Department for Environment, Food and Rural Affairs

STATISTICAL RELEASE: 14 February 2012

EMISSIONS OF AIR POLLUTANTS IN THE UK, 1970 TO 2010 – SUPPLEMENTARY

Emissions of twenty-six reported air pollutants have shown long-term improvement, with large reductions compared with levels in 1970 and 1990.

Emissions of the ten pollutants and their precursors covered by the UK Air Quality Strategy have seen reductions between 1990 and 2010 ranging from 21 per cent for ammonia through to 98 per cent for lead.

Between 2009 and 2010, of the ten pollutants covered by the UK Air Quality Strategy, for six the level of emissions showed an improvement, for two emissions changed little (particulates and ammonia), **and for two emissions increased by two per cent** (sulphur dioxide and polycyclic aromatic hydrocarbons).

Emissions of eight metals (which are not covered by the UK Air Quality Strategy) **have seen improvements** with reductions between 1990 and 2010 ranging from 61 per cent for selenium through to 90 per cent for cadmium.

Between 2009 and 2010, emissions of arsenic, chromium, mercury and nickel showed an improvement while emissions of cadmium, copper, selenium and zinc increased but not sufficiently to exceed levels in 2008 or earlier.

Emissions of five persistent organic pollutants (which are not covered by the UK Air Quality Strategy) **have seen improvements** with reductions between 1990 and 2010 ranging from 55 per cent for pentachlorophenol to 99 per cent for hexachlorobenzene.

Between 2009 and 2010 there was an improvement in emissions for three persistent organic pollutants, whilst hexachlorobenzene (HCB) and dioxins and furans increased by three and 14 per cent respectively.

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Why quantify UK emissions of air pollutants?

There are many sources of air pollution, including power stations, traffic, household heating, agriculture and industrial processes. The National Atmospheric Emissions Inventory (NAEI)[1] provides estimates of the amount and the type of pollutants that are emitted to the air each year from all UK sources. These are estimated to help to find ways of reducing the impact of human activities and the resulting air pollutants on the environment and our health.

The statistics presented here provide the public with information on current levels of and trends in emissions of these pollutants, and are used to inform air pollution policies both nationally and internationally.

This Defra National Statistics Release includes emissions of air pollutants that are covered by the UK Air Quality Strategy:

- Benzene
- 1,3-butadiene
- carbon monoxide
- lead
- nitrogen oxides
- ozone
- particulates (PM_{10} and $PM_{2.5}$)
- ammonia
- polycyclic aromatic hydrocarbons; and
- sulphur dioxide

It also covers 16 other air pollutants including metals and persistent organic pollutants:

- Arsenic
- Cadmium
- Chrominum
- Copper
- Mercury
- Nickel
- Selenium
- Zinc
- Lindane (Gamma HCH)
- Pentachlorophenol (PCP)
- Hexachlorobenzene (HCB)
- Polychlorinated Biphenyl (PCB)

[1] //naei.defra.gov.uk/index.php

- Dioxins and furans
- Non-methane volatile organic compounds (NMVOCs)
- Hydrogen chloride
- Hydrogen fluoride

The release is supplementary to the statistical release *Emissions of air pollutants in the UK, 1970 to 2010* of 15 December 2011. This reported emissions of sulphur dioxide, nitrogen oxides, non-methane volatile organic compounds and ammonia, which are covered by the **National Emission Ceilings Directive** (NECD) (see below). These pollutants are also presented here for completeness.

Although air pollution is an important local issue, the many pollutants can be carried long distances which means that the effects of emissions may be experienced many miles from their source.

The **UK Air Quality Strategy** contains policies for the assessment and management of air quality and implementation of European Union (EU) and international agreements including:

- The **National Emission Ceilings Directive** (NECD) sets ceilings for each EU Member State for emissions of ammonia, nitrogen oxides, sulphur dioxide and non-methane volatile organic compounds (NMVOCs). These pollutants are responsible for acidification and eutrophication of habitats, and formation of ground level ozone. Refer to the National Statistics release Emissions of air pollutants in the UK, 1970 to 2010 for more details.

- The **Convention on Long-range Transboundary Air Pollution** addresses some of the major environmental problems of the UNECE region through scientific collaboration and policy negotiation. Created in 1979, the Convention is extended by eight protocols that identify specific measures to be taken by Parties to cut their emissions of air pollutants. Parties develop policies and strategies to combat the discharge of air pollutants through exchanges of information, consultation, research and monitoring.

However not all pollutants reported are covered in the Air Quality Strategy. These other pollutants are still important in terms of potential effects on health and the wider environment, but action is not required in the UK to meet a particular standard.

Reductions in air pollutant emissions[2] are achieved by for example changes in fuel use (such as switching from coal to gas power stations), through reducing fuel use, through changes to industrial processes, through pollutant capture or conversion (for example catalytic convertors on vehicles), and through legal restrictions. Changes in behaviour such as making more sustainable transport choices also contribute to emissions reductions.

[2] For Defra policy on air emissions see www.defra.gov.uk/environment/quality/air/air-quality/

Behaviour and hence the level of emissions can be also influenced by changes in fuel price and the wider economic situation.

The NAEI is used to monitor emissions against the international targets, and the UK figures are reported annually to the European Commission via the European Environment Agency[3].

Some pollutants, referred to as greenhouse gases (such as carbon dioxide) may have little direct effect on health, but can contribute to changing global conditions and potentially give rise to dramatic changes in climate and sea level. Trends for greenhouse gases are produced by the NAEI, and are published separately by the Department for Energy and Climate Change[4].

Understanding air pollutant emissions figures

It should be noted that the mass of the emissions for the different pollutants should not be compared as their effects on health and the environment are very different.

Whilst overall reductions in air emissions may signify reductions in potential harm to human health or to the natural environment, the way the pollutant is emitted is also important. Emissions from high chimneys (for example power stations) will not affect air quality[5] (concentrations of pollutants) as much as the same quantity of emissions released at ground level such as from cars and buses. This is because pollutants emitted close to the ground do not generally get dispersed as well as pollutants emitted further from the ground.

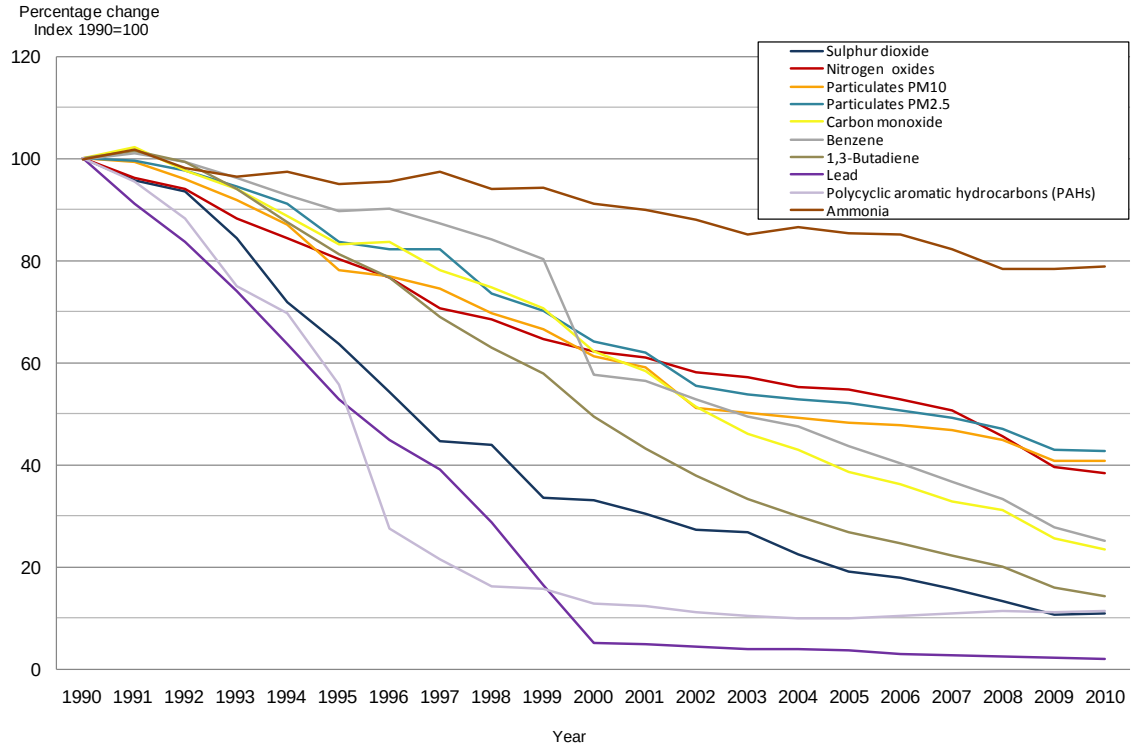
It is not possible, except for a limited number of large industrial processes, to measure emissions directly, so the NAEI is based on highly detailed assumptions on the amount of each air pollutant generated from different fuel use and activities in the UK. Refer to the NAEI[6] for more details.

Information on measured levels of pollutants in the air, along with their health effects, can be found on the UK Air Quality Archive. The European Environment Agency houses European air quality data and analyses, and provides a summary of the policies in place.

[3] www.eea.europa.eu/
[4] www.decc.gov.uk/en/content/cms/statistics/climate_stats/climate_stats.aspx
[5] A separate Defra National Statistics Release is published annually on air quality (next release in February 2012) see www.defra.gov.uk/statistics/environment/air-quality/
[6] //naei.defra.gov.uk/index.php

Emissions of pollutants covered by the UK Air Quality Strategy

Figure: Changes in emissions of pollutants covered by the UK Air quality Strategy, 1990- 2010, UK



- Emissions of the ten pollutants and their precursors covered by the UK Air Quality Strategy have seen reductions between 1990 and 2010 ranging from 21 per cent for ammonia through to 98 per cent for lead.

- **Between 2009 and 2010, of the ten pollutants covered by the UK Air Quality Strategy, for six the level of emissions showed an improvement**, for two emissions changed little (particulates and ammonia), **and for two emissions increased by two per cent** (sulphur dioxide and polycyclic aromatic hydrocarbons).

- A decline in coal use has been an important factor in the long-term reductions of a number of pollutants, including sulphur dioxide, particulates and certain metals.

- Road transport is a significant source for a number of pollutants, including particulates and nitrogen oxides. There have however been substantial long-term reductions due to

measures such as introduction of catalytic converters, unleaded petrol, and reduced sulphur and benzene content in fuel.

- The largest emission sources are not necessarily the greatest contributors to poor air quality. Exposure to air pollution also depends on other factors, such as proximity of the source and the efficiency of dispersion in the atmosphere.

- Ozone is covered by the UK Air quality Strategy, but is not included here because the majority of ground-level ozone arises from reactions between precursor pollutants (NOx, NMVOCs and carbon monoxide) in the presence of sunlight over a large area. Direct emissions of ozone do not occur.

- Although ozone precursor emissions have been substantially reduced in the long-term, this is not reflected in ozone concentrations in the air (see *Air Quality Statistics in the UK, 1987 to 2011- provisional*[7] for more information). A similar lack of an apparent link between emissions reductions and levels of ozone in the air is seen more widely in Europe.

- Historically, a reduction in livestock numbers and changes in fertiliser use led to a decline in ammonia emissions, although this is now levelling off.

[7] http://www.defra.gov.uk/statistics/files/Air-quality-statistics-in-the-UK-1987-to-2011-Provisional.pdf

Defra National Statistics Release:
Emissions of air pollutants in the UK, 1970 to 2010 - Supplementary

Table 1: Air pollutant emissions in the UK, 1970 to 2010

Pollutants	Units	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	% change 1990-2010	% change 2009-2010
Pollutants covered by the UK Air Quality Strategy (AQS)																	
Sulphur dioxide (SO_2)[1]	Kilotonnes	6,420	4,780	3,707	1,228	1,133	1,014	992	832	706	665	586	491	397	406	-89%	2%
Nitrogen oxides (NO_x)[1]	Kilotonnes	2,658	2,643	2,885	1,791	1,761	1,678	1,646	1,594	1,580	1,525	1,461	1,317	1,143	1,106	-62%	-3%
Particulates <10µm (PM_{10})	Kilotonnes	499	327	280	171	165	143	140	138	135	133	131	126	114	114	-59%	0%
Particulates <2.5µm ($PM_{2.5}$)	Kilotonnes	243	170	156	100	97	86	84	83	81	79	77	73	67	67	-57%	-1%
Carbon monoxide	Kilotonnes	9,847	8,336	9,087	5,653	5,303	4,677	4,194	3,901	3,510	3,280	2,982	2,818	2,317	2,125	-77%	-8%
Benzene	Kilotonnes	31	28	37	21	21	20	18	18	16	15	14	12	10	9	-75%	-10%
1,3-Butadiene	Kilotonnes	8	11	15	7	6	6	5	4	4	4	3	3	2	2	-86%	-10%
Lead	tonnes	7,471	8,289	2,887	149	142	132	116	118	107	88	79	73	63	59	-98%	-6%
Polycyclic aromatic hydrocarbons (PAHs)	tonnes	Not reported	Not reported	5,508	707	683	611	580	554	548	577	607	631	610	622	-89%	2%
Ammonia (NH_3)[1]	Kilotonnes	Not reported	363	360	328	324	317	307	312	307	307	296	283	283	284	-21%	0%
Metals not covered by the UK AQS																	
Arsenic	tonnes	79	54	46	20	17	15	15	14	14	14	14	14	13	13	-71%	-1%
Cadmium	tonnes	36	26	23	6	5	5	3	4	4	4	3	3	2	2	-90%	3%
Chrominum	tonnes	240	183	159	74	54	42	41	39	37	34	30	29	27	26	-83%	-2%
Copper	tonnes	217	158	142	81	70	64	67	65	61	60	59	59	50	51	-64%	2%
Mercury	tonnes	63	43	38	8	8	7	7	7	7	7	7	7	7	6	-83%	-15%
Nickel	tonnes	913	492	321	167	169	132	122	126	128	118	109	114	81	79	-75%	-3%
Selenium	tonnes	94	90	82	38	38	33	34	40	41	38	35	36	31	32	-61%	2%
Zinc	tonnes	1,488	1,013	982	620	582	535	459	465	418	388	396	368	342	355	-64%	4%
Persistent Organic Pollutants (POPs) not covered by the UK AQS																	
Lindane (Gamma HCH)	tonnes	Not reported	Not reported	99	33	29	22	19	17	14	13	11	10	9	8	-92%	-12%
Pentachlorophenol (PCP)	tonnes	Not reported	Not reported	751	605	576	541	508	476	451	427	404	383	363	343	-54%	-5%
Hexachlorobenzene (HCB)	kilograms	Not reported	Not reported	3170	80	70	66	64	75	71	66	62	58	32	32	-99%	3%
Polychlorinated Biphenyl (PCB)	kilograms	Not reported	Not reported	6626	1334	1269	1182	1149	1119	1058	1003	962	913	817	800	-88%	-2%
Dioxins and furans	grams International Toxic Equivalent (TEQ)[2]	Not reported	Not reported	1037	238	231	215	217	237	207	190	169	172	163	186	-82%	14%
Other pollutants not covered by the UK AQS																	
Non-methane volatile organic compounds (NMVOCs)[1]	Kilotonnes	2,010	2,247	2,762	1,586	1,481	1,389	1,260	1,163	1,088	1,039	1,002	922	822	789	-71%	-4%
Hydrogen chloride	Kilotonnes	333	306	270	82	69	43	39	28	19	17	14	12	11	12	-96%	4%
Hydrogen fluoride	Kilotonnes	14	11	10	4	4	5	5	5	5	5	5	4	3	3	-71%	1%

Notes
1. Toxic Equivalent (TEQ) is a more appropriate measure than the total grams, as it reflects the toxicity of mixtures of compounds.

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A National Statistics publication

National Statistics are produced to high professional standards set out in the Code of Practice for Official Statistics. They undergo regular quality assurance reviews to ensure they meet customer needs.

Responsible Defra statistician: Stephen Hall

Main notes

1. The statistics presented are calculated from the National Atmospheric Emissions Inventory (NAEI), produced for Defra and the Devolved Administrations by AEA Technology. A full report will be published later in the year, including detailed methodology. For further information on the inventory see the NAEI web site.

2. Some changes have been made in the 2010 NAEI estimates for Nitrogen Oxides emissions from UK road transport due to changes in emission factors and fleet composition data. Changes in emission factors from road transport result from changes in exhaust emission factors in light of new evidence on the emission performance of certain vehicle types under real world driving conditions.Changes in fleet composition data occurred following analysis of DfT's Automatic Number Plate

Recognition (ANPR) data for different road types and DVLA licensing data for the UK's Devolved Administrations. Changes in fleet composition data results from the provision of anonymised ANPR data for 256 sites in the UK between 2007-2010. These were analysed to define the composition of the fleet in terms of vehicle age (and hence Euro emission standard) and fuel type actually observed on different types of roads: urban, rural and motorways. These data were used in conjunction with vehicle licensing data for each Devolved Administration (DA) country to adjust current assumptions made when calculating the UK vehicle fleet, with the aim of providing a more realistic 'on-road' vehicle fleet by DA region.

3. For any given year considerable uncertainties may surround the estimates, although the uncertainty ranges of the emissions are highly pollutant dependent and have been significantly reduced over time based on the continuous work to improve the accuracy of the data. Historic data are recalculated each year to reflect changes in methodology, which is based on the most up-to-date information available.

4. Results for greenhouse gases, also covered in the NAEI, are published by Department of Energy and Climate Change (DECC) in a separate National Statistics release. For further details visit the DECC website

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