Department for Environment, Food and Rural Affairs
Nobel House, 17 Smith Square, London, SW1P 3JR
Public enquiries: 08459 33 55 77
Press enquiries: 020 7238 5334

STATISTICAL RELEASE **29 April 2010**

AIR QUALITY INDICATOR FOR SUSTAINABLE DEVELOPMENT 2009 FINAL RESULTS

The air quality indicator is one of the 68 indicators of the Government's Sustainable Development Strategy. It measures annual levels of pollution from particulates (PM_{10}) and ozone (O_3), the two pollutants thought to have the greatest health impacts, as well as the number of days on which levels of any one of a basket of five pollutants were 'moderate or higher'.

Headline results

- 2009 has seen a general improvement in monitored air quality compared to 2008.
- Urban background particulate levels averaged 19 micrograms per cubic metre (µg m^{-3}) in 2009, unchanged from 2008. These levels have fluctuated, but there has been an overall decreasing trend since 1993, the first year for which data were available.
- Roadside particulate levels averaged 22 µg m^{-3} in 2009, compared to 26 µg m^{-3} in 2008. Again, there has been a general downward trend since the series began in 1997.
- Urban background ozone* levels averaged 55 µg m^{-3} in 2009 compared to 59 µg m^{-3} in 2008 and 44 µg m^{-3} in 1992, the first available data. These levels had shown an overall increasing trend since 1992, but this has shown signs of levelling out in recent years.

* Measured as the daily maximum 8 hour running mean

- Rural ozone levels* averaged 68 µg m^{-3} in 2009, compared to 71 µg m^{-3} in 2008 and 59 µg m^{-3} in 1987, the first available data. There is no clear long term trend.

- In urban areas, air pollution in 2009 was recorded as moderate or higher on 10 days on average per site, compared with 26 days in 2008, and 59 days in 1993. This series has shown a high degree of year-on-year variability and there is no clear long term trend.

- In rural areas, air pollution in 2009 was moderate or higher for 32 days on average per site, compared with 45 days in 2008 and 21 days in 1987. This series has also fluctuated significantly over time, with no long term trend.

- These results are an update of those published on 28 January following the full quality control (ratification) process. The differences are minimal, the largest being a decrease in the average number of days of moderate or higher pollution at urban sites from 12 to 10 days.

Background

An air quality "headline" indicator was introduced in 1999 in support of the UK Sustainable Development Strategy. When this strategy was updated in 2005, a new air quality indicator was included, better reflecting the effects on health of long term exposure to lower levels of pollution. The indicator is split into two parts covering (a) annual exposure to pollutants and (b) the number of days when levels of pollutants are moderate or higher.

(a) Particulates and ozone

Part (a) of the indicator measures annual exposure to particulates and ozone (see Figure (a) below). It was introduced in the light of increasing evidence suggesting that long-term exposure to even low levels of particulates (PM_{10}) may have a significant effect on public health. The annual mean values for particulates are a useful measure of overall exposure to particulates at all concentrations. The annual average measures of PM_{10} have been included to reflect this.

The impact of long term exposure to low levels of ozone is currently less clear, but if there is no lower limit on the levels which have a health impact then the parameter used in the indicator gives the best representation of the overall annual impact of the short term effects of ozone pollution. The production of ozone is strongly influenced by the weather, more being created on hot, still, sunny days.

Results

Results and underlying data are show in Figure (a) and Table A.

- Urban background particulate levels were on average 19 micrograms per cubic metre (µg m^{-3}) in 2009, the same as in 2008. These levels have fluctuated, but there has been an overall decreasing trend since 1993, the first year for which data were available.

* Measured as the daily maximum 8-hour running mean

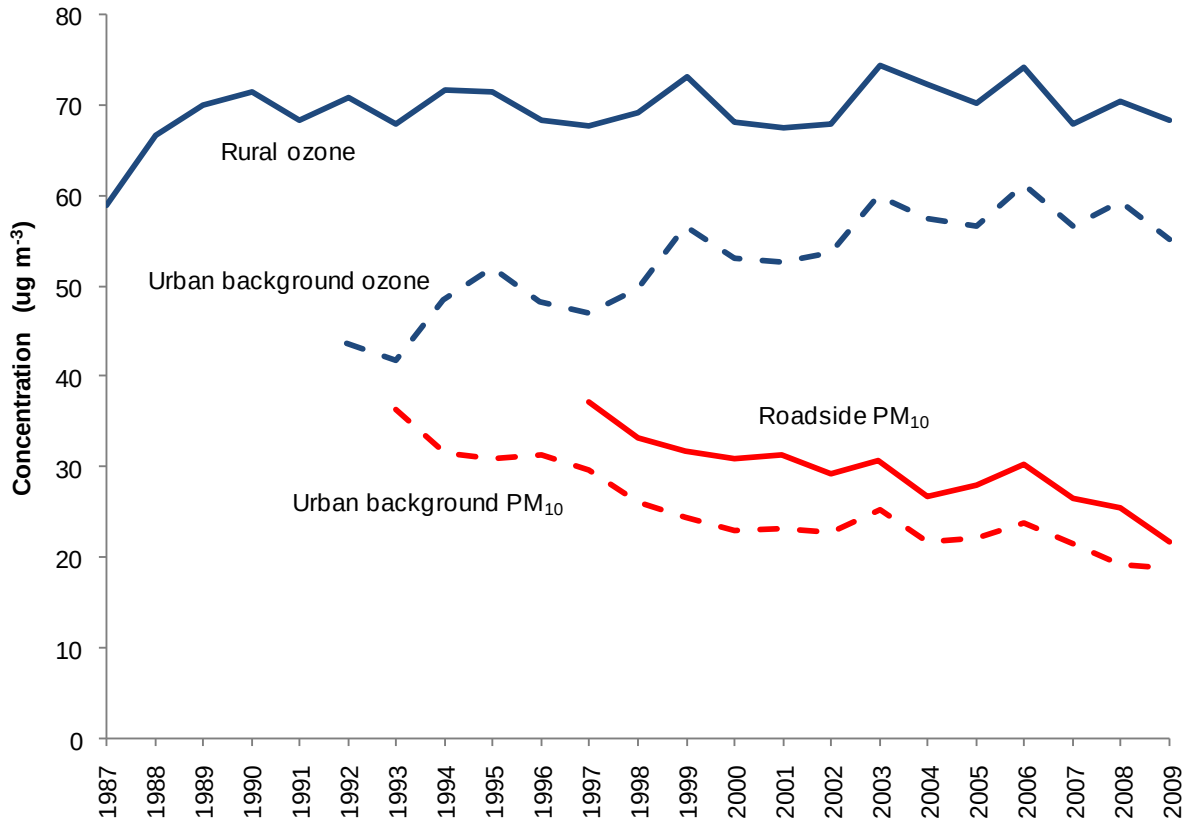
- Roadside particulate levels averaged 22 µg m^{-3} in 2009, compared to 26 µg m^{-3} in 2008. Similar to urban background levels, there has been a general downward trend since the series began in 1997.

- Urban background ozone levels averaged 55 µg m^{-3} in 2009 compared to 59 µg m^{-3} in 2008 and 44 µg m^{-3} in 1992. These levels showed an increasing trend since 1992, the first year for which data were available, although this has shown signs of levelling out in recent years.

- Rural ozone levels averaged 68 µg m^{-3} in 2009 compared to 71 µg m^{-3} in 2008 and 59 µg m^{-3} since the first available data in 1987. There is no clear long term trend.

- Both particulate and ozone concentrations are strongly influenced by weather, which will contribute to the fluctuations seen across the time series.

Figure (a): Levels of ozone and PM_{10}: 1987-2009 (Final), UK



Notes:

The ozone index shows the annual mean of the daily maximum 8 hour running mean. The PM_{10} index shows the annual average.

Table A: Annual average levels of Ozone and PM_{10} ($\mu g\ m^{-3}$)

Year	PM_{10}		Ozone	
	Urban Background	Roadside	Urban Background	Rural
1987	..	..	..	59
1988	..	..	..	67
1989	..	..	..	70
1990	..	..	..	71
1991	..	..	..	68
1992	..	..	44	71
1993	36	..	42	68
1994	31	..	48	72
1995	31	..	52	72
1996	31	..	48	68
1997	30	37	47	68
1998	26	33	50	69
1999	24	32	57	73
2000	23	31	53	68
2001	23	31	53	67
2002	23	29	54	68
2003	25	31	60	74
2004	22	27	57	72
2005	22	28	57	70
2006	24	30	61	74
2007	22	27	57	68
2008	19 (19) [1]	26 (22) [1]	59	71
2009	19	22	55	68

Notes to Table A:

1.Since 2008, upgrade of numerous PM_{10} monitoring instruments has enabled correction of measurements taken from sites using older equipment, by using the 'Volatile Correction Model' (VCM). These results are shown in parentheses. Non-VCM corrected data for 2008 are retained here for the purpose of year-on-year comparison. VCM corrections for 2009 are not yet completed. The impact of the VCM will be assessed when sufficient data points are available.

PM_{10}: annual mean: average across all included sites.

Ozone: annual mean of the daily maximum 8 hour running mean: average across all included sites

.. not available because of insufficient data

Not every site in the automatic monitoring network is included. Sites must also meet certain data capture targets to be used in the index. For both ozone and $PM_{10,}$ from 1987-97 data capture should be more than or equal to 50% of the year and from 1998 onwards it should be more than or equal to 75% of the year. For ozone this applies to both the full year and the summer period in isolation.

Cardiff Centre and Manchester Piccadilly were excluded in 1994 and 2001 respectively, because stone cutting adjacent to sites caused unrepresentative results. Narberth was excluded in 2004 and 2007 due to incorrect measurements. Great Dun Fell was excluded until 2001 due to sample lines being frozen. Reading New Town has been excluded in 2008 due to low data capture for PM_{10} caused by faulty new measuring instruments.

There have been minor revisions between the provisional and final releases following a full ratification of the collected data.

(b) Days with moderate or higher air pollution

Part (b) of the indicator measures days of moderate or higher pollution according to the Air Pollution Information Service bandings used in air pollution forecasting. The bandings are based on 5 pollutants- carbon monoxide, nitrogen dioxide, ozone, particulates (PM_{10}) and sulphur dioxide. These are recognised as the most important for causing short term health effects. At the moderate level, the effects of pollution may start to be noticeable to sensitive people.

Results

Results and underlying data are presented in Figure (b) and Table B

- In urban areas, air pollution in 2009 was recorded as moderate or higher on 10 days on average per site, compared with 26 days in 2008, and 59 days in 1993. Of the 35 sites meeting data capture criteria in both 2008 and 2009, 24 showed a decrease, 4 an increase, and 7 no change. The 3 sites with the highest number of pollution days in 2008 showed a large decrease in 2009. Although the change is substantial, it should be noted that the series shows a high degree of year-on-year variability, and a trend is not evident.

- In rural areas, air pollution in 2009 was moderate or higher for 32 days on average per site, compared with 45 days in 2008, and 21 days in 1987. Again, this series has also fluctuated significantly over time and there is no long term trend.

- The large fluctuations in pollution days are likely to be due largely to the effects of variability in weather from year to year.

Figure (b): Number of days when air pollution is moderate or higher: 1987-2009 (Final), UK

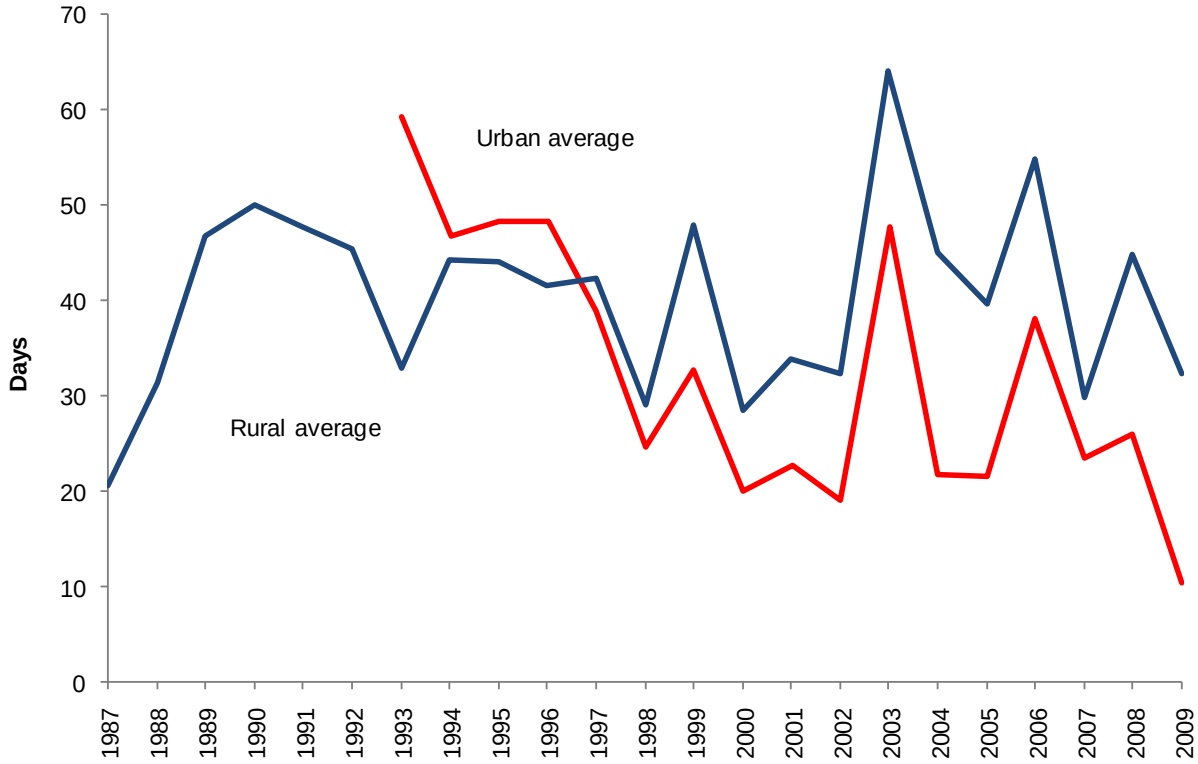


Table B: Average number of days of moderate or higher air pollution per site

Year	Urban sites	Rural sites
1987	..	21
1988	..	31
1989	..	47
1990	..	50
1991	..	48
1992	..	45
1993	59	33
1994	47	44
1995	48	44
1996	48	41
1997	39	42
1998	25	29
1999	33	48
2000	20	28
2001	23	34
2002	19	32
2003	48	64
2004	22	45
2005	21	40
2006	38	55
2007	23	30
2008	26	45
2009	10	32

Notes to Table B:

.. not available because of insufficient data

Not every site in the automatic monitoring network is included. Sites must also meet certain data capture targets to be used in the index. Urban sites are required to monitor PM_{10} and rural sites are required to monitor ozone. For the required pollutants, 1987-97 data capture should be more than or equal to 50% of the year, and from 1998 onwards it should be more than or equal to 75% of the year. For ozone this applies to both the full year and the summer period in isolation.

Cardiff Centre and Manchester Piccadilly were excluded in 1994 and 2001 respectively, because stone cutting adjacent to sites caused unrepresentative results. Narberth was excluded in 2004 and 2007 due to incorrect measurements. Great Dun Fell was excluded until 2001 due to sample lines being frozen. Reading New Town has been excluded in 2008 due to initial problems with new measuring instruments.

There have been minor revisions between the provisional and final releases following a full ratification of the collected data.

Causes of air pollution

- As ozone causes the vast majority of rural air pollution, a breakdown by pollutant for part (b) of the indicator is not presented for rural sites.

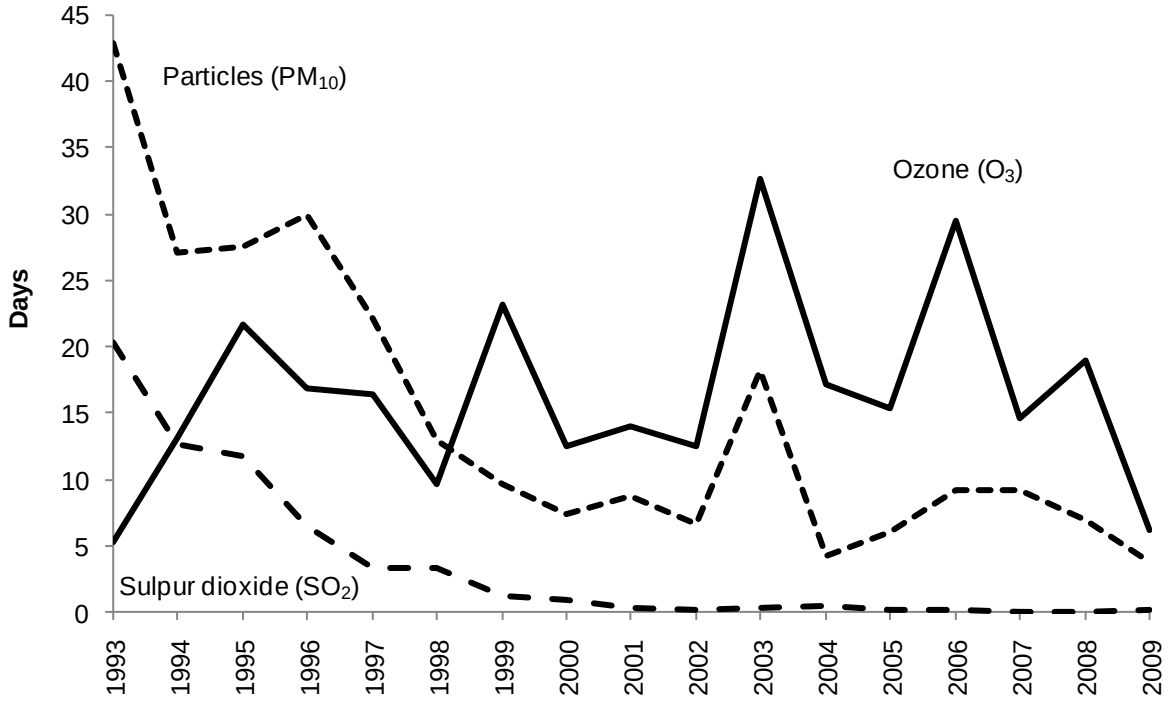
- At urban sites in 2009, two of the five pollutants, ozone and particulates, caused approximately 96 per cent of the pollution days, either separately or in combination with each other (see Figure (c) below). The decrease in the number of pollution days caused by ozone was responsible for much of the decrease in the overall number of pollution days. Between 1993 and 2009, the average number of days of pollution at urban sites caused by particulates, solely or in combination with other pollutants, has fallen from an average per site of 43 days to 4 days per year. Particulates come from numerous man-made and natural sources, and can be generated in the UK or transported from abroad. UK emissions of particulates have been reduced substantially in recent years, but the number of pollution days can fluctuate from year to year, largely due to variations in weather conditions.

- The average number of pollution days at urban sites caused by sulphur dioxide, solely or in combination with other pollutants, was 20 days per site in 1993. Since 2001, sulphur dioxide has not caused any pollution days, either solely or in combination with other pollutants.

- Carbon monoxide has not contributed to the number of pollution days since the series began. Nitrogen dioxide has impacted very rarely, at a maximum of 1 day.

- Since 1999, ozone has caused more days of moderate or higher pollution in urban areas than have particulates, as pollution by particulates has declined. However, the number of days caused by ozone pollution has no clear overall trend. A proportion of the ozone experienced in the UK originates from releases of precursor pollutants which form ozone that are blown over from mainland Europe. Weather conditions will also contribute to volatility of the series, with more ozone produced on hot, sunny days, as was the case during 2003 and 2006.

Figure (c) : Average number of days in 2009 when levels of ozone, particles and sulphur dioxide are moderate or higher at urban sites (Final), UK



Note: for the purposes of this chart, where a day is caused by more than one pollutant, it is counted for each pollutant i.e. there is double counting.

Table C: Average number of days of moderate or higher air pollution at urban sites caused by the each of the basket of 5 pollutants

Year	Ozone	Nitrogen dioxide	Carbon monoxide	Sulphur dioxide	Particulates (PM_{10})
1993	5	0	0	20	43
1994	13	0	0	13	27
1995	22	1	0	12	27
1996	17	0	0	6	30
1997	16	0	0	3	22
1998	10	0	0	3	13
1999	23	0	0	1	10
2000	12	0	0	1	7
2001	14	0	0	0	9
2002	12	0	0	0	7
2003	33	0	0	0	18
2004	17	0	0	0	4
2005	15	1	0	0	6
2006	29	0	0	0	9
2007	15	0	0	0	9
2008	19	1	0	0	7
2009	6	0	0	0	4

Notes to Table C:

Not every site in the automatic monitoring network is included. Sites must also meet certain data capture targets to be used in the index. Urban sites are required to monitor PM_{10} and rural sites are required to monitor ozone. For the required pollutants, 1987-97 data capture should be more than or equal to 50% of the year, and from 1998 onwards it should be more than or equal to 75% of the year. For ozone this applies to both the full year and the summer period in isolation.

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Notes to Editors

1. The air quality indicator is one of the 68 indicators of the Government's Sustainable Development Strategy published in March 2005, and includes the former air quality headline indicator of sustainable development. The banding system used in part (b) of the indicator is that of the Air Pollution Information Service.
2. More detailed data, site metadata and information are published on the UK Air Quality Archive.
3. Information about the health effects of air pollution can be found in the leaflet 'Air Pollution - what it means for your health'. This leaflet is available on the Defra website, along with further information on the Air Quality Strategy.
4. Further details and data relating to UK air quality are available on Defra's e-Digest of Environmental Statistics: http://www.defra.gov.uk/evidence/statistics/environment/index.htm.

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