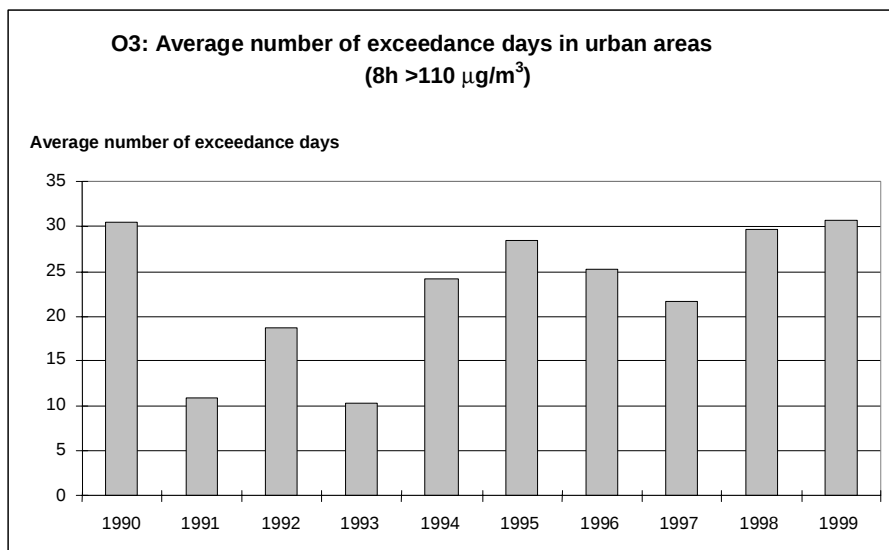


AP12a Exceedance days of air quality threshold values for ozone in urban areas



Title: Exceedance of the EU human health threshold value for ozone in urban areas in the EEA

Note: Exceedance days are days with an 8-hour average ozone concentration of more than 110 µg/m³ (the threshold value for protection of human health).

Source: EEA-ETC/AQ

☹ Ozone levels in Europe are exceeding the threshold set for protection of human health. Year-to-year fluctuations and changes in monitoring networks preclude firm conclusions on trends in population exposure; analysis of monitoring data suggests that peak ozone concentrations are decreasing, but median values are tending to increase.

Results and assessment

Relevance of the indicator for describing developments in the environment

Ground level (tropospheric) ozone is seen as one of the most prominent air pollution problems in Europe. It is caused by photochemical reactions with ozone precursors: non-methane volatile organic compounds, nitrogen oxides, carbon monoxide and methane in the atmosphere. These precursors can be aggregated on the basis of their tropospheric ozone-forming potential to assess the relative impact of the different pollutants.

Exposure to periods of a few days of high ozone concentration can have adverse health effects, in particular inflammatory responses and reduction in lung function. Exposure to moderate ozone concentrations for longer periods may lead to a reduction in lung function in young children. Tropospheric ozone can also affect ecosystems, mainly through damaging leaves and other parts of plants.

The indicator presented in this fact sheet is the number of days a year on which the current limit level for ozone ($110 \mu\text{g}/\text{m}^3$ for 8-hour mean concentration) set by the EC for the protection of human health is exceeded. Exceedance days are averaged for all ozone stations in a city and then a population-weighted average is calculated for all cities with reported ozone data. Indicator values before 1994 cover few cities and consequently have limited representativeness. Data after 1993 cover an urban population of 50 to 75 million. The indicator is subject to year-to-year fluctuations because of changes in the monitoring stations that report data, and also because it represents conditions with relatively high ozone concentrations; these depend on special meteorological situations, the occurrence of which varies from year to year.

Threshold levels are exceeded over a wide area and by a large margin. While most of the complex mechanisms of ozone formation and destruction and the relation of ground-level ozone to global tropospheric ozone are now reasonably well understood, the measures that have been agreed and implemented for reducing emissions of its precursors (see AP5b) are currently insufficient to prevent these exceedances.

Ozone also has an important role in air pollution by nitrogen dioxide (see AP13). Tropospheric ozone is an important greenhouse gas.

Policy relevance and policy references

The indicator is based on information collected under the current ozone Directive (92/72/EEC). A combined ozone and acidification abatement strategy has been developed by the Commission, resulting in proposals for a new Ozone Daughter Directive and a National Emission Ceiling Directive. In this proposed legislation, mutually consistent target values for ozone levels and for precursor emissions have been set for tackling the problems of acidification (AP1-3, 6) eutrophication and ozone. The proposed Ozone Directive sets ozone target values for 2010: with respect to human health, a threshold value of $120 \mu\text{g}/\text{m}^3$ as rolling 8h average may be exceeded during 25 days per year. This is consistent with the target for emissions of ozone precursors set in the proposed National Emission Ceilings Directive. Due to differences in the definitions of threshold values, information collected under the current Ozone Directive is not adequate to assess exceedances of the newly proposed threshold values. However, exceedances of the $120 \mu\text{g}/\text{m}^3$ threshold are probably occurring in a number of Member States.

Assessment

Although reductions in emissions of ozone precursors appear to have led to lower peak concentrations of ozone in the troposphere, the current limit level is frequently exceeded for large fractions of the population of the EU. Estimates for 1999 suggest that 42 % of the population was exposed to concentrations above the limit level on between 1 and 25 days, and 12 % on more than 50 days. There were more than 10 exceedance days in all EU countries except the Northern European countries and Portugal.

The reductions in ozone precursor emissions that should result from enforcement of the NECD and the CLRTAP Protocols are unlikely to reduce ozone concentrations to below the current and proposed limit values over the whole of the EEA. In North

West Europe about 25 exceedance days of the 120 µg/m³ limit are still expected in 2010.

Data

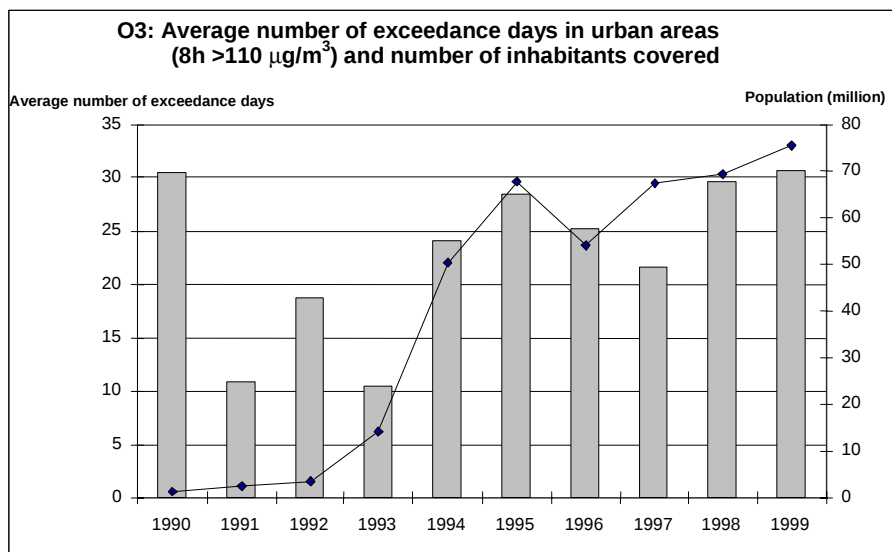
AP12 a: AVERAGE NUMBER OF DAYS WITH EXCEEDANCE OF 110 µg/m³ FOR O₃ (8h-mean)

URBAN STATIONS ONLY (source: data delivered under ozone directive)

POPULATION (IN MILLIONS) REFERS TO THE POPULATION IN CITIES WITH AT LEAST ONE STATION

<i>Exceedance days</i>	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Austria				29.40	37.66	29.96	26.13	19.93	29.61	20.94
Belgium		12.00	19.34	14.33	22.97	42.00	16.58	22.66	12.41	19.61
Germany					35.23	32.19	20.54	23.27	19.05	23.90
Denmark				5.90	22.04	9.10	9.12	5.33	4.71	6.75
Spain					8.02	2.20	15.79		33.20	24.99
Finland			8.00	5.00	3.00	10.00	6.00	2.00	4.00	2.00
France						23.31		18.79		12.04
United Kingdom				3.00	7.23	18.69	9.38	8.68	3.45	11.28
Greece						68.17	84.40	52.86	77.91	94.19
Ireland					0.00	10.00	1.00	2.00	2.00	1.00
Iceland										
Italy					30.05	42.04	54.91	54.75	67.57	83.19
Liechtenstein										
Luxembourg										
Netherlands	30.44	9.77	19.46	7.97	16.48	20.51	9.12	14.34	4.65	10.10
Norway							9.00	4.00	0.00	0.00
Portugal					0.00	0.00				6.22
Sweden										
<i>Average</i>	30.44	10.84	18.84	10.40	24.17	28.50	25.27	21.59	29.67	30.62

<i>Population</i>	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Austria				2.88	2.91	2.95	2.96	2.94	2.96	2.91
Belgium		1.26	1.90	1.90	1.90	1.26	2.12	2.40	2.89	3.06
Germany					20.28	20.65	21.67	22.28	21.69	22.28
Denmark				0.26	1.63	1.63	1.63	1.63	1.63	0.26
Spain					4.84	4.01	3.39		7.90	6.51
Finland			0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
France						12.64		16.36		10.66
United Kingdom				7.65	9.95	9.95	9.95	12.23	12.56	12.56
Greece						3.07	3.07	3.82	3.82	3.82
Ireland					0.95	0.95	0.95	0.95	0.95	0.95
Iceland										
Italy					5.79	8.85	6.86	3.27	13.36	10.16
Liechtenstein										
Luxembourg										
Netherlands	1.36	1.36	1.36	1.47	1.47	1.24	1.47	1.47	1.47	1.47
Norway							0.03	0.03	0.03	0.03
Portugal					0.30	0.30				0.72
Sweden										
<i>Total</i>	1.36	2.62	3.42	14.33	50.18	67.67	54.27	67.54	69.44	75.56



AP12a.2 Average number of exceedance days of ozone threshold value of 180 µg/m³ in urban areas and number of inhabitants covered.

Meta data

Technical information

1. Data source

Ozone exceedance data are obtained from the information submitted by EU Member States and other European countries under the ozone Directive (92/72/EEC).

Urban population data are obtained from the coverage STEU (Settlements in Europe) from the GISCO database.

2. Description of data

Data submitted under the ozone directive 92/72/EEC includes information on exceedances of a threshold of 110 µg/m³ as an 8h-mean. Ozone monitoring stations are characterised by the Member States as *rural*, *urban*, *street* and *other* depending on their direct surroundings. Only information from *urban* stations is included here.

3. Geographical coverage

Data are from EEA 18 countries as far as available.

4. Temporal coverage

1990 - 1998. Reporting under the ozone directive started in 1994; a limited number of Member States provided information for previous years.

5. Methodology and frequency of data collection

Information on exceedances and annual statistics is reported annually under the ozone directive 92/72/EEC.

6. *Methodology of data processing*

The number of exceedance days is calculated for each urban station. A city average number of exceedance days is obtained by averaging over all available urban stations. The urban average is obtained by averaging over the stations. The ozone monitoring data is linked to the population data in the STEU-coverage when city names correspond or when the distances between station and city centre is less than 5 km. A country-wide average is obtained by a population-weighted averaging over all reporting cities.

Quality information

7. *Strength and weakness (at data level)*

Data has been officially submitted to the Commission under the ozone directive. Station characteristics and representativeness is often not well documented.

The indicator as chosen provides information on the population living in the urban area for which monitoring information is available. Yearly changes in indicator value may result from changes in monitoring density and/or selected cities which will influence the total monitored population. The indicator is subject to year-to-year fluctuations as it represents episodic conditions, and these depend on particular meteorological situations, the occurrence of which varies from year to year.

8. *Reliability, accuracy, robustness, uncertainty (at data level)*

Most of the data are validated. The number of available data series varies considerably from year to year and for some years is very low. The indicator is subject to large year-to-year variations due to meteorological variability. When averaging over EEA18 this meteorologically-induced variation may be less.

By combining urban and street type station the population coverage will improve. However, as ozone concentrations at street level are reduced by locally emitted nitrogen oxides, this combination will lead to a underestimate of the number of exceedance days. The definition of station type is not unambiguous; the current set may well be contaminated with data from street-type stations.

9. *Further work required (for data level and indicator level)*

Better coverage in space and time by improved national reporting is expected for the future. Better documentation on station representativeness is needed.