Urban Industrial or Rural sites.

A1.4 As noted above, the number of sites that can be meaningfully included in the cross-site averages is severely limited by data capture. In order to overcome this, a secondary analysis has been performed focusing on proportional changes at each site. The annual mean concentration at each site for each specific year has been divided by the annual mean concentration at that site in 2001 (Equation A1.1). Each site-year is therefore given a "normalised" value which represents the measurements in that year as a fraction of those in 2001. These "normalised" values were then averaged across all sites by region, by site type, and across the whole of the UK.

Concentration (Year xxxx) / Concentration (2001) = Normalised Value Equation A1.1

A1.5 The same procedure has been used for the number of 24-hour PM_{10} exceedences, but it should be noted that this technique lends itself less well to this measure. This is because, for example, a doubling in the number of exceedences is, in practice, less significant for e.g. 1 to 2, than for 20 to 40. Despite this, it usefully shows general patterns.

A1.6 2001 was chosen as the reference year for this analysis because it was a year with good overall data capture. Using a different reference year will have only a small impact on the observed trend patterns. Clearly, all sites with no data for 2001 have had to be excluded from this analysis. In addition, two sites with zero 24-hour exceedences in 2001 have been excluded from the 24-hour PM_{10} analysis. These are Narberth and Lough Navar. Because locally-specific patterns weighted national patterns by an undue amount, three additional sites have been removed from the normalised PM_{10} data analysis. These are Manchester Piccadilly, Cardiff Centre and Newcastle Centre. All other sites have been included.

Appendix 2

Figure A2.1 Annual Mean Nitrogen Dioxide Concentrations in Eastern England (μg/m^3)

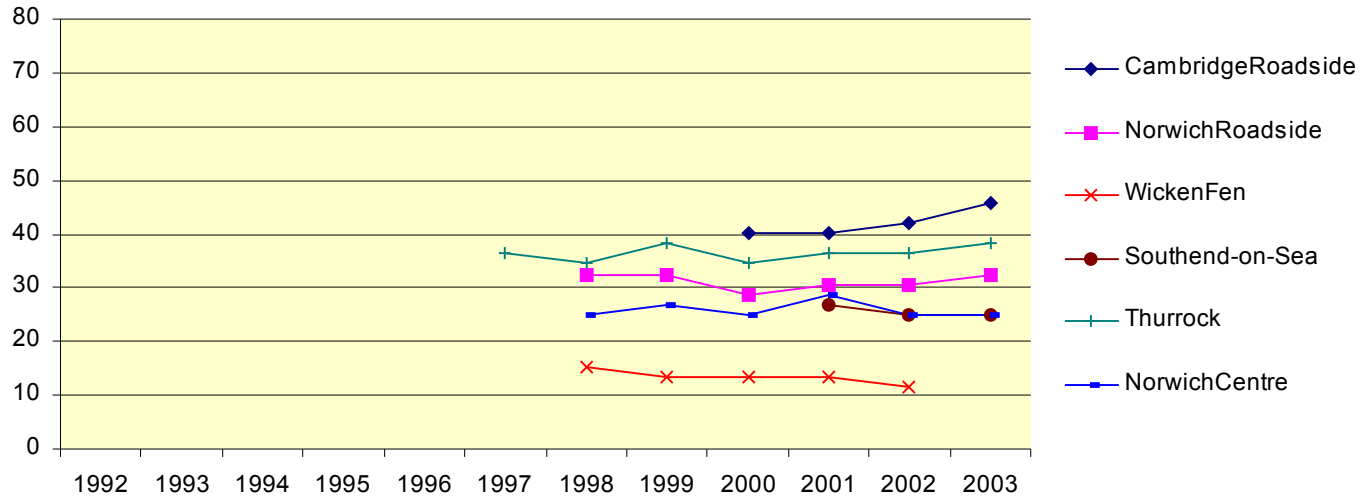


Figure A2.2 Annual Mean Nitrogen Dioxide Concentrations in the East Midlands (μg/m^3)

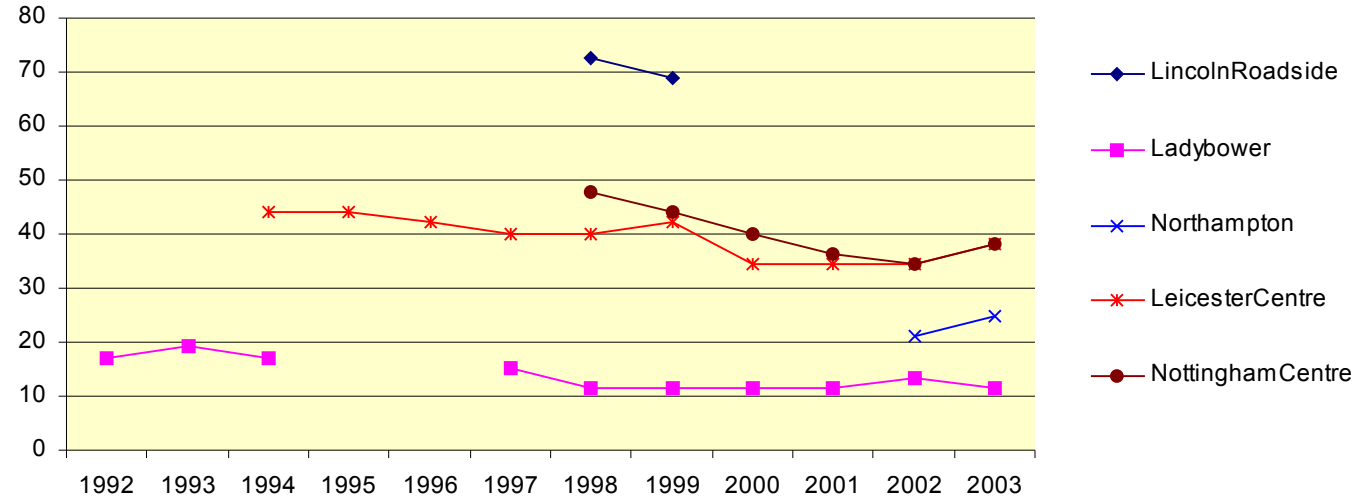


Figure A2.3 Annual Mean Nitrogen Dioxide Concentrations in North East England (μg/m^3)

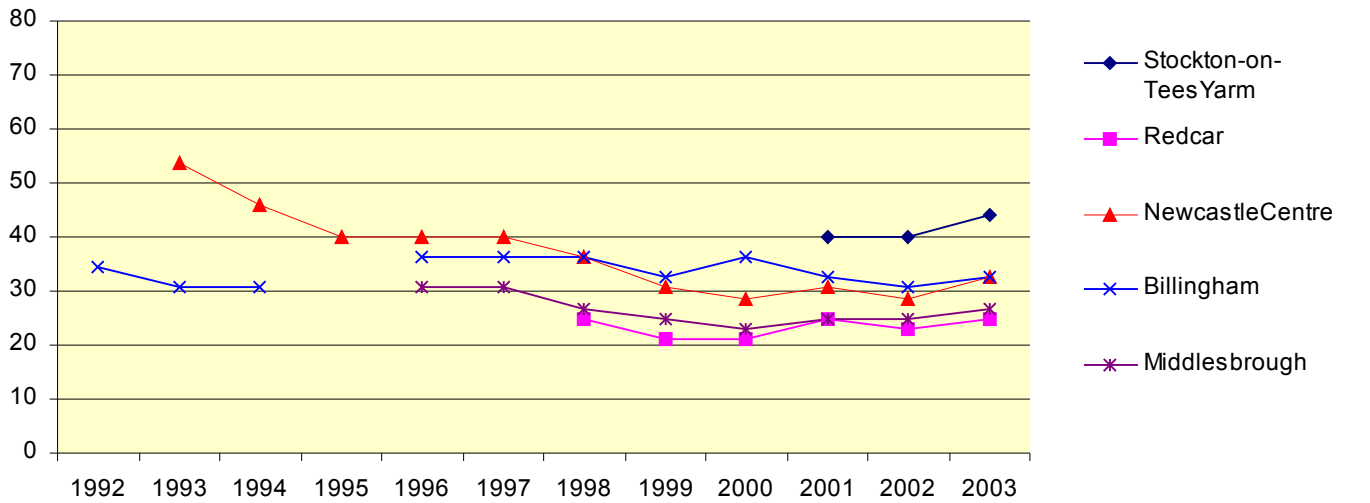


Figure A2.4 Annual Mean Nitrogen Dioxide Concentrations in North West England (μg/m^3)

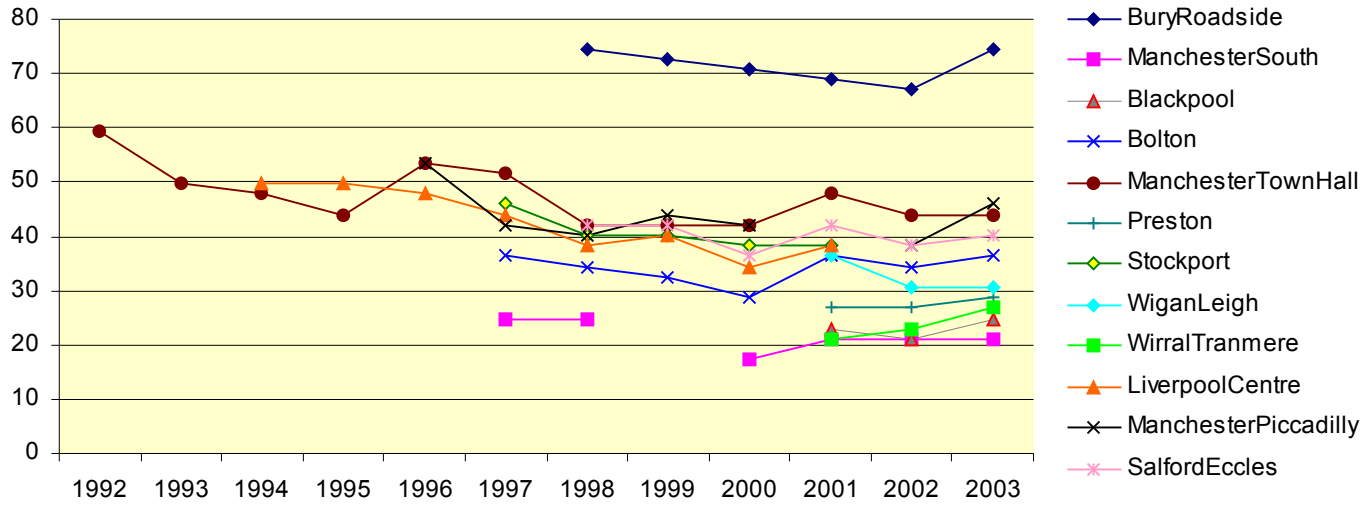


Figure A2.5 Annual Mean Nitrogen Dioxide Concentrations in South East England (μg/m^3)

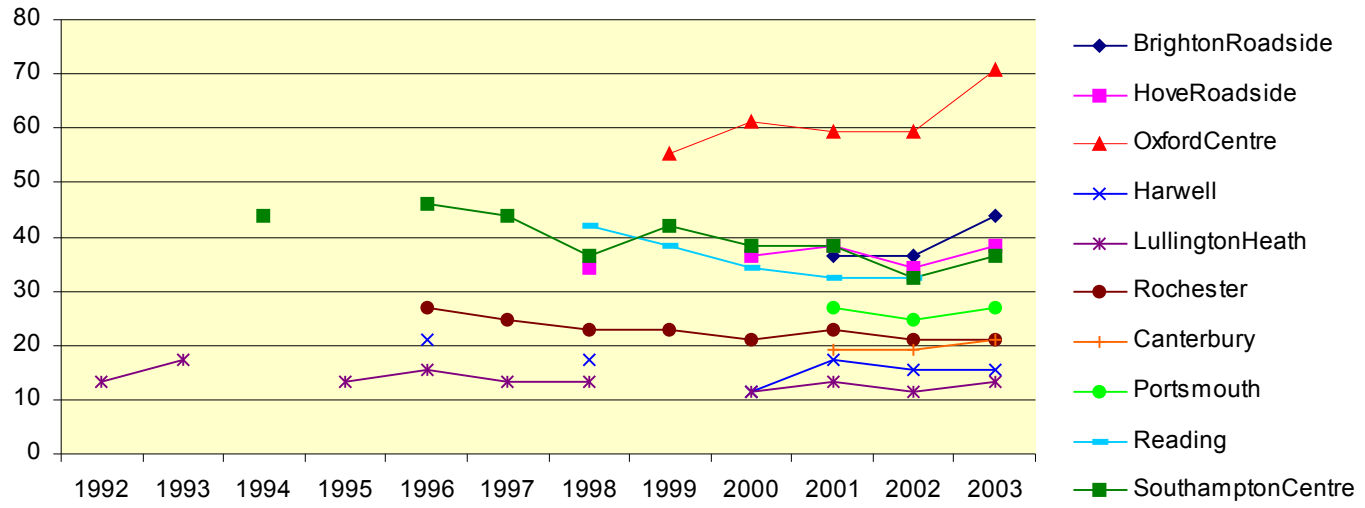


Figure A2.6 Annual Mean Nitrogen Dioxide Concentrations in South West England (μg/m^3)

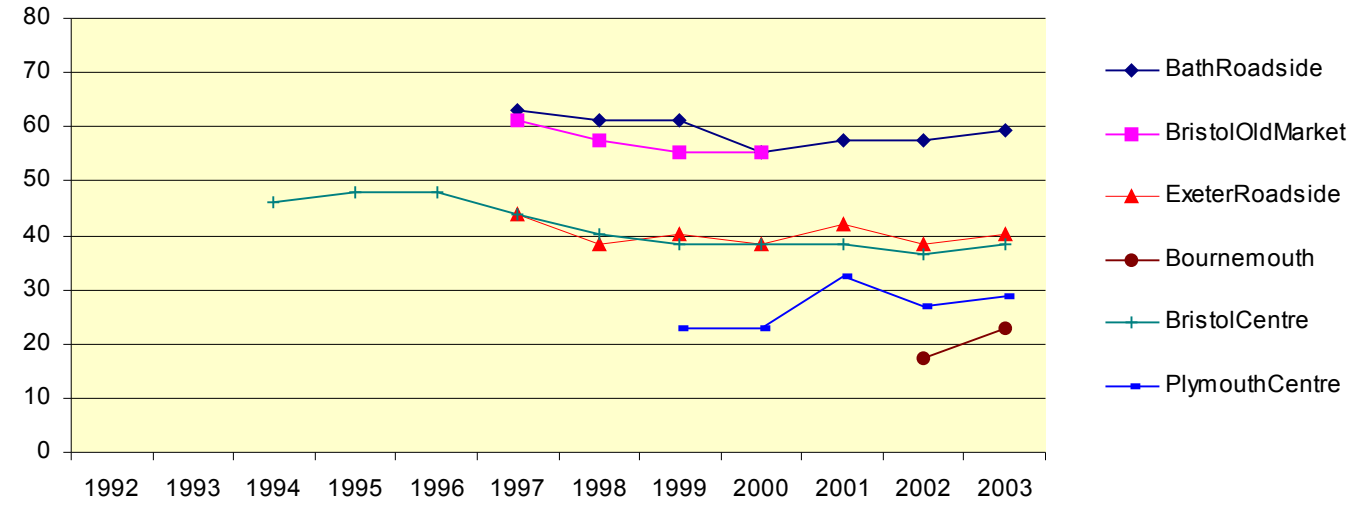


Figure A2.7 Annual Mean Nitrogen Dioxide Concentrations in Wales (μg/m^3)

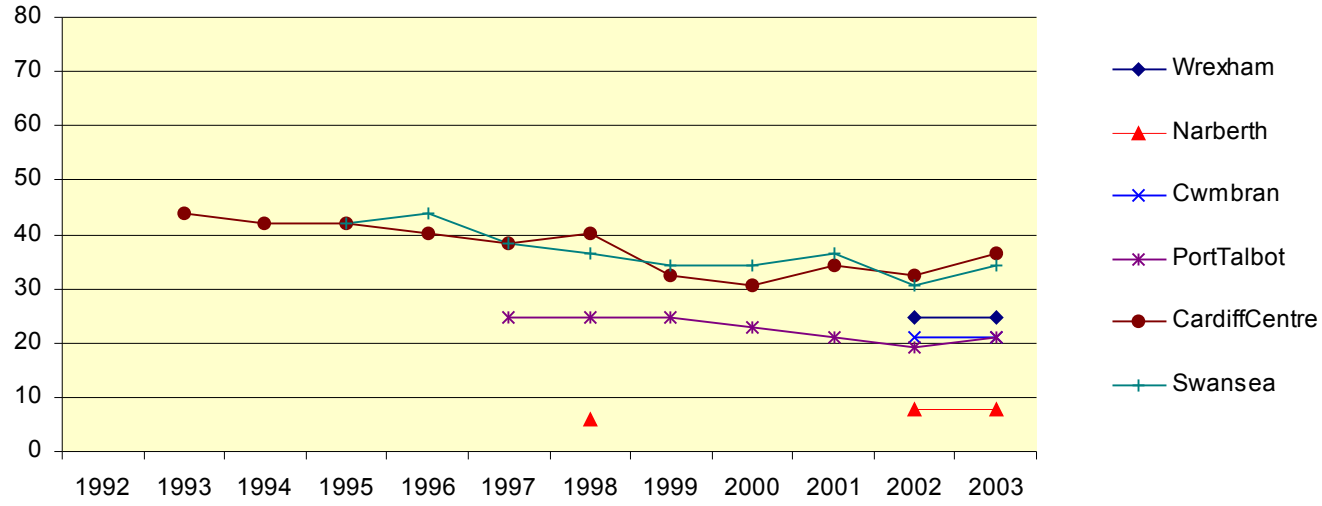


Figure A2.8 Annual Mean Nitrogen Dioxide Concentrations in the West Midlands (μg/m^3)

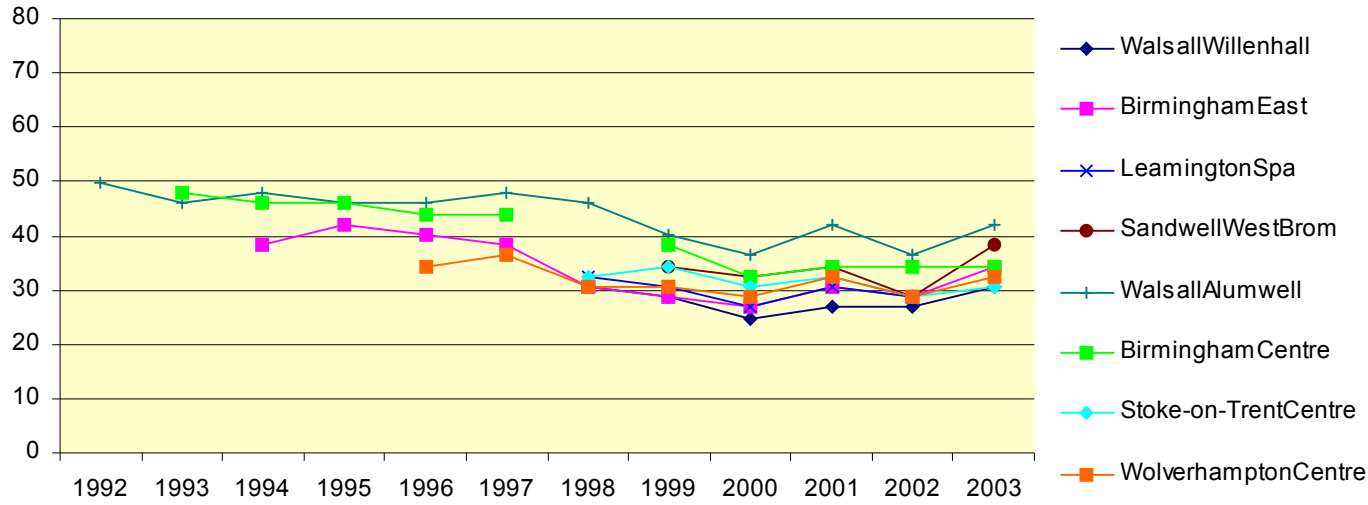


Figure A2.9 Annual Mean Nitrogen Dioxide Concentrations in Yorkshire and Humberside (μg/m^3)

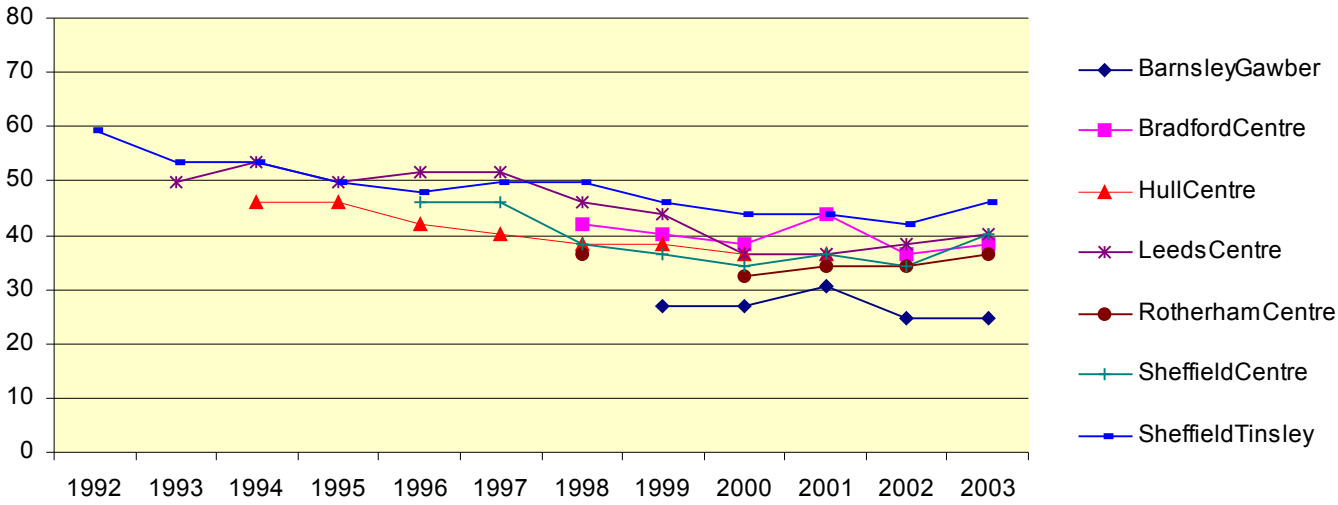


Figure A2.10 Annual Mean Nitrogen Dioxide Concentrations in Scotland and Northern Ireland (μg/m^3)

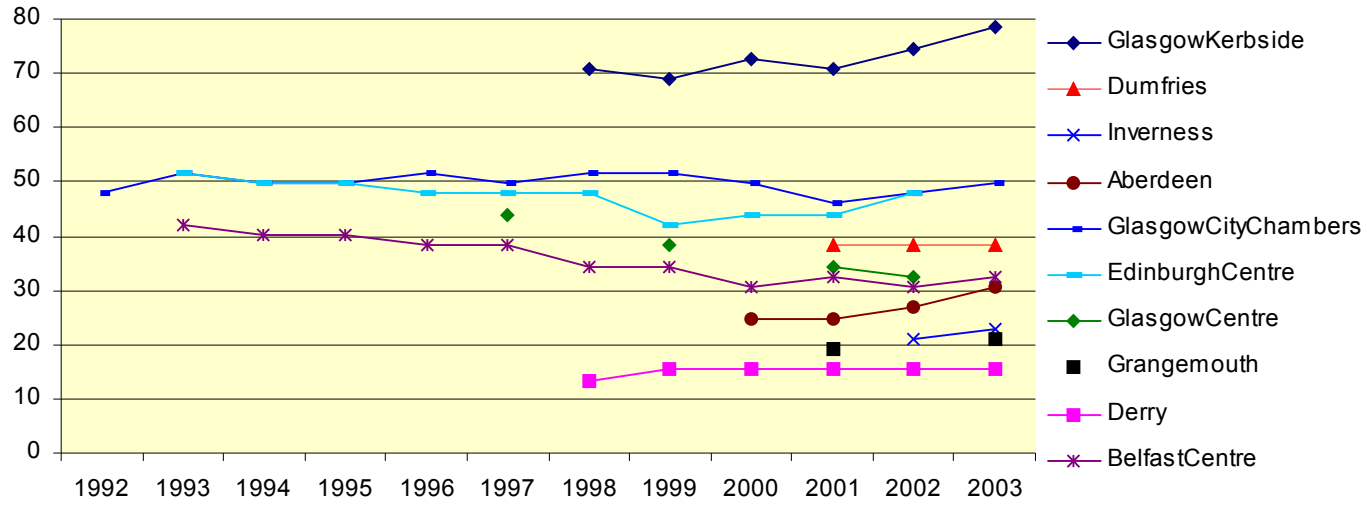


Figure A2.11 Annual Mean Nitrogen Dioxide Concentrations at Roadside and Kerbside Sites in London (μg/m^3)

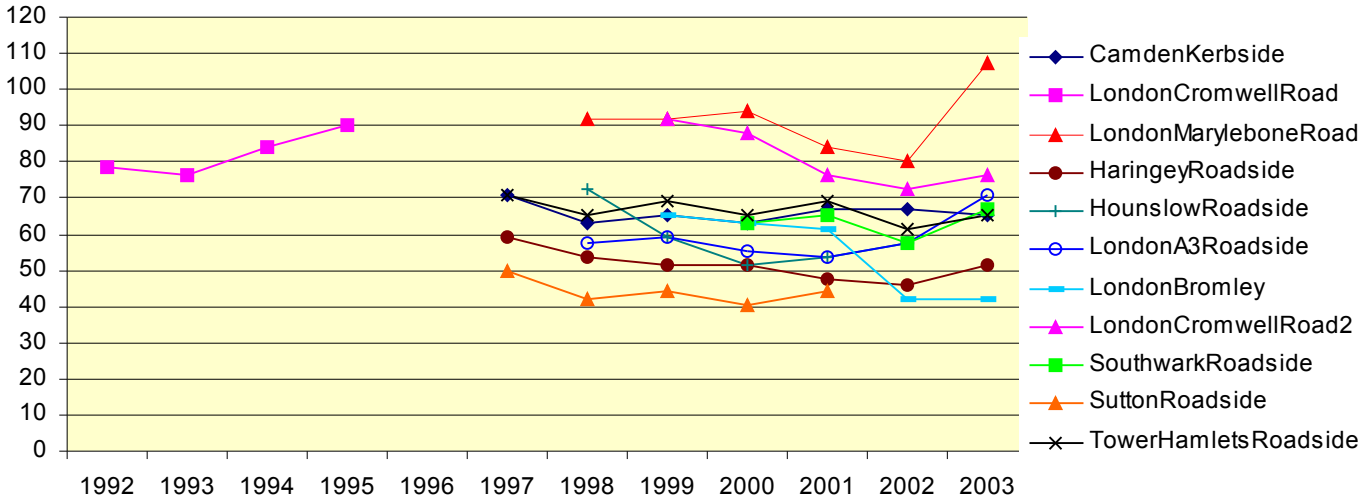


Figure A2.12 Annual Mean Nitrogen Dioxide Concentrations at Other London Sites (μg/m^3)

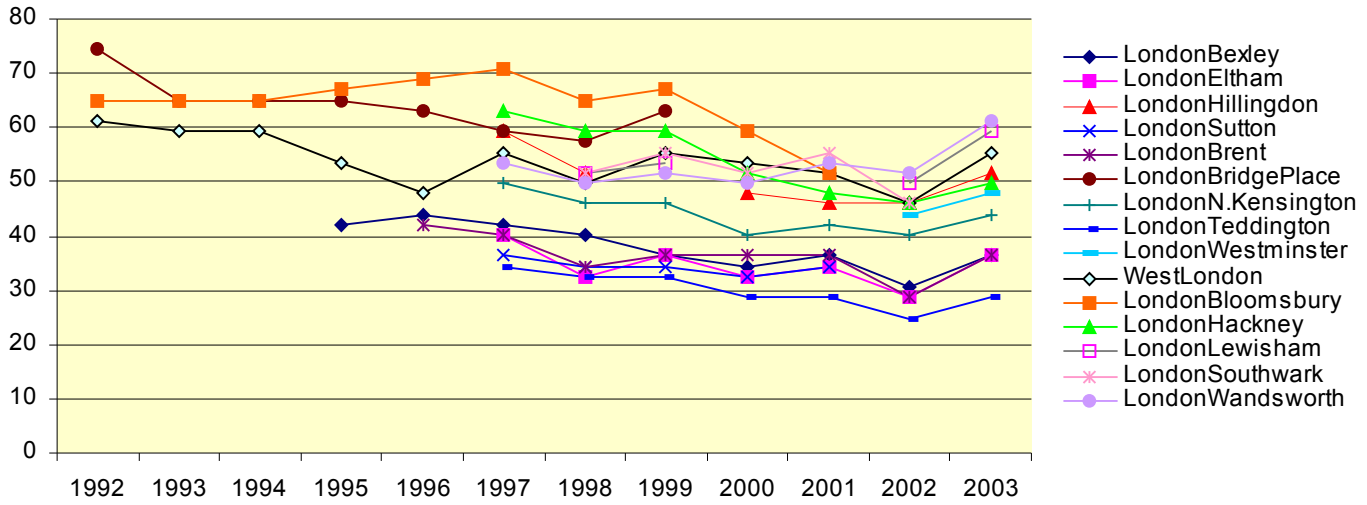


Figure A2.13 Average Annual Mean Nitrogen Dioxide Concentrations across 10 Roadside and Kerbside Sites ($\mu g/m^3$)

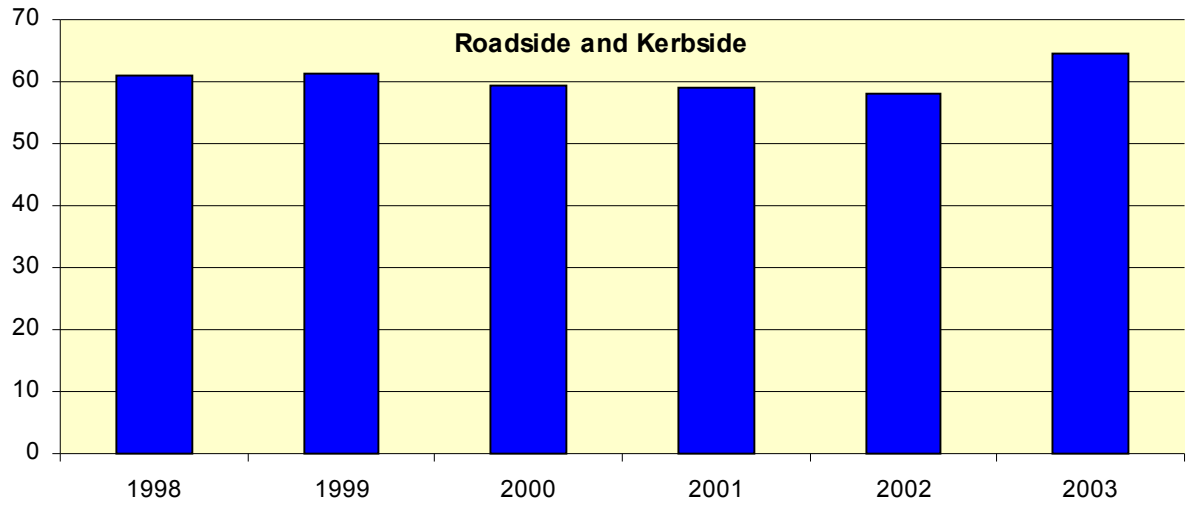


Figure A2.14 Average Annual Mean Nitrogen Dioxide Concentrations across 16 Urban Centre Sites ($\mu g/m^3$)

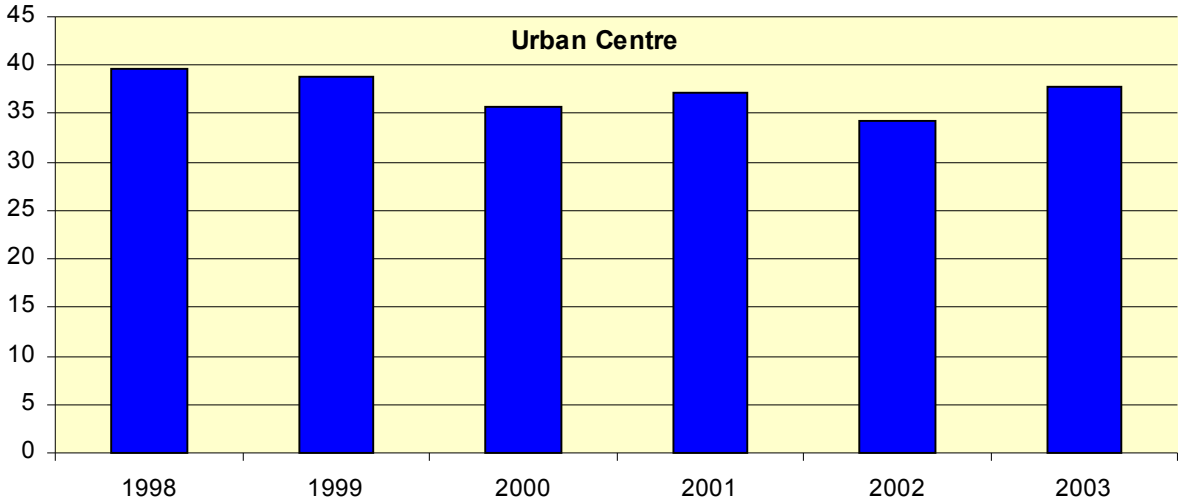


Figure A2.15 Average Annual Mean Nitrogen Dioxide Concentrations across 4 Urban Industrial Sites ($\mu g/m^3$)

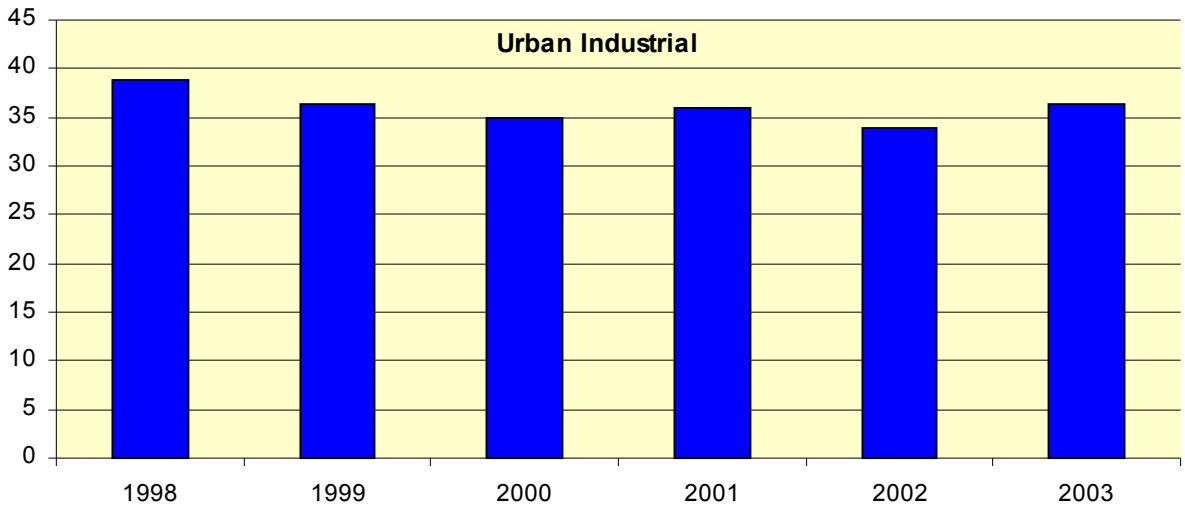


Figure A2.16 Average Annual Mean Nitrogen Dioxide Concentrations across 16 Urban Background and Suburban Sites (μg/m^3)

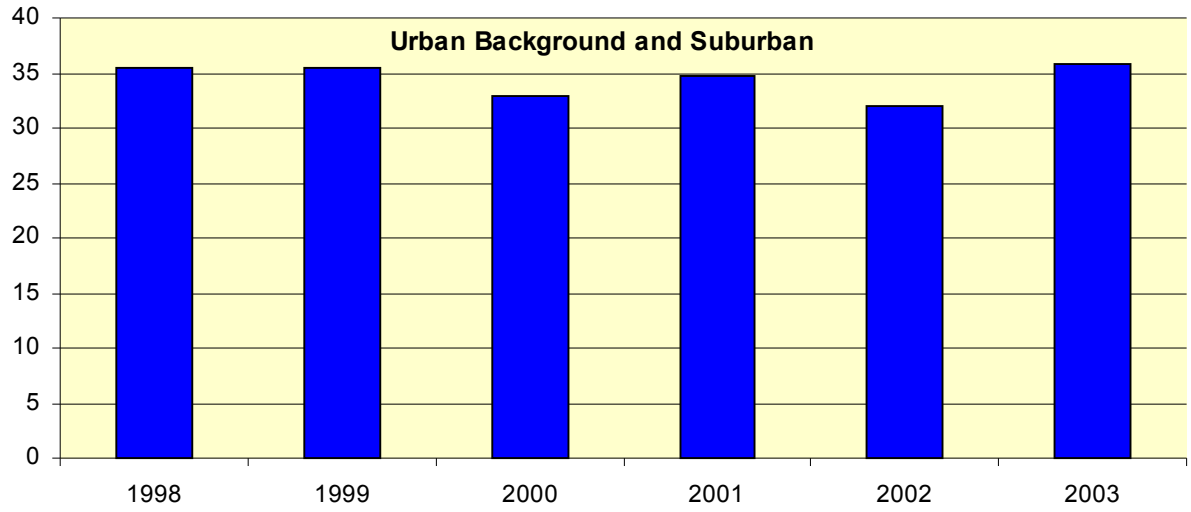


Figure A2.17 Average Annual Mean Nitrogen Dioxide Concentrations across 2 Rural Sites (μg/m^3)

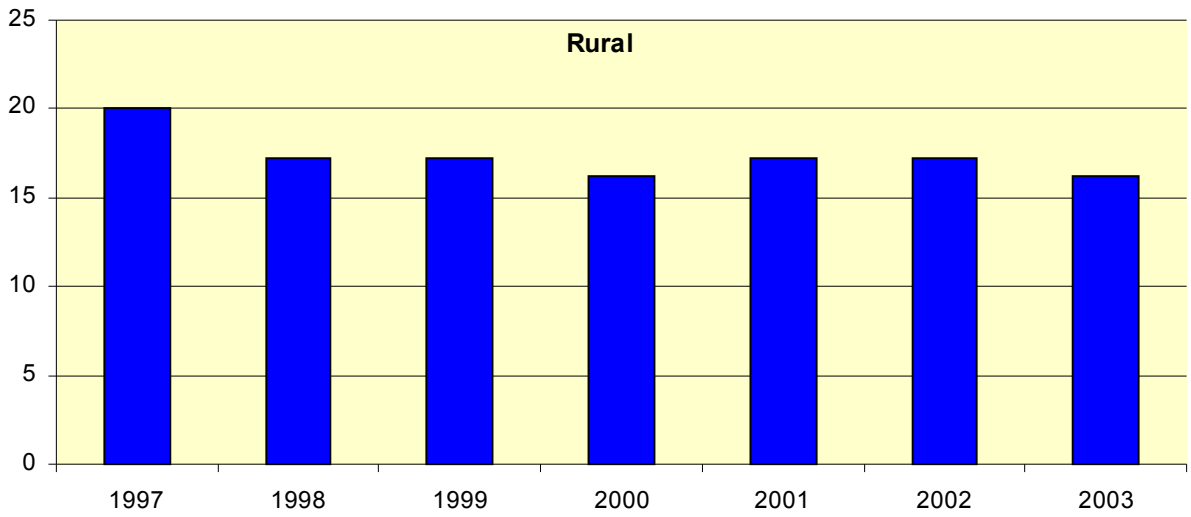


Figure A2.18 Normalised Nitrogen Dioxide Concentrations Averaged by Site Type

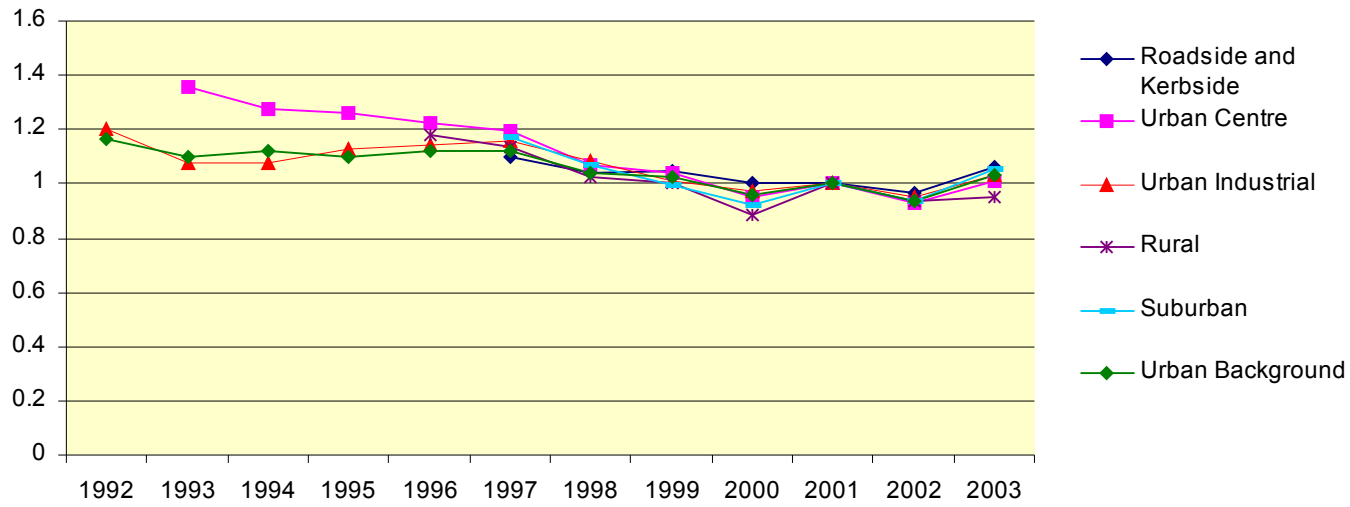


Figure A2.19 Normalised Nitrogen Dioxide Concentrations Averaged by Region

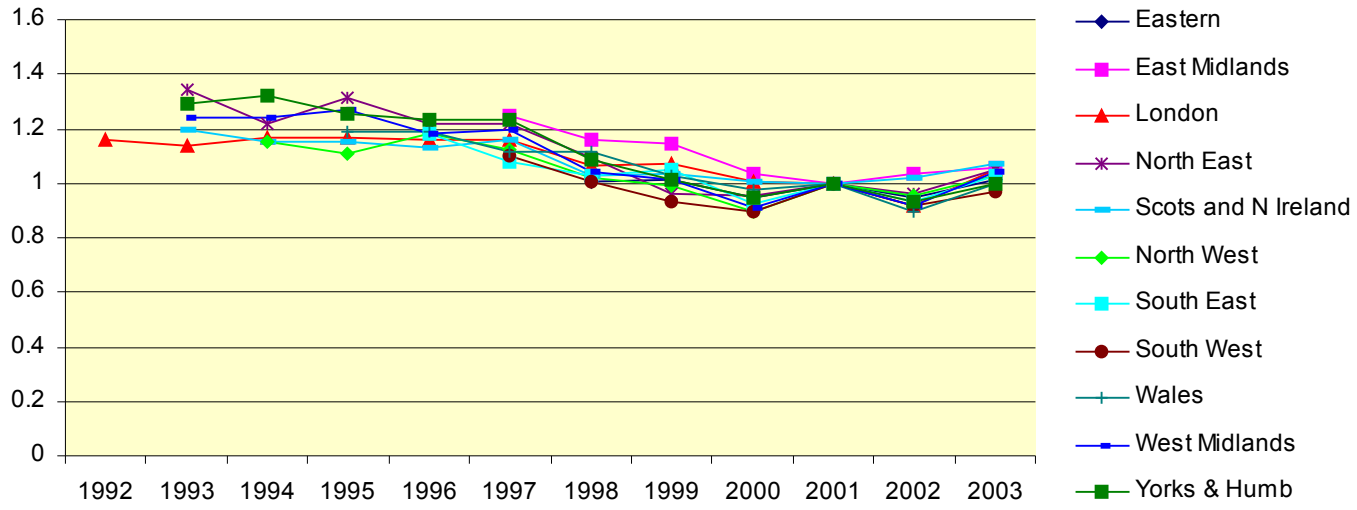
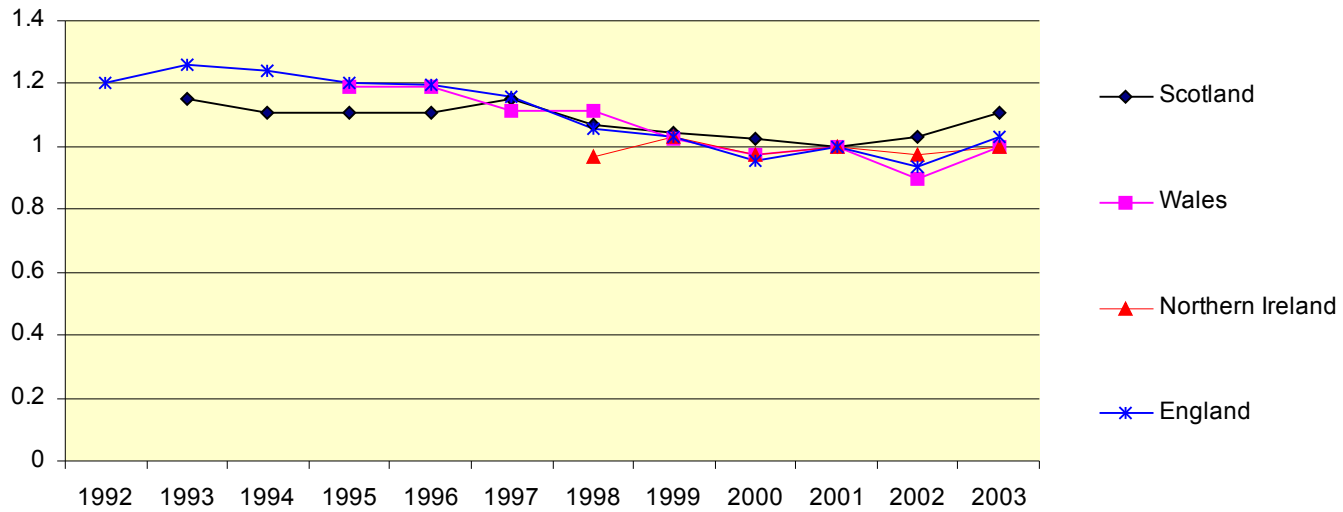


Figure A2.20 Normalised Nitrogen Dioxide Concentrations Averaged by Country



Appendix 3

A3.1 The number of exceedences of 200 μg/m^3 as a 1-hour mean nitrogen dioxide concentration is difficult to show graphically. The data for all site-years with at least 90% data capture are therefore tabulated below.

Table A3.1 The Number of Exceedences of 200 μg/m^3 as a 1-hour Mean Nitrogen Dioxide Concentration, each Year at each Site With at Least 90% Data Capture.

Region	Site	Type	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
E	CambridgeRoadside	Roadside									0	0	0	
E	NorwichRoadside	Roadside							0		0	0	0	0
E	StOsyth	Rural												0
E	WickenFen	Rural							0					
E	Stevenage	Suburban	0	0										
E	Southend-on-Sea	Urban background										0	0	
E	Thurrock	Urban background								0	0	0	0	1
E	NorwichCentre	Urban centre							0	0	0	0	0	0
EM	LincolnRoadside	Roadside							41	14				
EM	Ladybower	Rural	0						0		0		0	0
EM	Northampton	Urban background											0	0
EM	LeicesterCentre	Urban centre			0	1	0	1	0	0	0	0	0	0
EM	NottinghamCentre	Urban centre							0	0	0		0	0
L	CamdenKerbside	Kerbside						34	6	7	0	0	2	4
L	LondonCromwellRoad	Kerbside	49	32	68	133								
L	LondonMaryleboneRoad	Kerbside							71	64	104	60	2	434
L	HaringeyRoadside	Roadside						32	0	1		0	0	
L	HounslowRoadside	Roadside								0	0	0		
L	LondonA3Roadside	Roadside							0	6	0	0		
L	LondonBromley	Roadside								0			0	0
L	LondonCromwellRoad2	Roadside								12	13	2	0	6
L	SuttonRoadside	Roadside						12	0	0		3		
L	TowerHamletsRoadside	Roadside						40	10	11	3		2	4
L	LondonBexley	Suburban				1	3	0	0	0	0	0		0
L	LondonEltham	Suburban						14		0	0	0	0	0
L	LondonHillingdon	Suburban						18			0	0	0	
L	LondonSutton	Suburban						0	0	0	0	0		
L	LondonBrent	Urban background						12	0	0	0		0	1
L	LondonBridgePlace	Urban background	71	9	59	44	26	21	1					
L	LondonN.Kensington	Urban background					4	20	2	0	3	4	0	0
L	LondonTeddington	Urban background						7	0	0	0	0	0	0
L	LondonWestminster	Urban background											0	
L	WestLondon	Urban background	11	9	20	10	17	38	0	1	0	0	0	0
L	LondonBloomsbury	Urban centre		5	15	24	17	20	0	9	0			
L	LondonHackney	Urban centre						35	3	9	1	0		3
L	LondonLewisham	Urban centre							0	0			0	1
L	LondonSouthwark	Urban centre							0	0	0	0		
L	LondonWandsworth	Urban centre						13	0	0	0	0	0	8
NE	Stockton-on-TeesYarm	Roadside										0	1	
NE	Redcar	Suburban							0	0	0		0	0
NE	NewcastleCentre	Urban centre		14	8	0	0	0	0		0		0	0
NE	Billingham	Urban industrial	1	1	1				3	0	2	3	3	2
NE	Middlesbrough	Urban industrial					0	1	0	0		1		0
NI	Derry	Urban background									0	0	0	0
NI	BelfastCentre	Urban centre		6	0	15	3	0	0	0			0	0
NW	BuryRoadside	Roadside							6		5	11	0	
NW	ManchesterSouth	Suburban						0	0			0		0
NW	Blackpool	Urban background											0	0
NW	Bolton	Urban background							0	0	0	4	0	0
NW	ManchesterTownHall	Urban background	84	9	109	12	4	6	0	0	0	11	0	0
NW	Preston	Urban background										0	0	0
NW	Stockport	Urban background						0	0	0	0	22		
NW	StockportShawHeath	Urban background												2
NW	WiganLeigh	Urban background										0	0	0
NW	WirralTranmere	Urban background										0	0	0
NW	LiverpoolCentre	Urban centre			0	0	0	0	0	0	0	1		
NW	ManchesterPiccadilly	Urban centre					7	0	0	0	0		0	3
NW	SalfordEccles	Urban industrial							0	1	0	13	0	1

Table A3.1 (continued) The Number of Exceedences of 200 μg/m^3 as a 1-hour Mean Nitrogen Dioxide Concentration, each Year at each Site With at Least 90% Data Capture.

Region	Site	Type	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Scot	GlasgowKerbside	Kerbside							65	46	18	54	38	42
Scot	Dumfries	Roadside											0	3
Scot	Inverness	Roadside											0	0
Scot	Aberdeen	Urban background									0	0	0	
Scot	GlasgowCityChambers	Urban background	0		3	0	3	15	4	3	7	8	5	0
Scot	EdinburghCentre	Urban centre		1	0	3	0		0		1	8		
Scot	GlasgowCentre	Urban centre						4					2	
Scot	Grangemouth	Urban industrial										0		0
SE	BrightonRoadside	Roadside										0	3	
SE	HoveRoadside	Roadside							0			0	0	0
SE	OxfordCentre	Roadside								4	2	0	0	23
SE	Harwell	Rural											0	
SE	LullingtonHeath	Rural				0					0	0	0	
SE	Rochester	Rural						0	0	0		0	0	0
SE	Canterbury	Urban background										0	0	0
SE	Portsmouth	Urban background										0	0	0
SE	Reading	Urban background							0	0	0	0	0	
SE	ReadingNewTown	Urban background												
SE	SouthamptonCentre	Urban centre			0		0	3	0	0	0	0	0	0
SW	BathRoadside	Roadside							2				0	0
SW	BristolOldMarket	Roadside						2	5					
SW	ExeterRoadside	Roadside						0	0	0	0	0	3	0
SW	Bournemouth	Urban background											0	0
SW	BristolCentre	Urban centre			0	3	0		2	0	0	0	0	
SW	PlymouthCentre	Urban centre										0	0	0
Wales	Wrexham	Roadside												1
Wales	Cwmbran	Urban background											0	
Wales	PortTalbot	Urban background							0	0		0	0	0
Wales	CardiffCentre	Urban centre		0	15	0	0	0	0	0	0	0	7	
Wales	Swansea	Urban centre				0	0	0	0	0	0	0	0	0
WM	WalsallWillenhall	Suburban							0			2	0	0
WM	BirminghamEast	Urban background			9	24		3	0	0	0	0	0	0
WM	LeamingtonSpa	Urban background							0	0	0	0	0	
WM	SandwellWestBromwich	Urban background								0		0	0	
WM	WalsallAlumwell	Urban background	19	2	13		0	1		0	1	0	0	0
WM	BirminghamCentre	Urban centre		1	5	21	0	1		0	0	1	0	
WM	CoventryCentre	Urban centre							0					
WM	Stoke-on-TrentCentre	Urban centre									0	0	0	0
WM	WolverhamptonCentre	Urban centre					0	8	0	0	0	0	0	1
Y	BarnsleyGawber	Urban background									0			0
Y	BradfordCentre	Urban centre							0	0	0	18	0	1
Y	HullCentre	Urban centre			2	0	1	0	0	0	0	0		
Y	LeedsCentre	Urban centre			7	1	0	2	0	0	0	0		
Y	RotherhamCentre	Urban centre									1	0	0	0
Y	SheffieldCentre	Urban centre					1	0	0	0	0	0	0	0
Y	SheffieldTinsley	Urban industrial	21	33	7		0	1	5	0	0	0	0	0

A3.2 In order to provide some rudimentary analysis of these data, focusing only on sites with data for 2003 and at least 1 of the 2 preceding years (2001 and 2002) those sites which measured more exceedences of 200μg/m^3 in 2003 than in either preceding year were identified. These are listed in Table A3.2. Those sites that measured fewer exceedences than in one of the 2 preceding years were also identified. These are also listed in Table A3.2. Finally those sites with no reported change over these 3 years were identified. The results show that despite some sites showing large increases in the number of 1-hour exceedences, on the whole there has been no significant net worsening of air quality with regard to the 1-hour NO_2 standard.

Table A3.2 Sites Reporting a Deterioration, Improvement, and No Net Change in Air Quality with Regard to the 1-hour Nitrogen Dioxide Standard during the period 2001 to 2003 (inclusive).

Sites With More Exceedences of the 1-hour NO_2 standard in 2003 than in either of the 2 previous years	Sites With an Equal Number of Exceedences[1] of the 1-hour NO_2 standard in 2003 as in 1 of the 2 previous years	Sites With Fewer Exceedences of the 1-hour NO_2 standard in 2003 than in 1 of the 2 previous years
CamdenKerbside	NorwichRoadside	GlasgowKerbside
LondonMarylebone Road	LondonBromley	ExeterRoadside
LondonCromwellRoad2	SouthwarkRoadside	LondonN.Kensington
TowerHamletsRoadside	Inverness	Bolton
Dumfries	HoveRoadside	ManchesterTownHall
OxfordCentre	BathRoadside	GlasgowCityChambers
Thurrock	Ladybower	BradfordCentre
LondonBrent	Rochester	Billingham
LondonHackney	LondonBexley	Middlesbrough
LondonLewisham	LondonEltham	SalfordEccles
LondonWandsworth	Redcar	
ManchesterPiccadilly	ManchesterSouth	
WolverhamptonCentre	WalsallWillenhall	
	Northampton	
	LondonTeddington	
	WestLondon	
	Derry	
	Blackpool	
	Preston	
	WiganLeigh	
	WirralTranmere	
	Canterbury	
	Portsmouth	
	Bournemouth	
	PortTalbot	
	BirminghamEast	
	WalsallAlumwell	
	NorwichCentre	
	LeicesterCentre	
	NottinghamCentre	
	NewcastleCentre	
	BelfastCentre	
	SouthamptonCentre	
	PlymouthCentre	
	Swansea	
	Stoke-on-TrentCentre	
	RotherhamCentre	
	SheffieldCentre	
	Grangemouth	
	SheffieldTinsley	
13 sites in total	**40 sites in total**	**10 sites in total**

[1] Invariably zero

Appendix 4

Figure A4.1 Annual Mean NO_x Concentrations in Eastern England ($\mu g/m^3$)

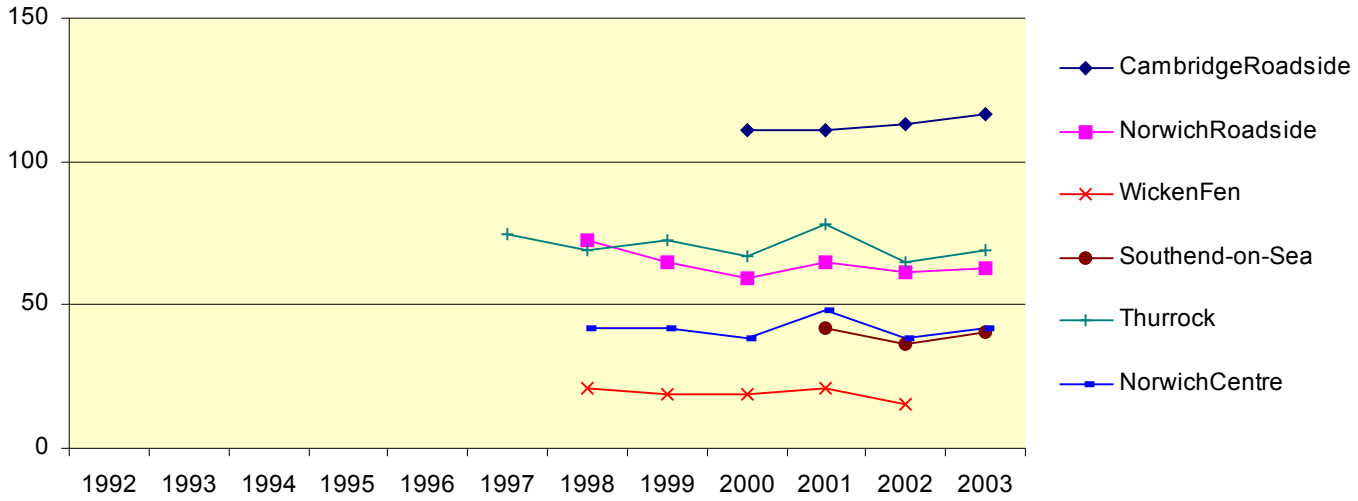


Figure A4.2 Annual Mean NO_x Concentrations in the East Midlands ($\mu g/m^3$)

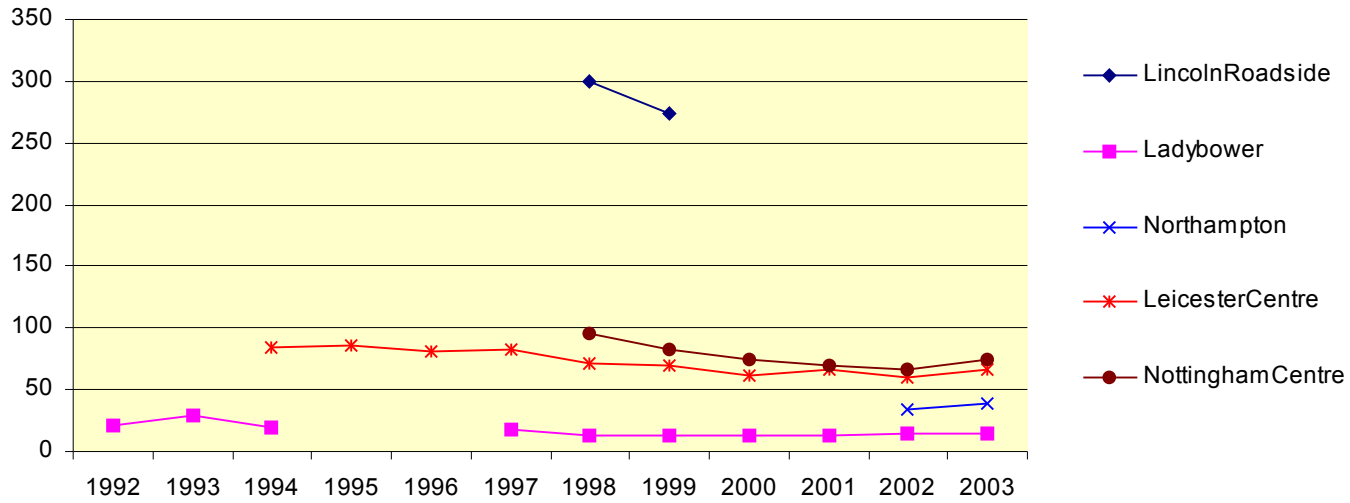


Figure A4.3 Annual Mean NO_x Concentrations in North East England ($\mu g/m^3$)

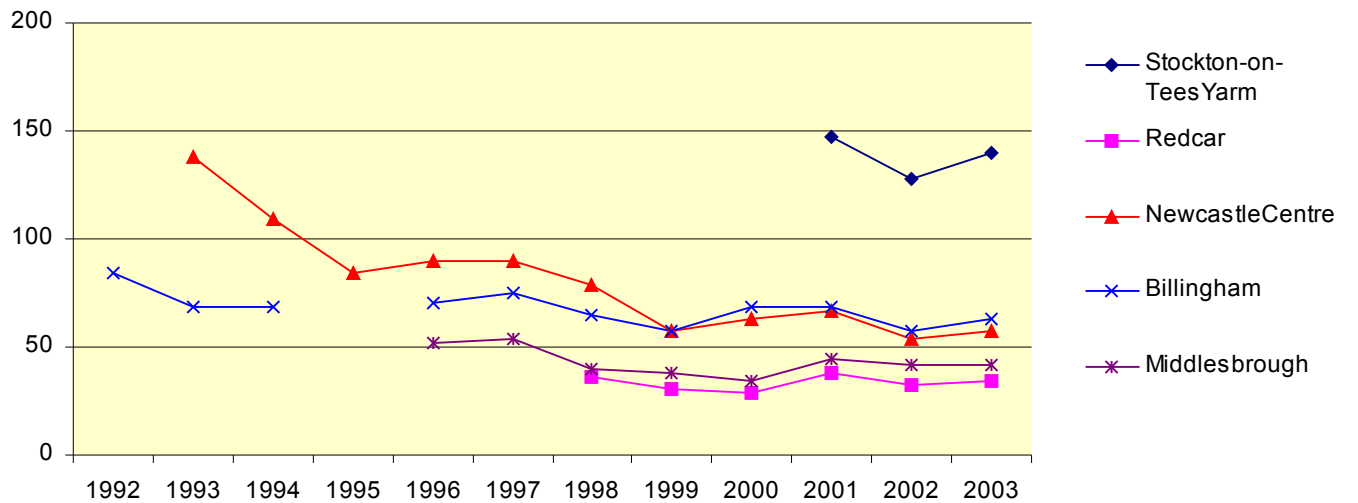


Figure A4.4 Annual Mean NO_x Concentrations in North West England ($\mu g/m^3$)

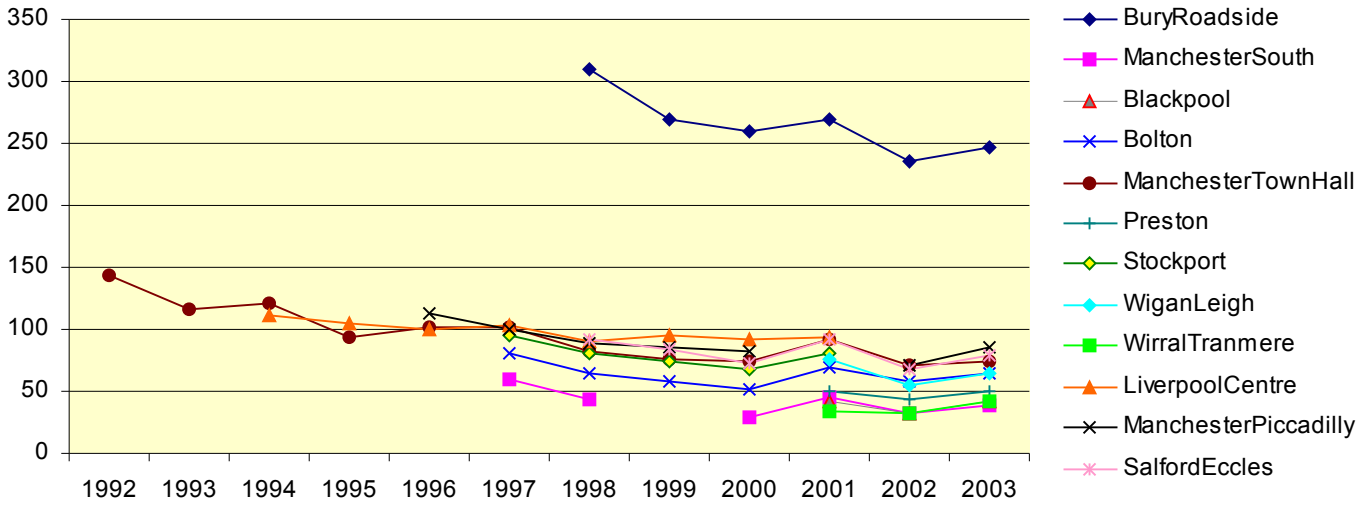


Figure A4.5 Annual Mean NO_x Concentrations in South East England ($\mu g/m^3$)

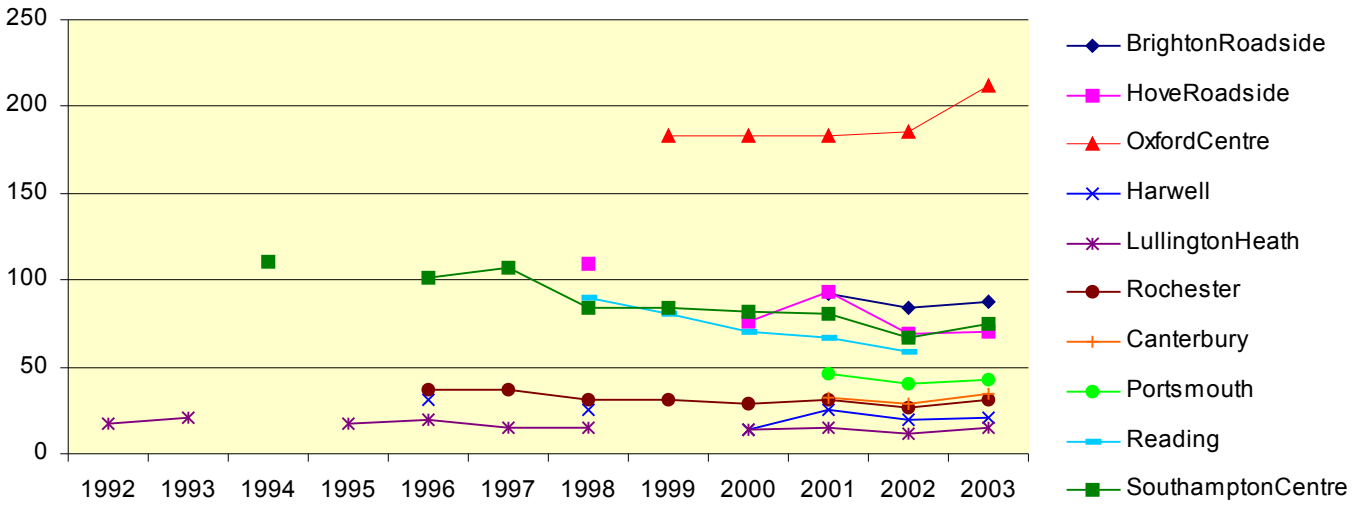


Figure A4.6 Annual Mean NO_x Concentrations in South West England ($\mu g/m^3$)

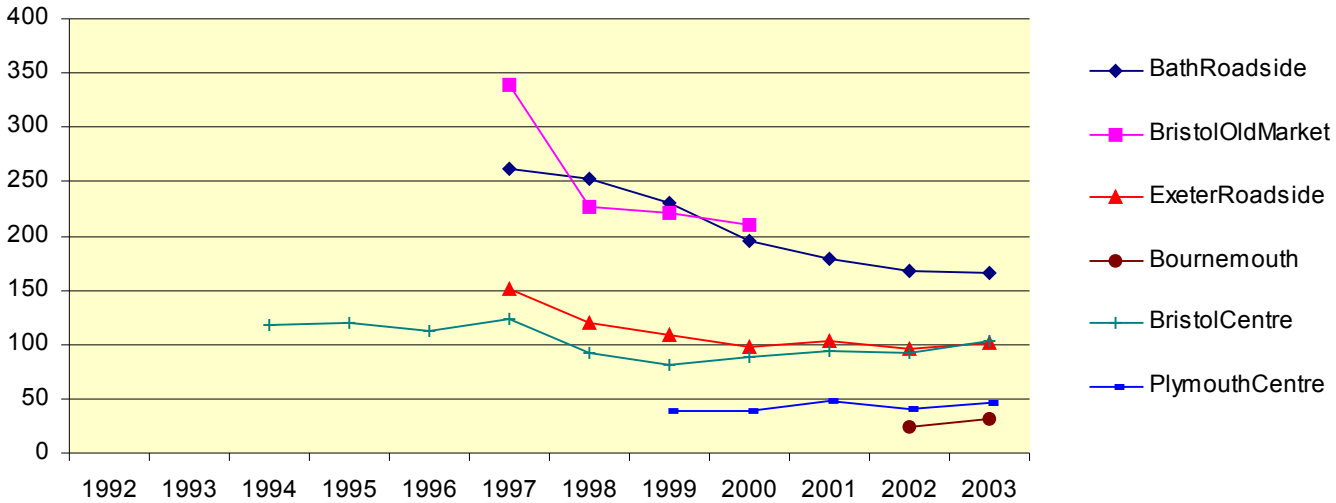


Figure A4.7 Annual Mean NO_x Concentrations in Wales ($\mu g/m^3$)

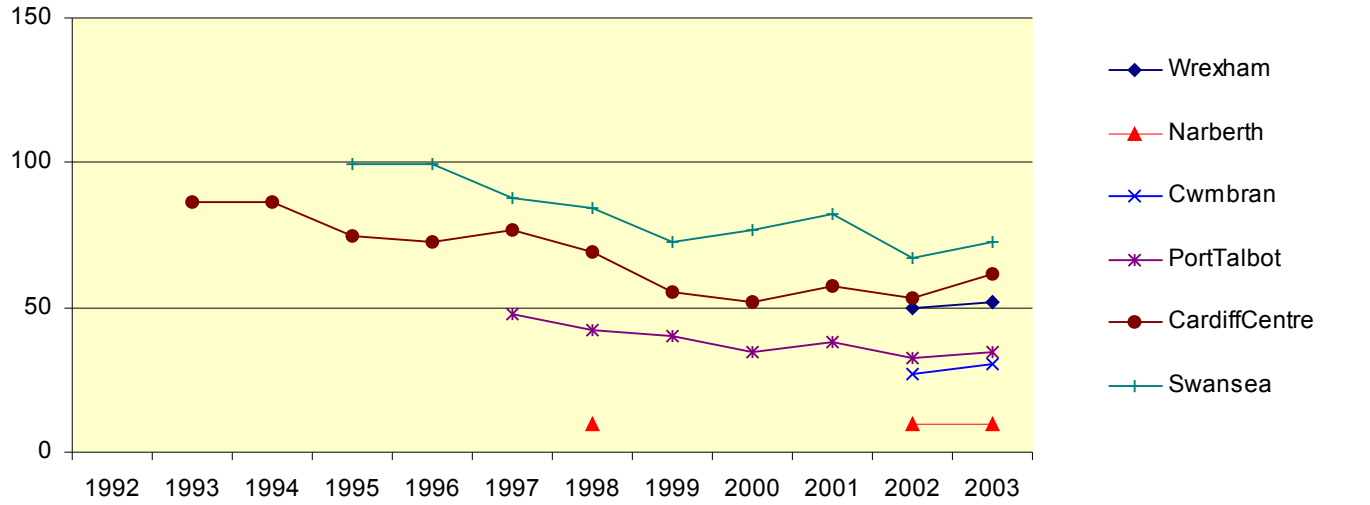


Figure A4.8 Annual Mean NO_x Concentrations in the West Midlands ($\mu g/m^3$)

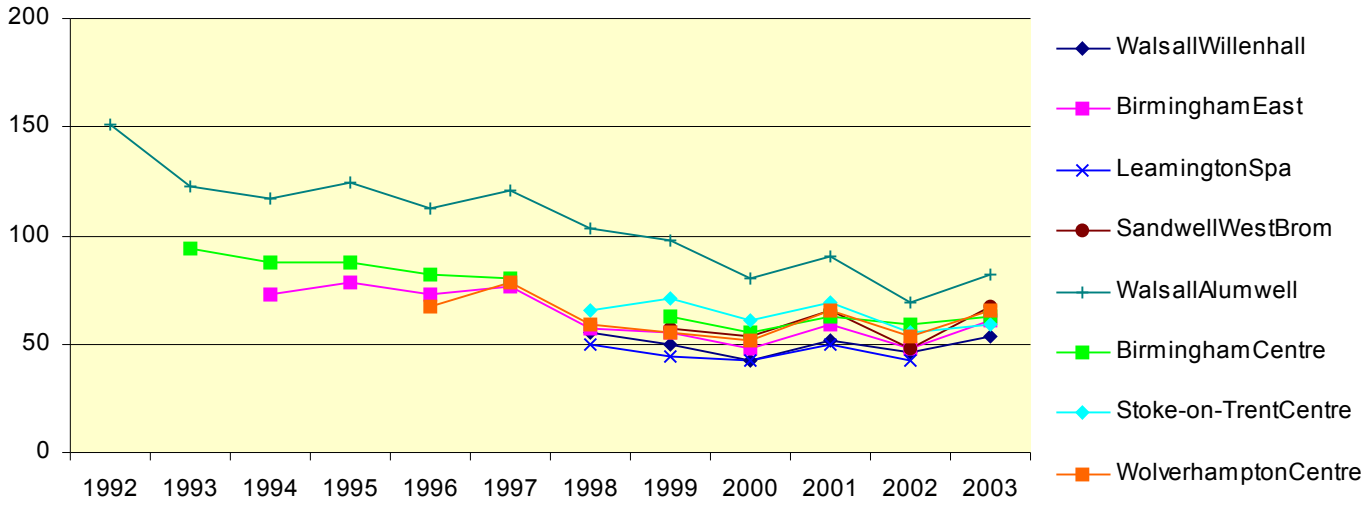


Figure A4.9 Annual Mean NO_x Concentrations in Yorkshire and Humberside ($\mu g/m^3$)

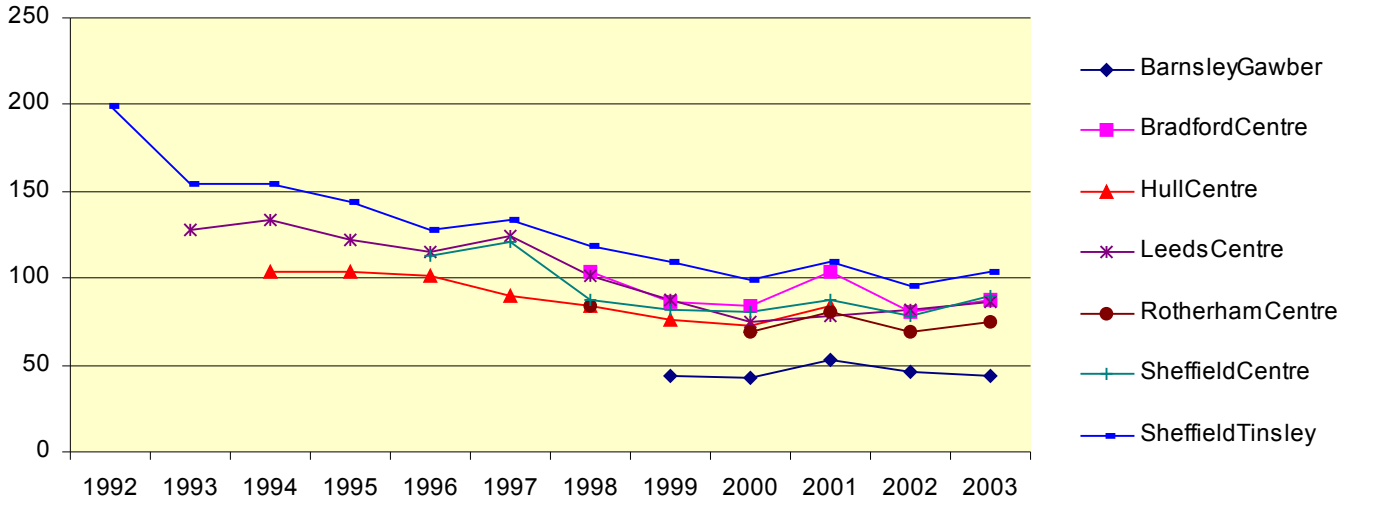


Figure A4.10 Annual Mean NO_x Concentrations in Scotland and Northern Ireland ($\mu g/m^3$)

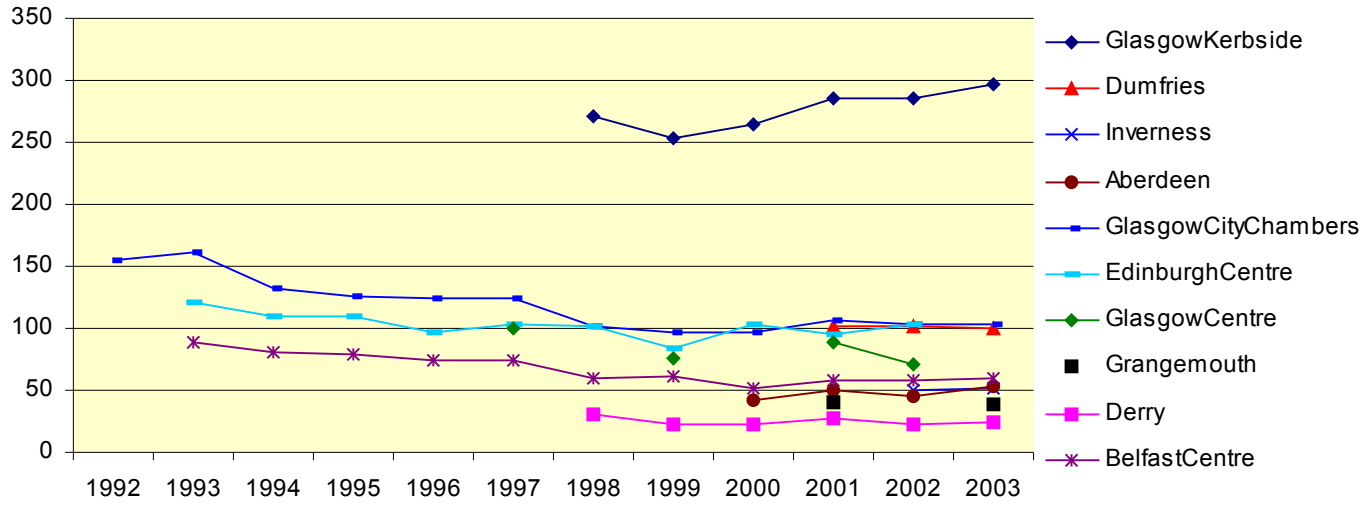


Figure A4.11 Annual Mean NO_x Concentrations at Roadside and Kerbside Sites in London ($\mu g/m^3$)

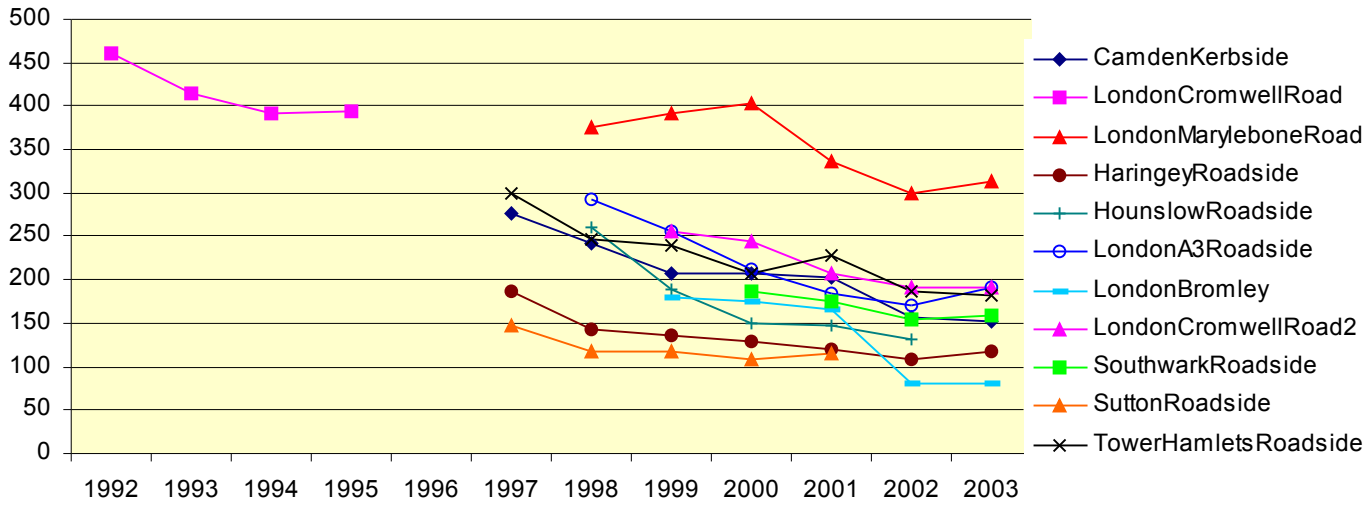


Figure A4.12 Annual Mean NO_x Concentrations at Other London Sites ($\mu g/m^3$)

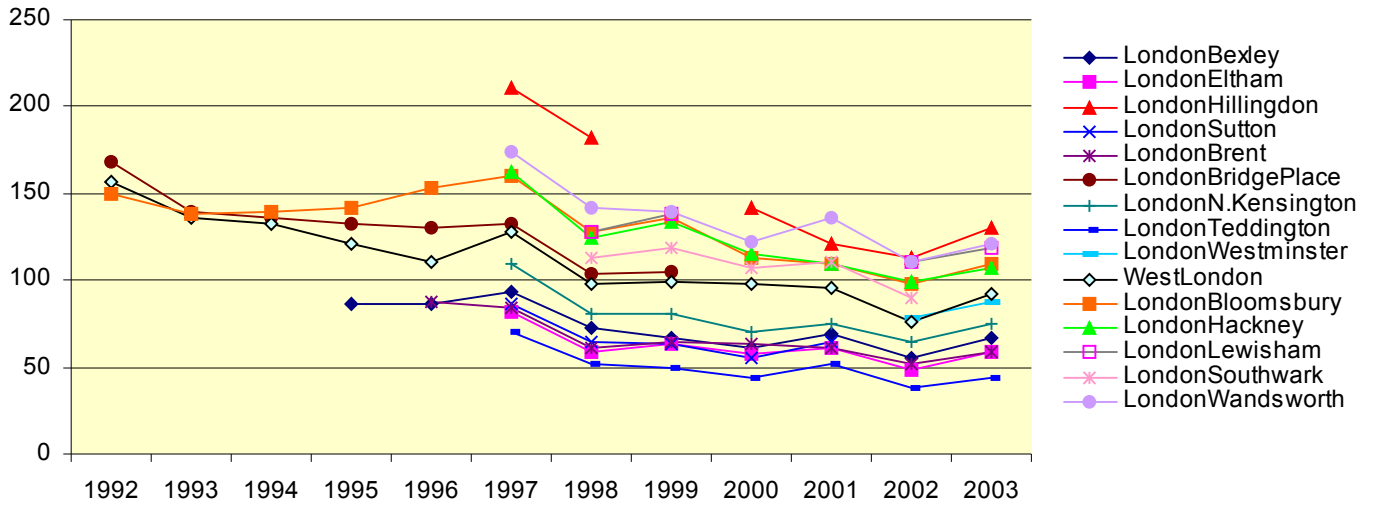


Figure A4.13 Average Annual Mean NO_x Concentrations across 10 Roadside and Kerbside Sites ($\mu g/m^3$)

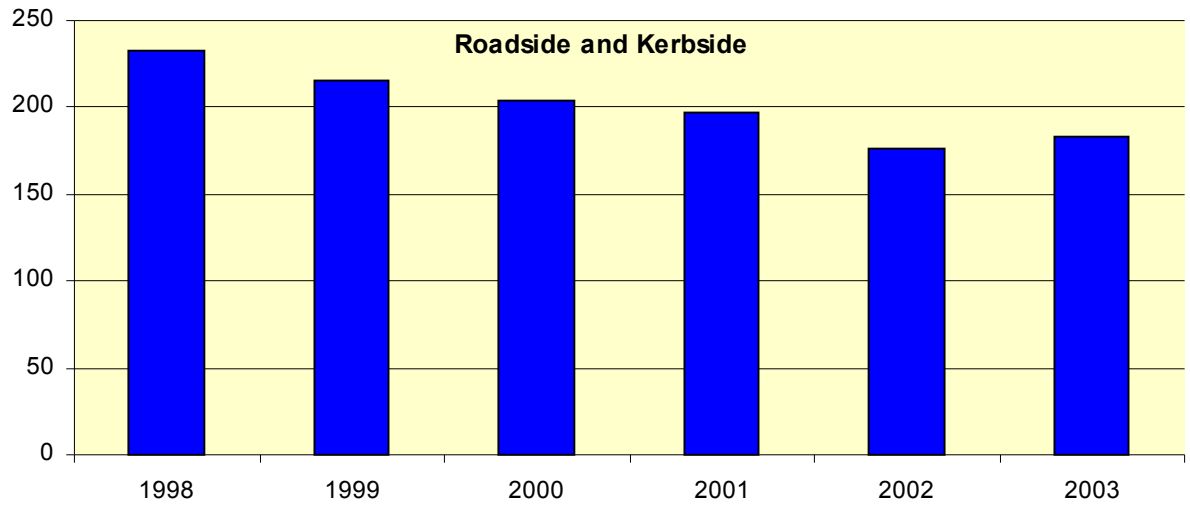


Figure A4.14 Average Annual Mean NO_x Concentrations across 16 Urban Centre Sites ($\mu g/m^3$)

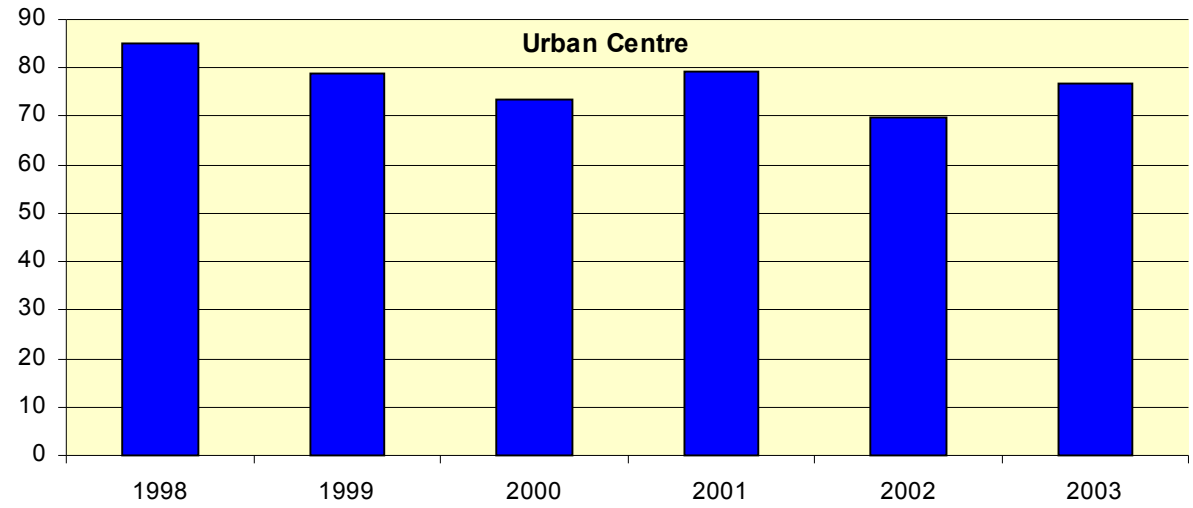


Figure A4.15 Average Annual Mean NO_x Concentrations across 4 Urban Industrial Sites ($\mu g/m^3$)

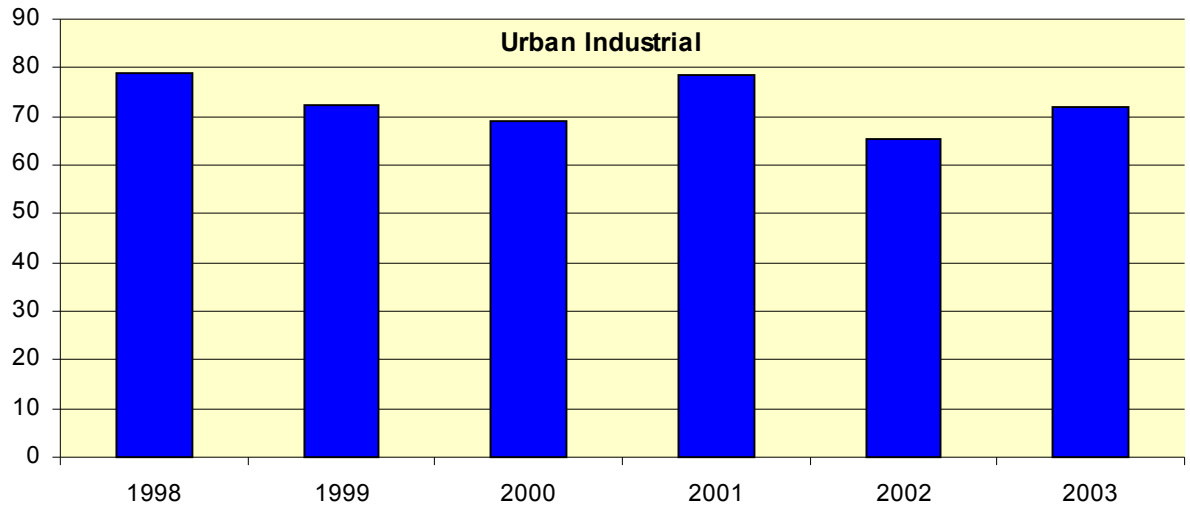


Figure A4.16 Average Annual Mean NO_x Concentrations across 16 Urban Background and Suburban Sites ($\mu g/m^3$)

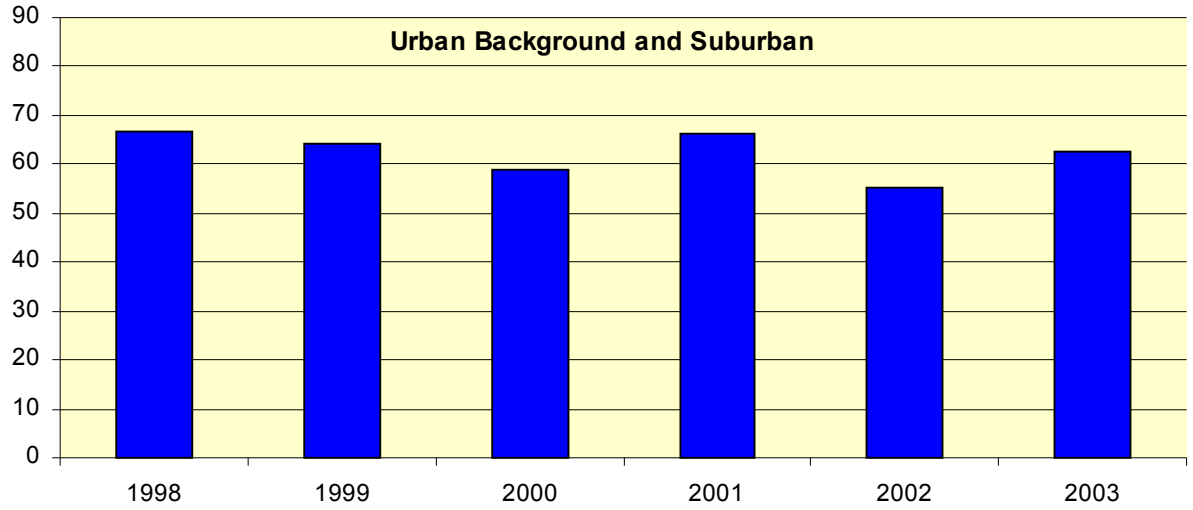


Figure A4.17 Average Annual Mean NO_x Concentrations across 2 Rural Sites ($\mu g/m^3$)

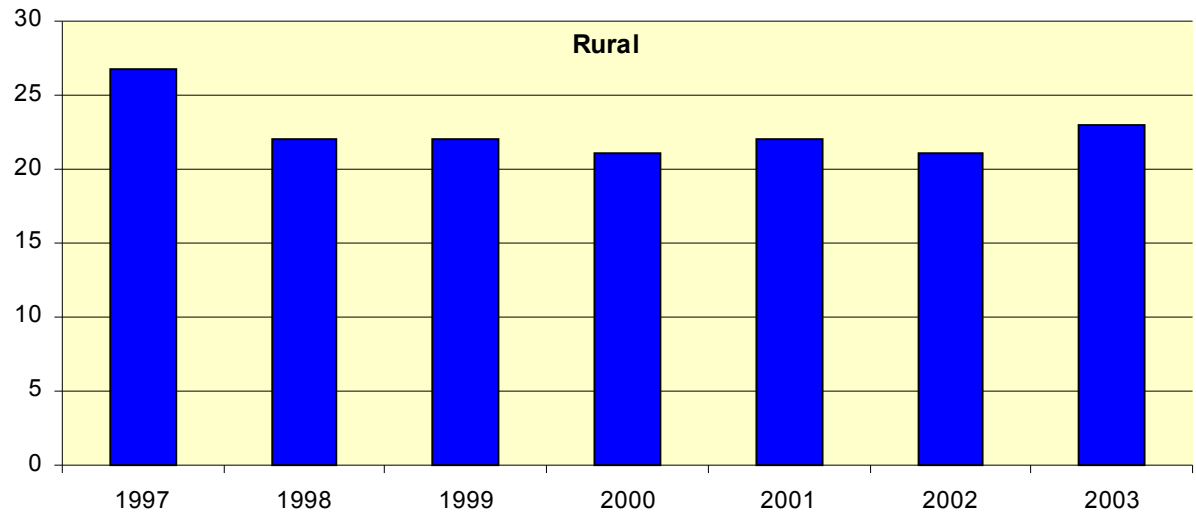


Figure A4.18 Normalised NO_x Concentrations Averaged by Site Type

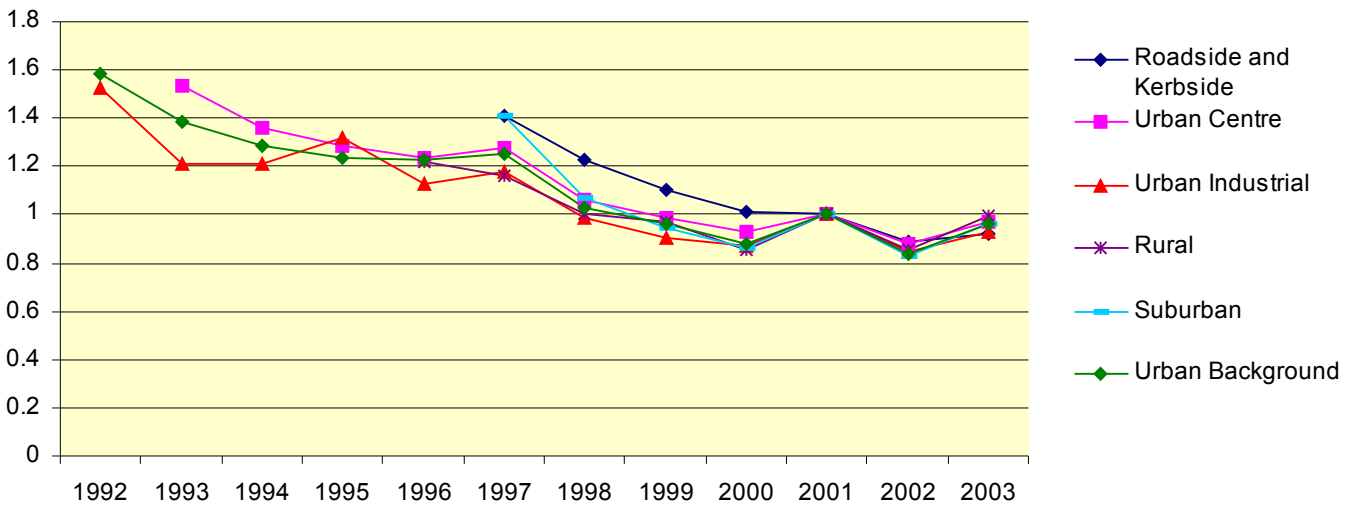


Figure A4.19 Normalised NO_x Concentrations Averaged by Region

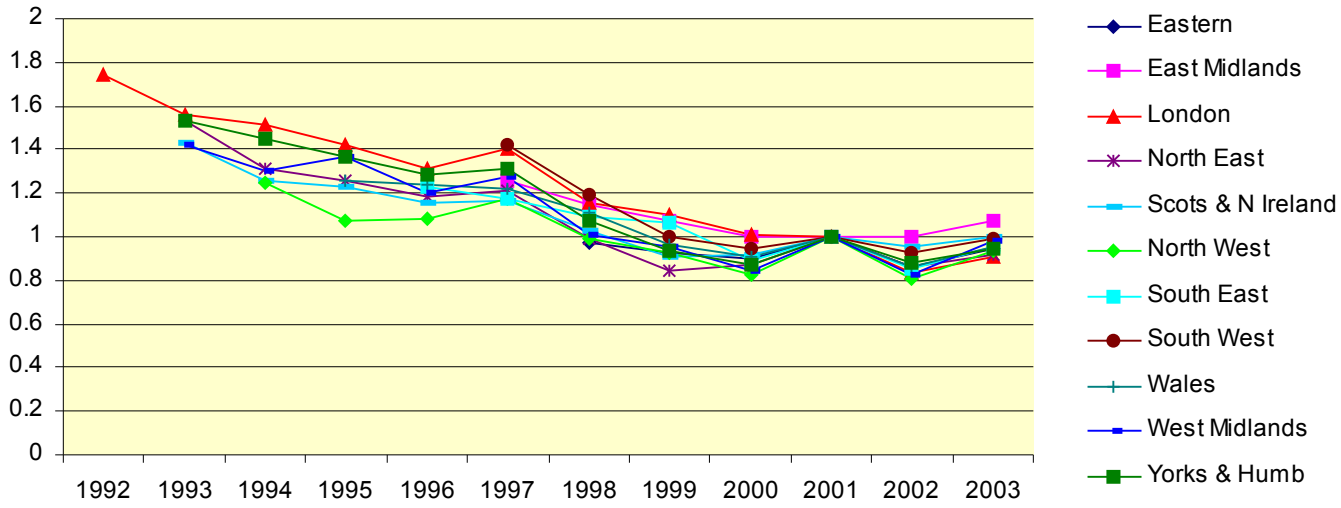
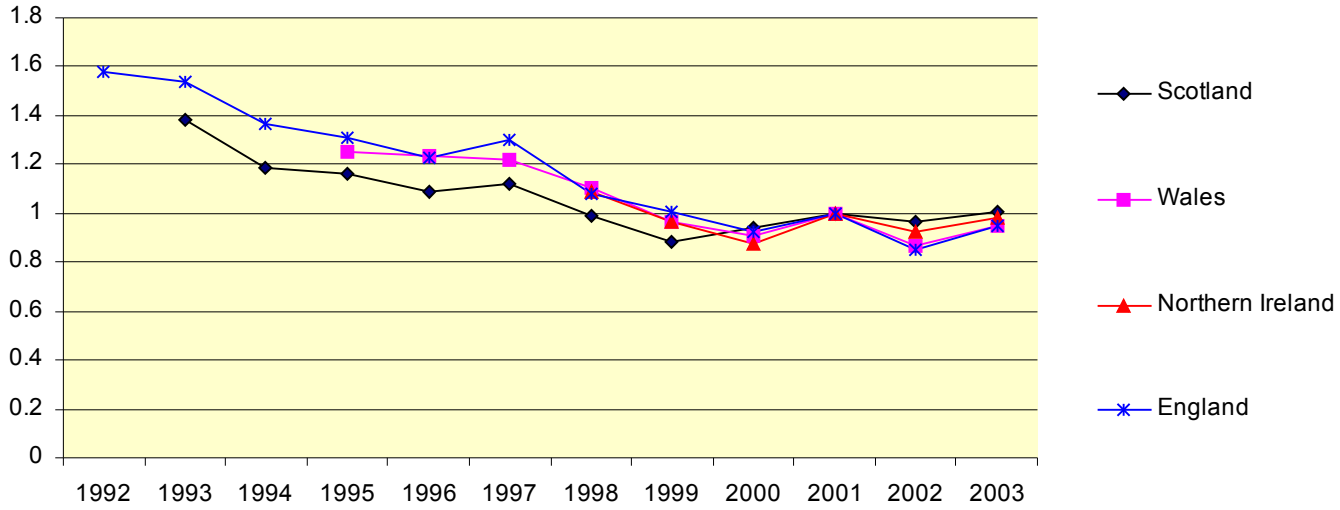


Figure A4.20 Normalised NO_x Concentrations Averaged by Country



Appendix 5

Figure A5.1 Annual Mean PM_{10} Concentrations in Eastern England ($\mu g/m^3$)

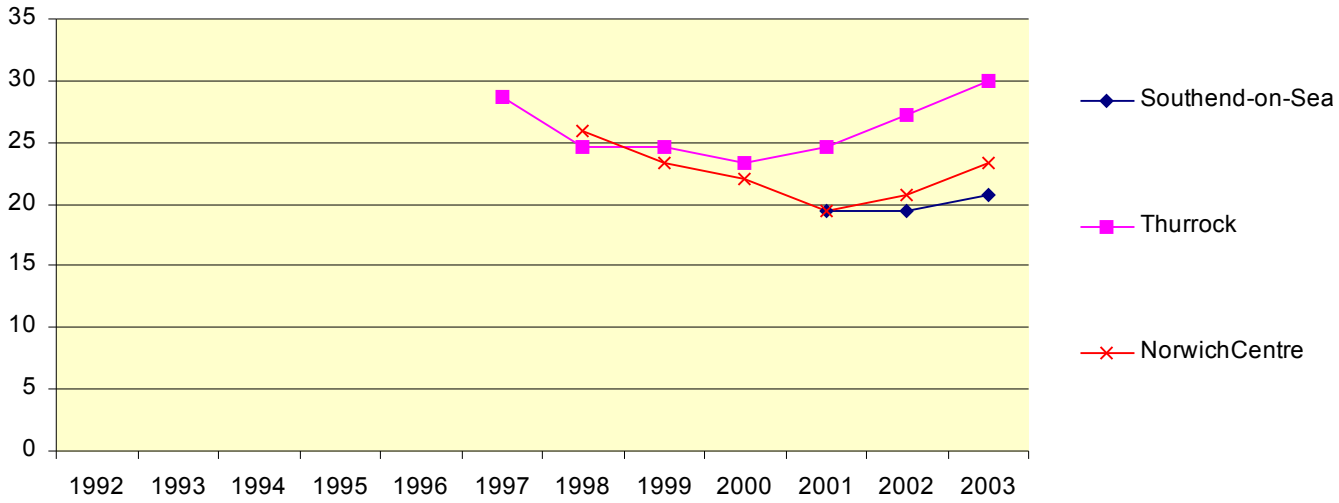


Figure A5.2 Annual Mean PM_{10} Concentrations in the East Midlands ($\mu g/m^3$)

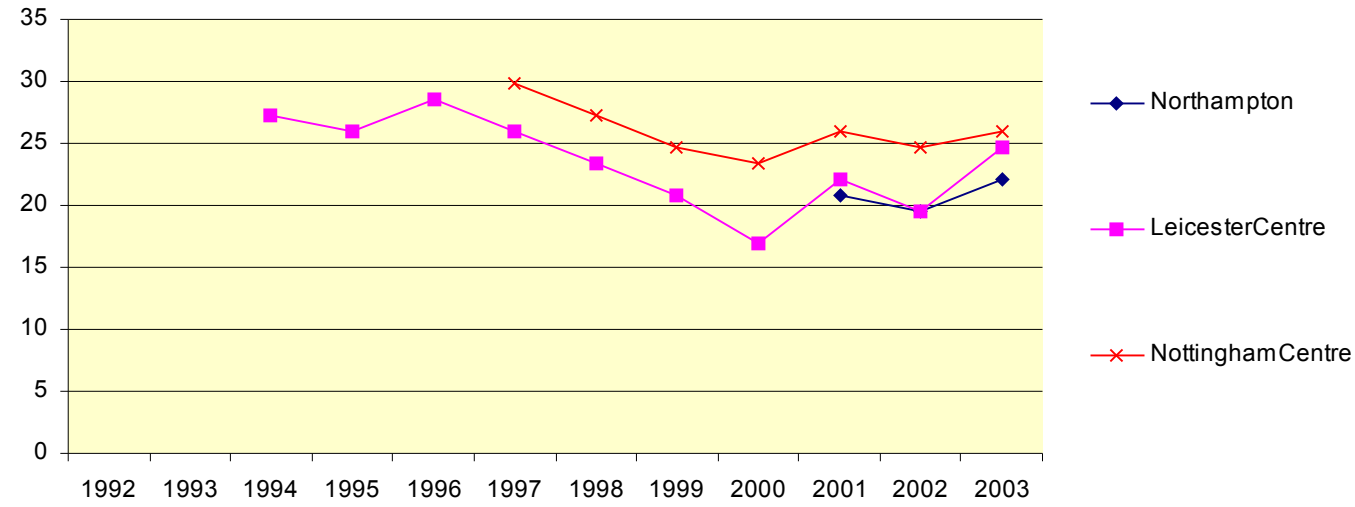


Figure A5.3 Annual Mean PM_{10} Concentrations in North East England ($\mu g/m^3$)

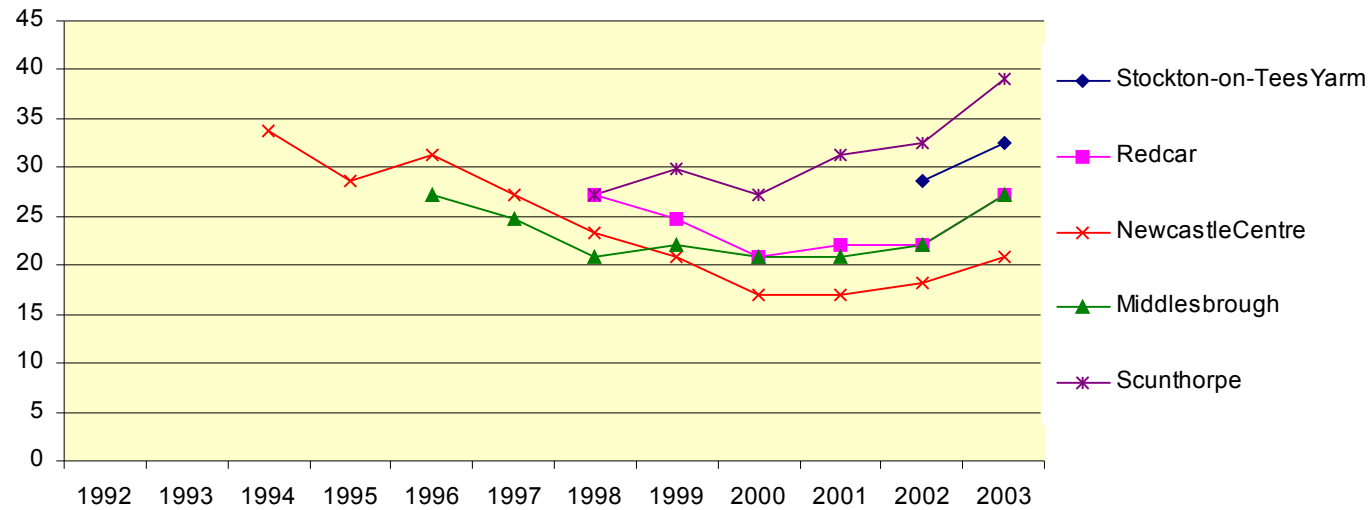


Figure A5.4 Annual Mean PM_{10} Concentrations in North West England ($\mu g/m^3$)

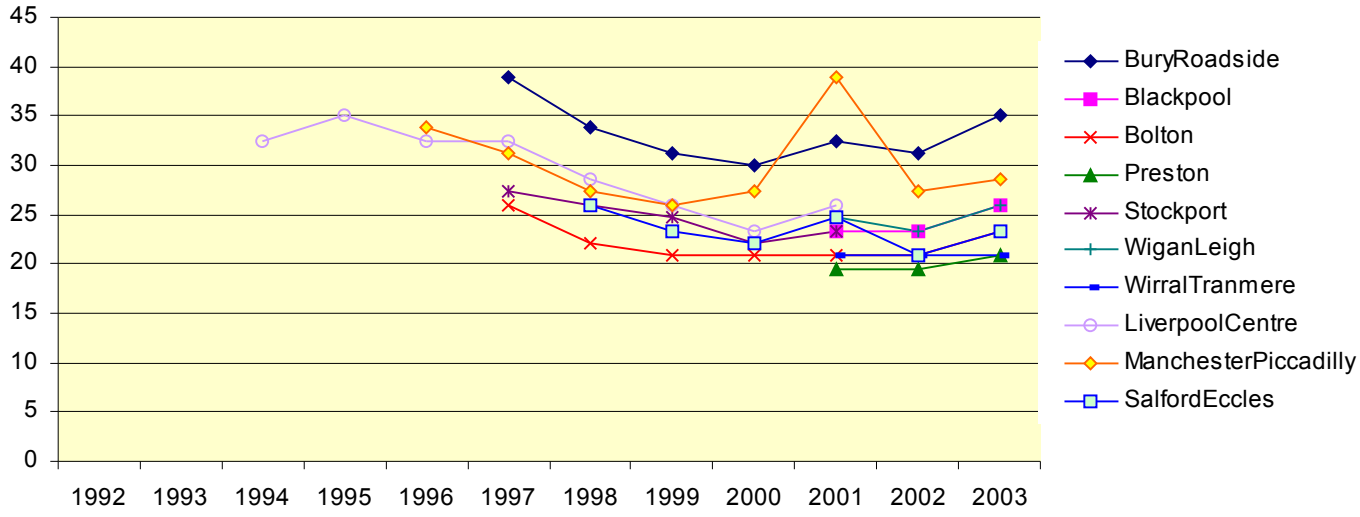


Figure A5.5 Annual Mean PM_{10} Concentrations in South East England ($\mu g/m^3$)

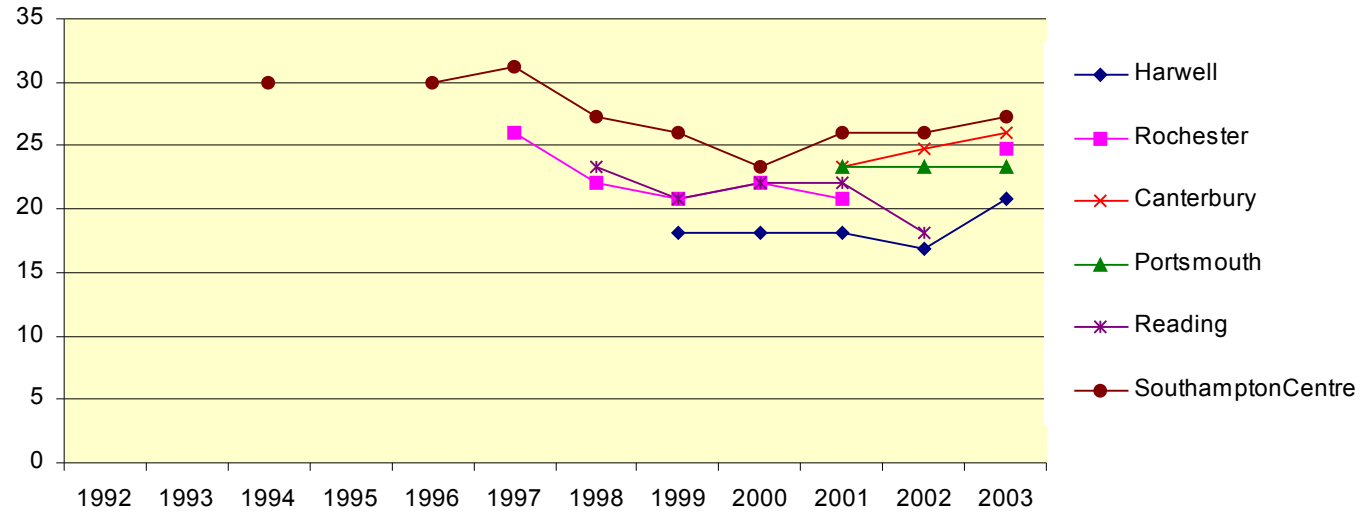


Figure 5.6 Annual Mean PM_{10} Concentrations in South West England ($\mu g/m^3$)

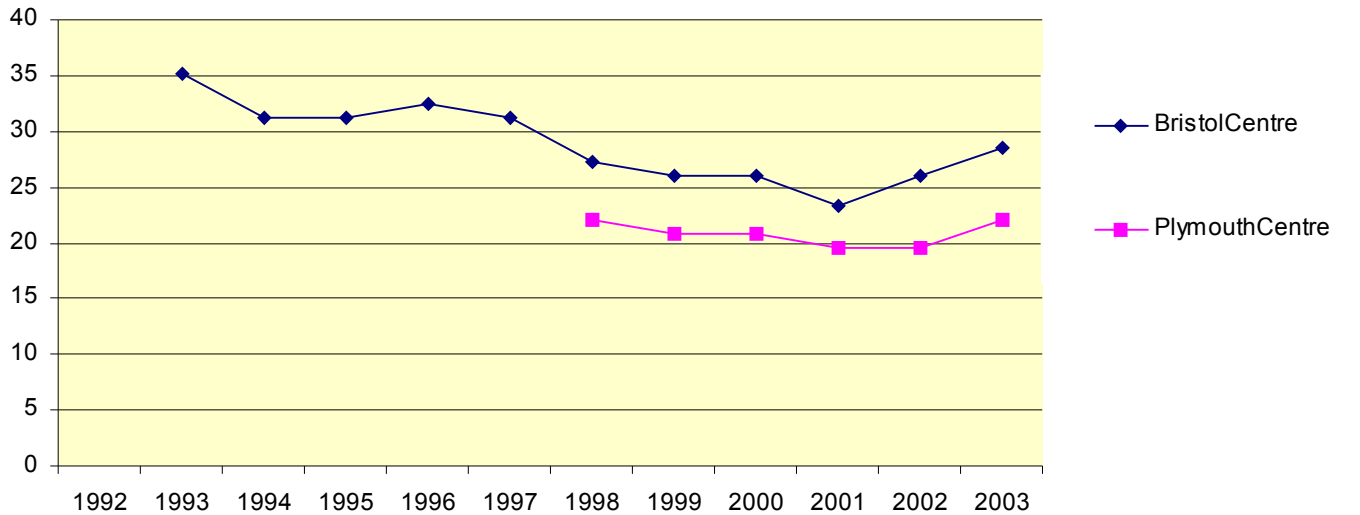


Figure A5.7 Annual Mean PM_{10} Concentrations in Wales ($\mu g/m^3$)

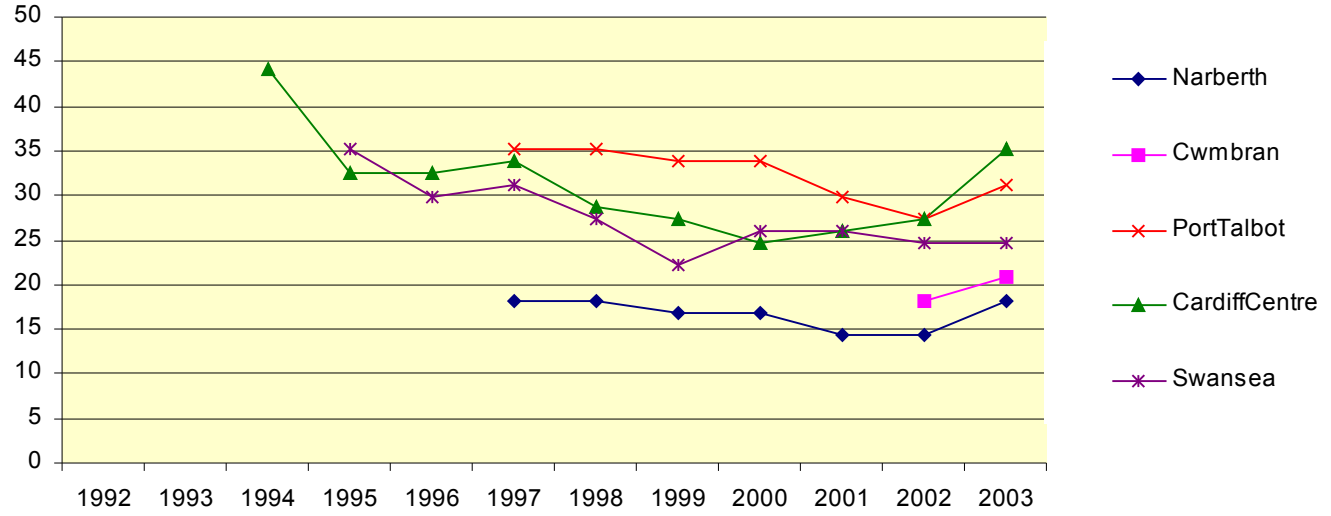


Figure A5.8 Annual Mean PM_{10} Concentrations in the West Midlands ($\mu g/m^3$)

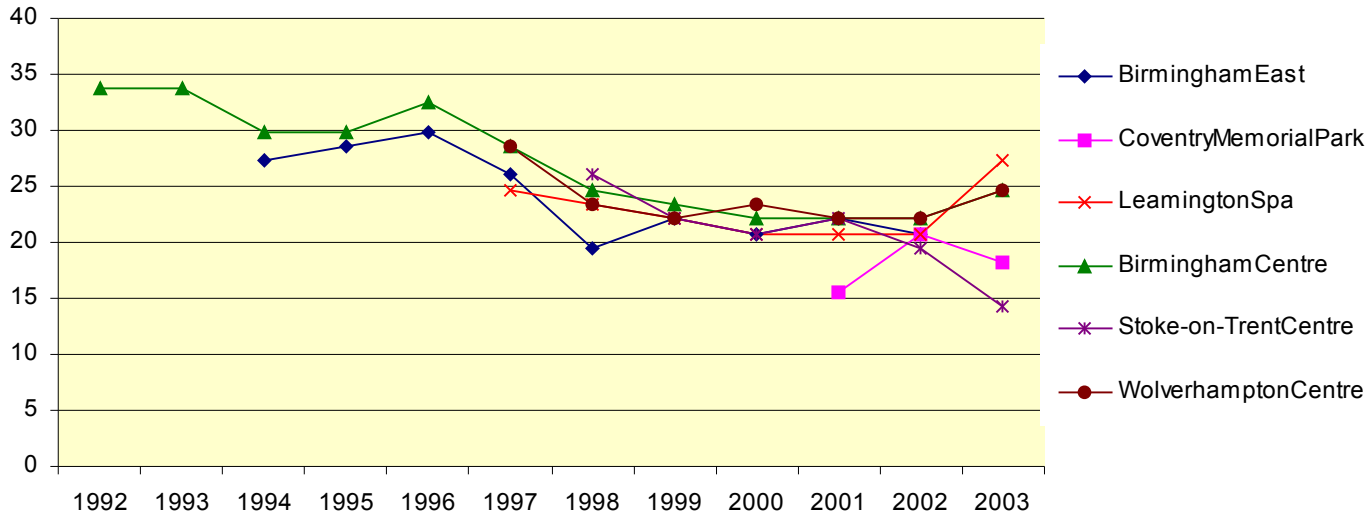


Figure A5.9 Annual Mean PM_{10} Concentrations in Yorkshire and Humberside ($\mu g/m^3$)

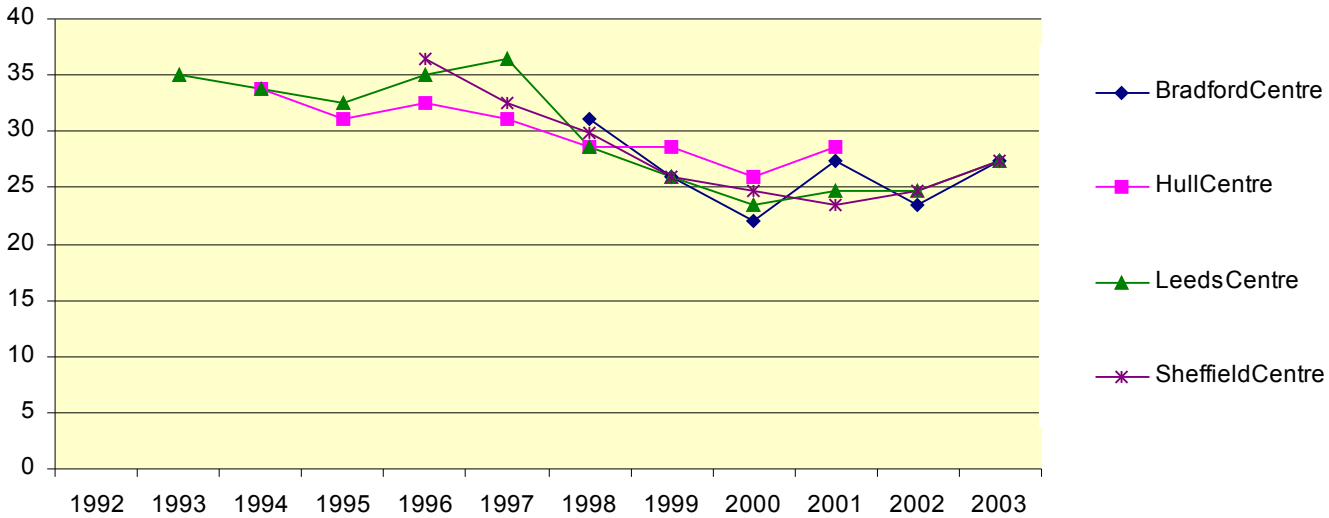


Figure A5.10 Annual Mean PM_{10} Concentrations in Scotland ($\mu g/m^3$)

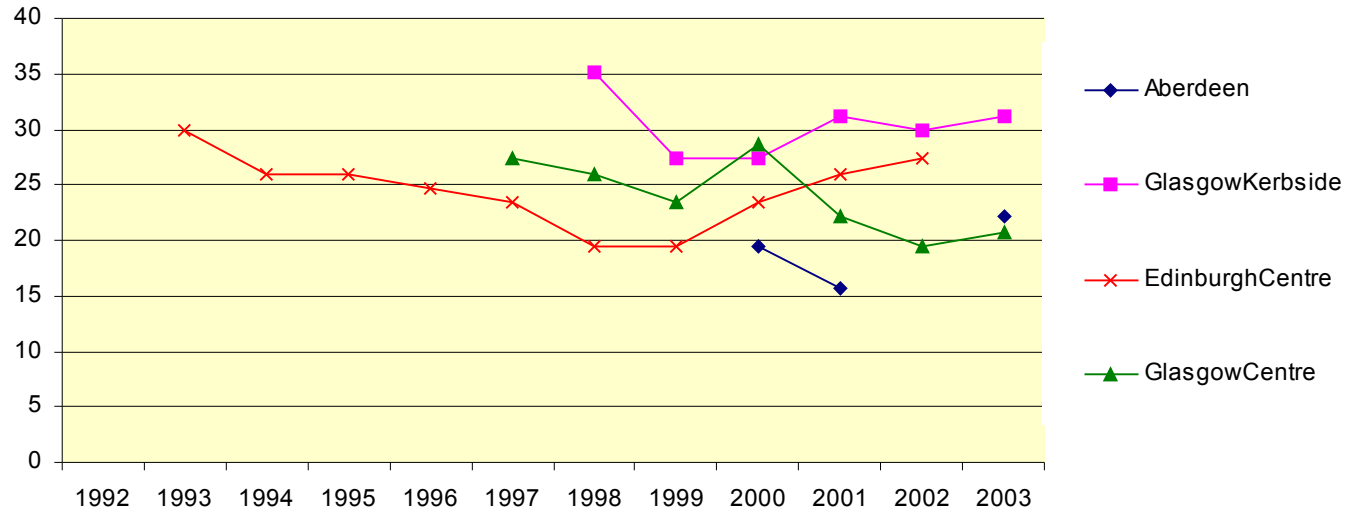


Figure A5.11 Annual Mean PM_{10} Concentrations in Northern Ireland ($\mu g/m^3$)

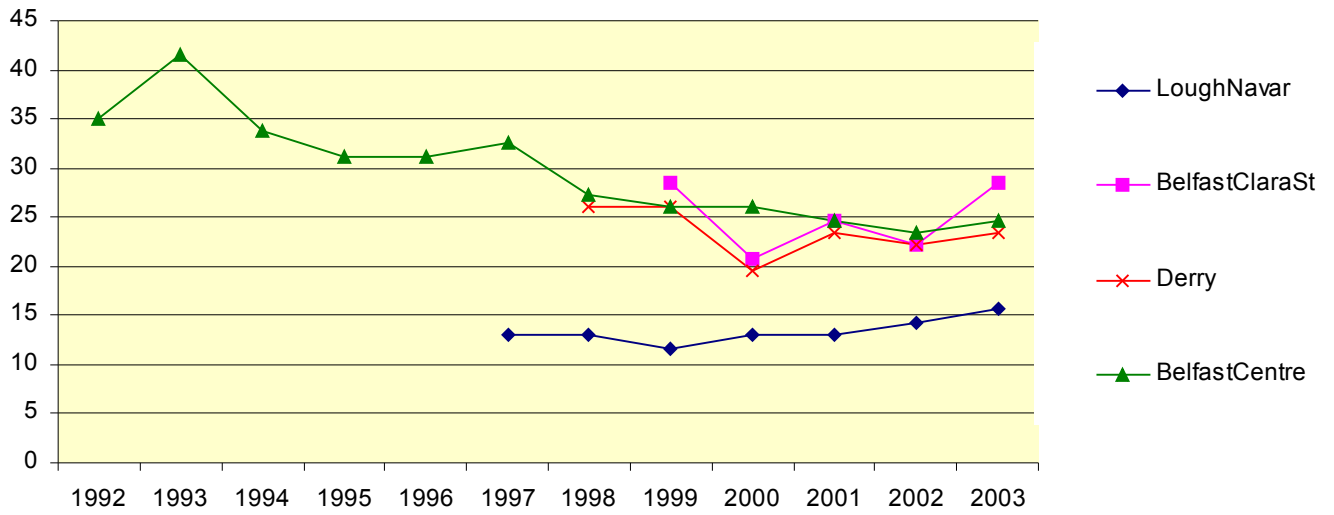


Figure A5.12 Annual Mean PM_{10} Concentrations at Roadside and Kerbside Sites in London ($\mu g/m^3$)

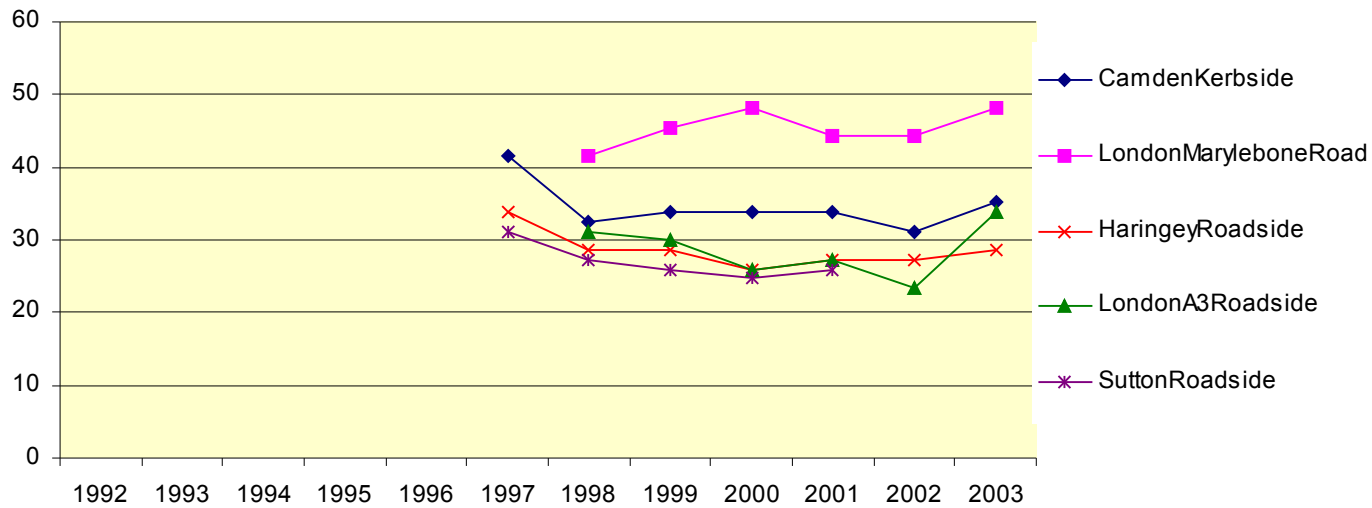


Figure A5.13 Annual Mean PM_{10} Concentrations at Other London Sites ($\mu g/m^3$)

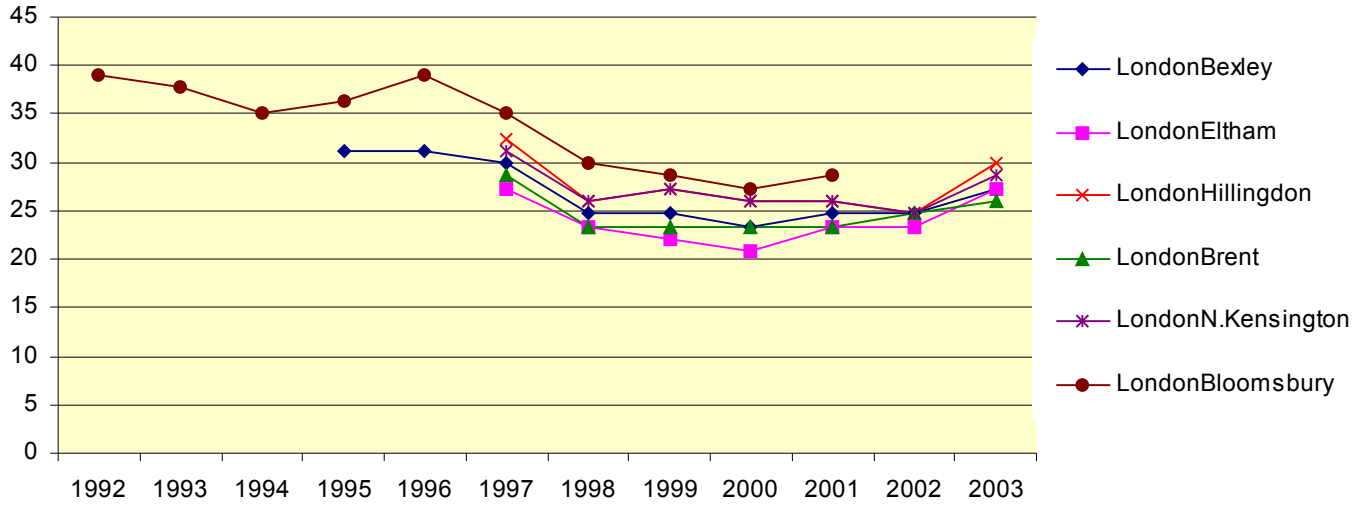


Figure A5.14 Average Annual Mean PM_{10} Concentrations across 6 Roadside and Kerbside Sites ($\mu g/m^3$)

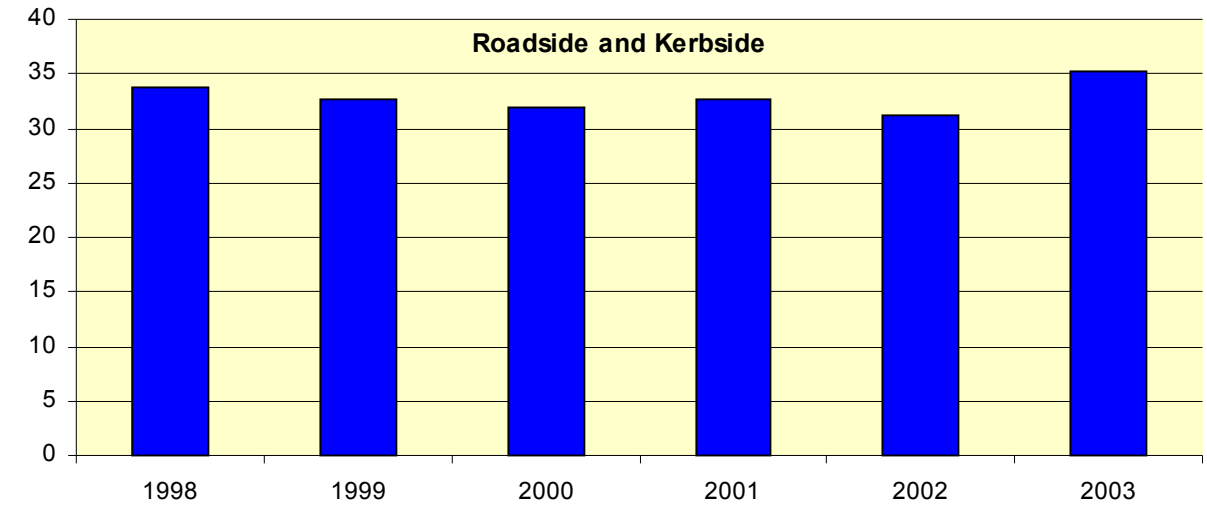


Figure A5.15 Average Annual Mean PM_{10} Concentrations across 18 Urban Centre Sites ($\mu g/m^3$)

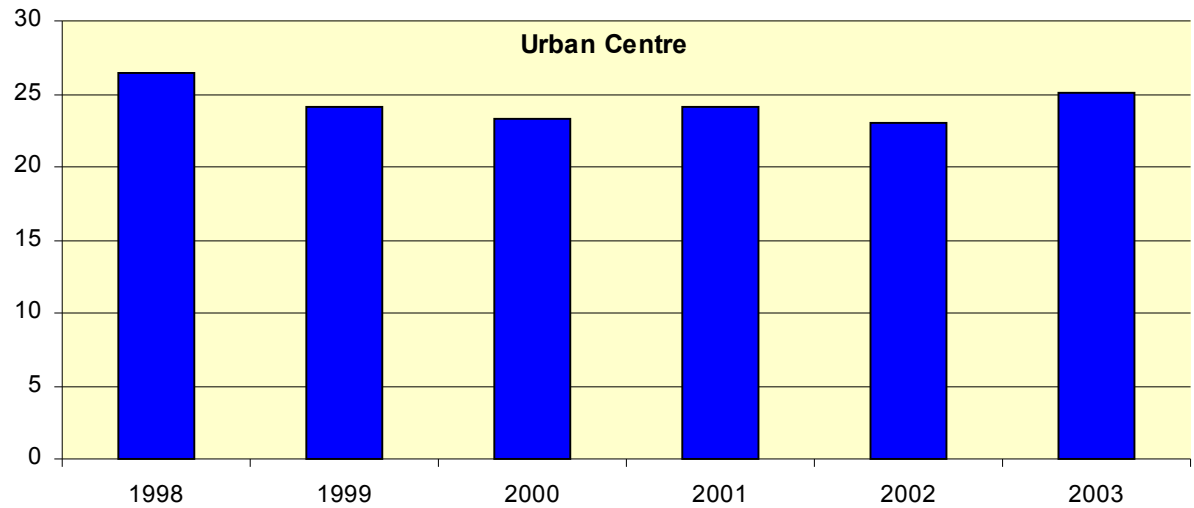


Figure A5.16 Average Annual Mean PM_{10} Concentrations across 3 Urban Industrial Sites ($\mu g/m^3$)

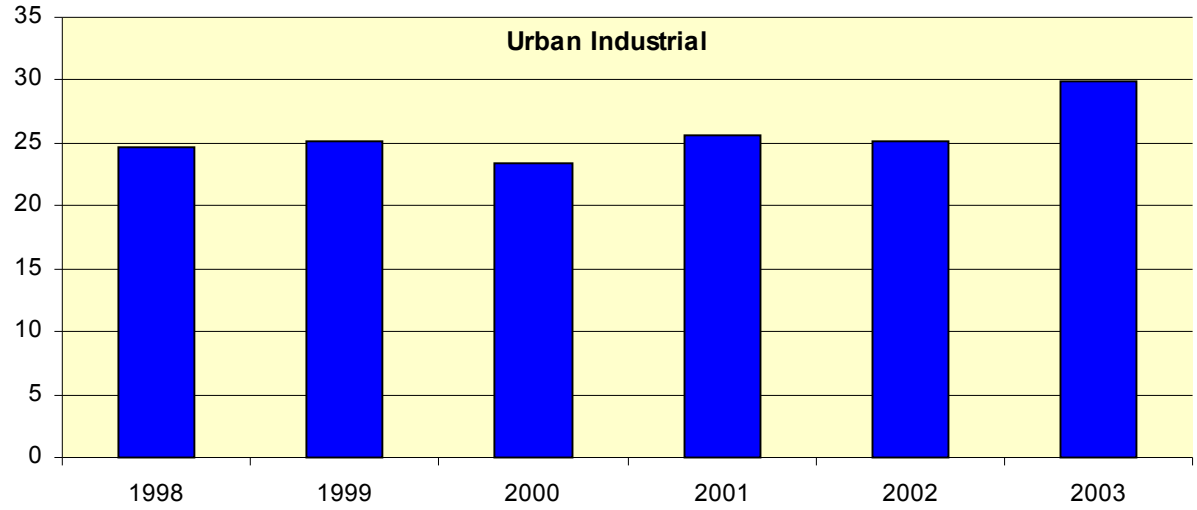


Figure A5.17 Average Annual Mean PM_{10} Concentrations across 11 Urban Background and Suburban Sites ($\mu g/m^3$)

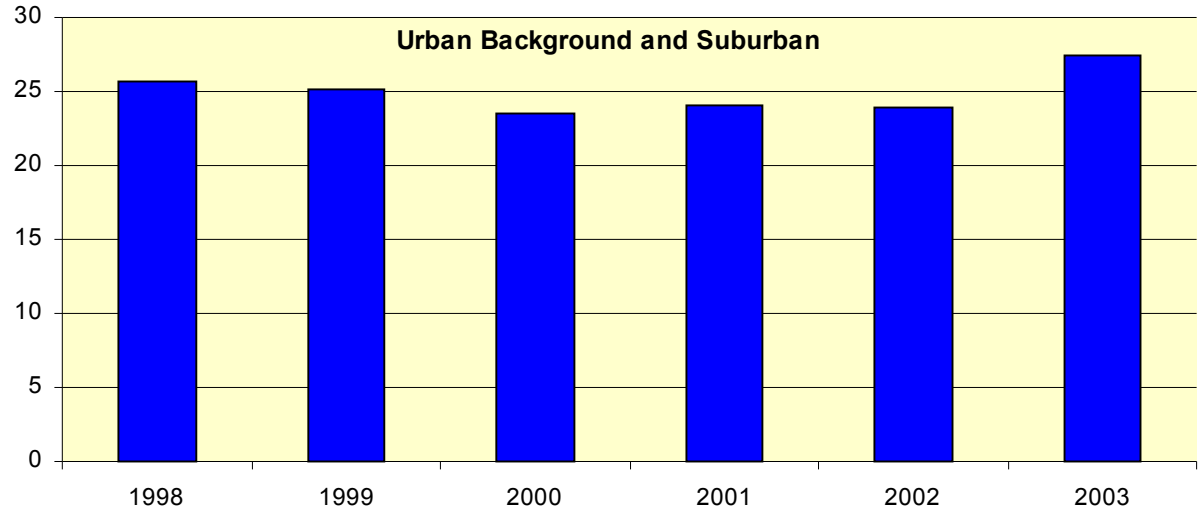


Figure A5.18 Average Annual Mean PM_{10} Concentrations across 2 Rural and Remote Sites ($\mu g/m^3$)

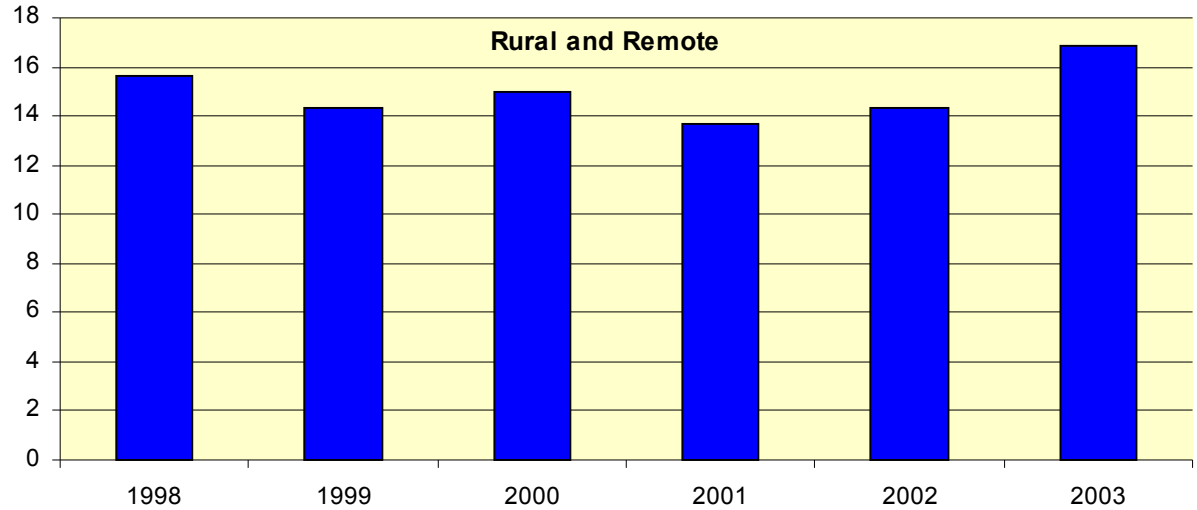


Figure A5.19 Normalised Annual Mean PM_{10} Concentrations Averaged by Site Type

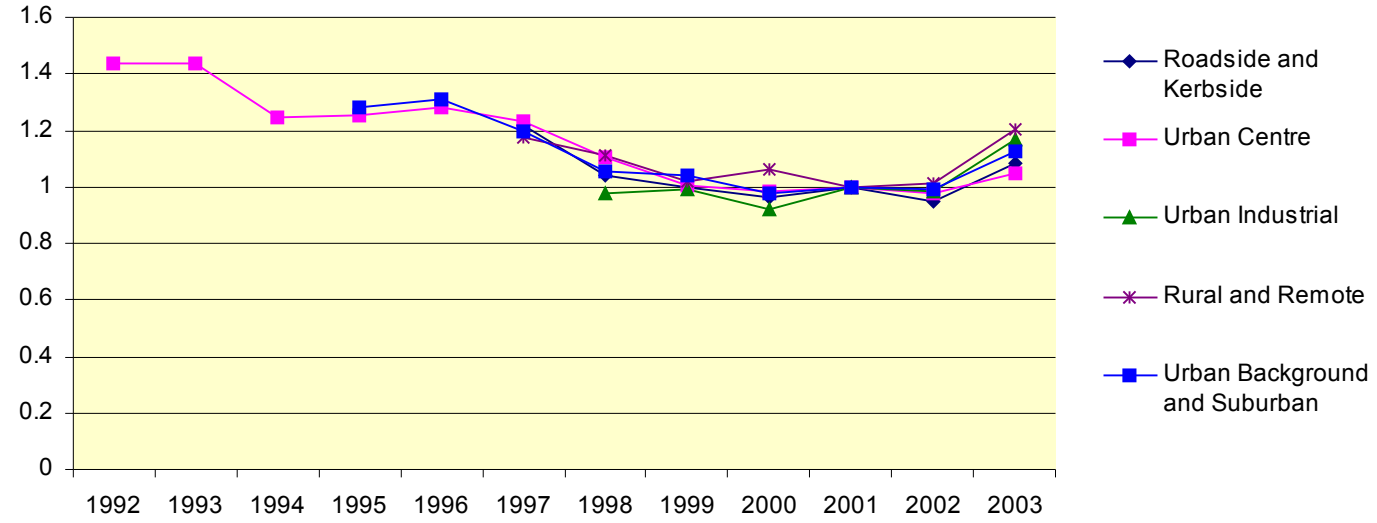


Figure A5.20 Normalised Annual Mean PM_{10} Concentrations Averaged by Region

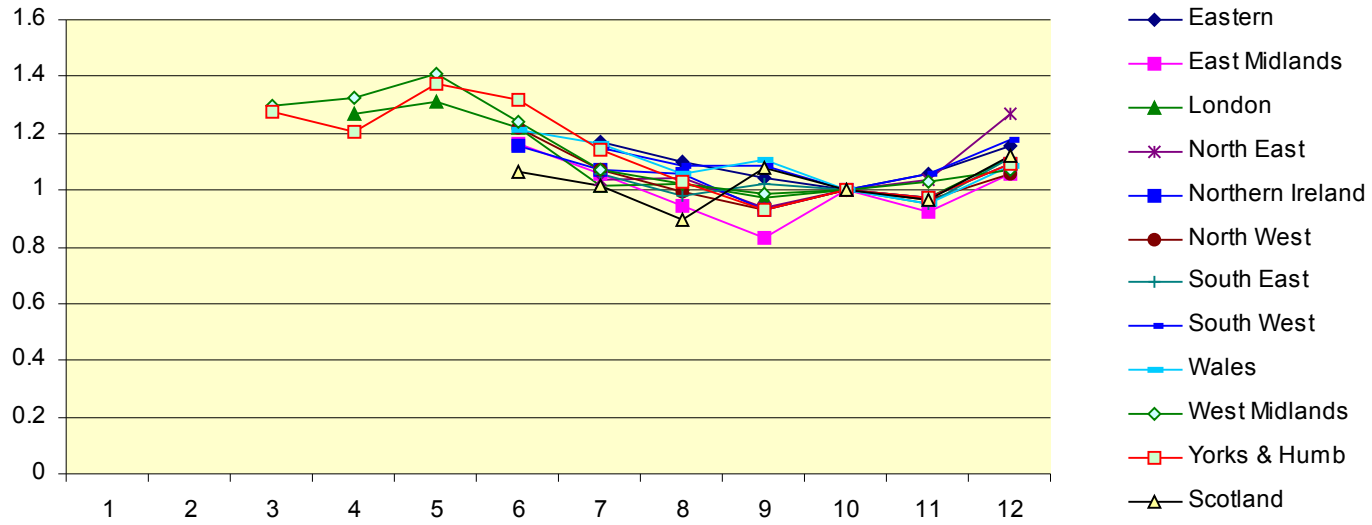
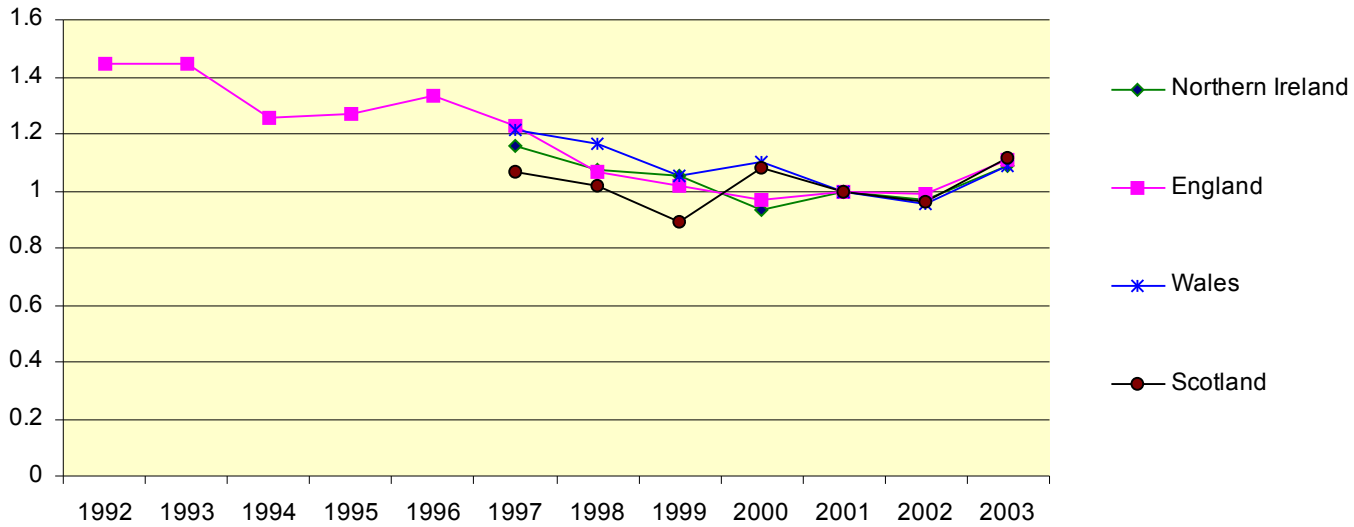


Figure A5.21 Normalised Annual Mean PM_{10} Concentrations Averaged by Country



Appendix 6

Figure A6.1 Number of 24-hour PM_{10} Exceedences in Eastern England

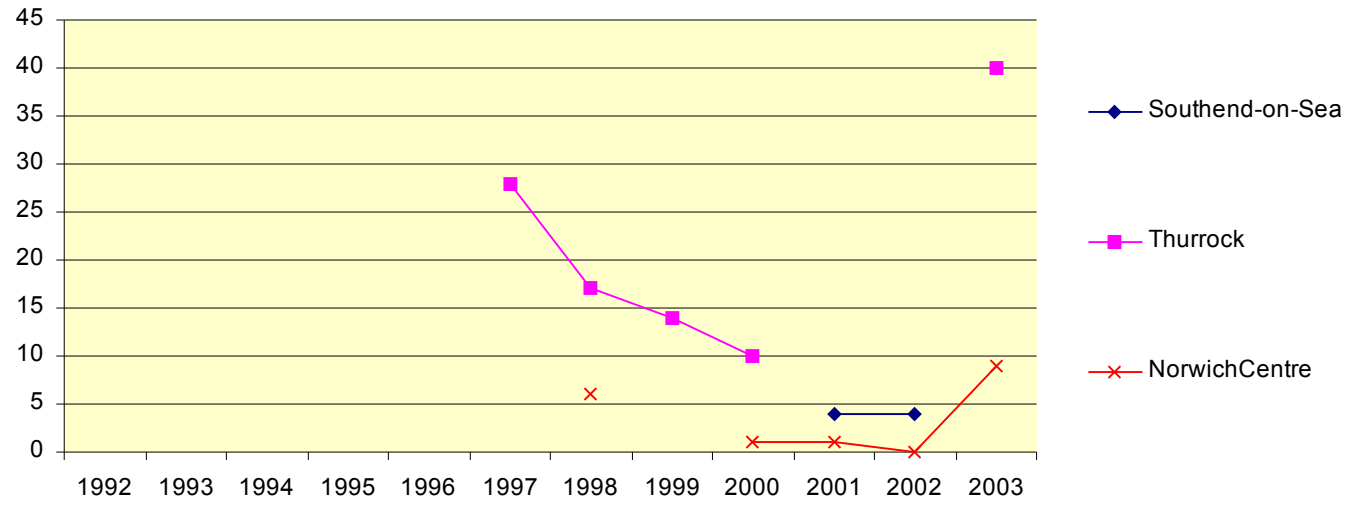


Figure A6.2 Number of 24-hour PM_{10} Exceedences in the East Midlands

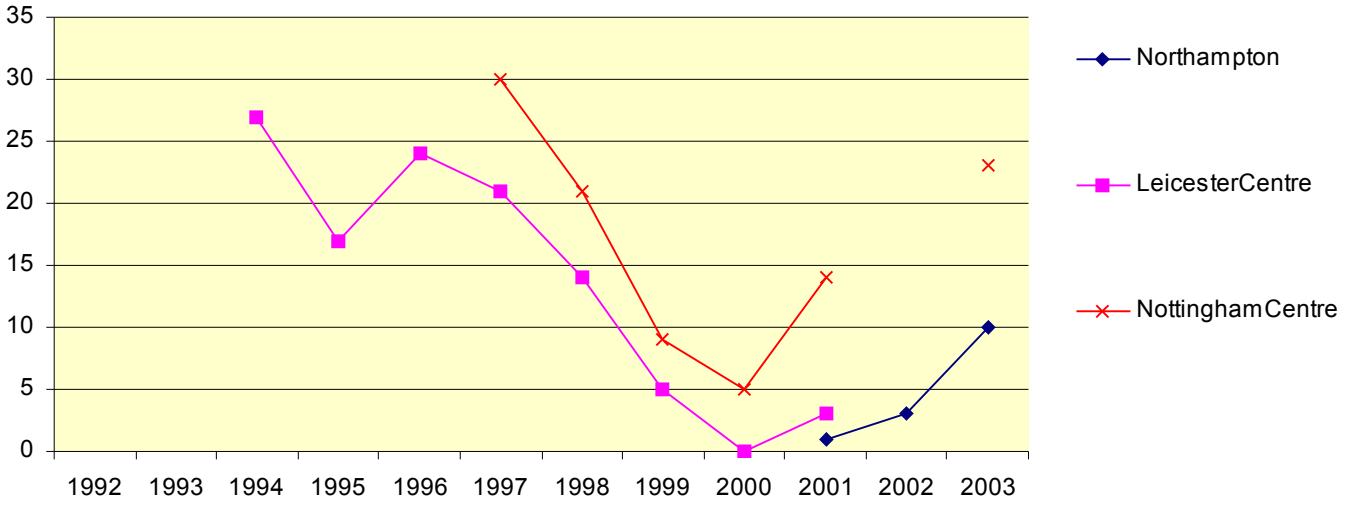


Figure A6.3 Number of 24-hour PM_{10} Exceedences in North East England

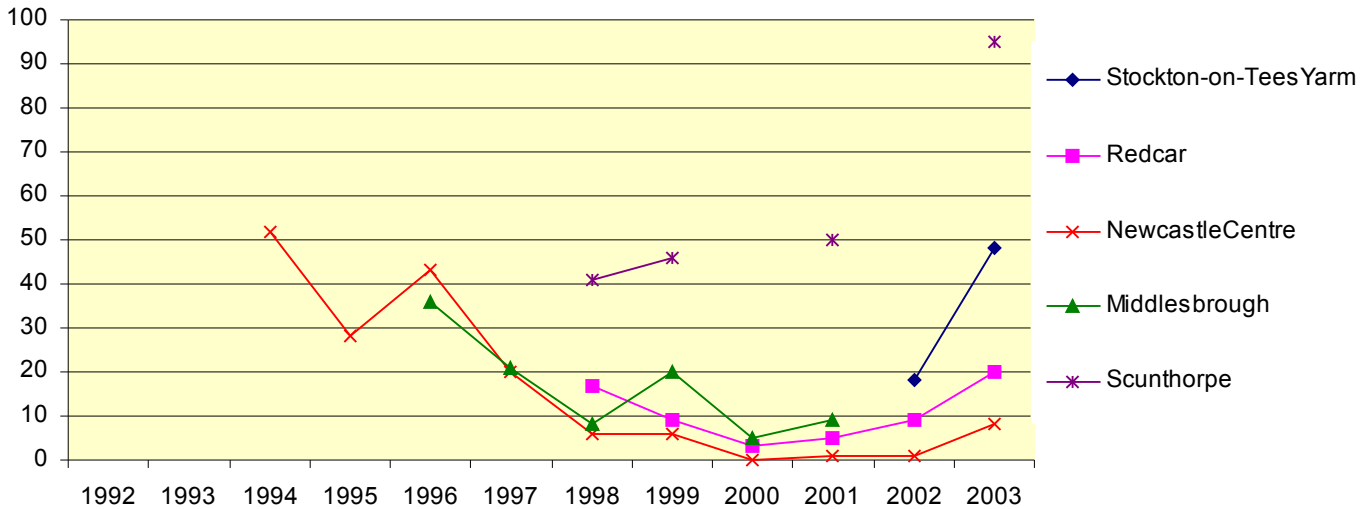


Figure A6.4 Number of 24-hour PM_{10} Exceedences in North West England

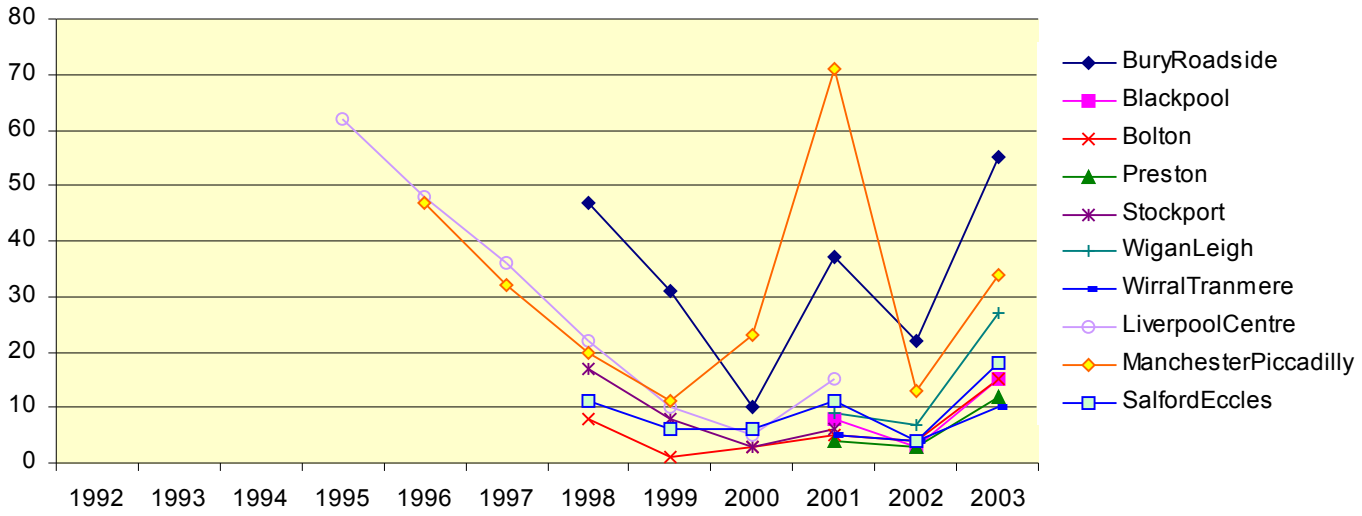


Figure A6.5 Number of 24-hour PM_{10} Exceedences in South East England

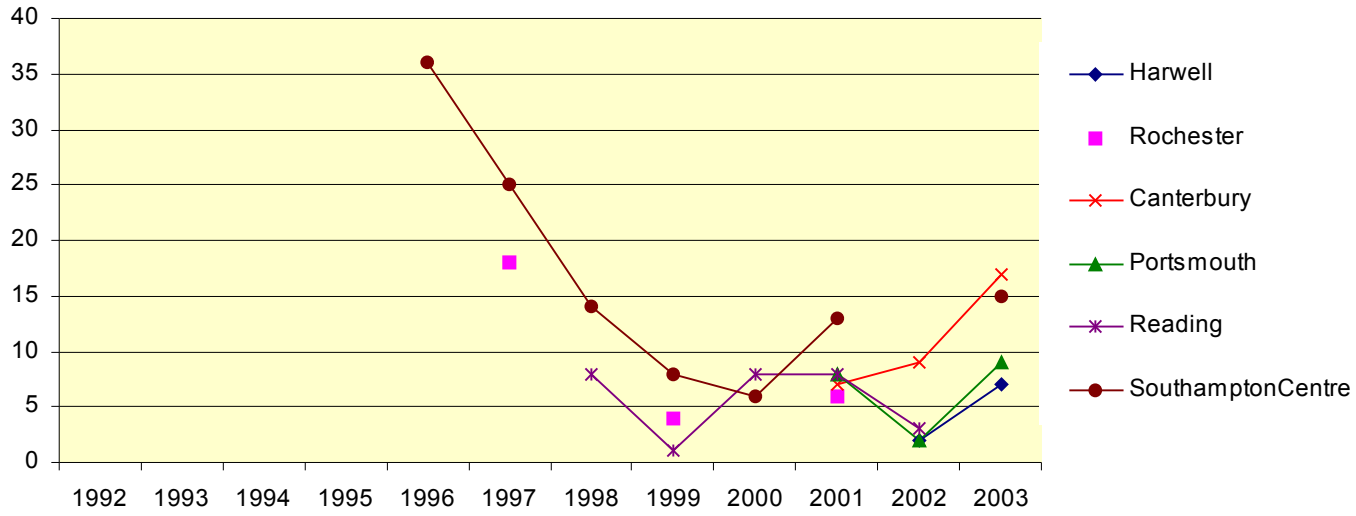


Figure A6.6 Number of 24-hour PM_{10} Exceedences in South West England

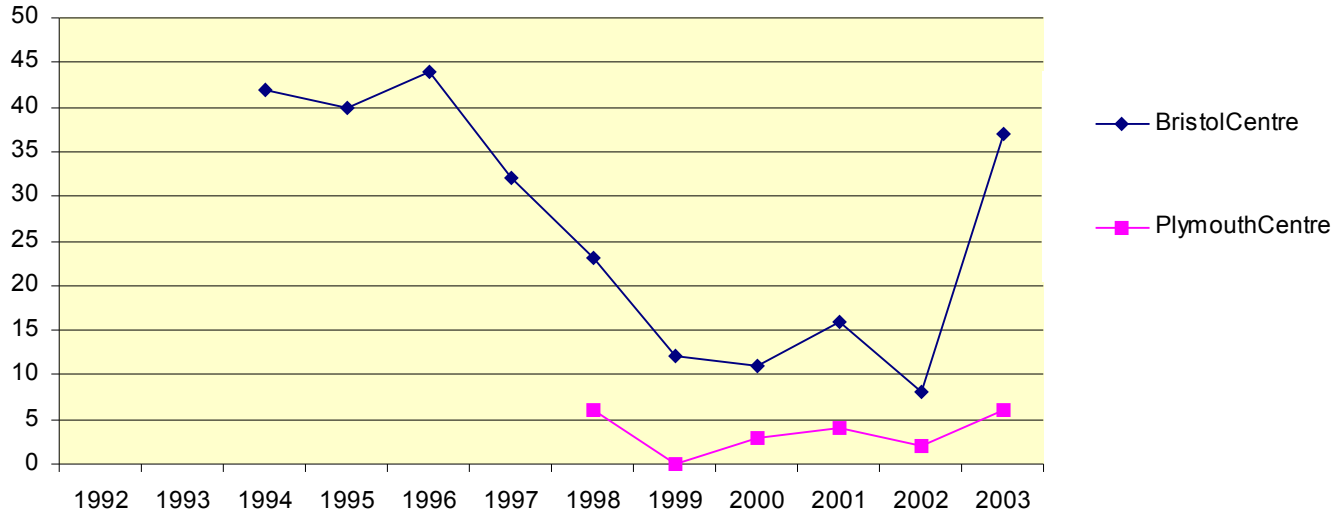


Figure A6.7 Number of 24-hour PM_{10} Exceedences in Wales ($\mu g/m^3$)

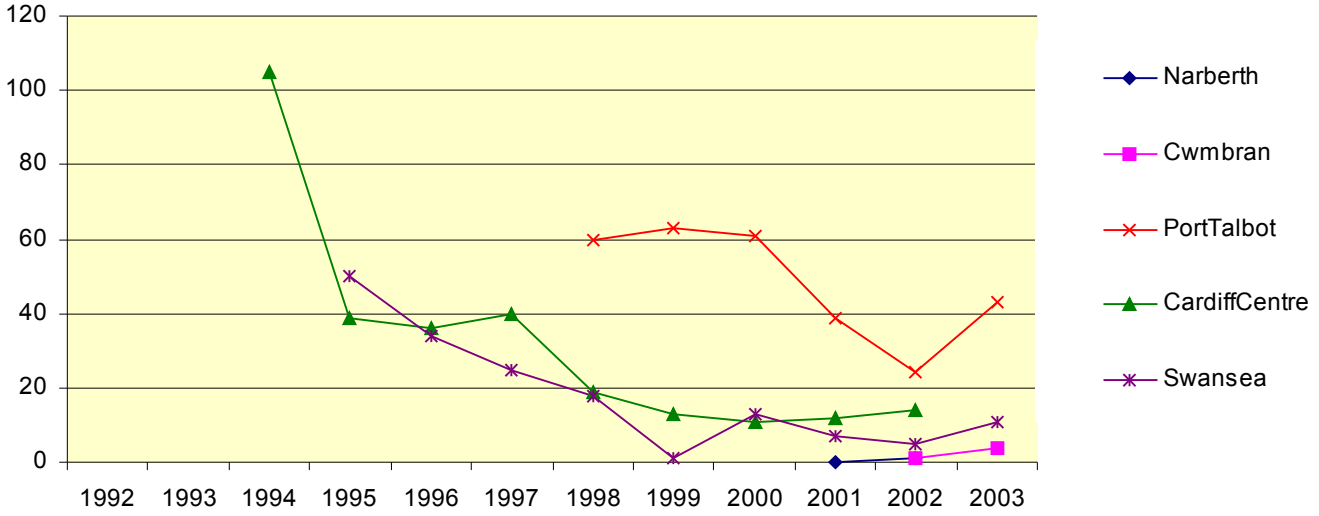


Figure A6.8 Number of 24-hour PM_{10} Exceedences in the West Midlands

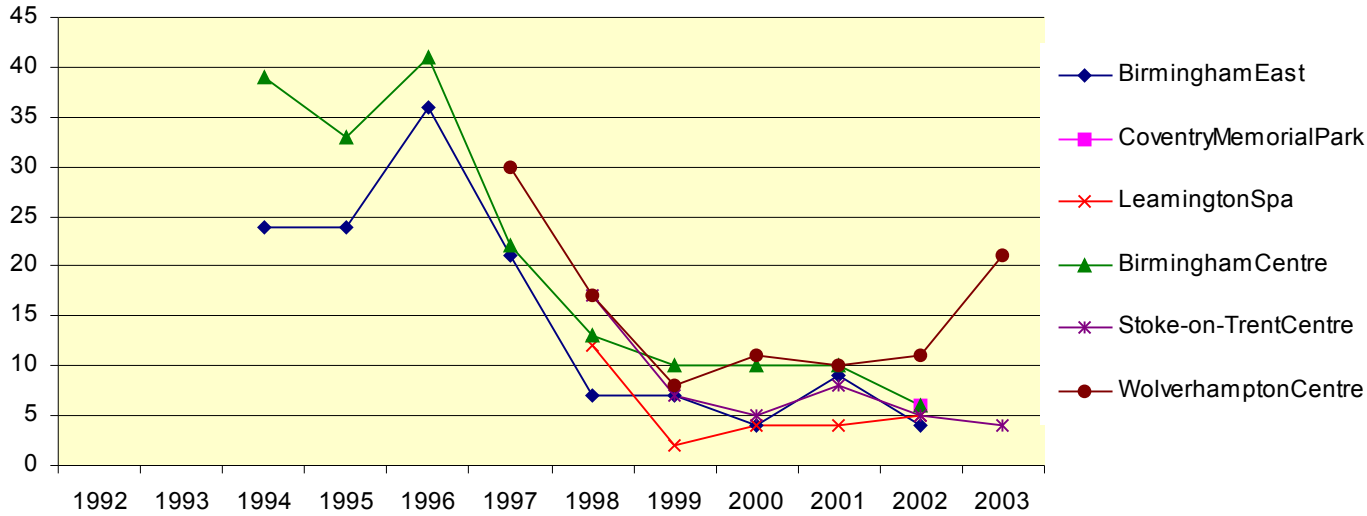


Figure A6.9 Number of 24-hour PM_{10} Exceedences in Yorkshire and Humberside ($\mu g/m^3$)

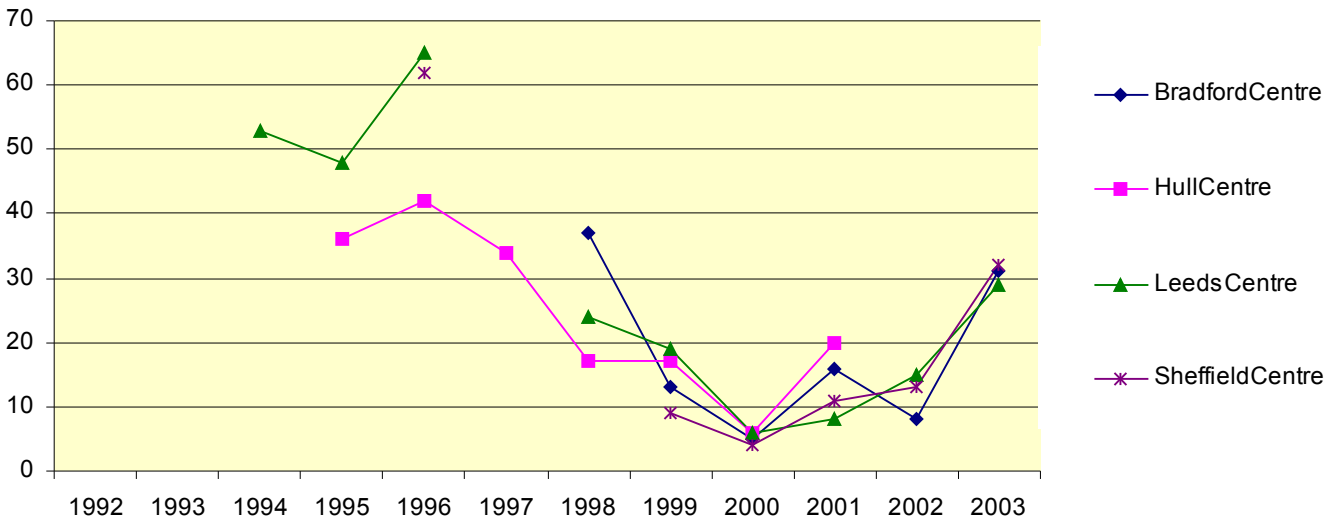


Figure A6.10 Number of 24-hour PM_{10} Exceedences in Scotland

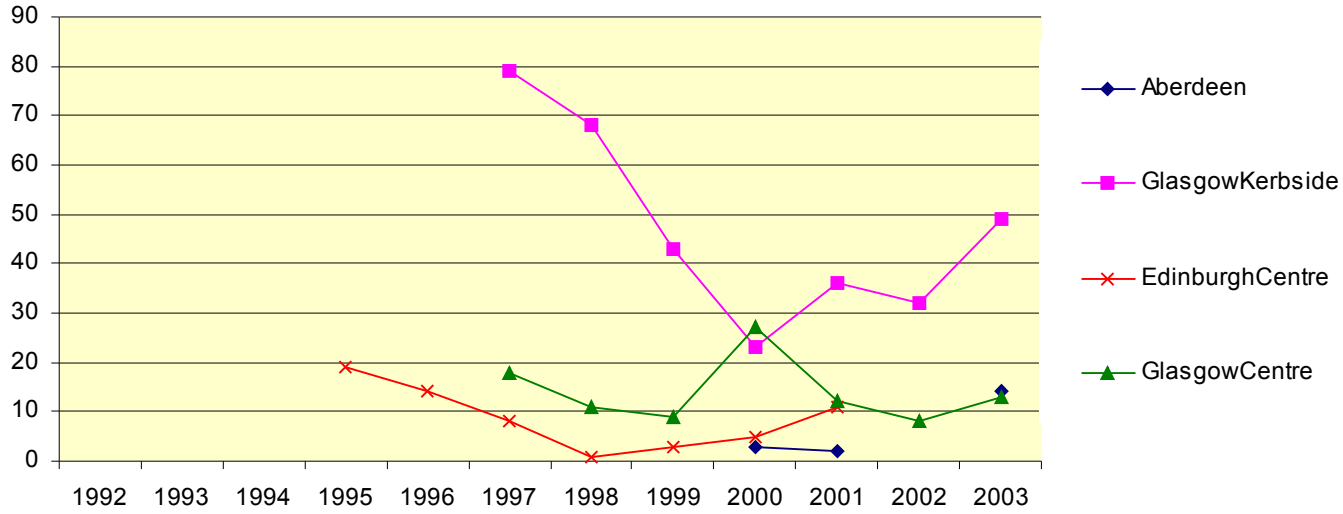


Figure A6.11 Number of 24-hour PM_{10} Exceedences in Northern Ireland

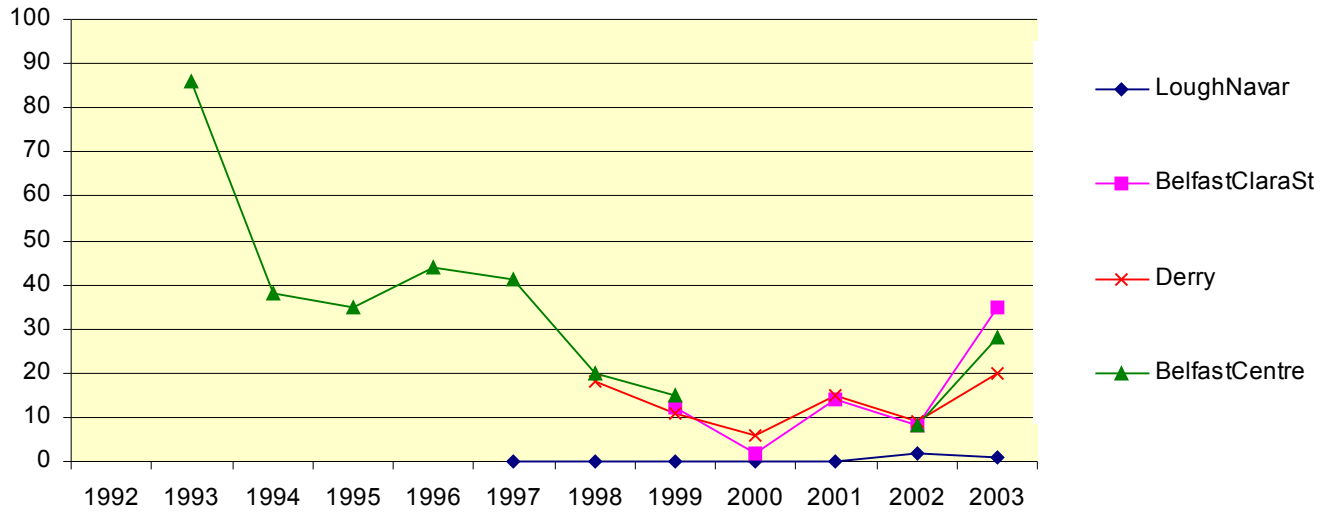


Figure A6.12 Number of 24-hour PM_{10} Exceedences at Roadside and Kerbside Sites in London

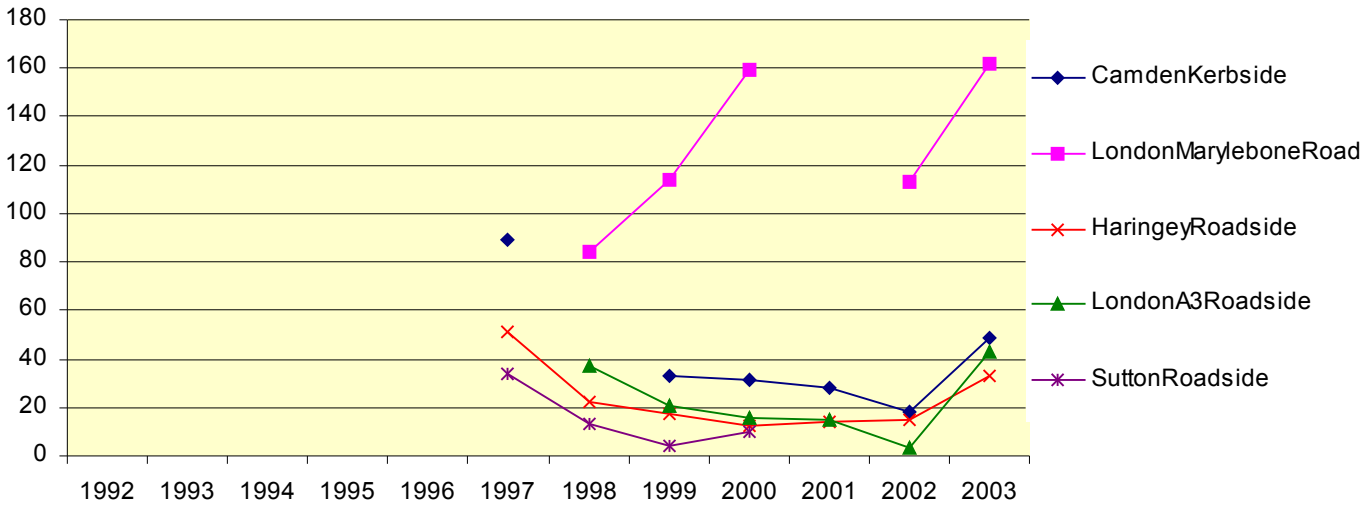


Figure A6.13 Number of 24-hour PM_{10} Exceedences at Other London Sites ($\mu g/m^3$)

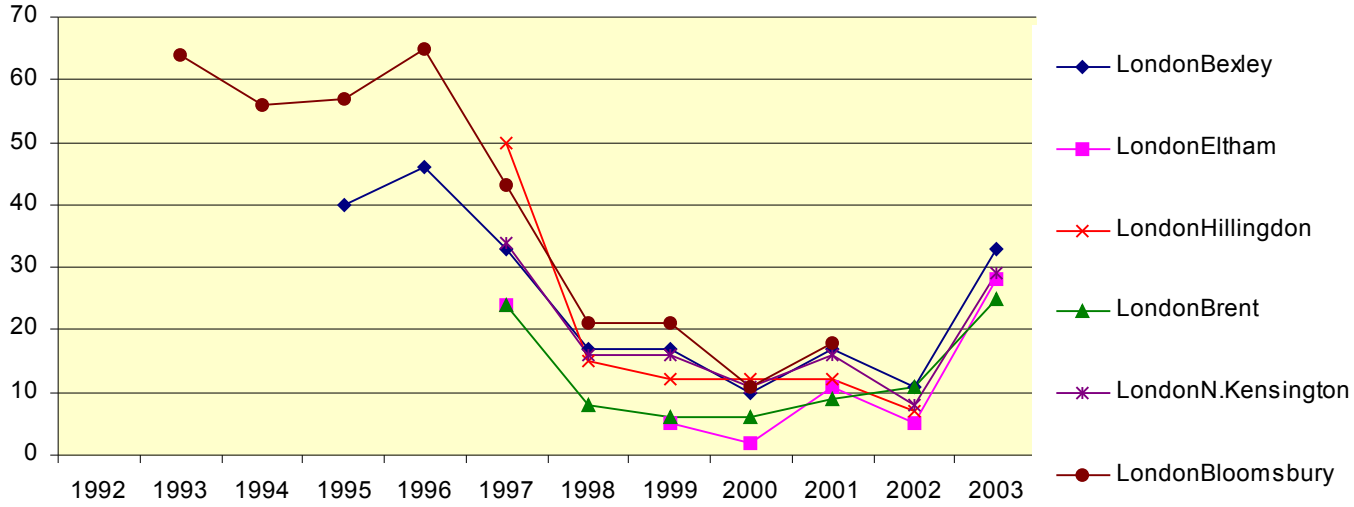


Figure A6.14 Average Number of 24-hour PM_{10} Exceedences across 4 Roadside and Kerbside Sites

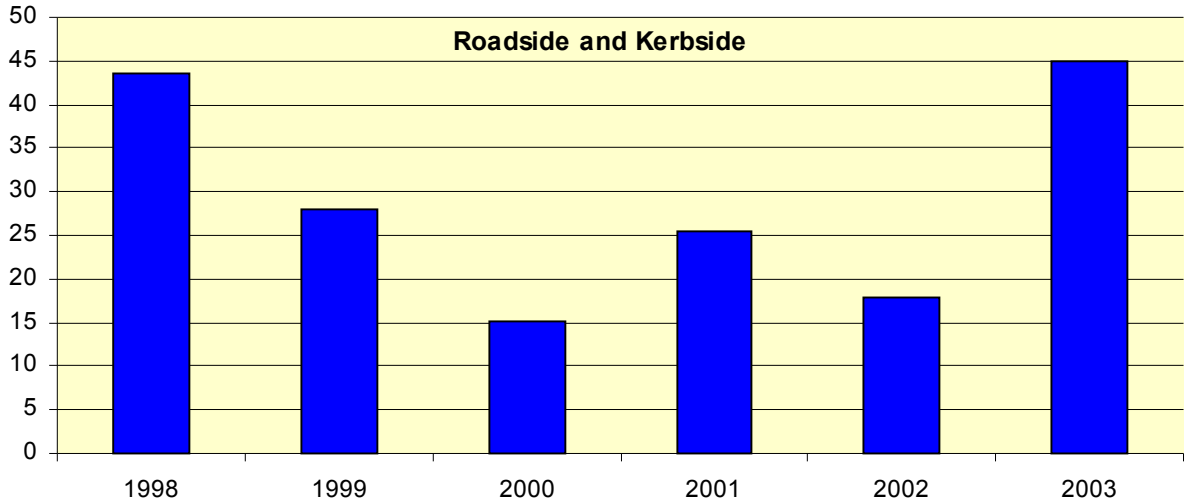


Figure A6.15 Average Number of 24-hour PM_{10} Exceedences across 10 Urban Centre Sites ($\mu g/m^3$)

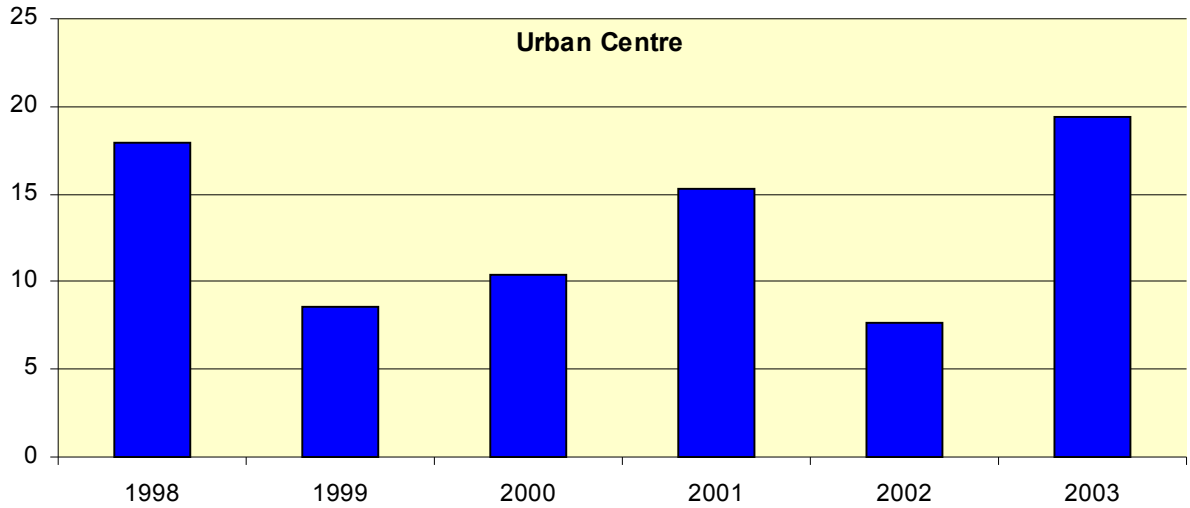


Figure A6.16 Average Number of 24-hour PM_{10} Exceedences across 7 Urban Background and Suburban Sites

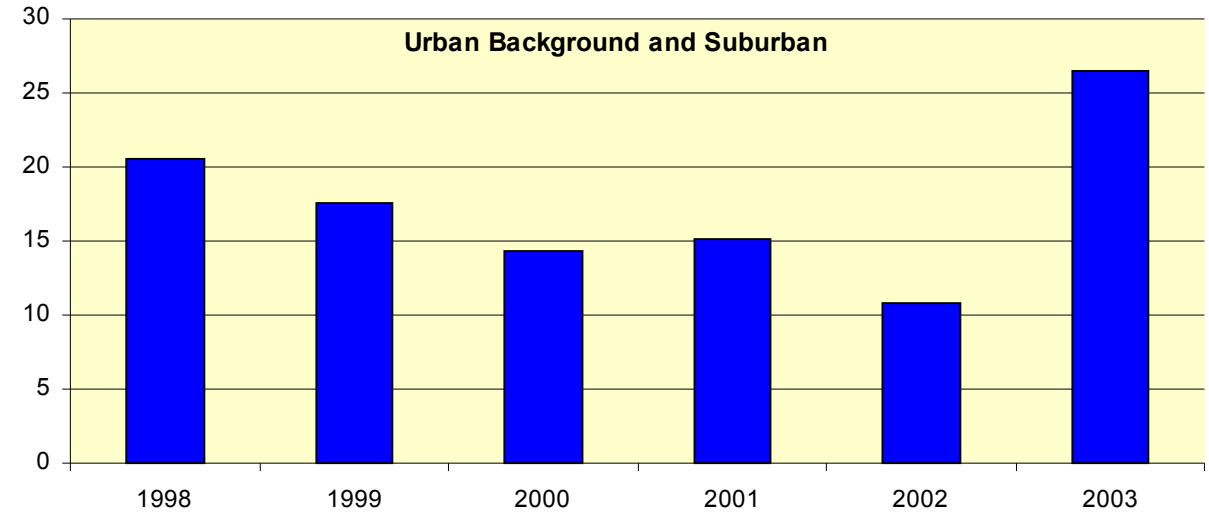


Figure A6.17 Normalised Number of 24-hour PM_{10} Exceedences Averaged by Site Type

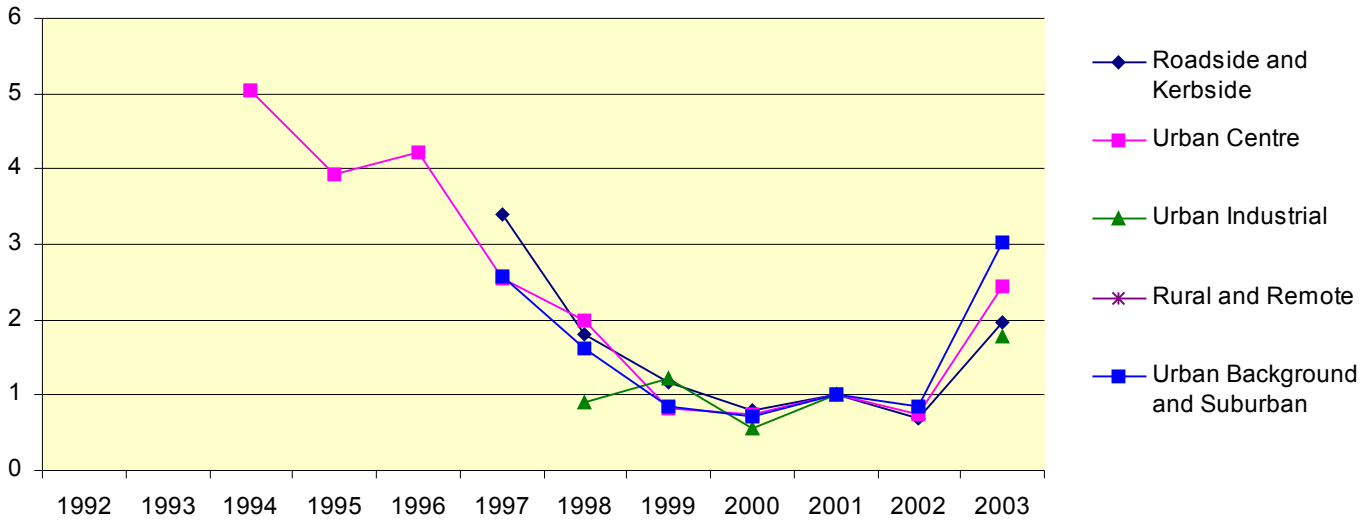
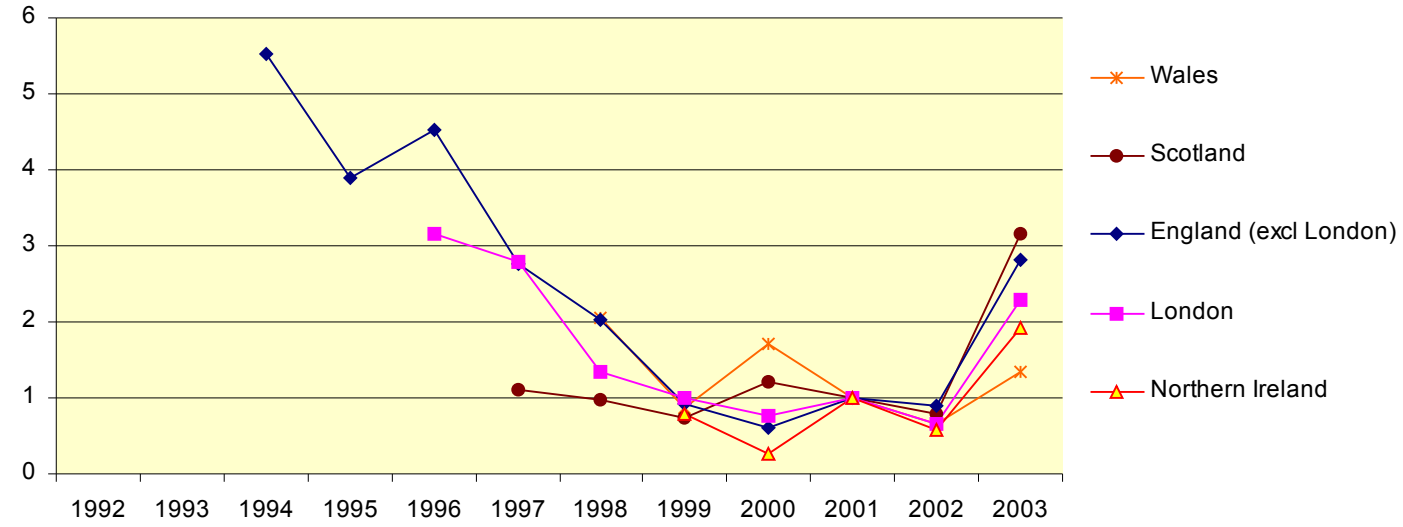


Figure A6.18 Normalised Annual Mean PM_{10} Concentrations Averaged by Region/Country[1]



[1]The 90% data capture limitations prevented smaller sub-divisions