Reporting on ambient air quality assessment

Preliminary results for 2006

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Cover page: Breaching of the PM_{10} limit values is observed in almost all Member States. Wood burning is an important source of primary PM_{10}.

Cover photo © Frank de Leeuw

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Summary

EU Member States have submitted annual reports on air quality in 2006 to the European Commission under the Air Quality Framework Directive (96/62/EC). The reports were provided in the form of a predefined questionnaire. The present report gives a preliminary overview and analysis of the submitted information.

This report is based on information available at the European Topic Centre on Air and Climate Change on 27 November (that is, nearly 2 months after the official submission deadline). By that date, questionnaires from Luxembourg, Malta and of several regions within Italy were missing.

The analyses indicate that the designation of zones seems to be incomplete in a number of Member States. Zones designated for the protection of human health should cover the whole territory and the total population of a Member State. A nearly complete coverage is in general found for sulphur dioxide, nitrogen dioxide, PM_{10} (with exceptions for Belgium and Estonia) and ozone (except France). Lower coverages are found in the case of lead, benzene and carbon monoxide.

The number of zones where an exceedance of the limit or target values has been observed in 2006 does not differ strongly from the numbers observed in 2005. The limit values of PM_{10} (daily and annual) and nitrogen dioxide (annual) and the target value of ozone are the most frequently exceeded. Exceedances of the limit value of sulphur dioxide (both hourly and daily), carbon monoxide and lead are observed in a small number of zones (less than 5%).

The monitoring information on $PM_{2.5}$ concentrations is still limited: 20 Member States report data for 294 stations which is similar to the situation in 2005. Exceedances of the limit value of 25 $\mu g/m_3$ as annual mean are observed in 12 of the 20 Member States on reporting $PM_{2.5}$.

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1. Introduction

This document gives a first preliminary overview of the annual reports by Member States to the European Commission on the results of the assessment of their air quality in 2006. These reports have been submitted under the Air Quality Framework Directive[1], following Commission Decision 2004/461/EC[2], which specifies the information to be sent in detail and provides a set of forms to be filled in. In the remaining of this report this Decision will be called 'the AQ questionnaire' or, when the context is clear, simply 'the questionnaire'.
This report has been prepared by the European Topic Centre on Air and Climate Change (ETC/ACC) of the European Environment Agency upon a request of DGEnvironment. A more extensive analysis of the 2006-questionnaire is foreseen to be available by November 2008.

Member State reports addressed in this document
This document deals with the reports by the 27 EU Member States on the year 2006 submitted under the First Daughter Directive[3], the Second Daughter Directive[4] and the Third Daughter Directive[5]. The year 2006 is the first year for reporting by the new Member States Romania and Bulgaria.
The assessments in this report are based on the information received by ETC/ACC before 27 November 2007 (note that the official deadline was 1 October 2007). At that moment Luxembourg and Malta have not submitted any information. Italy has delivered parts of the questionnaire: from 12 of the 21 regions a separate questionnaire has been received. Gibraltar submitted its questionnaire separately from the UK. Separate (regional) questionnaires for one Member State complicate and delay the processing of the data.
Norway has voluntary submitted a questionnaire which has been included in the analyses.

Reporting under the Exchange of Information Decision
In parallel to the reporting under the Framework Directive, which mainly focuses on compliance checking with obligations under the air quality directives, such as limit values, Member States are sending detailed information from their monitoring networks each year under the Exchange of Information Decision (EoI)[6]. These extensive reports contain to a large extent individual 'raw' data (e.g. all hourly concentrations) and include extensive complementary information about the monitoring stations (metadata). The European Topic Centre on Air and Climate Change publishes annually an assessment of these reports (see, for the assessment of the 2005-data: Mol et al., 2007). To avoid duplicate reporting by Member States, some of the data that are needed for evaluating the reports under the Framework Directive (particularly the metadata of stations) are only sent under EoI. Deadline for submitting the EoI information is 1 October. The processing of the 2006 EoI-data is in full progress while preparing this report and is therefore not yet available. Assessment of those parts of the questionnaire related to monitoring stations has to be postponed until the EoI reporting cycle is finished. These aspects will be discussed in the final assessment report (November 2008).

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1 Council Directive 96/62/EC on ambient air quality assessment and management.
2 Commission Decision 2004/461/EC laying down a AQ questionnaire to be used for annual reporting on ambient air quality assessment under Council Directives 96/62/EC and 1999/30/EC and under Directives 2000/69/EC and 2002/3/EC of the European Parliament and of the Council.
3 Council Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air (amended by Commission Decision 2001/744/EC).
4 Directive 2000/69/EC relating to limit values of benzene and carbon monoxide in ambient air.
5 Directive 2002/3/EC relating to ozone in ambient air.
6 Council Decision 97/101/EC establishing a reciprocal exchange of information and data from network and individual stations measuring ambient air pollution within the Member States (amended by Commission Decision 2001/752/EC).

Quality of the data received and implications for this overview

To facilitate the submission of the data, the Commission has made the AQ questionnaire available to the Member States in Excel format. This format does not reject erroneous data, and during the processing numerous small errors, e.g. spurious spaces, had to be removed before all reports could be joined in a database. A second form of trivial errors is the use of other symbols than prescribed in the questionnaire, for example, ticking an "o", "x" or "+" in stead of the prescribed "y"; using a comma as separator while the semi-colon is prescribed. Although in general the information is unambiguous, a time consuming correction of this type of errors is necessarily for an automatic processing of the data. There were also errors that required more insight for correction, such as inconsistent use of zone and pollutant codes or use of codes that were not allowed. Another difficult type of error is that MS do not use the same codes for stations in the AQ questionnaire and EoI reports.

As far as reasonable, it was attempted to resolve these errors by expert judgement. In order to make a fast publication of this initial assessment possible, no feedback[7] with the MS was sought in this stage. It is most likely that we made mistakes while making corrections or completing the missing information. In view of these corrections and remaining mistakes, this preliminary report provides only a statistical overview of the air quality status at the national level. Not all aspects of the questionnaire will be discussed here. Focus will be on the designation of zone and their air quality status. The number and reasons of exceedances of the limit or target values will be briefly discussed. In chapter 6 a summary of the $PM_{2.5}$ concentrations as measured in 2006 will be presented. More detailed information will be presented in the final report.

Abbreviations used

Member States have been abbreviated following the ISO3166-1 country alpha-2 code[1]:

Austria: AT; Belgium: BE; Cyprus: CY; Czech Republic: CZ; Denmark: DK; Estonia: EE; Finland: FI; France: FR; Germany: DE; Greece: GR; Hungary: HU; Ireland: IE; Italy: IT; Latvia: LV; Lithuania: LT; Luxembourg: LU; Malta: MT; Netherlands: NL; Poland: PL; Portugal: PT; Slovakia: SK; Slovenia: SI; Spain: ES; Sweden: SE; United Kingdom: GB[2], and Norway: NO.

AQ questionnaire questionnaire	Questionnaire on air quality set out by Commission Decision 2004/461/EC
CO	Carbon monoxide
EoI	Exchange of Information Decision: Council Decision 97/101/EC, amended by Commission Decision 2001/752/EC
EU27	The 27 EU Member States after accession of 12 new Member States in 2004 and 2007
LV	Limit value
MOT	Margin of Tolerance (see the legend to Tables 3 and 4)
MS	Member State(s)
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
Pb	Lead
PM_{10}	Particulate matter composed of particles smaller than 10 micrometer in aerodynamic diameter
$PM_{2.5}$	Particulate matter composed of particles smaller than 2.5

[7] Directly after the submission deadline a feedback has been sent to the national contact persons (on 19 October). This feedback concerned the quantity (the number of zones, number of exceedances, etc.) not the quality or consistency of the information in the questionnaire. The first feedback action, however, resulted in a few cases in a revision of the questionnaire. Revisions received before or on 19 November have been included in this report. A feedback with the MS on the quality of the information is planned in the beginning of 2008; emphasis will initially be on a correct and complete definition of the zones.

	micrometer in aerodynamic diameter
O_3	Ozone
SO_2	Sulphur dioxide
TV	Target value (O_3)
LTO	Long Term Objective (O_3)

Notes
1: see http://www.iso.ch/iso/en/prods-services/iso3166ma/02iso-3166-code-lists/index.html
2. including Gibraltar.

Disclaimer

This report contains summary information based on data delivered before 27 November[8], that is, within less then two months after the deadline set by the decision. The information describing the situation in 2006 is based on the submitted information only. Information submitted under the EoI is being processed and is therefore not yet available as additional input in the assessment. For processing the information, the ETC/ACC has, where needed, corrected or completed the information. Due to time constraints the Member States have not been consulted in this process. Hence, this report should be regarded as preliminary and it cannot be used for legal compliance checking.

[8] After 27 November while preparing report questionnaire from four additional Italian regions and from Iceland have been received; Belgium Finland, Italy (one region) and Spain have submitted updates of their questionnaire. This newly received information has not been included in this preliminary assessment.

2. Designation of zones

Designated zones in the Member States to assess and manage air quality vary widely dependant on the chosen variable: size, population, measured individual pollutant or types of protection targets. The total number of zones that Member States design to assess and manage air quality is not strictly defined. Member States are free in defining their own zone structure and characteristics (population and area)which makes mutual comparison of final results between countries more difficult.

Table 1 gives an overview of the total number of zones defined for 2006. The total number of 1027 zones is, notwithstanding the enlargement with Bulgaria (6 zones) and Romania (4 zones), lower than in 2005 (1064 zones, Vixseboxse and de Leeuw, 2007). This difference is mainly caused by the missing information from Italy: only 12 from the 21 regions have submitted a questionnaire. Minor differences are seen for Germany (plus 2 zones), Spain (minus 2 zones) France (minus 1 zone), United Kingdom (plus 1 zone, namely Gibraltar). However, similar numbers as last year does not necessarily implies the designation of zones is similar in both years as zone boundaries or designation between pollutants may have been changed.

Table 1. Number of zones per Member State in 2006, including the designation of the zones for individual pollutants or types of protection targets.

		SO2		NO2	NOx					
	total	health	ecosystem	health	vegetation	PM10	Pb	benzene	CO	O3
AT	19	11	11	11	8	11	11	11	11	11
BE	17	12	12	11	11	10	13	8	8	9
BG	6	6	6	6	6	6	6	6	6	6
CY	1	1	1	1	1	1	1	1	1	1
CZ	15	15	15	15	15	15	15	15	15	15
DE	120	74	85	80	94	77	67	79	79	63
DK	10	3	3	9	5	9	2	4	9	9
EE	4	4	4	4	4	2	0	0	3	4
ES	138	138	28	138	29	138	138	138	138	138
FI	18	14	1	14	1	14	14	3	14	2
FR	88	81	74	86	79	81	28	36	33	60
GB	44	44	44	44	44	44	44	44	44	44
GR	4	4	4	4	4	4	0	1	4	4
HU	11	11	11	11	11	11	11	11	11	11
IE	4	1	1	1	1	4	4	4	4	4
IT	97	65	52	84	68	77	38	62	71	65
LT	3	3	3	3	3	3	3	3	3	3
LU	no information received									
LV	2	2	2	2	2	2	1	2	1	2
MT	no information received									
NL	9	9	9	9	1	9	4	0	0	0
PL	362	362	314	362	314	362	362	362	362	362
PT	26	25	25	25	25	25	1	21	15	25
RO	4	4	4	4	4	4	4	4	4	4
SE	6	6	6	6	6	6	0	6	3	6
SI	9	9	9	6	6	6	6	6	6	6
SK	10	10	10	10	10	10	10	10	10	9
EU27	**1027**	**914**	**734**	**946**	**752**	**931**	**783**	**837**	**855**	**863**
NO	7	3	3	7	0	7	0	7	5	6
all	1034	917	737	953	752	938	783	844	860	869

The lowest number of zones is found for the two objectives related to the protection of ecosystems and/or vegetation. In relation to the protection of health, the number of zones defined for SO_2, NO_2 and PM_{10} tends to be higher than for the other four pollutants.
About a quarter of the zones has been given the status of agglomeration zone which has certain implications for the number of required monitoring stations. The ratio of the number of agglomerations to the total number of zones varies strongly between the Member States: from 100% classified as agglomeration in Bulgaria, Cyprus and Romania to 3% in Poland with a median value of 35% for the EU27.
Information on population and area of the zones is provided on voluntary basis in most of the case: information on the area is missing for 10% of the zones, information on the population is almost complete (available for 98% of the zones). National totals on area and population the data provided by Eurostat or the FAO has been used here as a reference.
Table 2 gives an overview of the fraction of the total population living in agglomerations. This fraction varies between about 20% For Finland to 100% in Cyprus and Bulgaria. The relative low number for Italy is caused by the incomplete filling of the questionnaire as some regions have not yet reported. On the average about one third of the EU27 population reside in an agglomeration.

Table 2. Fraction (%) of population living in agglomerations per Member State in 2006, for individual pollutants in relation to health protection.

	SO2	NO2					
	health	health	PM10	Pb	benzene	CO	O3
AT	25	25	25	25	25	25	25
BE	23	23	23	23	17	17	17
BG	105	105	105	105	105	105	105
CY	95	95	95	95	95	95	95
CZ	27	27	27	27	27	27	27
DE	34	34	34	33	34	34	34
DK	25	34	34	22	34	34	34
EE	35	35	35	0	0	35	35
ES	55	55	55	55	55	55	55
FI	19	19	19	19	19	19	19
FR	39	39	39	29	27	27	28
GB	42	42	42	42	42	42	42
GR	41	41	41	0	33	41	41
HU	24	24	24	24	24	24	24
IE	0	0	26	26	26	26	26
IT	15	18	19	13	17	17	19
LT	26	26	26	26	26	26	26
LU (a)							
LV	32	32	32	0	32	32	32
MT (a)							
NL	30	30	30	8	0	0	0
PL	23	23	23	23	23	23	23
PT	45	45	45	0	45	45	45
RO (b)	-	-	-	-	-	-	-
SE	31	31	31	0	31	31	31
SI	19	19	19	19	19	19	19
SK	12	12	12	12	12	12	12
EU27	32	33	33	27	30	30	30
NO	0	27	27	0	27	27	24

(a) no information received
(b) no information on population available

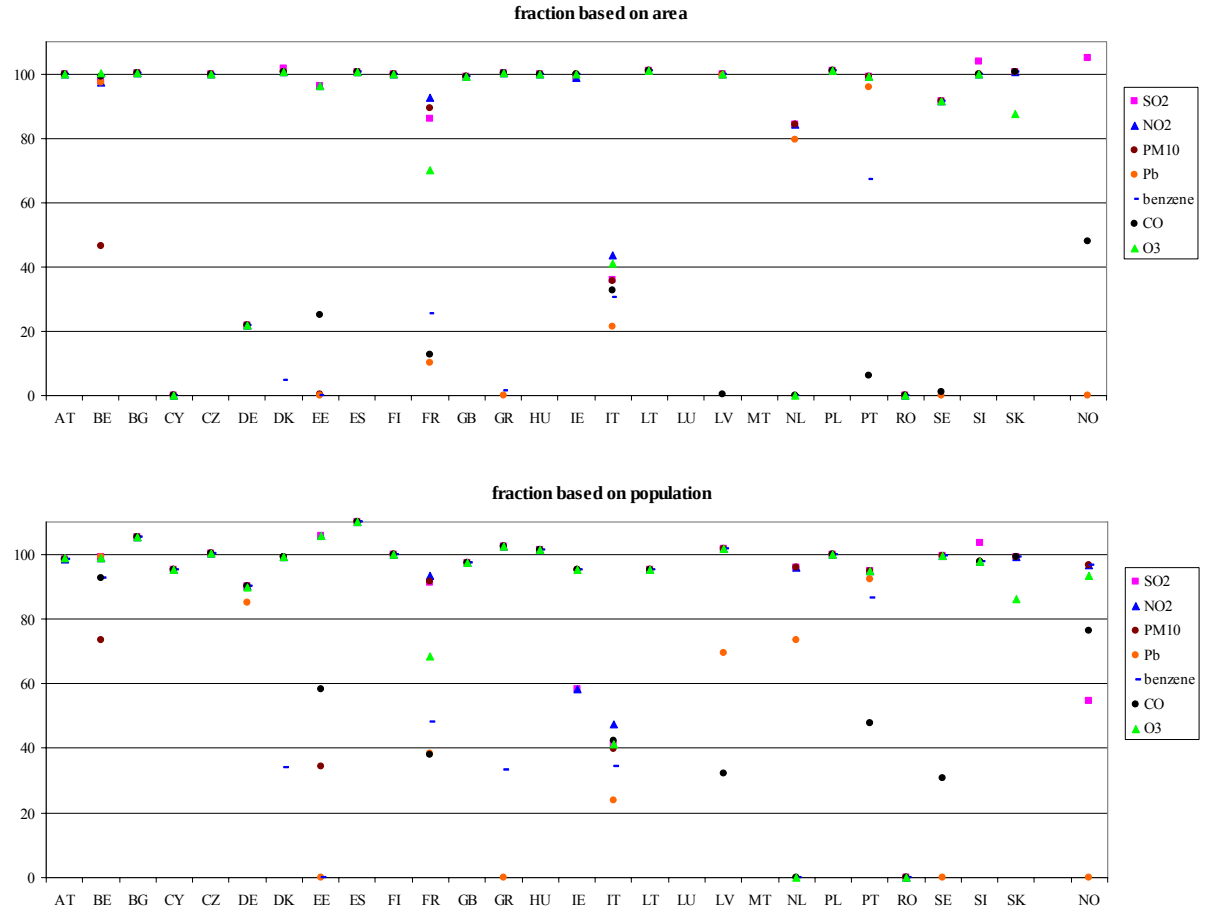


Figure 1. The total area (top) and population (bottom) of zones designated in relation to health protection as fraction of the national area and population. Note that no questionnaire is available for Luxembourg and Malta; Romania did not provide information on area and population. Information for Italy is based on an incomplete set of questionnaires.

The limit values for the protection of human health apply throughout the whole territories of the Member States, so areas that do not belong to any zone related to health protection should not exist. Similar, the population living is zones related to health protections should add up to the national total population numbers. Figure 1 compares the totals of area and population calculated for each of the seven health related objectives with the corresponding national area and population. For most, but not all Member States the total surface area of the health-related zones indeed added up to the total surface area of the country within a range of 5%. Small diviations from the 100% are to be expected in view of the different information sources and by difference in base year of the census.
In nine Member States (AT, BG, CY, CZ, ES, FI, GB, HU, PL) the population totals are the same for the seven pollutants and are close to the 100% indicating that the total territory has been assigned. For the other countries the coverage may add to about 100% but it varies slightly for the various pollutants. This indicates (minor) inconsistencies in the zone designation.
A nearly complete coverage is in general found for SO_2, NO_2, PM_{10} (with exceptions for BE and EE) and O_3 (except FR). Lower coverages are found in the case of lead, benzene and CO. Three Member States have not designated zones for one or more pollutants: Estonia (Pb and benzene); Greece (lead) and the Netherlands (benzene, CO and ozone).

3. Overview of zones where air quality thresholds were exceeded

If measurements or model calculations show that a limit value or limit value plus margin of tolerance is exceeded somewhere in the zone, the whole zone is designated as being in exceedance of this threshold. Table 3 summarises the exceedance status of zones[9] per limit value and per Member State. As no questionnaire has been received from Luxembourg and Malta, these countries have not been included in the tables and further discussion.

There are some discrepancies between the number of zones listed in Table 3 and the numbers presented in Table 1. In Table 3 the term *undefined* means that the air quality status in these zones have been defined in form 2 to be applicable for the given combination pollutant/ protection target but the air quality status in the specified zone has not been given in the forms 8 or 9. On the other hand, Table 3 includes information on the AQ status of pollutants for zones which not have been designated for these pollutants. To a large extent these discrepancies might result from mistakes (e.g misprinting zone codes) in the respective forms. It is expected that the discrepancies will not influenced the conclusions at the aggregated level presented here.

Figure 3 shows for all limit/target values the percentage of zones in exceedance. Both for zones and agglomerations the fraction is expressed taking the total number, the total population or the total area of zones and agglomerations, respectively, as reference. The graphs are arranged with the percentages in decreasing order, thus indicating the stringency of the limit/target values.
The PM_{10} daily limit value seems the most difficult to attain, with 43% of the zones and 60% of the population in the EU27 in exceedance of the limit value. The ozone target values, both for health and vegetation, appear to be somewhat less stringent with respect to the number of zones in exceedance. Referring to agglomerations or population, the yearly limit value of NO_2 has the second highest score. Figure 3 shows that the most frequent exceedance is observed for the daily an d annual limit value of PM_{10}, the annual limit value of NO_2 and for the ozone health-related target value. For all the indicators shown in Figure 3, exceedances of the health related target values of SO_2 (both hourly and daily), lead, CO, and benzene and of the ecosystem/vegetation related limit values for SO_2 (annual and winter mean) and NOx are observed in less than 10% of the cases.

- ***It should be noted that the number or percentage of zones in exceedance is only a crude indicator for the area in exceedance. In the first place, the exceedance area might be the entire zone area or just a few hundred square metres at a hotspot. In the second place, some Member States have made very large zones, so very few zones, for pollutants that are everywhere substantially below the air quality thresholds. Hence, the number or percentage of zones cannot be used to estimate the area in exceedance or to compare actual population exposure to air pollution between different Member States or even between regions within a Member State.***

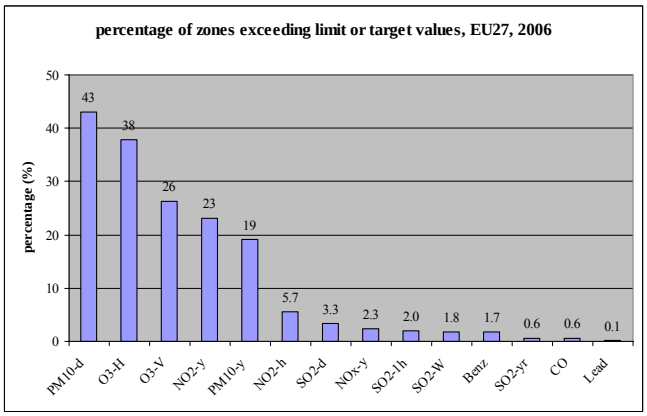
[9] It should be noted that the total area or population of zones with exceedance is not given here because it is not a useful parameter to characterise exposure to exceedance: in many zones only a limited area, e.g. near a number of streets, may be in exceedance.

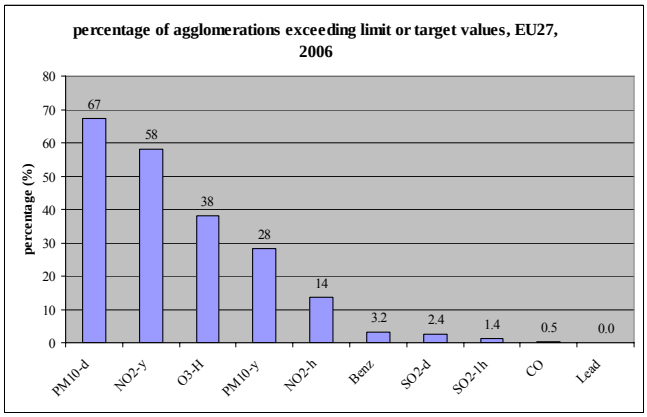
Table 3a. Summary of exceedance status of zones in EU Member States in 2006 with respect to the limit values and limit valus plus margin of tolerance for sulphur dioxide and nitrogen oxides.

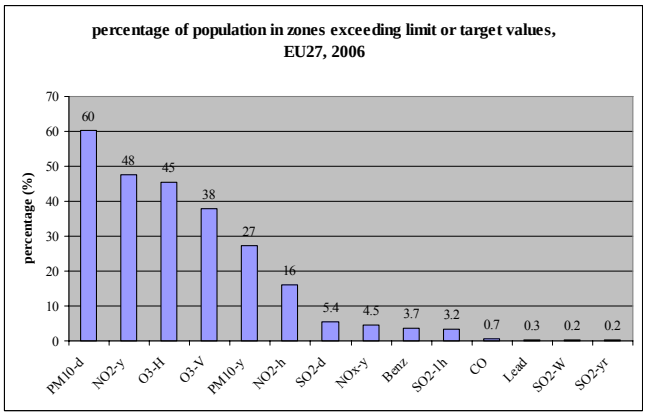
	SO2 health 1h			SO2 health day			SO2 year			SO2 winter			NO2-h				NO2-y				NOx-y		
MS	undef	<LV	>LV	undef	<LV	>LV	undef	<LV	>LV	undef	<LV	>LV	undef	<LV	LV - MOT	>MOT	undef	<LV	LV - MOT	>MOT	undef	<LV	>LV
AT	0	11	0	0	11	0	3	8	0	3	8	0	0	9	2	0	0	2	2	7	0	7	1
BE	0	12	0	0	12	0	12	0	0	12	0	0	0	10	0	1	0	7	3	1	11	0	0
BG	0	5	1	0	3	3	5	1	0	5	1	0	0	3	2	1	0	4	1	1	5	1	0
CY	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0
CZ	0	15	0	0	13	2	0	15	0	0	15	0	0	14	1	0	0	9	3	3	0	15	0
DE	0	74	0	10	64	0	70	15	0	70	15	0	0	74	4	2	0	37	8	35	79	15	0
DK	0	3	0	0	3	0	0	3	0	0	3	0	0	9	0	0	0	7	1	1	0	5	0
EE	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	0	4	0	0	0	3	1
ES	9	125	4	9	126	3	0	29	1	0	29	1	10	124	2	2	10	111	8	9	0	27	0
FI	0	14	0	0	14	0	0	1	0	0	1	0	0	14	0	0	0	13	0	1	0	1	0
FR	4	69	4	4	68	5	24	43	0	24	42	0	6	66	5	2	7	51	8	13	36	33	1
GB	0	43	1	0	43	1	28	15	0	28	15	0	2	41	0	1	0	4	2	38	28	15	0
GR	1	3	0	1	3	0	4	0	0	4	0	0	1	2	1	0	1	1	1	1	4	0	0
HU	0	11	0	0	11	0	10	1	0	10	1	0	0	10	1	0	0	8	1	2	11	0	0
IE	0	4	0	0	4	0	0	1	0	0	1	0	0	4	0	0	0	4	0	0	0	1	0
IT	0	63	0	0	63	0	0	21	0	0	13	0	0	65	10	2	0	37	12	28	17	10	5
LT	0	3	0	0	3	0	2	1	0	2	1	0	0	2	1	0	0	3	0	0	2	1	0
LV	0	2	0	0	2	0	1	1	0	1	1	0	0	2	0	0	0	1	1	0	1	1	0
NL	0	9	0	0	9	0	8	1	0	8	1	0	0	7	2	0	0	0	0	9	0	1	0
PL	122	238	2	0	348	14	0	314	0	314	0	0	122	239	0	1	0	349	9	4	0	314	0
PT	3	22	0	3	22	0	20	5	0	20	5	0	2	21	0	2	2	20	1	2	19	6	0
RO	0	3	1	0	4	0	0	1	0	0	1	0	0	3	0	1	0	4	0	0	0	1	0
SE	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	0	3	1	2	0	6	0
SI	0	7	2	0	8	1	0	7	2	0	7	2	0	6	0	0	0	6	0	0	0	2	4
SK	3	9	0	3	9	0	9	3	0	9	3	0	3	9	0	0	3	6	3	0	9	3	0
EU27	142	747	15	30	845	29	188	496	3	502	173	3	146	738	29	15	23	692	65	148	222	468	12
NO	0	7	0	0	7	0	3	0	0	3	0	0	0	6	0	1	0	3	1	3	0	0	0
total	142	754	15	30	852	29	191	496	3	505	173	3	146	744	29	16	23	695	66	151	222	468	12

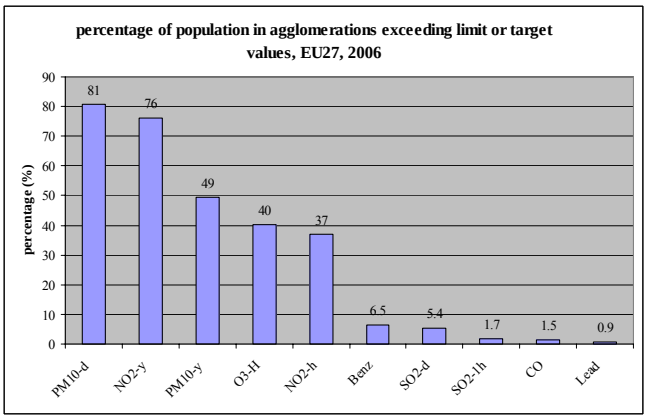
Table 3b. Summary of exceedance status of zones in EU Member States in 2006 with respect to the limit values and for particulate matter, lead, benzene and carbon monoxide and the target values and long-term objectives for ozone.

	PM10 health day			PM10 health year			lead			benzene			CO			Ozone health				Ozone vegetation			
MS	und ef	<LV	>LV	und ef	<LV	>LV	und ef	<LV	>LV	und ef	<LV	>LV	und ef	<LV	>LV	und ef	<LTO	LTO - TV	>TV	und ef	<LTO	LTO - TV	>TV
AT	0	0	11	0	8	3	0	11	0	0	11	0	0	11	0	0	0	0	11	3	0	0	8
BE	0	1	10	0	8	3	3	10	0	0	10	0	3	7	0	0	0	7	2	0	0	8	1
BG	0	0	6	0	0	6	0	5	1	1	5	0	0	4	2	0	0	5	1	5	0	1	0
CY	0	0	1	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1
CZ	0	0	15	0	6	9	0	15	0	0	14	0	0	15	0	0	0	0	15	0	0	0	15
DE	0	41	36	0	72	5	0	67	0	0	78	1	0	79	0	0	0	35	28	17	0	18	28
DK	3	3	3	3	4	2	0	2	0	3	1	0	4	5	0	2	5	2	0	2	7	0	0
EE	0	2	2	0	4	0	0	1	0	0	0	0	0	4	0	0	0	2	2	4	0	0	0
ES	10	67	61	10	85	43	23	115	0	62	76	0	15	123	0	15	18	52	53	17	23	45	53
FI	0	13	1	0	14	0	0	14	0	0	3	0	0	14	0	0	0	2	0	0	0	2	0
FR	7	63	9	9	69	1	6	42	0	2	51	0	3	56	0	1	4	30	44	7	3	33	31
GB	0	13	31	0	42	2	0	44	0	0	43	1	0	44	0	0	0	44	0	0	2	42	0
GR	1	0	3	1	0	3	0	0	0	0	0	1	1	3	0	0	1	0	3	0	1	0	3
HU	0	1	10	0	7	4	0	11	0	0	11	0	0	11	0	0	0	7	4	10	0	0	1
IE	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	3	1	0	3	1	0	0
IT	0	18	49	0	43	24	1	34	0	0	57	3	0	68	1	1	2	2	50	16	1	3	34
LT	0	0	3	0	3	0	0	3	0	0	3	0	0	3	0	0	0	2	1	2	0	1	0
LV	0	2	0	0	2	0	0	2	0	0	2	0	0	1	0	0	2	0	0	1	1	0	0
NL	0	0	9	0	4	5	0	4	0	0	5	0	0	9	0	0	0	8	1	0	2	7	0
PL	19	244	99	0	309	53	0	362	0	0	354	7	0	361	1	0	0	275	87	0	1	313	0
PT	2	14	9	2	19	4	0	1	0	7	15	0	2	13	0	3	1	8	13	20	1	0	4
RO	1	0	3	1	2	1	3	1	0	1	3	0	0	3	1	0	0	0	4	0	0	0	1
SE	0	3	3	0	6	0	0	6	0	0	6	0	0	6	0	0	0	5	1	0	0	5	1
SI	0	1	5	0	4	2	3	3	0	4	2	0	2	4	0	0	0	1	5	0	1	0	5
SK	3	0	9	3	5	4	3	9	0	5	7	0	4	8	0	4	0	2	5	4	0	1	6
EU27	46	490	379	29	716	170	42	763	1	85	757	13	34	848	5	26	36	482	330	111	42	472	192
NO	0	3	4	0	6	1	0	7	0	0	7	0	0	7	0	2	1	3	0	2	2	2	0
total	44	493	381	27	718	173	42	770	1	85	764	13	34	855	5	28	37	485	330	113	44	474	192









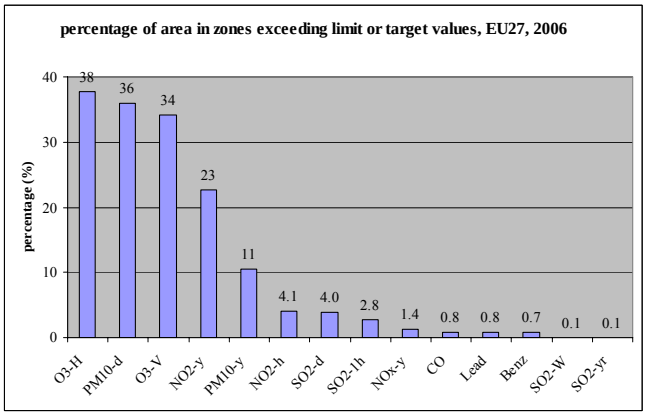


Figure 3. Overview of zones and agglomeration exceeding air quality thresholds. Top left: percentage of zone; top right, percentage of agglomerations; middle left, percentage of population in zones; middle right, percentage of population in agglomerations; bottom, percentage of area in zones. In each graph the percentage are arranged in decreasing order. Zones and agglomerations with an undefined air quality status have not been included.

Information related to derogation situations

Correction for natural sources for SO_2

None of the Member States indicated exceedances due to natural SO_2 sources in 2005.

Correction for natural sources for PM_{10}

The First Daughter Directive gives Member States in Article 5(4) the possibility of subtracting the contribution from natural events from the PM_{10} concentrations before comparing these with the limit values. This has been done in 2006 for some stations by Greece, Spain, Portugal and Cyprus. For

nearly all stations the natural events were described as 'transport of natural particles from dry regions outside the Member State'; in two cases 'wild-land fire outside the Member State' was indicated as second reason.

Table 4 shows the effect of the correction on the number of stations with exceedance. The corrections brought 11 stations (or 7 % of the total 148) below the daily limit value; for the annual limit value the compliance status was brought down under exceedance status with 3 stations (or 3.6 % of the total 83).

Table 4 Influence of the correction for natural events on the number of stations exceeding the limit values for PM_{10} in 2006. The numbers indicate the number of stations to which the correction has been applied, not the total number of stations with exceedances in the Member States mentioned.

MS	Number of stations with exceedance of PM_{10}:			
	Daily limit value		Annual limit value	
	before correction	after correction	before correction	after correction
CY	1	1	1	0
GR	6	6	6	6
ES	148	105	91	62
PT	8	0	3	0

Not included in the table are stations listed by France and Estonia where the limit value was not exceeded.

Correction for winter sanding for PM_{10}

The First Daughter Directive also gives Member States the possibility of subtracting the contribution due to winter sanding of roads before comparing PM_{10} concentrations with the limit values. For two stations in Latvia and two stations in Italy such corrections for the daily limit value were reported for 2005, and for two stations in Latvia for the annual limit value. The corrections brought none of the reported stations below the allowed 35 daily exceedances of the limit value; the corrections of the annual mean concentrations did also not bring these levels below the annual limit value.

Table 5 Influence of the correction for winter sanding on the number of stations exceeding the limit values for PM_{10} in 2006. The numbers indicate the number of stations to which the correction has been applied, not the total number of stations with exceedances in the Member States mentioned.

MS	Number of exceedance reporting cases of PM_{10} daily and estimated annual mean concentration due to WINTER SANDING:			
	Daily limit value		Annual limit value	
	before correction	After correction	before correction	After correction
EE	1	(a)		
FI	2	0		
LT	3	0		
LV	2	2	2	2
SK	24	21	8	7

Not included in the table are stations listed by Slovakia, Lithuania and Estonia where the limit value was not exceeded.
(a) number of exceedances after correcting not reported.

4. Summary of individual exceedance

Figure 4 gives an overview of the number of exceedances that Member States reported for each station measured where the limit value of PM_{10} is breached. In the summer period (April-September) the number is relatively low; the averaged concentration during an exceedance is in the summer around 70 µg/m^3. The number of exceedances is higher in the winter month and reaches in 2006 a maximum in January. In the winter period the averaged exceedance concentration is between 70 and 100 µg/m^3. The Member States report only exceedances when the total number of exceedances is above the allowed number of 35 days. The total number of exceedance days will therefore be higher than shown in Figure 4.

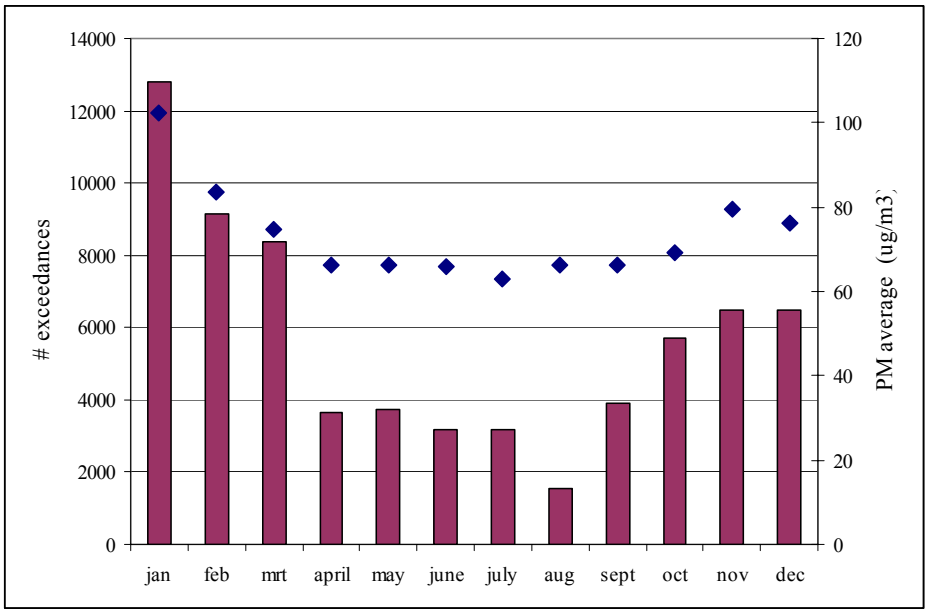


Figure 4. Number of exceedances and averaged concentration during an exceedance (µg/m^3) of the daily limit value of PM_{10} per month, 2006.

Figure 5 gives a similar overview for the exceedances of the ozone long term objective for health protection, that is, the number of days with a daily maximum 8-hour mean concentration in excess of 120 µg/m^3. In contrast to the PM_{10} exceedance days, all exceedances have to be reported here. This graphs shows exceedances of this LTO almost exclusively occurs during the summer months. A peak is observed in July. In July 2006 the strongest ozone episode occurred between 17-28 July. During this period more than half of the total number of exceedances during summer 2006 of the information and alert threshold and a quarter of the total number of exceedances of the long-term objective were observed (EEA, 2007). The averaged concentration during an exceedance day is 140 µg/m^3.

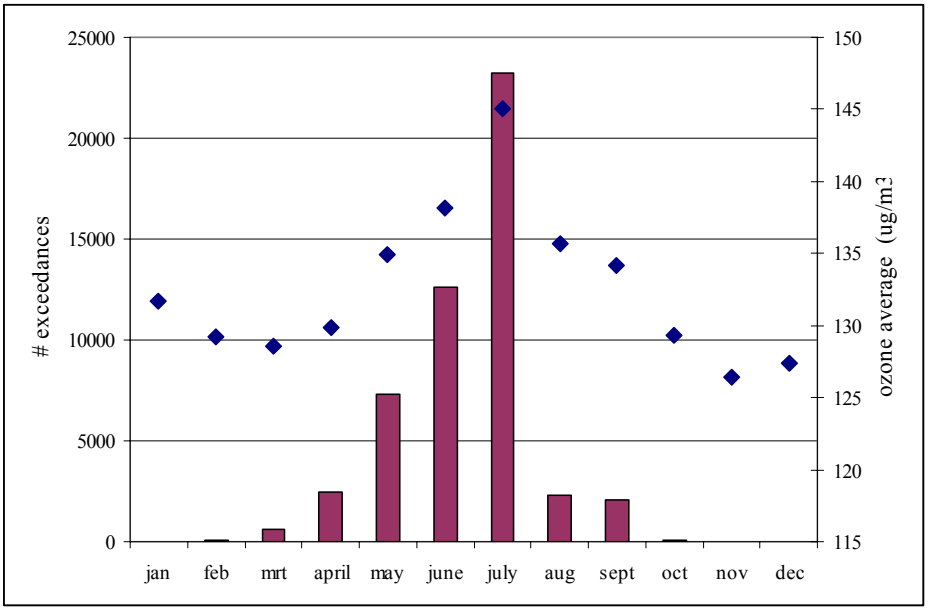


Figure 5. Number of exceedances and averaged concentration during an exceedance (µg/m^3) of the ozone long term objective for health protection per month, 2006.

Figure 6 gives an overview of the reasons of exceedance that Member States reported for each measured exceedance of the limit value plus, if existing, the margin of tolerance. The very few exceedances for benzene and CO have not been included in the figure. Also for the two SO_2 ecosystem limit values only a very few exceedances have been reported; however, they are included in the graph for comparison with the SO_2 health related limit values.

It should be noted that the reasons of exceedance were not always filled in. Typically for 80-100% of the exceedances of a limit value one or more reasons were reported. Because often several reasons were given for an exceedance, the total number of reasons given tends to be substantially larger than the number of exceedances (up to a factor of two).

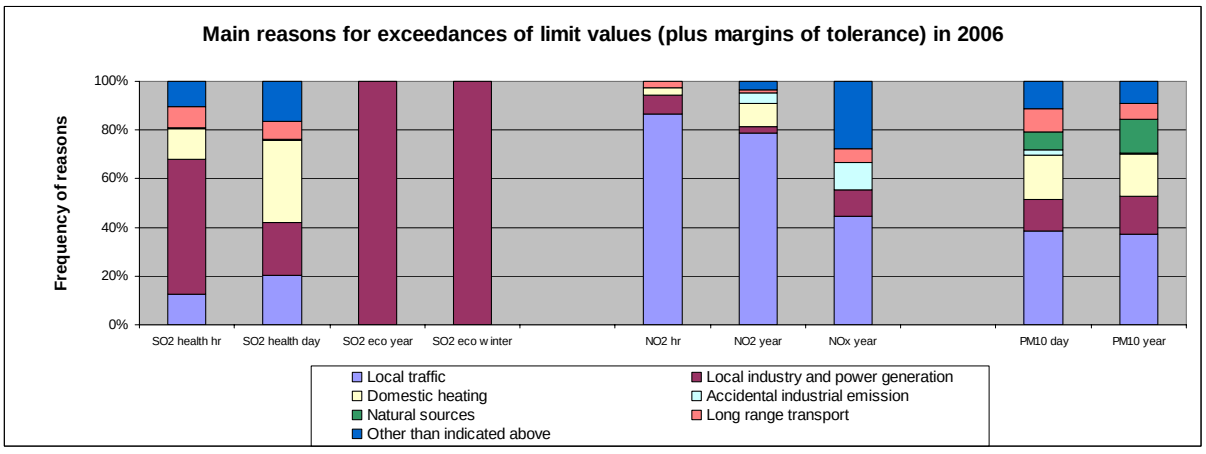


Figure 6 Frequency with which a reason for exceedance of a limit value (plus margin of tolerance) was indicated (2006). The detailed set of reasons reported by the Member States have been grouped here into seven clusters.

The profiles are quite different per pollutant. For SO_2 the vast majority of the exceedances is due to local industry and power generation. The few other cases are attributed to "Domestic heating", "local traffic", "Long range transport". For NO_2 (≈ 80 %) and also NO_x, (40 %) local traffic is the major cause of exceedances.

For PM_{10}, the local contribution from traffic and industry was indicated to be an important reason for exceedance in 50% of the cases. The traffic contribution is less dominant than for NO_2. A substantial number of exceedances were not related to local sources. Of these, "domestic heating" and, for the annual mean, "natural sources" were of importance. Interestingly, only few exceedances were (partially or entirely) ascribed to long range transport of air pollution, in spite of the fact that in many parts of Europe the large scale background is substantial.

Member States also reported the reasons for exceedance of the information and alert threshold and the long term objective for the protection of health of ozone. Those reasons are summarised in Figure 7. In many cases (over two-third of all exceedances) the reason was not filled in. Of the reasons reported, local sources (traffic, industry and power generation) have a share of 20-30%. This is at first sight remarkable, because often local (NOx) sources generally tend to decrease the ozone peaks. The cluster "natural sources" accounts for less then 13%. The fairly large group "Other than indicated above" consists mainly "Transport from other regions within the country" and 'Local urban sources'.

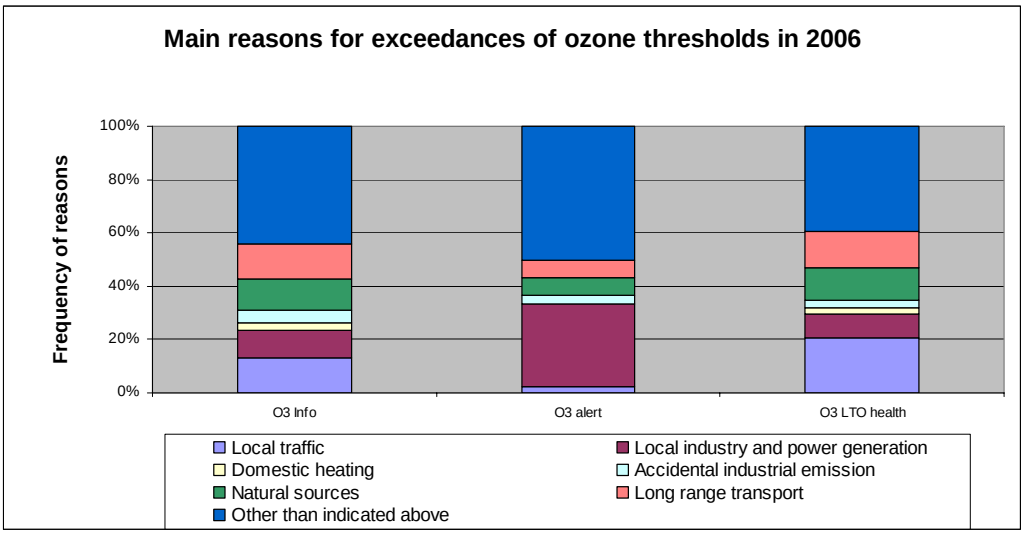


Figure 7. Frequency with which a reason for exceedance was indicated for an ozone threshold (2006).

5. Measurement methods for particulate matter

Several measurement methods are in use for PM_{10} and $PM_{2.5}$. The First Daughter Directive specifies the gravimetric method (collection on a filter and gravimetric mass determination) as the reference method and it allows other methods to be used, provided that equivalence with the reference method can be demonstrated. To achieve this equivalence, Member States may apply a correction factor (or correction equation). Figure 8 shows that, in terms of the number of monitoring sites, for PM_{10} the beta-absorption method is more common (39%) than the oscillating microbalance method (TEOM – 28%)) in 2006 , while in the newer and much smaller $PM_{2.5}$ network oscillating microbalance method (34%) is used at considerably more sites than beta-absorption (29%). Gravimetry, the reference method, has a slightly larger share for $PM_{2.5}$ than for PM_{10}. In a few cases a less commonly used method (TSP or Black smoke measurement with correction, optical techniques) was used.

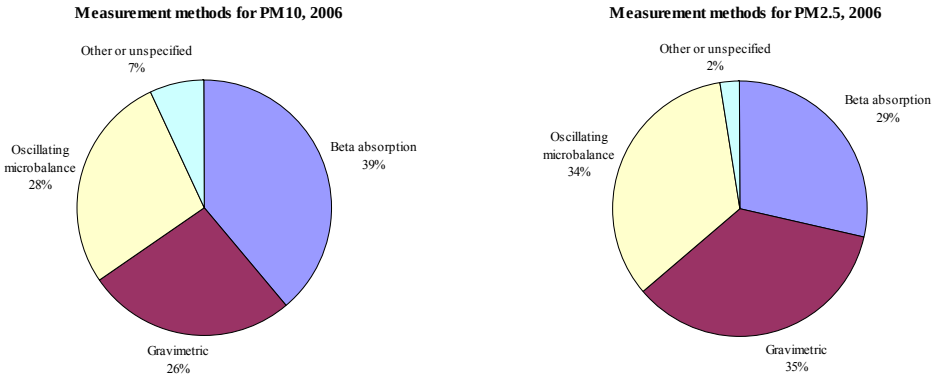


Figure 8. Measurements methods for PM_{10} and $PM_{2.5}$ in 2006.

Within Member States there is sometimes a clear preference for a particulate matter measuring method. For PM_{10} measuring for example, the 'Beta absorption method' is the only method used in Estonia, Greece, Latvia, Lithuania, The Netherlands and Portugal. The 'Oscillating microbalance method' on the other hand is the preferred method used in Cyprus, Slovenia, UK, France and Slovakia. The reference 'Gravimetric method' is only in two countries above 50%, in Denmark and Ireland (57%). The general conclusions for $PM_{2.5}$ are that the same differences occur between countries and there isn't a real similarity within countries between PM_{10} and $PM_{2.5}$ measuring methods. It has to be noted that the absolute number of stations that measure $PM_{2.5}$ (294) is limited and influences final results. Nearly all $PM_{2.5}$ measurements are co-located with PM_{10} measurements.

6. Overview of PM2.5 measurements

In order to gather data for evaluating a possible $PM_{2.5}$ threshold, the First Daughter Directive requires that "each Member State shall choose the number and the siting of the stations at which $PM_{2,5}$ is to be measured as representative of concentrations of $PM_{2,5}$" and to report the results of those measurements. Over 2006 seven Member States (EE, LT, LU, LV, MT, NL, SI) did not report such data. The other Member States sent $PM_{2.5}$ data for in total 221 stations; almost all of these stations were also reported for PM_{10}.

Table 6 and Figure 9 summarize the observed data for each of the Member States; only station with a sufficient data coverage (as indicated by the MS) are included. Stations with a measured concentration above 25 μg/m^3 (proposed limit value to be met in 2015) exist in many regions, many of then in central and eastern Europe (CZ, BG, PL, SK). The frequency distribution (Figure 10) shows that the level of 25 μg/m^3 is exceeded at about 15% of the stations; at 35% of the stations the annual mean is in excess of 20 μg/m^3.
Figure 11 illustrates the range of $PM_{2.5}$ concentrations, distinguishing traffic stations, industrial stations and background stations (based on the classification reported under the Exchange of Information Decision, as far as the stations could be identified). The levels are not clearly different. It should be noted that this overlap of ranges does not imply that levels are not increased near industry or traffic; it is more likely that the variability in background levels dominates the ranges. The background stations include urban, suburban as well as rural background station, which explains the wide range in concentrations observed at the background stations.

Table 6. Number of $PM_{2.5}$ monitoring stations, average, minimum and maximum value of the annual mean concentrations per Member State, 2006.

MS	Number of stations	Averaged Annual mean (μg/m³)	Max of annual mean (μg/m³)	Min of annual mean (μg/m³)
AT	6	25.0	29.0	21.0
BE	9	17.9	24.4	13.0
BG	4	30.5	45.0	6.0
CY	2	25.0	27.4	22.6
CZ	21	27.1	50.4	13.7
DE	37	19.3	32.0	8.0
DK	3	12.7	15.0	11.0
ES	63	17.5	30.4	6.0
FI	6	8.8	11.0	6.7
FR	55	14.4	27.0	10.0
GB	5	15.6	21.0	12.0
GR	2	19.5	31.0	8.0
HU	3	22.3	24.9	20.9
IE	1	9.0	9.0	9.0
IT	13	24.1	40.0	11.4
NO	12	14.1	23.1	9.9
PL	4	26.5	38.8	20.7
PT	15	13.8	24.7	3.3
RO	2	37.0	43.0	31.0
SE	8	14.3	21.0	11.0
SK	4	25.3	33.3	13.8
Total	275	18.3	50.4	3.3

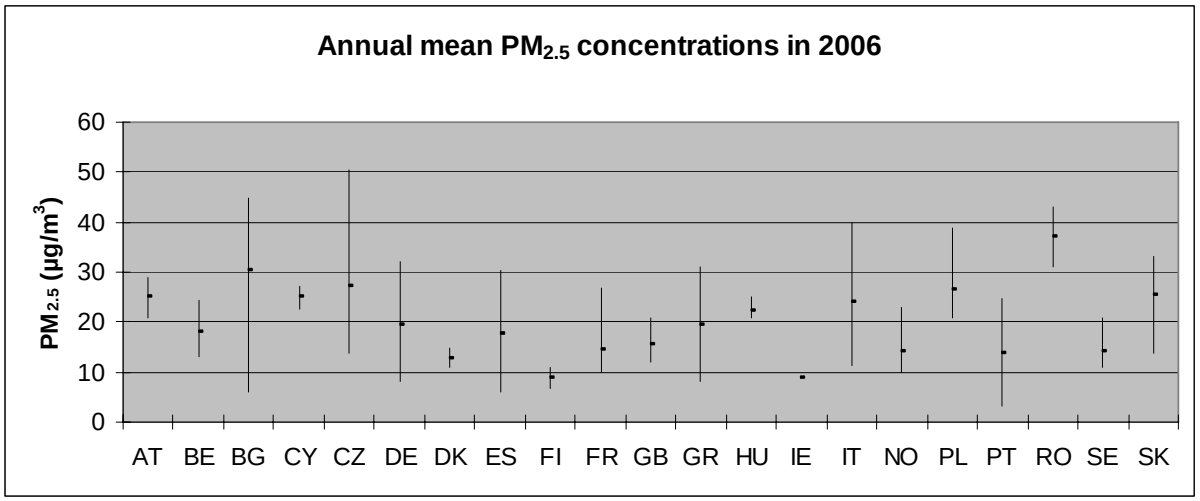


Figure 9 Annual mean (and maximum / minimum value) $PM_{2.5}$ concentrations in 2006 per station type.

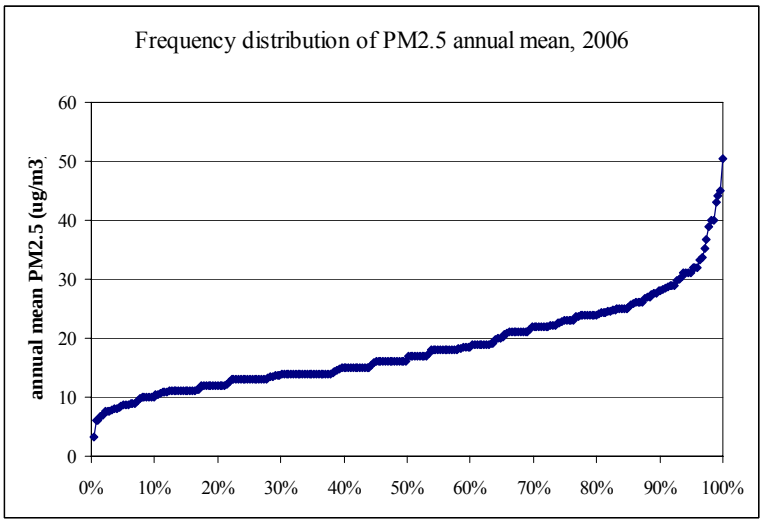


Figure 10. Frequency distribution on $PM_{2.5}$ annual mean concentrations, 2006.

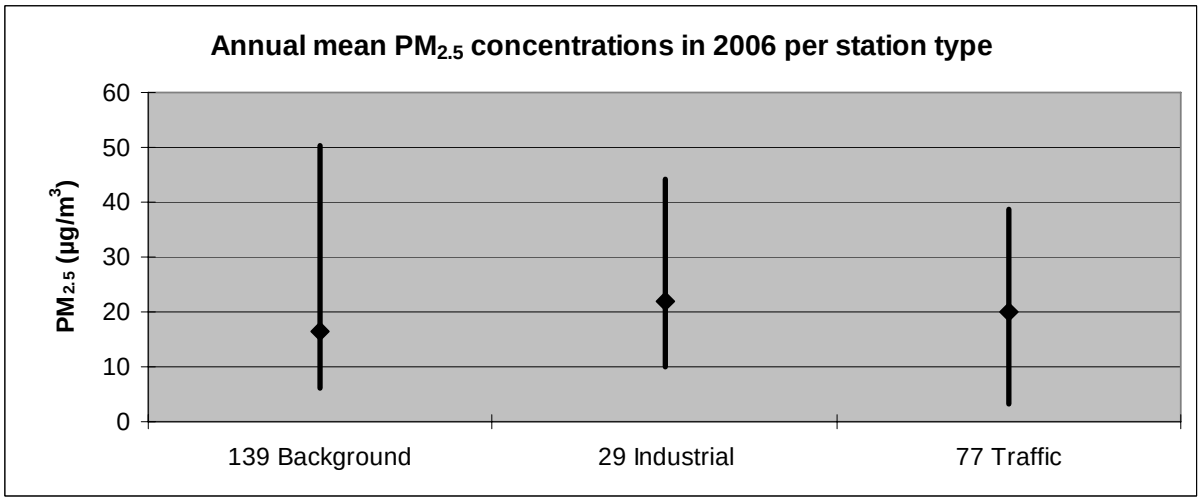


Figure 11. Annual mean (and maximum/minimum value) $PM_{2.5}$ concentrations in 2006 per station type.

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