

# Reporting on ambient air quality assessment in the EU Member States, 2008



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**Cover page:**

*Power plant in the Dutch landscape. Next to local traffic power generation is seen as one of the major sources contributing to exceedances.*

Cover photo ©. Frank de Leeuw (2010)

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## Summary

In 2008 the percentage of zones in Member States where the limit (LV) or target value (TV) was exceeded, was highest for the daily limit value of PM<sub>10</sub> (36%) and the health-related target value of O<sub>3</sub> (45%).

When compared to the 2007 zone exceedances in Europe, exceedances for the O<sub>3</sub> health target value were nearly as high (-1%). Explanation might be the similar weather conditions in Europe for these years. During both summers no persistent periods with elevated ozone concentrations have been observed throughout whole Europe.

Both PM<sub>10</sub> daily limit value and PM<sub>10</sub> annual limit value exceedances decreased. The first decreased by 6% to 36% (PM<sub>10</sub> daily limit value), the latter by 4% to 13% (PM<sub>10</sub> annual limit value).

EU 27 zones exceeding the NO<sub>2</sub> (24%) annual limit values increased by 1%. The percentage of zones exceeding the NO<sub>x</sub> annual limit value decreased from 10% in 2007 to 7% in 2008.

## General

European Air Quality legislation is built on the principle that the Member States divide their territory into a number of air quality management zones and agglomerations. In these zones and agglomerations, the Member States should assess the air quality using measurements, modelling or other empirical techniques. Delimitations of zones may differ between different pollutants in order to optimize management of air quality due to differences in sources and abatement strategies. Where limit levels are exceeded, the Member States should prepare an air quality plan or programme to ensure compliance with the limit value before the date when the limit value formally enters into force. In addition, information on air quality have to be disseminated to the public.

EU Member States have submitted annual reports on air quality in 2008 to the European Commission under the Air Quality Framework Directive (96/62/EC). The reports were provided in the form of a predefined questionnaire (<http://ec.europa.eu/environment/air/quality/legislation/reporting.htm>). The present report gives an overview and analysis of the submitted information for the year 2008. It is an update of the previous reporting cycle from 2001-2007; reports over these years are available from the above website. A preliminary analysis of the 2008-situation based on incomplete, unchecked data has been published in December 2009.

(see [http://air-climate.eionet.europa.eu/reports/ETCACC\\_TP\\_2009\\_10\\_prelim\\_AQQanalysis\\_2008](http://air-climate.eionet.europa.eu/reports/ETCACC_TP_2009_10_prelim_AQQanalysis_2008))

In the last few years the reporting requirements from the Member States have evolved, following the successive entering into force of the four daughter directives 1999/30/EC, 2000/69/EC, 2002/3/EC and 2004/107/EC and following the accession of new Member States to the EU. The year 2005 was the first year over which 25 EU Member States had to report on assessment under the first three daughter directives. Since 2007 (reporting on the situation in 2006) Bulgaria and Romania have been included in a EU27 report. In total 29 countries report as Iceland and Norway submit voluntarily reports. Switzerland provides information on exceedance of ozone target values on a voluntary basis.

## Zone designation

The total number of reporting zones in 2008 in the EU 27 (930) was slightly higher than in 2007 (909). The major 2008 zoning changes compared to 2007 are:

- Germany reduced the number of zones from 120 to 111 zones
- Spain increased the number of zones from 138 to 153 zones

- Portugal increased the number of zones from 27 to 34 zones

The zone designation for the Fourth Daughter Directive is nearly complete. However, Greece and Luxemburg have not yet defined zones for these pollutants and in three other Member States the defined zones cover less than 60% of the population. Zones for the other pollutants still do not cover the entire population in nine countries.

Voluntary information for ‘Area size’ (99%) and ‘Population totals’ (99%) per zone was submitted by the Member States. This information is almost complete, as it was already in 2007.

In the EU27, 30% of the zones are classified as agglomeration<sup>1</sup>. Approximately one third of the EU-population is living in zones classified as agglomerations.

The total number of zones differs for each pollutant. In the EU27 the highest number of zones is designated for NO<sub>2</sub> (817) and PM<sub>10</sub> (816), the lowest number is designated for ecosystem protection (NO<sub>x</sub> 399 and SO<sub>2</sub> 396).

The Member States have the obligation to report over the total area of their country for the health protection target pollutants. The territory coverage for the health related pollutants is fairly good but does not reach the mandatory 100% in all Member States, see Table S1. For comparison vegetation related components have been included in the Table, note that the limit values set for the protection of ecosystems and vegetation a 100% coverage is not required.

**Table S1: Number of zones per pollutant/protection target (totals for EU27) and territory area coverage in 2008 (EU27 averaged, minimum and maximum coverage for the 27 MS).**

pollutant	Number of zones	Area coverages (%)		
		aver	min	max
NO <sub>2</sub>	817	99	93	100
PM <sub>10</sub>	816	99	93	100
SO <sub>2</sub> -health	799	98	89	100
O <sub>3</sub>	579	98	67	100
CO	756	92	19	100
benzene	717	87	0	100
Pb	643	84	0	100
Ni	535	83	0	100
Cd	536	82	0	100
As	533	82	0	100
BaP	509	77	0	100
SO <sub>2</sub> -ecosystems	396	72	0	100
NO <sub>x</sub> -vegetation	399	71	0	100

\*data extracted from form 2

### Station characteristics

In general, the number of stations is in agreement with the criteria set in the AQ Directive in 60 – 80% of the zones. For ozone, SO<sub>2</sub>, arsenic, cadmium and nickel nearly 80% of the zones is in agreement with the criteria (Figure 5.1). The number of stations is too low in about 20% of the zones for ozone

<sup>1</sup> An agglomeration is defined as “a zone that is a conurbation with a population in excess of 250 000 inhabitants or, where the population is 250 000 inhabitants or less, with a given population density per km<sup>2</sup> to be established by the Member State”.

and 32% for PM<sub>10</sub>, in 2007 this was 31% for ozone and 20% for PM<sub>10</sub>. Fulfilling the criteria on the number of stations for the now obligatory 4<sup>th</sup> DD-compounds is slightly better than for the traditional compounds. The lack of information for these new compounds is not worse than for the traditional ones.

The differences between the Member States are large. Compliance is nearly complete in the Czech Republic and the three Baltic states, where PM<sub>10</sub> is the only significant problem. Ten Member States have relatively gaps in the required number of stations per zone: France, Spain, Belgium, the Netherlands, Denmark, Austria, Hungary, Slovenia, Malta and Cyprus. For other Member States the assessment regime in many zones could not be defined as essential information is lacking. This is the case for Portugal, Italy, Ireland, Poland and Germany. Several countries do not meet the criteria on station numbers for three or more compounds lacking compliance in at least 50% of the zones: the United Kingdom, Finland, Slovakia, and Bulgaria. In Sweden and Romania the situation is only slightly better. In Greece and Luxembourg an adequate assessment is impossible as these countries have not specified the zones for the 4<sup>th</sup> DD.

For zones exceeding the assessment thresholds for ecosystems (SO<sub>2</sub>) and vegetation (NO<sub>x</sub>) it is difficult to do a precise check. The minimum number of stations is defined as one station per 20000 or 40000 km<sup>2</sup> when respectively the upper or lower assessment threshold is exceeded. Most zones are much smaller than these sizes. All large zones, for which sufficient information was available for a judgement, were assessed to have enough measurement stations.

## Exceedances

The pollutants that show most exceedances of limit and target values in 2008 are PM<sub>10</sub> daily and O<sub>3</sub>. PM<sub>10</sub> exceeds the limit value in 36% of all EU27 zones and in 53% of the agglomerations; for O<sub>3</sub> these percentages are 45% of the zones and 33% of the agglomerations.

The fractions of the EU27 population potentially exposed to concentrations above the limit or target values (that is, the fraction living in zones where exceedances have been reported) are:

- 45% of EU27 population lives in zones exceeding PM<sub>10</sub> limit value (2007: 47%, 2006: 60%)
- 49% of EU27 population lives in zones exceeding NO<sub>2</sub> annual limit value (2007 47%, 2006: 49%)
- 46% of EU27 population lives in zones exceeding O<sub>3</sub> health target value (2007 48%, 2006: 46%)

Is the air quality getting any better? If the 2007 percentages of zones in exceedance are compared with the 2008 results we can draw the following tentative conclusions

- PM<sub>10</sub> zone exceedances are lower in 2008
- O<sub>3</sub> zone exceedances are similar for both health and vegetation
- Percentage of zones exceeding the annual limit value of NO<sub>2</sub> increased with 1%
- NO<sub>x</sub> zone exceedances decreased with 3%

However, caution is needed interpreting these air quality trend conclusions as the number and designation of zones can differ from year to year. The year-to-year changes in the fraction of population affected are even more uncertain due to missing information (either on the air quality assessment or the population number) for a number of zones.

**Table S2: EU27 zone exceedances of limit or target value in 2005-2008<sup>2</sup> by pollutant**

<b>EU27</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
<b>O<sub>3</sub>-Vegetation</b>	<b>25%</b>	<b>27%</b>	<b>46%</b>	<b>46%</b>
<b>O<sub>3</sub>-Health</b>	<b>35%</b>	<b>39%</b>	<b>46%</b>	<b>45%</b>
<b>PM<sub>10</sub> daily</b>	<b>44%</b>	<b>45%</b>	<b>42%</b>	<b>36%</b>
<b>NO<sub>2</sub> annual</b>	<b>25%</b>	<b>18%</b>	<b>23%</b>	<b>24%</b>
<b>PM<sub>10</sub> annual</b>	<b>17%</b>	<b>20%</b>	<b>17%</b>	<b>13%</b>
<b>NO<sub>x</sub></b>	<b>4%</b>	<b>3%</b>	<b>10%</b>	<b>7%</b>
<b>NO<sub>2</sub> Hourly</b>	<b>6%</b>	<b>2%</b>	<b>3%</b>	<b>3%</b>
<b>SO<sub>2</sub> Daily</b>	<b>2%</b>	<b>3%</b>	<b>2%</b>	<b>1%</b>
<b>SO<sub>2</sub> Hourly</b>	<b>2%</b>	<b>2%</b>	<b>2%</b>	<b>1%</b>
<b>SO<sub>2</sub> annual</b>	<b>1%</b>	<b>1%</b>	<b>0%</b>	<b>1%</b>
<b>Lead</b>	<b>0%</b>	<b>0%</b>	<b>1%</b>	<b>1%</b>
<b>Benzene</b>	<b>3%</b>	<b>0%</b>	<b>0.3%</b>	<b>0.4%</b>
<b>CO</b>	<b>0%</b>	<b>1%</b>	<b>1%</b>	<b>0%</b>
<b>SO<sub>2</sub> Winter</b>	<b>5%</b>	<b>2%</b>	<b>0.3%</b>	<b>0.3%</b>

\* data extracted from form 8 and 9

The general reason for the exceedances of the limit values reported by Member States are in line with the conclusions of previous years and are summarized as local traffic, industry and domestic heating. More detailed for the most important pollutants the dominant reasons are:

- PM<sub>10</sub> both daily and annual LV : local traffic, 31% (2007: 31%)
- NO<sub>2</sub> annual LV : local traffic, 85% (2007: 69%)

<sup>2</sup> for NO<sub>2</sub> the limit value and for ozone the target value attainment date is 2010

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## 1. Introduction

This document gives an overview of the annual reports from Member States to the European Commission on the results of the assessment of their air quality in 2008. These national reports have been submitted under the Air Quality Framework Directive<sup>3</sup>, following Commission Decision 2004/461/EC<sup>4</sup>, 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 questionnaire’ or, when the context is not directly clear, ‘the AQ 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 DG Environment.

Last year a modification of the questionnaire and related guidance has been prepared to enable reporting of 4<sup>th</sup> Daughter Directive (4<sup>th</sup> DD)<sup>5</sup>. For the year 2007 reporting on the 4<sup>th</sup> DD pollutants was on a voluntary basis, for the year 2008 reporting is mandatory. The changes introduced in the questionnaire in 2007 relate to the inclusion of relevant forms covering monitoring of arsenic (As), nickel (Ni), cadmium (Cd), mercury (Hg), benzo(a)pyrene (BaP) and related polycyclic aromatic hydrocarbons (PAH) in ambient air and deposition. The questionnaire consists of 28 forms (see Annex I) with in total 86 sub-forms.

This year further changes have been introduced in the questionnaire to enable the communication of information on the application of Articles 15 and 22 of Air Quality Directive 2008/50/EC. Forms are included to inform on the attainment of PM<sub>2.5</sub> target value (on a voluntary basis in 2009, target value in force in 2010). The updated questionnaire and guidance document have been made available at the website of DG Environment<sup>6</sup>.

Assessments of the air quality in zones in the EU Member States based on the questionnaire for the years 2001-2007 are available from the web site of DG Environment<sup>6</sup>.

### Member State reports addressed in this document

This document primarily deals with the reports by the EU Member States on the year 2008 submitted under the air quality directive<sup>7</sup>, and the Fourth Daughter Directive<sup>4</sup>. The assessments in this report are based on the information received by ETC/ACC before 1 May 2010 (the official deadline for submission was 30 September 2009). By that date all Member States have delivered their reports. On a voluntary basis Norway submitted a questionnaire; in contrast to earlier years, no report from Iceland has been received. Switzerland provided information on the ozone air quality.

All questionnaires have been uploaded by the Member States on Reportnet CDR (<http://cdr.eionet.europa.eu/>). In the period 19-21 October 2009 the ETC/ACC has send out a mailing to all contact persons to confirming the receipt of the questionnaire. In this mailing several tables summarizing the information received from the Member States have been included. In March 2010 a second mailing was send to the Member States. This mailing focussed on possible inconsistencies within the questionnaire itself and with the meta-information as provided under the Exchange of Information decision, see below.

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<sup>3</sup> Council Directive 96/62/EC on ambient air quality assessment and management.

<sup>4</sup> Commission Decision 2004/461/EC laying down an 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.

<sup>5</sup> EC(2004) Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air, Official Journal L23, 26/01/2005, pp 3-16.

<sup>6</sup> <http://ec.europa.eu/environment/air/quality/legislation/reporting.htm>

<sup>7</sup> EC (2008) Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe. Official Journal, L 152 11.6.2008, pp 1-44.



In both mailings Member States were invited to check the summaries which had been provided by the ETC/ACC. A number of Member States submitted a revised questionnaire or separate form(s). All updates received before May 2010 have been included in this analysis.

### **Air Quality health standards**

Humans can be affected by exposure to air pollutants in ambient air. In response, the European Union has developed an extensive body of legislation which establishes health based standards and objectives for a number of pollutants in ambient air. These apply over differing periods of time because the observed health impacts associated with the various pollutants occur over different exposure times. Standards for PM<sub>2.5</sub> have been introduced in the Air Quality Directive. An indicative limit value of 20 µg/m<sup>3</sup> is to be attained by 2020. This limit value will have to be confirmed via a review in 2013. In addition two new exposure related obligations are set<sup>8</sup>. An overview of air quality health standards is given in Annex II.

### **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 submit detailed information from their monitoring networks each year under the Exchange of Information Decision (EoI)<sup>9</sup>. These extensive reports contain monitoring data (e.g. all hourly concentrations) and include extensive complementary information about the monitoring stations (metadata). The ETC/ACC publishes annually an assessment of these reports (see, for the assessment of the 2008-data: Mol et al., 2010). To avoid duplicate reporting by Member States, some of the data that are needed for evaluating the reports under the air quality directives (particularly the meta-information on monitoring stations) are only sent under the EoI. All monitoring stations used for compliance checking under the AQ Directive have to be included in the set of monitoring stations submitting data under the EoI. Deadline for submitting the EoI information is 1 October. In the assessment of those parts of the questionnaire related to monitoring stations, the information extracted from the EoI has been included.

### **Quality of the data received and implications for this overview**

To facilitate the submission of the data, the European 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 or its guidelines, for example, ticking an “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 codes and pollutant codes in the various forms 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. Member States reacted actively on the feedback reports of the ETC/ACC. As a result the quality of the data has been improved over the years.

### ***Disclaimer***

This report contains summary information based on data delivered before 1 May 2010. Revisions prepared by Member States after this date have not been included. In order to enable an automatic processing of the national reports, the ETC/ACC has made a number of (in general editorial) changes in the submitted questionnaires. In this process it can not be excluded that mistakes or

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<sup>8</sup> For more details see <http://ec.europa.eu/environment/air/quality/standards.htm>

<sup>9</sup> 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).

misinterpretations have been made. Hence, this report presents an overview of the air quality in the Member States of the European Union but it cannot be used for legal compliance checking.

#### Abbreviations used

*Member States have been abbreviated following the ISO3166-1 country alpha-2 code<sup>1</sup>:*

Austria: AT; Belgium: BE; Bulgaria: BG; 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; Romania: RO; Slovakia: SK; Slovenia: SI; Spain: ES; Sweden: SE; United Kingdom: GB<sup>2</sup>, and Switzerland: CH, Iceland: IS and Norway: NO.

AEI	Average Exposure Indicator (PM <sub>2.5</sub> )
AQ questionnaire	Questionnaire on air quality set out by Commission Decision 2004/461/EC
As	Arsenic
B(a)P or BaP	Benzo(a)pyrene
Cd	Cadmium
CDR	Central Data Repository
CO	Carbon monoxide
DD	Daughter Directive
Eol	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
LAT	Lower assessment threshold
LTO	Long Term Objective (O <sub>3</sub> )
LV	Limit value
MOT	Margin of Tolerance
MS	Member State(s)
Ni	Nickel
NO <sub>2</sub>	Nitrogen dioxide
NO <sub>x</sub>	Nitrogen oxides
O <sub>3</sub>	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PM <sub>10</sub>	Particulate matter composed of particles smaller than 10 micrometer in aerodynamic diameter
PM <sub>2.5</sub>	Particulate matter composed of particles smaller than 2.5 micrometer in aerodynamic diameter
SO <sub>2</sub>	Sulphur dioxide
TEOM	Tapered Element Oscillating Microbalance
TEOM-FDMS	Tapered Element Oscillating Microbalance- Filter Dynamics Measurement System
TV	Target value

Notes

1 see <http://www.iso.ch/iso/en/prods-services/iso3166ma/02iso-3166-code-lists/index.html>

2 Including Gibraltar.

## 2. Designation of zones

The number of zones in 2008 in the EU27 (930) was slightly higher than in 2007 (909). The major 2008 zoning adjustments compared to 2007 are:

- Germany reduced the number of zones from 120 to 111 zones
- Spain increased the number of zones from 138 to 153 zones
- Portugal increased the number of zones from 27 to 34 zones

The zone designation for the Fourth Daughter Directive is nearly complete. However, Greece and Luxemburg have not yet defined zones for these pollutants and in three other Member States the defined zones cover less than 60% of the population. Zones for the pollutants listed in the first three daughter directives still do not cover the entire population in nine countries.

Voluntary information for 'Area size' (99%) and 'Population totals' (99%) per zone was submitted by the Member States. This information is almost complete, as it was already in 2007.

In the EU27, 30% of the zones are classified as agglomeration. Approximately one third of the EU27 population is living in zones classified as agglomerations.

The total number of zones differs for each pollutant. In the EU27 the highest numbers of zones are designated for NO<sub>2</sub> (817) and PM<sub>10</sub> (816), the lowest numbers are designated for ecosystem protection (NO<sub>x</sub> 399 and SO<sub>2</sub> 396).

### *How have the Member States designated their zones?*

The Member States have designated zones to assess and manage air quality in order to comply with EU-regulations. To optimize management of air quality due to differences in sources and abatement strategies, the delimitations of zones may differ between pollutants.

As the Member States are free in defining their own zone structure and characteristics (population and area), the designated zones vary widely dependent on the chosen variable: size, population, measured individual pollutant or types of protection targets. This complicates mutual comparison of final results between countries. A large part of the countries apply the same zones for nearly all pollutants, but other countries have designated specific zones for many individual pollutants.

Table 1 gives an overview of the total number of zones defined for 2008 (Form 2). Compared to 2007 (Vixseboxse and de Leeuw, 2008) there are only small changes in the number of zones. Eight Member States have indicated (Form 0) a change in the zone definition for one or more pollutants. Most changes relate to the introduction of the 4<sup>th</sup> DD pollutants; 15 Member States had no zones reported for these pollutants until this year. By now only Greece and Luxemburg have not yet designated zones for any of the 4<sup>th</sup> DD pollutants. Zones for one of the 4<sup>th</sup> DD pollutants are also lacking in Cyprus, Estonia and Romania. Greece has no zones designated for lead; zones designated for the protection of ecosystems and vegetation have not been defined by Belgium, Hungary and Lithuania.

In relation to the protection of health, the number of zones defined for SO<sub>2</sub>, NO<sub>2</sub> and PM<sub>10</sub> tends to be higher (appr. 800) than for the other pollutants (600-750). The number of zones for the 4<sup>th</sup> DD-pollutants is relatively low, 509-536. The lowest number of zones is found for the two objectives related to the protection of ecosystems and/or vegetation. In contrast to zones designated in relation to the protection of human health, it is not mandatory that zones designated in relation to the protection of ecosystems and vegetation cover the whole territory.

Table 1. Number of zones per Member State in 2008, including the designation of the zones for individual pollutants or types of protection targets (data extracted from form 2).

Member State	Total (a)	SO <sub>2</sub>		NO <sub>2</sub>	NO <sub>x</sub>	PM <sub>10</sub>	Lead	benzene	CO	Ozone	As	Cd	Ni	BaP
		health	eco											
AT	19	11	8	11	8	11	11	11	11	11	11	11	11	11
BE	22	12	0	11	0	11	13	7	7	6	12	12	12	6
BG	6	6	1	6	1	6	6	5	6	6	4	4	5	6
CY	1	1	1	1	1	1	1	1	1	1	1	1	1	0
CZ	15	15	15	15	15	15	15	15	15	15	15	15	15	15
DE	111	79	15	84	15	81	72	84	84	63	66	66	66	68
DK	3	3	3	3	1	3	3	3	3	3	3	3	3	3
EE	4	4	4	4	4	4	2	2	4	4	0	2	2	2
ES	153	135	32	137	32	138	87	125	134	136	76	76	76	76
FI	18	14	1	14	1	14	14	3	14	2	2	2	2	2
FR	81	71	66	76	70	76	37	52	52	79	45	45	45	37
GB	44	44	44	44	44	44	44	44	44	44	44	44	44	44
GR	4	4	4	4	4	4	0	2	4	4	0	0	0	0
HU	11	11	0	11	0	11	11	11	11	11	11	11	11	11
IE	4	4	1	4	1	4	4	4	4	4	4	4	4	4
IT	145	130	47	136	51	136	94	118	131	95	9	9	9	16
LT	3	3	1	3	0	3	3	3	3	3	3	3	3	3
LU	3	3	1	3	1	3	3	1	2	3	0	0	0	0
LV	2	2	1	2	1	2	2	2	2	2	2	2	2	2
MT	2	2	1	2	1	2	2	2	2	2	2	2	2	1
NL	9	9	1	9	1	9	9	9	9	9	9	9	9	9
PL	186	170	125	170	125	170	170	170	170	28	170	170	170	170
PT	34	20	8	25	9	25	1	1	1	19	9	9	9	9
RO	21	21	2	20	2	21	21	20	20	15	20	21	19	0
SE	6	6	6	6	6	6	6	6	6	6	6	6	6	6
SI	12	9	7	6	4	6	7	6	6	6	7	7	7	6
SK	11	10	1	10	1	10	5	10	10	2	2	2	2	2
<b>EU27</b>	<b>930</b>	<b>799</b>	<b>396</b>	<b>817</b>	<b>399</b>	<b>816</b>	<b>643</b>	<b>717</b>	<b>756</b>	<b>579</b>	<b>533</b>	<b>536</b>	<b>535</b>	<b>509</b>
IS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO	7	2	2	6	0	7	0	4	5	6	0	0	0	1
CH	4	0	0	0	0	0	0	0	0	4	0	0	0	0
<b>all</b>	<b>941</b>	<b>801</b>	<b>398</b>	<b>823</b>	<b>399</b>	<b>823</b>	<b>643</b>	<b>721</b>	<b>761</b>	<b>589</b>	<b>533</b>	<b>536</b>	<b>535</b>	<b>510</b>

(a) Total refers here to the total number of zones designated by a Member State. As for each pollutant/protection target a different set of zones might be defined, the total equals or is larger than the number of zones per pollutant per protection target.

For other compounds than the 4<sup>th</sup> DD pollutants, the designated zones are more or less the same as in 2007, except for a few countries. Large changes are observed in Italy and Spain. In Italy the number of zones for the protection of ecosystem/vegetation reduced sharply (for both SO<sub>2</sub> and NO<sub>x</sub> with 53 zones); in case of lead, the number of zones increased by 17 for Italy and decreased by 51 for Spain. In Germany the total number of zones reduced (from 120 to 111) but there are only minor changes in the number of zones for each pollutant/protection target combination. Clearly the number of combined zones, designated for two or more pollutant/protection targets, has increased. Smaller changes have been implemented in France and Slovakia. The total number of zones in the EU27 countries showed a slight increase to 930 in 2008 after a more pronounced decrease to 909 in 2007 (Table 2).

Information on population and area has been provided, on voluntary basis, for nearly all zones. As in 2007, this information is provided for 99% of the zones (Table 3). In the case of Germany, information

on population and area was partly lacking. As far as possible, the information from the 2007-submission or extracted from the 2008-geographical information has been used as substitute.

Table 2. Total number of zones per Member State in 2004-2008 (data extracted from form 2); highlighted boxes indicate the number of zones designated was different then in previous year(s).

Member State	Total zones 2004	Total zones 2005	Total zones 2006	Total zones 2007	Total zones 2008
AT	19	19	19	19	19
BE	17	17	17	18	22
BG			6	6	6
CY	1	1	1	1	1
CZ	15	15	15	15	15
DE	145	118	120	120	111
DK	10	10	10	3	3
EE	16	4	4	4	4
ES	140	140	138	138	153
FI	18	18	18	18	18
FR	85	87	88	81	81
GB	43	43	44	44	44
GR	4	4	4	4	4
HU	11	11	11	11	11
IE	4	4	4	4	4
IT	137	144	121	143	145
LT	3	3	3	3	3
LU			3	3	3
LV	2	2	2	2	2
MT	3	2	2	2	2
NL	9	9	9	9	9
PL	362	362	362	186	186
PT	26	26	26	27	34
RO*			4	21	21
SE	6	6	6	6	6
SI	9	9	9	10	12
SK	10	10	10	11	11
<b>EU25</b>	<b>1095</b>	<b>1064</b>	<b>1046</b>	<b>882</b>	<b>903</b>
<b>EU27</b>			<b>1056</b>	<b>909</b>	<b>930</b>

\* No country coverage in 2006

In the EU27 about 30% of the zones have been given the status of *agglomeration*<sup>10</sup>, which has 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, partially reflecting the level of urbanisation. Less than 10% of the zones are classified as agglomeration in Finland, Hungary and Poland. Cyprus and Luxemburg have no agglomerations assigned. On the other hand, in Bulgaria, Denmark, the United Kingdom, Lithuania and the Netherlands more than 60 % is classified as agglomeration.

<sup>10</sup> An agglomeration is defined as “a zone that is a conurbation with a population in excess of 250 000 inhabitants or, where the population is 250 000 inhabitants or less, with a given population density per km<sup>2</sup> to be established by the Member State”.

Table 3. The percentage of the total population covered by agglomerations as defined for a number of health-related pollutants and the total population per Member State (data extracted from form 2; population (per 1/1/2008) taken from Eurostat); highlighted boxes indicate the number of zones designated was different then the previous year(s).

	Total population	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	Benzene	CO	Ozone	B[a]P <sup>a</sup>
AT	8 318 592	25	25	25	25	25	25	25
BE	10 666 866	23	23	23	23	23	17	20
BG	7 640 238	100	100	100	86	100	100	100
CY	789 269	0	0	0	0	0	0	0
CZ	10 381 130	27	27	27	27	27	27	27
DE	82 217 837	34	34	34	34	34	34	33
DK	5 475 791	23	23	23	23	23	23	23
EE	1 340 935	34	34	34	34	34	34	30
ES	45 283 259	52	52	52	50	52	52	45
FI	5 300 484	19	19	19	19	19	19	19
FR	63 982 881	39	40	40	38	38	40	30
GB	61 179 256	42	42	42	42	42	42	42
GR	11 213 785	39	39	39	32	39	39	0
HU	10 045 401	24	24	24	24	24	24	24
IE	4 401 335	24	24	24	24	24	24	24
IT	59 619 290	41	41	41	41	41	29	11
LT	3 366 357	27	27	27	27	27	27	27
LU	483 799	0	0	0	0	0	0	0
LV	2 270 894	32	32	32	32	32	32	32
MT	410 290	67	67	67	67	67	67	67
NL	16 405 399	31	31	31	31	31	31	31
PL	38 115 641	24	24	24	24	24	24	24
PT	10 617 575	41	41	41	0	0	40	40
RO	21 528 627	27	27	27	27	27	19	0
SE	9 182 927	31	31	31	31	31	31	31
SI	2 010 269	19	19	19	19	19	19	19
SK	5 400 998	12	12	12	12	12	8	8
EU27	497 649 125	37	37	37	35	36	35	29
IS	315 459	0	0	0	0	0	0	0
NO	4 737 171	0	28	28	28	28	24	19
CH	7 593 494	0	0	0	0	0	75	0

(a) For the other 3 pollutants listed in the 4<sup>th</sup> DD, in general similar fractions are found.

On the average about one third of the EU27 population reside in agglomerations (Table 3) whereas the agglomerations cover 4% of the total land area. Excluding Cyprus, which has not defined an agglomeration but only one zone covering the whole country, and Bulgaria which has designated all zones as agglomeration, the percentage of the national population living in agglomerations varies between 12% (Slovakia) to 67% (Malta). Other countries where more than 40% of the population is living in agglomerations are Spain, Italy and the United Kingdom.

## *Do zones related to health protection cover the whole territory?*

The limit values for the protection of human health apply throughout the whole territory of the Member States. Therefore, areas that do not belong to any zone related to health protection should not exist. Consequently, the population living in zones related to health protection should add up to the national total population number. National totals on area and population, provided by Eurostat<sup>11</sup> or the FAO<sup>12</sup>, have been used here as a reference. However, small deviations are to be expected in view of the different information sources and deviating census base years.

Within a deviation of 5%, the total surface area of the health-related zones indeed added up to the national surface area for most of Member States. For SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub> and ozone, the designated zones are in good agreement throughout the entire EU27 with only deviations up to 10% in France and up to 30% in Italy. For the other components the national area is less well covered, although 17 Member States are in good agreement. In Estonia, France, Greece, Italy and Luxemburg the coverage is less than 80% for six components and in Bulgaria for three.

However, next to a complete coverage of the area, it is more important to have a full coverage of the total population. Figure 2 compares the national population with the total population in zones designated for each of the health related objectives. Again, a nearly complete coverage is in general found for SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub> and ozone. Lower coverages are found in the case of benzene and CO. Lead and the 4<sup>th</sup> DD pollutants have the least coverage.

Excluding the 4<sup>th</sup> DD pollutants, population-based zone agreement within a 5% deviation has been attained by 18 Member States. Notable exceptions are France and Italy, where for several major health protection components less than 80% of the population appears to be residing in designated zones. Other countries with apparent shortcomings are Estonia, Greece, Luxemburg and Slovakia. Minor differences from a full coverage are visible in Portugal, Romania and Bulgaria.

For the 4<sup>th</sup> DD pollutants, the population coverage is also close to 100% in 18 Member States. However, for Estonia, France, Greece, Italy and Luxemburg the designated zones for all 4<sup>th</sup> DD pollutants cover less than 60% of the total population. An apparent covering of less than 70% for one or two 4<sup>th</sup> DD pollutants still exists in Bulgaria, Romania, Cyprus and Malta.

The conclusion is that 18 of the EU-27 Member States have zones designated which apparently meet the EU criteria of a full coverage of the population. Nine Member States have still a lack of agreement, and agreement is very poor in five Member States for the 4<sup>th</sup> DD pollutants.

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<sup>11</sup> <http://appsso.eurostat.ec.europa.eu/nui/show.do>

<sup>12</sup> <http://faostat.fao.org/>

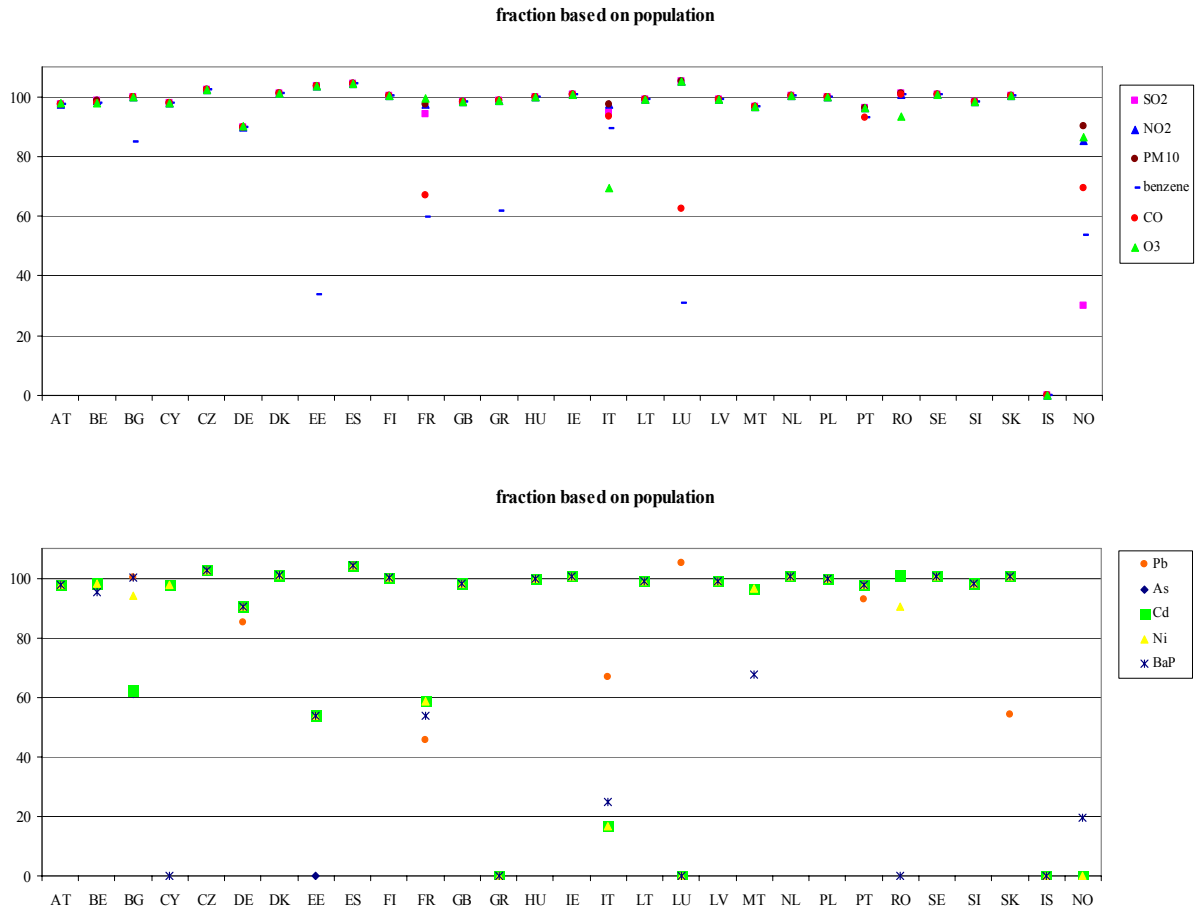


Figure 1. The total population living in zones designated in relation to health protection as fraction of the national population. Note that no questionnaire is available for Iceland. Switzerland has designated zones for ozone only and is not included in the graph. Data extracted from form 2.



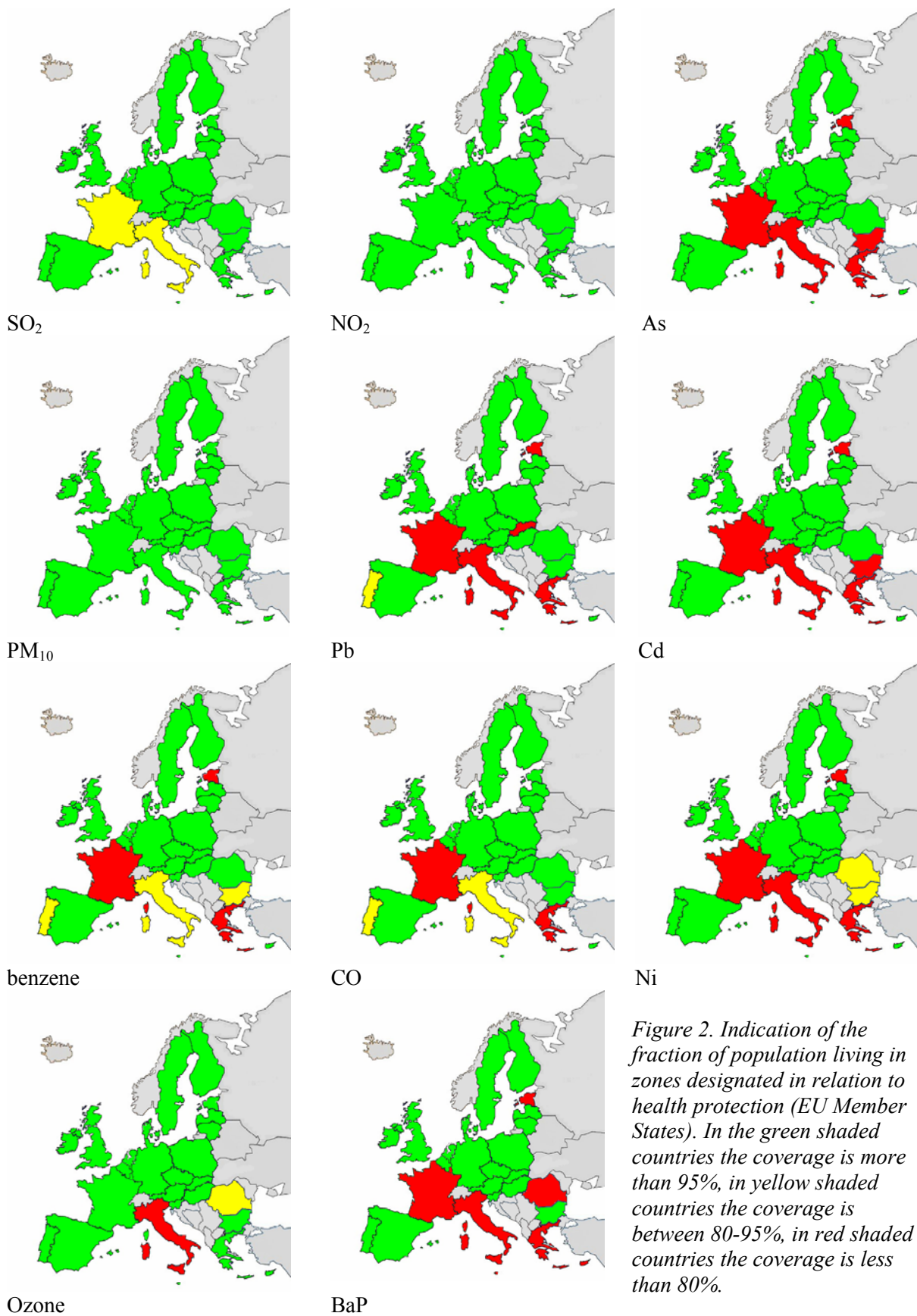


Figure 2. Indication of the fraction of population living in zones designated in relation to health protection (EU Member States). In the green shaded countries the coverage is more than 95%, in yellow shaded countries the coverage is between 80-95%, in red shaded countries the coverage is less than 80%.

### 3. Air Quality assessments

If a limit value or limit value plus margin of tolerance is exceeded somewhere in a zone, as indicated by measurements or model calculations, the whole zone is designated as being in exceedance of this threshold. The focus is on pollutants/protection targets, where compliance poses problems. The information presented in this chapter is mainly extracted from the forms 2, 8 and 9 of the AQ questionnaire. An overview of the limit and target values is given in Annex II.

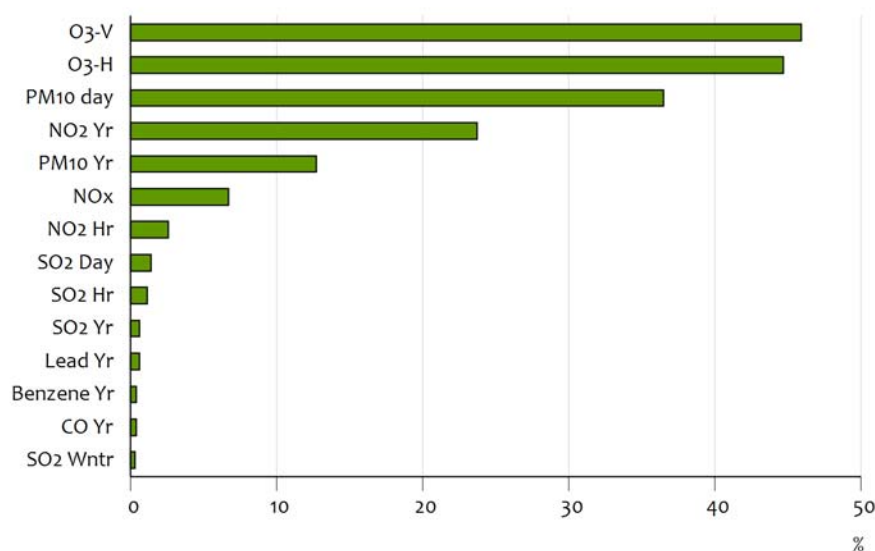
- *It should be noted that the number or percentage of zones in exceedance is only a crude indicator for the area in exceedance. In the first place, the exceedance area might be the entire zone area or just a few hundred square metres at a hotspot. In the second place, some Member States have made very 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.*

#### *Which limit value or target values are most frequently exceeded?*

The number of zones in Member States in 2008 where the limit value or target value was exceeded, was greatest for the daily limit value of PM<sub>10</sub> (36%) and the health-related target value of O<sub>3</sub> (45%).

Summaries of the exceedance status of zones per pollutant/protections target and Member State are available in Annex IV; more detailed information for each of the zones is listed in Annex V.

#### EU27 zones in exceedance, 2008



**Figure 3: Percentage of zone in exceedances in 2008<sup>13</sup>**

<sup>13</sup> for NO<sub>2</sub> and ozone the limit value and target value attainment date is 2010

## Has air quality improved in 2008 compared with previous years?

Compared to the situation in 2007 the zones where levels were exceeding the O<sub>3</sub> health target value (to be attained in 2010) looked rather similar. The explanation might be the in general similar weather conditions in Europe in both years.

When compared to the situation in 2006, most striking is the increase (+7%) in exceedance zones for the O<sub>3</sub> health target value. This increase is not supported by ozone forming favourable weather conditions in 2007 or 2008. Ozone levels during the summers of 2007 and 2008 were the lowest since reporting of Europe-wide data commenced in 1997 (EEA, 2009).

EU27	2005	2006	2007	2008
O <sub>3</sub> -V	25%	27%	46%	46%
O <sub>3</sub> -H	35%	39%	46%	45%
PM <sub>10</sub> day	44%	45%	42%	36%
NO <sub>2</sub> Yr	25%	18%	23%	24%
PM <sub>10</sub> Yr	17%	20%	17%	13%
NO <sub>x</sub>	4%	3%	10%	7%
NO <sub>2</sub> Hr	6%	2%	3%	3%
SO <sub>2</sub> Day	2%	3%	2%	1%
SO <sub>2</sub> Hr	2%	2%	2%	1%
SO <sub>2</sub> Yr	1%	1%	0%	1%
Lead Yr	0%	0%	1%	1%
Benzene Yr	3%	0%	0.3%	0.4%
CO Yr	0%	1%	1%	0%
SO <sub>2</sub> Wntr	5%	2%	0.3%	0.3%

\* form 8/9

**Table 5: Percentage of zones in exceedances of limit or target value in 2005-2008<sup>14</sup>, EU27.**

On the whole for the EU27 (see Table 5), the percentage of PM<sub>10</sub> zone-exceedances decreased slightly between 2005 and 2008. For O<sub>3</sub> the percentages of zone exceedances of the health- and vegetation related target value increased considerably from 2005/2006 to 2007/2008. The situation for NO<sub>2</sub> zone-exceedances looks different from year to year, but no tendency is seen. For the rest of the pollutants the number of exceedances zones is relatively small and does not show any tendency to increase or decrease.

It should be stressed that caution is needed interpreting these tendencies in percentages of zone exceedances as the number and designation of zones can differ from year to year. The binary approach (yes/no exceedance) does not give information on the severity of the exceedances.

Tables IV.1 to IV.3 (Annex IV) show the number of zones in exceedance, per Member State and pollutant in 2008. There are discrepancies between the number of zones listed in Table 1 and the numbers presented in Tables IV.1 to IV.3. This is due to the fact that in a number of cases the air quality status has been given for a zone while this zone was not designated for this pollutant/protection target.

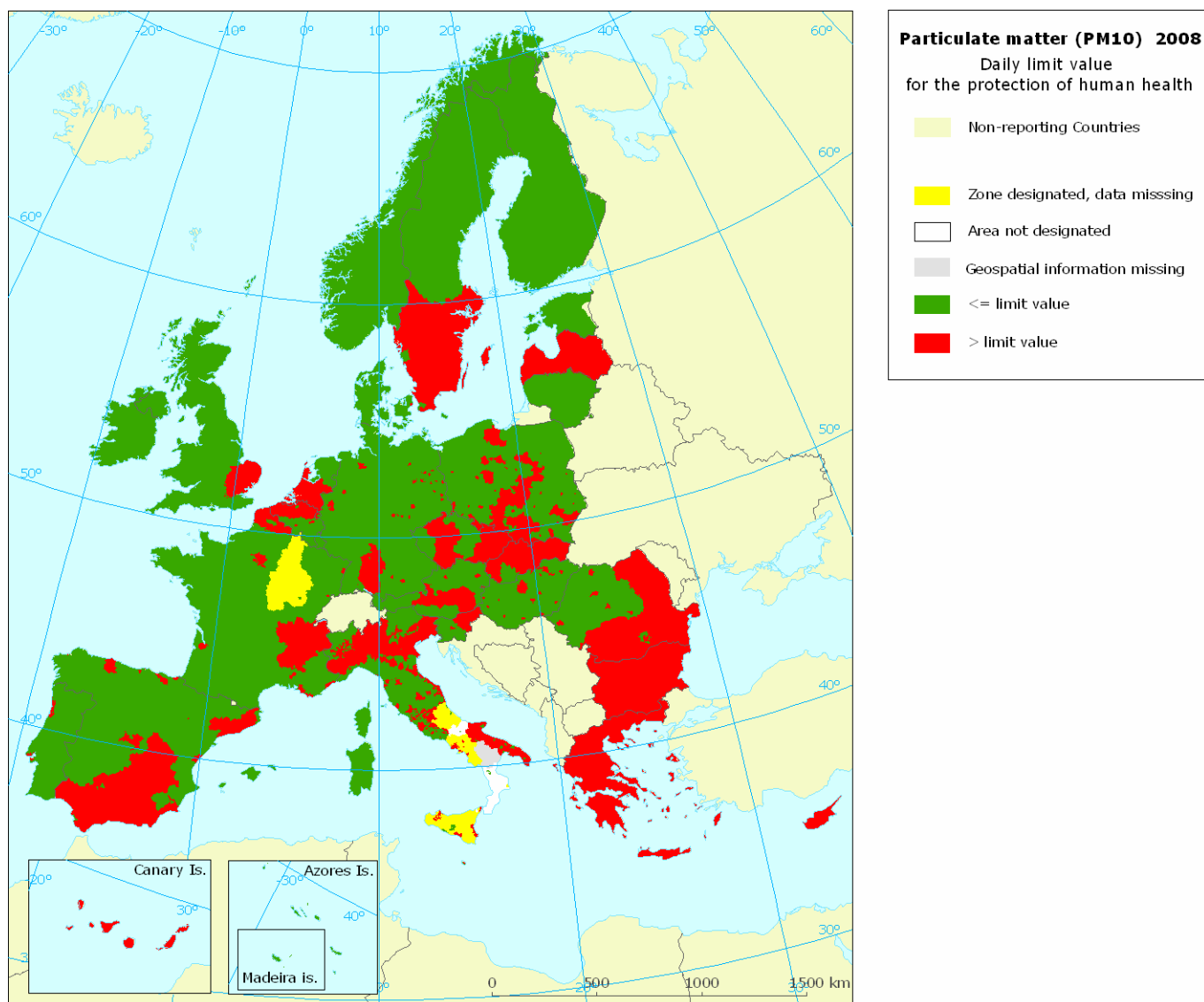
### 2008 exceedance maps for PM<sub>10</sub> and O<sub>3</sub>

Figure 4 and Figure 5 show the EU27 zone exceedance maps for PM<sub>10</sub> day and O<sub>3</sub> health target (to be attained in 2010). The white areas in the maps represent areas in Member States that were not designated into zones. The yellow territories are areas that were designated into zones but air quality

<sup>14</sup> for NO<sub>2</sub> and ozone the limit value and target value attainment date is 2010

status was not reported on. In both cases those Member States are not fulfilling the criteria of the Directive as zoning and reporting is mandatory for all health related pollutants.

Figure 4 shows exceedances of the PM<sub>10</sub> daily limit value in a number of isolated urban agglomerations and regions with well-documented high PM<sub>10</sub> levels (Po valley, Central Europe, Ruhr area, Netherlands, Northern Belgium, London, see for example the monitoring based maps presented in de Smet et al., 2009). On the other hand, it also suggests exceedances in southern Sweden and Latvia. Here exceedance has been reported at one or two hot-spot stations resulting in a whole non-compliance zone.



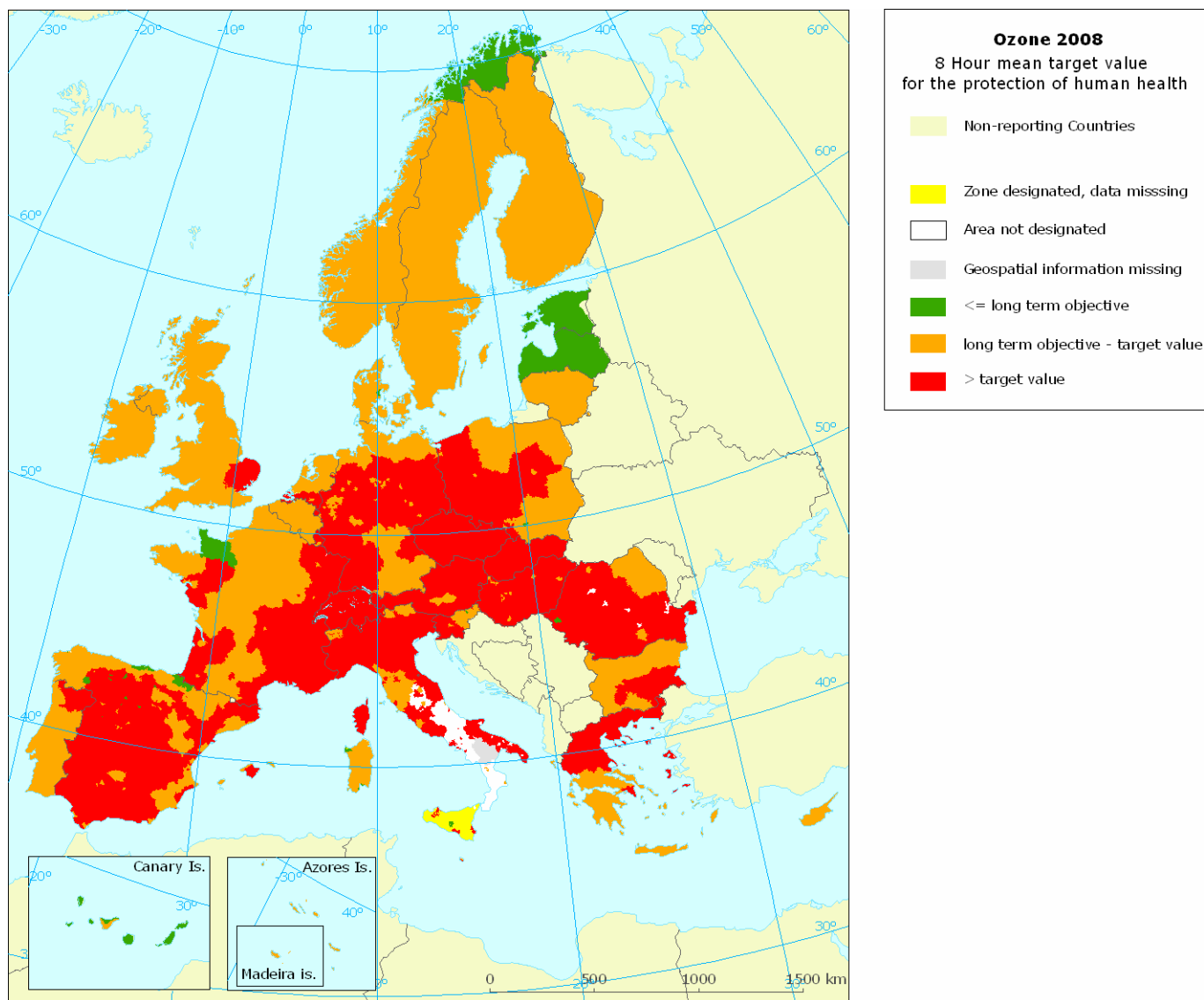
\*data extracted from form 8 and 9 of AQ questionnaire

**Figure 4: EU27 PM<sub>10</sub> zone in exceedance of daily limit value, 2008**

Information on exceedances of the daily PM<sub>10</sub> limit value is generally based on monitoring data. For 7 zones exceedances are reported based on modelled results; these zones are all located in the Netherlands.

Of all zones for which the ozone target value was exceeded in 2008, 27 zones are located in Italy and reporting is based on modelled results.

Maps showing the exceedances of the other limit and target values are presented in Annex III.



\*data extracted from form 8 and 9 of AQ questionnaire

**Figure 5: EU27 O<sub>3</sub> health zone in exceedance, 2008**

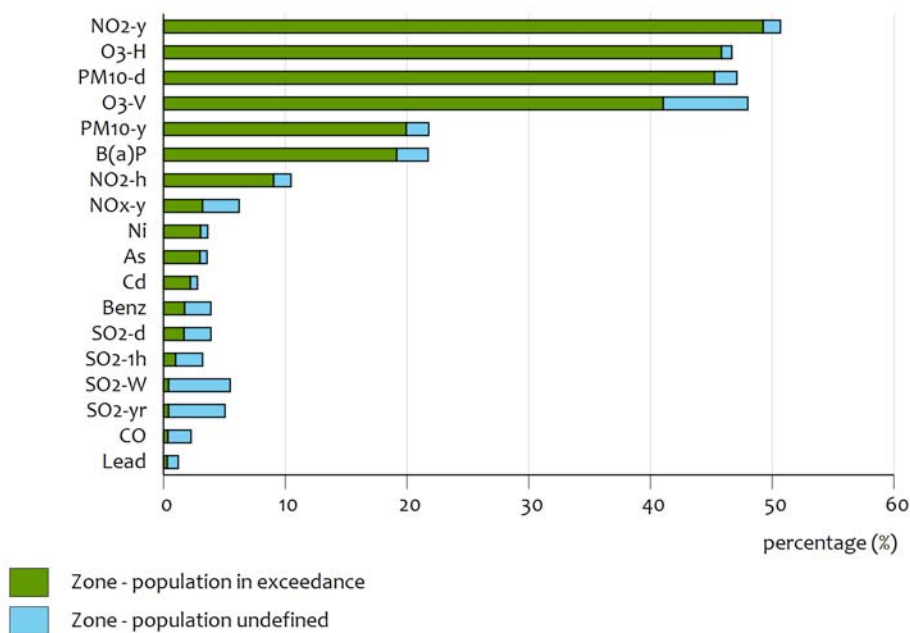
A list presenting how the air quality in 2008 in zones in Member States is related to air quality thresholds laid down in the EU air quality directives is available as excel spreadsheet; see Annex V. The list is based on the information submitted by the Member States to the European Commission before 15 May 2010. Resubmissions or further communication by Member States after this date are not included in this list.

### Population in zones with exceedances

#### *How many people live in zones where the limit or target value is exceeded?*

Figure 6 shows that in 2008 45% of the EU27 population lived in zones where the daily PM<sub>10</sub> limit value was exceeded. For NO<sub>2</sub> and O<sub>3</sub> health the percentage of population affected are 49% and 46% respectively. The number of zones that exceeded the AQ thresholds is 36% (PM<sub>10</sub> day); 45% (O<sub>3</sub> health) and 24% (NO<sub>2</sub> year).

### EU27 share of population in zones exceeding limit or target values, 2008



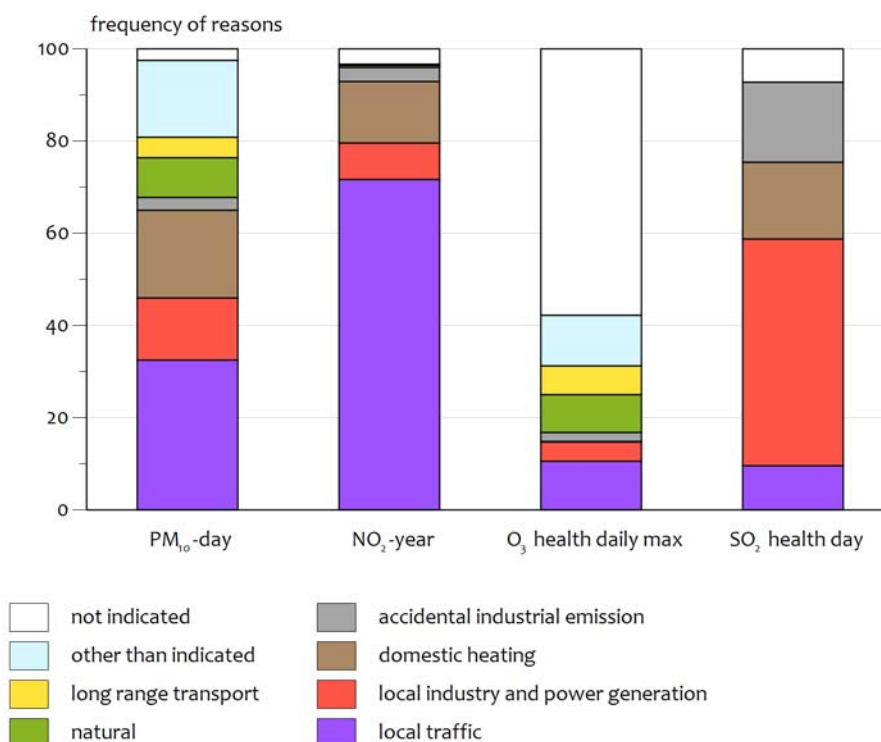
\* data extracted from form 8 and 9 of AQ questionnaire

**Figure 6: Population living in zones exceeding air quality thresholds, 2008**

### *What are the reported reasons for the exceedances in the zones according to the Member States?*

The most frequently mentioned reasons of exceedances of the daily PM<sub>10</sub> limit value are local traffic (31%), domestic heating (17%) and local industry and power generation (14%). In most of the cases no reason has been given for exceedances of the ozone alert threshold. According to the reports by the Member States the exceedances of the NO<sub>2</sub> yearly limit value are caused predominantly by local traffic (85%).

### Main reasons for exceedances of LVs (& MOT) in 2008



\* data extracted from form 11 and 13 of AQ questionnaire

**Figure 7: Reported reasons for exceedances of limit and target values of PM<sub>10</sub>, NO<sub>2</sub>, O<sub>3</sub> and SO<sub>2</sub>, 2008**

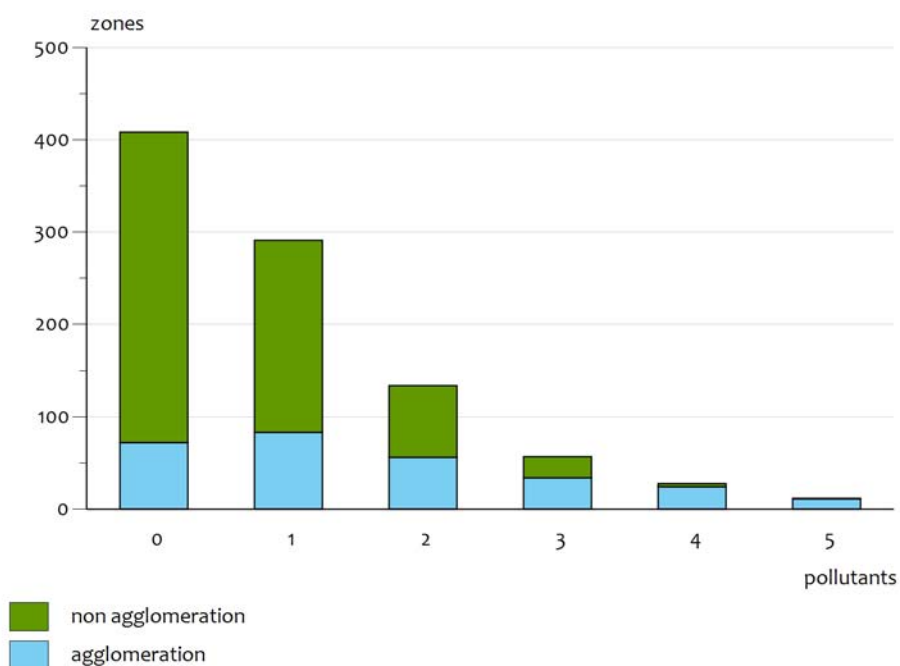
Figure 7 shows the main reasons mentioned for exceedances for the daily LV of PM<sub>10</sub>, the annual LV of NO<sub>2</sub>, O<sub>3</sub> health TV and the daily LV of SO<sub>2</sub>. The percentages mentioned are the shares from the total reported reasons by the Member States.

### Multi pollutant exceedances

#### *How many zones are there in the EU where air quality thresholds are exceeded for several pollutants?*

If air quality thresholds are exceeded for several pollutants in the same zone, this is called a multi pollutant exceedance.





data extracted from form 8 and 9 of AQ questionnaire

**Figure 8: EU27 exceedance zones by number of pollutants and zone type, 2008**

In 231 zones (25% of all zones (n=930); 27% of the 871 zones designated for two or more pollutants) the limit or target values of two or more pollutants have been exceeded simultaneously. These zones require most challenging integrated air pollution assessment strategies. In 2008 there were 134 zones in the EU27 that have air quality thresholds exceedances for 2 pollutants. There are 57, 28 and 12 zones that have exceedances for 3, 4 and 5 pollutants respectively. A multi-exceedance situation for 3 or more pollutants is relatively more frequently observed in agglomerations.

### *How many people live in zones with multi pollutant exceedances in EU27 in 2008?*

Table 6 shows the population that is affected by pollutant exceedances. The number of people living in zones with 5 pollutants in exceedance amounts to 15.6 million in the EU27. 216 million people live in zones with 2 or more pollutant zone exceedances.



**Table 6: EU 27 population in exceedance zones by number of pollutants and zone type (in million), 2008**

	# pollutants	0	1	2	3	4	5	Grand Total
	EU 27	agglomeration zones	28	45	40	40	25	15
non agglomeration zones		198	155	53	35	6.4	0.1	448
Grand Total		226	199	93	76	31.4	15.6	641

\*data extracted from the form 2, 8 and 9

### *Were granted time extensions actually needed?*

For PM<sub>10</sub>, time extensions are granted in 49 zones for the daily limit value. Not in all cases the zone codes given in the derogation request could be traced in the 2008 questionnaires. Zones in the Czech Republic and Poland were re-numbered in 2008 but a match with the derogation request could be made. For a number of zones in Germany (3 zones) and Italy (2 zones) no unambiguous match could be made. From the 44 zones retrieved in the 2008 questionnaires, 18 zones have reported that PM<sub>10</sub> levels are in compliance with the daily limit value.

Time extension has been granted for 9 zones for the annual PM<sub>10</sub> limit value. In 5 zones concentrations are reported to be already below the annual limit value in 2008. About half of granted time extensions for PM<sub>10</sub> seem to be redundant and might automatically be withdrawn.

For NO<sub>2</sub> time extensions have been granted for 9 zones which all exceed in 2008 the limit value plus the margin of tolerance.

### *How many Member States reported incidents on derogation situations for pollutants?*

In 2008 derogation was only applied for PM<sub>10</sub>. Ten Member States (AT, CY, DE, ES, FR, GB, GR, IT, MT,PT) reported (Table 7) on derogation – natural events?

**Table 7 Influence of the PM<sub>10</sub> - ‘natural events’ – correction (a).**

Member State	Daily limit value				Yearly limit value			
	Number of stations		number of zones		number of stations		number of zones	
	before correction	after correction	before correction	after correction	before correction	after correction	before correction	after correction
AT	2		2					
CY	1		1		1		1	
DE	2	1	2	1				
ES	123	72	46	30	41	20	18	7
FR	8	7	4	3	3	2	3	2
GB	3	2	3	2	1		1	
GR	15	11	4	4	12	9	4	4
PT	3		3		1		1	
MT	1		1					
IT	4	3	1	1	1	1	1	1
Total	162	96	67	41	60	32	29	14

\*data extracted from form 23

(a) Note: the numbers indicate stations and zones to which the correction was applied, not the total number of stations and zones with exceedance in the Member States mentioned.

Table 7 shows the effect of the ‘natural events’ correction on stations and zones with PM<sub>10</sub> exceedance. The correction brought 26 zones (66 stations) below the daily limit value; for the annual limit value the correction resulted in a non-compliance status for 15 zones (28 stations). The appliance of PM<sub>10</sub> – ‘winter sanding’ – correction was not reported by any of the Member States. None of the Member States indicated exceedances due to natural SO<sub>2</sub> sources in 2008.

### ***Were limit values laid down in Directive 85/203/EEC still exceeded in 2008?***

The “old” limit values (Directive 85/203/EEC) remain in force until the new ones set in the first Daughter Directive (now included in the AQ Directive) take over. Until 1 January 2010 this applies only to the “old” NO<sub>2</sub> limit value. This old limit value for NO<sub>2</sub> of 200 ug/m<sup>3</sup> was exceeded in 13 zones in 2008 (extracted from form 26); 10 of these zones were situated in Bulgaria and Romania. For all the zones air quality plans have been made.

## 4. Changes in PM<sub>10</sub> air quality

### *Does the reported data shows improvements over the years?*

Using reported data the trend in the current (2008) set of zones can be determined. For each year the AQ status in a zone can be defined by at least one measurement station. Only one station with exceedance already results in the whole zone being in exceedance. It is essential to realize that when assessing the air quality in a zone using this binary approach (it is/it is not in compliance) improvements in air quality could be covered up: (i) there could well be a reduction in the number of stations per zone with exceedances; (ii) there can also be a reduction in the degree of exceedance (i.e. how far over the threshold the exceedance actually is). Of course, a worsening in air quality could be covered up by opposite reasons.

Figure 9 shows a combined GIS map of the last 3 reported years indicating where problem areas are located. It is evident that exceedance of the PM<sub>10</sub> daily limit value are persistent in large parts of the EU.

A more detailed analysis using the observed time series at AirBase stations (Mol et al, 2010) showed for the last ten years a downward tendency, in particularly since 2006. This, however, must be interpreted with great care: a significant downward trend is observed only at a relatively small number of stations (20-30% of all stations included in the analysis) and the set of stations used is not representative for the EU27 as a whole.

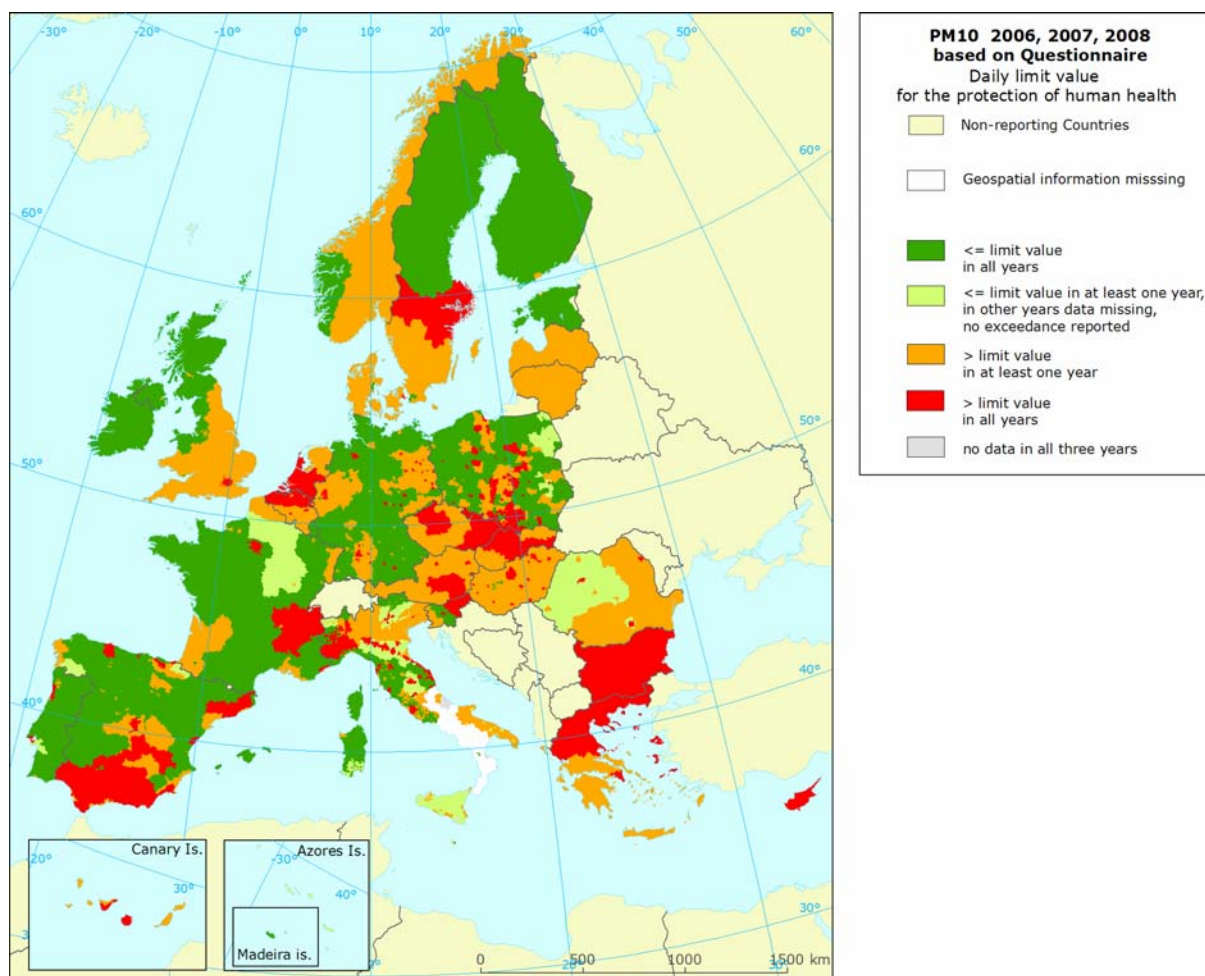


Figure 9. EU27 Exceedances of PM<sub>10</sub> daily limit value, 2006-2008

## 5. Monitoring networks

### *Zones where the number of stations was too low*

#### Stations related to health protection

The Air Quality Directive and the 4<sup>th</sup> Daughter Directive list criteria for determining the minimum number of monitoring stations per zone. The minimum number of stations per zone depends on (1) exceedance of the upper or lower assessment threshold (the assessment regime) specified in the directives, (2) the population of the zone, (3) the agglomeration status and (4) on whether supplementary assessment had been carried out. Member States must also assess the air quality in the vicinity of point sources, but the directives do not specify the number of stations. Member States are responsible for having an adequate air quality assessment system in all of their zones; it is important to note that this may require more stations than the minimum that was checked here. In many cases, the actual number of stations was considerably higher than this minimum.

The analysis presented here is based on the voluntarily reported population and area data (Form 2) and on the assessments of air quality in a zone in relation to the upper and lower assessment thresholds (Form 10). Not all Member States delivered the (voluntary) information in Form 10. As far as possible the information has been completed on basis of information extracted from AirBase. To retrieve this information, the “EoI station code” was needed to link the station data in the two reports (Form 3, see also Chapter 6). The assessment regime is evaluated on the basis of five consecutive years. For each station in AirBase valid data over the period 2004-2008 was collected; valid data was defined here by a minimum data coverage<sup>15</sup>. The regime observed during at least three individual years is assigned to the station. The assessment regime of a zone is based on the worst situation observed at the individual stations located in the zone.

In general, the number of stations is in agreement with the EU-legislation in 60 – 80% of the zones. For ozone, SO<sub>2</sub>, As, Cd and Ni this is the case for nearly 80% of the zones (Figure 10). Probably the actual percentage of zones in compliance will be higher, but for all compounds except ozone essential information is missing for at least 20% of the zones. In those cases the assessment regime is not clear and the minimum number of stations per zone cannot be derived.

Compared to 2007, the situation has changed but not really improved. In 2008 the number of stations is too low in about 20% of the zones for ozone and 32% for PM<sub>10</sub>; in 2007 this was 31% for ozone and 20% for PM<sub>10</sub>. For B[a]P 15% of the zones have too few stations, this is also the case for 8% of the NO<sub>2</sub>-zones for and for 6% of the benzene zones. Compliance on the number of stations for the now obligatory 4<sup>th</sup> DD-compounds is slightly better than for the traditional compounds. The lack of information for these new compounds is not worse than for the traditional ones. Note that for the heavy metals listed in the 4<sup>th</sup> DD the levels are below the lower assessment threshold in many zones; in these zones monitoring is not mandatory.

The differences between the Member States are large. Compliance with the criteria on station numbers is nearly complete in the Czech Republic and the three Baltic states. PM<sub>10</sub> is the only significant problem: in the Czech Republic and Lithuania 32 and 40% of the PM<sub>10</sub>-zones had a too low number of stations (Figure 10).

A lot of Member States have shortcomings in the required number of stations per zone: France, Spain, Belgium, the Netherlands, Denmark, Austria, Hungary, Slovenia, Malta and Cyprus. Some of these countries have for many compounds a relatively small number of zones with too few stations, such as

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<sup>15</sup> Following Mol et al (2010) the minimum requirements on data coverage were set to 75% (for SO<sub>2</sub>, NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, CO, ozone), 50% (benzene) and 14 % (lead, 4<sup>th</sup> DD pollutants).

France. On the other hand, Cyprus, Malta and Hungary have sufficient stations in all zones for all compounds except for the PM<sub>10</sub>-zones which have too few stations.

For other Member States the assessment regime in many zones is undefined as essential information is lacking. This is the case for Portugal, Italy, Ireland, Poland and Germany. Also, in Ireland, Italy and Poland up to 50% of the zones are not in compliance for ozone and at least one other compound.

Several countries have for three or more pollutants too few monitoring stations in at least 50% of the zones: the United Kingdom, Finland, Slovakia, and Bulgaria. In Sweden and Romania the situation is only slightly better. In Greece and Luxembourg an adequate assessment is impossible as these countries have not specified the zones for the 4<sup>th</sup> DD. An overview of the situation in the EU27 as a whole and typical examples for the situation in the various Member States is given in Figure 10.

#### Stations related to ecosystem and vegetation protection

For zones exceeding the assessment thresholds for ecosystems and vegetation it is difficult to do a precise check. The minimum number of stations is defined as one station per 20000 or 40000 km<sup>2</sup> when respectively the upper or lower assessment threshold is exceeded. Most zones are much smaller than these sizes.

As far as sufficient information was available, all large zones were found to have enough stations. Most countries supplied sufficient information to check the number of stations needed per zone, except Poland and Portugal. As Poland has a large number of zones for ecosystems and vegetation, still 35% of the EU-zones is lacking information for this assessment. Belgium and Hungary did not report having any stations for ecosystems or vegetation, and Slovakia has apparently such stations only in the agglomeration of Bratislava.

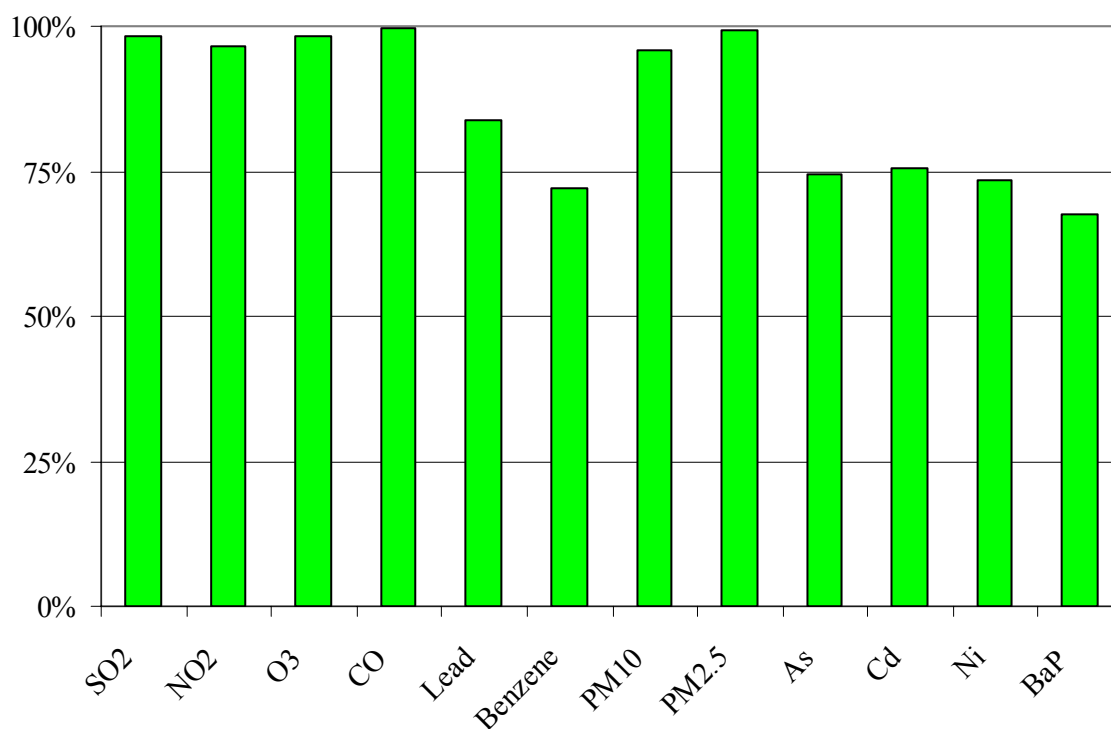


Figure 10: Compliance with the obliged minimum number of stations in zones, 2008

## 6. Comparison with EoI information

### *How many monitoring stations reported in the Questionnaire could be traced in AirBase?*

The Exchange of Information decision requires that for all stations used for compliance checking (that is, all stations listed in the questionnaire) meta-information and concentration data has to be submitted. A comparison of the information in questionnaire and in AirBase shows that for the stations listed in Form 3 almost 98 % can be retrieved from AirBase. The largest discrepancies have been found for France, Greece and Italy. The correspondence for ozone stations (Form 4) is nearly complete (more than 99.6%). When matching at the level of a measurement configuration (that is, checking whether the 2008 concentration data of a station/pollutant combination listed in Form 3 or 4 is available from AirBase) larger differences are found, see Figure 11. For the classical pollutants (SO<sub>2</sub>, NO<sub>2</sub>, CO, O<sub>3</sub>) for nearly all measurement configurations the concentrations data are also included in the national EoI submissions. For benzene and the pollutants in the 4<sup>th</sup> Daughter Directive in less than 75% of the cases a positive match could be made.



**Figure 11. Fraction of measurement configurations listed in Form 3 and 4 for which 2008 monitoring data is available in AirBase.**

### *How much do reported exceedances and info in AirBase overlap in 2008?*

The following is a first explorative exercise to compare AirBase and Questionnaire at the data level. In no way the results should be interpreted as judgements or reprimands on reported information. The results are preliminary and indicate how much both data sets are comparable and up to date. Discrepancies can help both reporting cycles improve their quality. Further improving the match between the datasets will close the gaps. At the same time the exercise can provide insights in the way Member States use their measurements for exceedance reporting purposes.

We will compare here the number of zones in exceedance of a limit or target value for four LV/TV as listed in the questionnaire (data from the forms 8 and 9) with results obtained from the AirBase information. Table 14 summarizes the number of zones in exceedances according to both datasets (“Overlapping zones”), the number of zones reported in the questionnaire only (“Reported extra”) and the number of zones found in AirBase only (“AirBase extra”). In Table 14 the light colours all mean that no zone was in exceedance. Bright colours mean that at least one zone was in exceedance according to questionnaire data (yellow), AirBase data (red) or both (orange).

For the health related ozone target value (Table 14a) the AirBase information indicates that there are 7 more zones in exceedance which are not reported in the questionnaire. On the other hand, the questionnaire lists in total 109 zones in exceedance which could not be identified based on AirBase information. Mainly Spain and Italy contribute to this discrepancy. In the case of Spain this could be explained by the fact that Spain based the assessment on modelling results in 14 zones. The use of model results in the assessment of 27 zones closes the gap in case of Italy only partly.

A comparison for NO<sub>2</sub> (annual LV) and PM10 (annual and daily limit value is given in the Tables 14b and 14d). Here a more or less similar picture can be observed. More detailed analysis will be needed to further explain the discrepancies found.

**Table 14a Overlap between ozone health zones in exceedance reported in questionnaire and extracted from AirBase data (EoI).**

Country	Reported extra	Overlapping zones	AirBase extra
AT	1	9	
BG	1		
CY			1
CZ	1	14	
DE	1	25	2
ES	14	30	2
FR	3	31	
GB	1		
GR	1	2	
HU	1	5	
IT	71	27	
MT	1		
LU	1		
NL		2	
PL	2	8	
PT	1		
RO	9		
SI		2	2
SK		2	
<b>EU27</b>	<b>109</b>	<b>157</b>	<b>7</b>
CH		4	
<b>all</b>	<b>109</b>	<b>161</b>	<b>7</b>



**Table 14b** Overlap between NO<sub>2</sub> (annual limit value) zones in exceedance reported in questionnaire and extracted from AirBase data (EoI).

Country	Reported extra	Overlapping zones	AirBase extra
AT	7		1
BE	1	2	
BG		1	
CZ	1	2	
DE	42	3	2
DK		1	
ES		6	4
FR	15	1	1
GB	6	2	
GR		3	
HU	1		
IT	23	16	1
LU		1	
LV			1
MT	1		
NL		1	3
PL	2		
PT	3		
RO	2	1	
SE	2		
SK	1	1	1
<b>EU27</b>	<b>107</b>	<b>40</b>	<b>12</b>
NO	5		
<b>all</b>	<b>112</b>	<b>40</b>	<b>12</b>

**Table 14c** Overlap between PM<sub>10</sub> (annual limit value) zones in exceedance reported in questionnaire and extracted from AirBase data (EoI).

Country	Reported extra	Overlapping zones	AirBase extra
BG	6		
CY		1	
CZ		1	
DE	1		
DK	1		
ES	4	14	
FR	5		
GB	1		1
GR	4		
IT	24	1	
LV		1	
PL	15	5	
RO	3		
SI		1	
SK		2	
<b>EU27</b>	<b>64</b>	<b>26</b>	<b>1</b>

**Table 14d Overlap between PM<sub>10</sub> (daily limit value) zones in exceedance reported in questionnaire and extracted from AirBase data (EoI).**

Country	Reported extra	Overlapping zones	AirBase extra
AT	1	4	
BE	4	5	
BG		6	
CY		1	
CZ		7	1
DE		12	2
DK	1		
ES	12	34	1
FR	1	16	
GB		2	1
GR		4	
HU		3	2
IT	8	54	
LV		2	
MT	1		
PL	12	53	
PT	5		
RO		3	
SE		3	1
SI		4	
SK		8	
EU27	45	221	8

## 7. Overview of available information on PM<sub>2.5</sub>

### Summary

- The number of PM<sub>2.5</sub> monitoring stations increased in 2008; nearly all stations report raw data under the EoI.
- Designation of stations used for the determination of the averaged exposure indicator (AEI) is far from complete. The number of (sub)urban background stations is in line with the requirements for determining the AEI but the representativeness of the stations for estimating population exposure can not yet be judged.
- Concentrations above 25 µg/m<sup>3</sup> (target value to be met in 2010, limit value to be met in 2015) are observed at about 10% of the stations in 10 Member States.
- Estimates of the AEI (based on all available (sub)urban background stations) results in AEI-levels of 20 µg/m<sup>3</sup> in 8 Member States.

This chapter gives a first, preliminary overview of the PM<sub>2.5</sub> information reported by the Member States in their annual questionnaire and EoI data submission.

An overview of the PM<sub>2.5</sub> monitoring networks in the MS is presented in Table 12 (extracted from Form 3). Compared to the reporting for 2007, for 2008 an increasing number of Member States have reported on the PM<sub>2.5</sub> levels at an increasing number of stations. PM<sub>2.5</sub> has been measured at 518 stations in 2008. For nearly all stations listed in the questionnaire monitoring data also reported under the EoI. Notable exception emerged for France: for more than 20 stations listed in the questionnaire monitoring data has not been submitted to AirBase. An overview of the measurement methods is given in Figure 12 and Table 12.

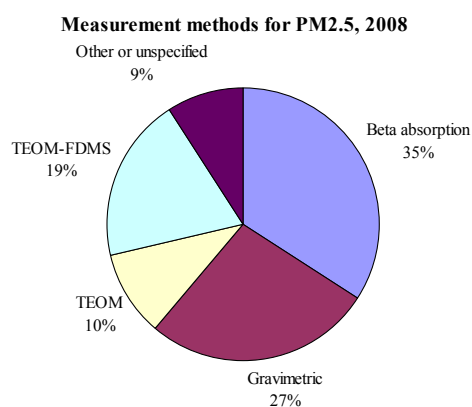


Figure 12. Measurement methods used in sampling of PM<sub>2.5</sub> (data taken from Form 3).

Six Member States have identified stations used for the determination of the Average Exposure Indicator (AEI). These stations should be representative for the exposure of the population; surprisingly five stations are classified as “urban traffic” or “urban industrial” stations while “(sub)urban background” is expected. At a few stations identified as AEI-station no PM<sub>2.5</sub> measurements were made.

The Air Quality Directive sets requirements for the number of stations for the assessment of the AEI: a minimum of one sampling point per million inhabitants summed over agglomerations and additional urban areas with more than 100 000 inhabitants should be operational. An estimate of the required number of AEI-stations could be based on the population living in agglomerations. However, as some larger cities with more than 100 000 inhabitants might not be part of an agglomeration, this estimate

gives only a minimum number of stations. An upper estimate might be given by the total urban population within a Member State. This information (data for 2008) has been taken from the World Population Prospect (UN, 2008).

For most of the Member States the number of (sub)urban background stations operational in 2008 (Table 12; taken from AirBase) falls in general in the range of AEI stations required using the two estimates of urban population mentioned above. However, from this limited analysis it can not be concluded whether the stations are representative for the population exposure throughout the territory of the Member State.

**Table 12. Number of PM<sub>2.5</sub> stations in EU Member States as reported in the questionnaire, number of stations labelled as being used to determine the AEI, number of stations as reported to AirBase having data for 2008 (number of sub-urban background stations in parentheses), population living in agglomerations and a summary of the applied measurement method (a).**

MS	Number of stations	Used for AEI	Number of stations in AirBase	Urban population <sup>(e)</sup>	Measurement method				
					Beta absorption	Gravimetric	TEOM	TEOM-FDMS	Other, unspecified
AT	12		12 (4)	2.1 - 5.6	0	10	0	2	0
BE	30	4 <sup>(b)</sup>	32 (10)	2.4 - 10.2	5	0	1	9	15
BG	3		4 (2)	7.7 - 5.4	0	3	0	0	0
CY	1		3 (0)	0 - 0.6	0	0	0	0	0
CZ	31		32 (18)	2.8 - 7.5	23	8	0	0	0
DE	80		98 (50)	28.1 - 60.8	26	38	6	0	14
DK	8	3	11 (4)	1.3 - 4.7	7	0	4	0	0
EE	3		2 (2)	0.5 - 0.9	3	0	0	0	0
ES	97		92 (21)	23.4 - 34.4	39	47	11	0	0
FI	7		7 (2)	1 - 3.3	4	0	3	0	0
FR	56	4	35 (26)	25.6 - 47.9	0	0	7	49	0
GB	47	36 <sup>(c)</sup>	54 (37)	25.5 - 54.9	1	3	6	39	0
GR	5		5 (3)	4.3 - 6.8	4	0	1	0	21
HU	3		3 (1)	2.5 - 6.8	3	0	0	0	0
IE	1	0 <sup>(d)</sup>	1 (0)	1 - 2.7	0	1	0	0	0
IT	50		74 (28)	24.6 - 40.1	35	7	8	0	0
LT	3		3 (0)	0.9 - 2.3	3	0	0	0	0
LU	1		1 (0)	0 - 0.4	0	0	1	0	0
LV	7	2	7 (2)	0.7 - 1.5	7	0	0	0	0
MT	3		3 (1)	0.3 - 0.4	2	0	0	1	0
NL	19		20 (7)	5.1 - 13.5	0	19	0	0	0
PL	13		13 (11)	9 - 23.3	5	8	0	0	0
PT	19		17 (5)	4.4 - 6.3	19	0	0	0	0
RO	2		2 (0)	5.7 - 11.6	0	2	0	0	0
SE	10		9 (2)	2.9 - 7.7	0	1	8	1	0
SI	3		(0)	0.4 - 1	0	0	0	0	0
SK	4		4 (3)	0.7 - 3	0	0	0	4	0
Total	518	49	544 (239)		186	147	56	105	50

(a) note that due to parallel measurements the total number of instruments exceeds the total number of stations;

(b) of which two urban traffic;

(c) of which three urban industrial; in total 43 stations are identified as "AEI-station" but PM<sub>2.5</sub> is observed at only 36 stations;

(d) two stations are identified as "AEI-station" but at none of them PM<sub>2.5</sub> is observed;

(e) range in urban population; number on the left is the total urban population in agglomerations, number on the right is extracted from the UN-World Urbanisation Prospect (data for 2008).

*Exceedance of limit value*

An annual mean PM<sub>2.5</sub> concentration of 25 µg/m<sup>3</sup> has been set as limit value to be met in 2015 (as target value it enters into force by 1-1-2010). In Form 14d three Member States listed - on a voluntary basis - exceedances at 10 individual stations (Table 13).

More Member States have provided information on statistical parameters of daily mean PM<sub>2.5</sub> levels in Form 18. Using this extended set of observations, in total 42 exceedance situations in 10 Member States can be counted. In fair agreement herewith the 2008 data extracted from AirBase shows exceedances at 52 stations in 11 Member States, however at 12 of these station data coverage is below 10% which makes the annual average not representative. In Table 13 the additional exceedance situations (if based on a data coverage of more than 75%) are listed.

**Table 13. Exceedances of the limit value (25 µg/m<sup>3</sup> set for 2015) measured at individual stations, 2008 (data taken from Form 14d (top panel) and form 18 plus AirBase (lower panel)).**

MS	Zone code	Eol station code	type of station	type of area	Concentration (µg/m <sup>3</sup> )
CZ	CZ080	CZ0TBOM	Background	suburban	38.7
CZ	CZ080	CZ0TOPO	Background	suburban	25.5
CZ	CZ080	CZ0TOPR	Industrial	urban	36.3
CZ	CZ080	CZ0TOZR	Background	urban	29.4
CZ	CZ080	CZ0TTRO	Background	urban	26.7
CZ	CZ080	CZ0TVER	Background	rural	37.7
FR*	FR15A00001	FR15039	Traffic	rural	27
FR*	FR20A00001	FR20013	Traffic	suburban	30
RO**	RO0801	RO0070A	Traffic	urban	31
RO**	RO0801	RO0069A	Industrial	urban	33
Additional stations available in AirBase and/or Form 18					
BG	BG0001	BG0059A	Traffic	suburban	41.3
BG	BG0005	BG0046A	Background	suburban	41.5
BG	BG0006	BG0026A	Background	urban	27.2
FR	nz	FR04053	Traffic	suburban	29.5
GR	EL0003	GR0035A	Background	suburban	29.5
HU	HU0011	HU0020A	Traffic	urban	28.0
IT	IT0103	IT0554A	Background	urban	34.4
IT	IT0110	IT1522A	Background	rural	26.6
IT	IT0301	IT1868A	Background	urban	31.7
IT	IT0301	IT1692A	Background	urban	31.7
IT	IT0301	IT1737A	Background	urban	31.1
IT	IT0301	IT0777A	Traffic	urban	27.9
IT	IT0301	IT0782A	Background	urban	26.9
IT	IT0301	IT1650A	Background	urban	26.1
IT	IT0302	IT1464A	Background	rural	33.3
IT	IT0302	IT1876A	Background	suburban	27.9
IT	IT0303	IT1875A	Background	urban	28.1
IT	IT0303	IT1388A	Industrial	rural	26.7
IT	IT0303	IT1736A	Background	rural	25.5
IT	nz	IT1693A	Industrial	suburban	26.6
LV	LV0002	LV000L1	Traffic	urban	25.6
PL	PL.12.01.a.01	PL0039A	Background	urban	37.5
PL	PL.12.01.a.01	PL0038A	Background	urban	33.5
PL	PL.24.01.a.14	PL0242A	Background	urban	40.4
SK	SKZI01	SK0020A	Background	urban	25.1

\* not reporting to AirBase

nz: listed in AirBase only, no zone connected

\*\* data coverage less than 75%

Figure 13 gives an overview of the observed concentrations per station type (Mol et al, 2010). At rural stations lower concentrations are measured than in urban areas. The observed differences in concentration at urban and traffic stations are small.

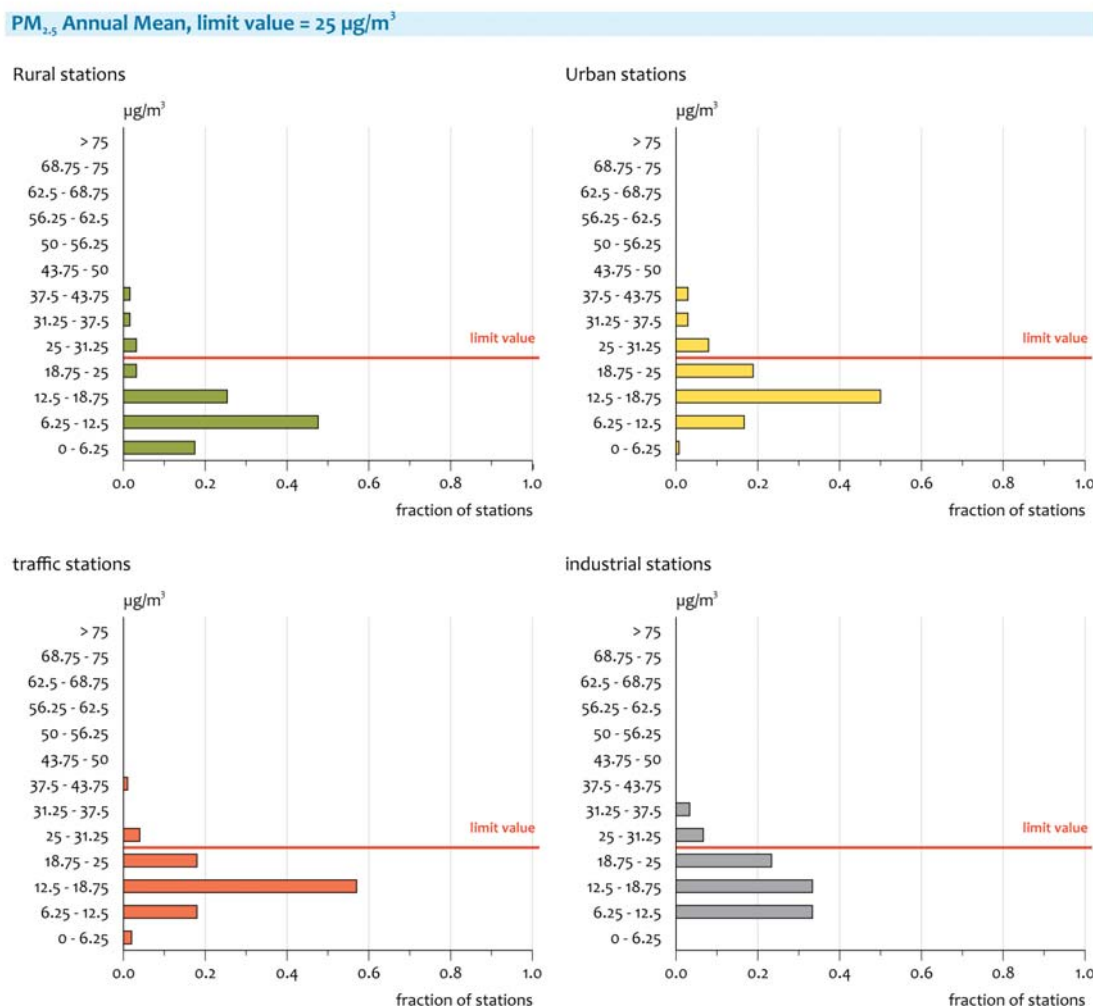


Figure 13. Frequency distribution of annual mean concentration measured at different station type, data extracted from AirBase for 2008. Only stations with data coverage of 75% or more are included (Mol et al, 2010).

Table 14 and Figure 14 summarize the observed data for each of the Member States (data extracted from Form 18, number of stations per Member State may differ from the number reported in Form 3). The top panel of Figure 14 once more demonstrates where and to which extent maximum concentrations exceeds the limit value. The lower panel of Figure 14 presents the concentrations averaged over all available (sub)urban background stations (blue squares) and averaged for the AEI-designated stations (red squares). The latter averages seem to be slightly higher than when averaging over all (sub)urban background stations. The AEI-designated stations will be located in the more densely populated areas.

The (voluntary) information on PM<sub>2.5</sub> assessment in zones (Form 9) might give a too optimistic view of the PM<sub>2.5</sub> air quality situation in 2008. Monitoring results shown in Table 14 and Figure 14 indicate that in at least 10 Member States (and at least 26 zones) the current levels are exceeding the PM<sub>2.5</sub> limit value. The limited information provided in Form 9 lists 105 zones with concentration levels

below the limit value and seven zones where concentrations are above the limit value. However, for the majority of zones (704 zones) information is missing.

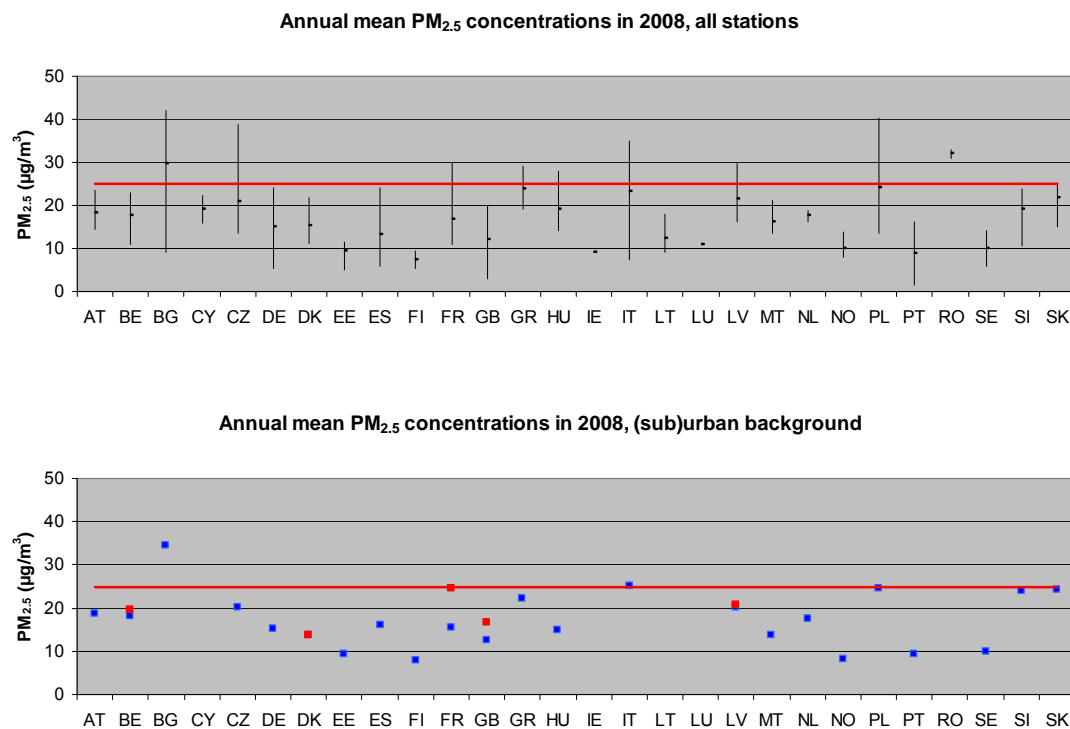


Figure 14. Annual mean (and maximum / minimum value)  $PM_{2.5}$  concentrations in 2008 per Member State, the red line corresponds to the target value of  $25 \mu g/m^3$  to be met in 2010. The bottom panel show the concentration averaged over all (sub)urban background stations (blue squares) and averaged over the station designated for determining the AEI (red squares; data taken from Form 18).

Table 14. Number of  $PM_{2.5}$  monitoring stations, average, minimum and maximum value of the annual mean concentrations per Member State, 2008 (data taken from Form 18).

MS	Number of stations	Averaged Annual mean ( $\mu\text{g}/\text{m}^3$ )	Max of annual mean ( $\mu\text{g}/\text{m}^3$ )	Min of annual mean ( $\mu\text{g}/\text{m}^3$ )
AT	12	18.3	23.6	14.3
BE	30	17.8	23.0	11.0
BG	4	29.8	42.0	9.0
CY	2	19.2	22.4	16.0
CZ	22	21.0	38.7	13.5
DE	75	15.1	24.0	5.3
DK	7	15.4	21.8	11.2
EE	3	9.4	11.6	4.9
ES	99	13.3	24.0	6.0
FI	7	7.2	9.3	5.3
FR	45	16.6	30.0	11.0
GB	8	12.1	20.0	3.0
GR	5	23.8	29.0	19.0
HU	3	19.0	28.0	14.0
IE	1	9.2	9.2	9.2
IT	47	23.3	35.0	7.3
LT	3	12.3	18.0	9.0
LU	1	11.0	11.0	11.0
LV	7	21.4	29.8	16.2
MT	3	16.2	21.3	13.6
NL	4	17.5	18.8	16.2
NO	16	10.0	13.9	7.9
PL	13	24.0	40.4	13.5
PT	21	8.7	16.3	1.4
RO	2	32.0	33.0	31.0
SE	9	10.0	14.0	6.0
SI	3	19.1	23.9	10.6
SK	4	21.9	25.1	15.0
Total	456	16.2	42.0	1.4



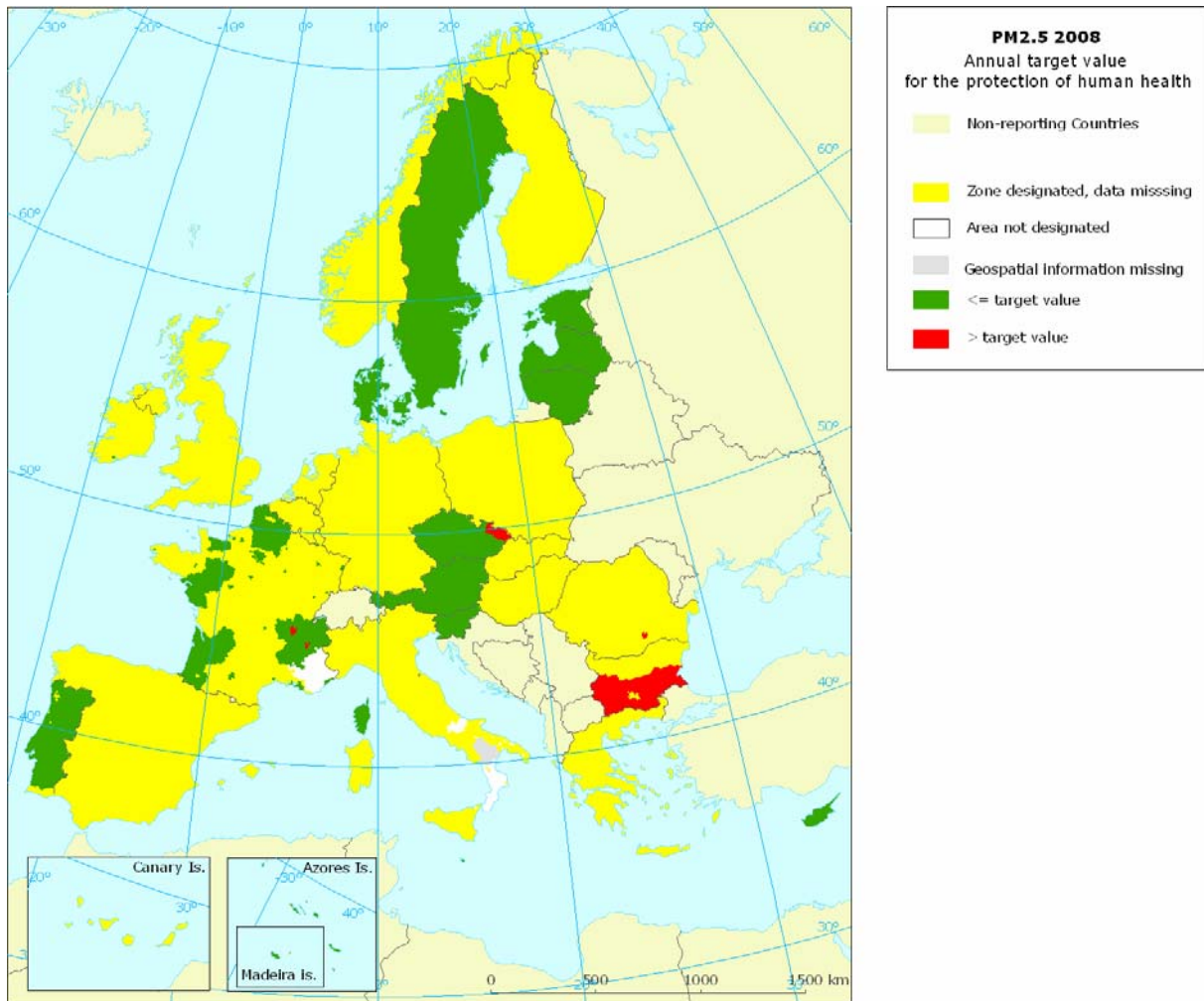


Figure 15: EU27 PM<sub>2.5</sub> zones in exceedance, 2008

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## Annex I: List of forms in AQ questionnaire

Form 0	General information, update history
Form 1	Contact body and address
Form 2	Delimitation of zones and agglomerations
Form 3	Stations and measuring methods used for assessment under first, second and fourth DD
Form 4	Stations used for assessment of ozone, including nitrogen dioxide and nitrogen oxides in relation to ozone
Form 5	Stations and measuring methods used for the assessment of recommended volatile organic compounds (3 <sup>rd</sup> DD) and other relevant PAH and metals in ambient air and deposition (4 <sup>th</sup> DD)
Form 6	Stations and measurement methods used for the assessment of other ozone precursor substances
Form 7	Methods used to sample and measure PM <sub>10</sub> and PM <sub>2.5</sub> , ozone precursor substances, arsenic, cadmium, nickel, mercury, PAH: optional additional codes to be defined by the Member State
Form 8	List of zones and agglomerations where levels exceed or do not exceed limit values or limit values plus margin of tolerance for pollutants listed in first and second DD
Form 9	List of zones and agglomerations where levels exceed or do not exceed target values or long term objectives for ozone and arsenic, cadmium, nickel, B(a)P and PM <sub>2.5</sub>
Form 10	List of zones and agglomerations where levels exceed or do not exceed upper assessment thresholds or lower assessment thresholds, including information on the application of supplementary assessment methods
Form 11	Individual exceedances of limit values and limit values plus the margin of tolerance of pollutants listed in first and second DD
Form 12	Reasons for individual exceedances: optional additional codes to be defined by the Member State
Form 13	Individual exceedances of ozone thresholds
Form 14	Exceedance of target values of ozone, arsenic, cadmium, nickel, benzo(a)pyrene and PM <sub>2.5</sub>
Form 15	Annual statistics of ozone, arsenic, cadmium, nickel, and benzo(a)pyrene
Form 16	Annual average concentrations of ozone precursor substances of mercury and other relevant PAH and deposition rates of mercury and other relevant PAH
Form 17	Monitoring data on 10 minutes mean SO <sub>2</sub> levels
Form 18	Monitoring data on 24hr mean PM <sub>2.5</sub> levels
Form 19	Tabular results of and methods used for supplementary assessment
Form 20	List of references to supplementary assessment methods referred to in Form 19
Form 21	Exceedance of limit values for SO <sub>2</sub> due to natural sources
Form 22	Natural SO <sub>2</sub> sources: optional additional codes to be defined by Member State
Form 23	Exceedance of limit values of PM <sub>10</sub> due to natural events
Form 24	Exceedance of limit values of PM <sub>10</sub> due to winter sanding
Form 25	Consultations with other MS on transboundary pollution
Form 26	Exceedances of limit values laid down in Directives 85/203/EEC
Form 27	Reasons for exceedances of limit values laid down in Directives 85/203/EEC: optional additional codes to be defined by the Member State

## Annex II. Air Quality Health Standards

Under EU law a limit value is legally binding from the date it enters into force subject to any exceedances permitted by the legislation. A target value is to be attained as far as possible by the attainment date. The table below shows the EU air quality health standards.

Pollutant	Concentration	Averaging period	Legal nature	Permitted exceedances each year
Fine particles (PM <sub>2.5</sub> )	25 µg/m <sup>3</sup>	1 year	Target value entered into force 1.1.2010	n/a
	25 µg/m <sup>3</sup>		Limit value enters into force 1.1.2015	
	20 µg/m <sup>3</sup>		Indicative limit value enters into force 1.1.2020 (to be confirmed)	
Sulphur dioxide (SO <sub>2</sub> )	350 µg/m <sup>3</sup>	1 hour	In force	24
	125 µg/m <sup>3</sup>	24 hours	In force	3
Nitrogen dioxide (NO <sub>2</sub> )	200 µg/m <sup>3</sup>	1 hour	Limit value entered into force 1.1.2010	18
	40 µg/m <sup>3</sup>	1 year	Limit value entered into force 1.1.2010*	n/a
PM <sub>10</sub>	50 µg/m <sup>3</sup>	24 hours	In force**	35
	40 µg/m <sup>3</sup>	1 year	In force**	n/a
Lead (Pb)	0.5 µg/ m <sup>3</sup>	1 year	In force	n/a
Carbon monoxide (CO)	10 mg/ m <sup>3</sup>	Maximum daily 8 hour mean	In force	n/a
Benzene	5 µg/ m <sup>3</sup>	1 year	Limit value enters into force 1.1.2010**	n/a
Ozone	120 µg/ m <sup>3</sup>	Maximum daily 8 hour mean	Target value enters into force 1.1.2010	25 days averaged over 3 years
Arsenic (As)	6 ng/ m <sup>3</sup>	1 year	Target value enters into force 31.12.2012	n/a
Cadmium (Cd)	5 ng/ m <sup>3</sup>	1 year	Target value enters into force 31.12.2012	n/a
Nickel (Ni)	20 ng/ m <sup>3</sup>	1 year	Target value enters into force 31.12.2012	n/a
Polycyclic Aromatic Hydrocarbons	1 ng/ m <sup>3</sup> (expressed as concentration of Benzo(a)pyrene)	1 year	Target value enters into force 31.12.2012	n/a

\*Under the Directive 2008/50/EC the Member State can apply for an extension of up to five years (i.e. maximum up to 2015) in a specific zone. Request is subject to assessment by the European Commission. In such cases within the time extension period the limit value applies at the level of the limit value plus maximum margin of tolerance (48 µg/m<sup>3</sup> for annual NO<sub>2</sub> limit value).

\*\*Under the Directive 2008/50/EC the Member State can apply for an extension until three years after the date of entry into force of the Directive (i.e. June 2011) in a specific zone. Request is subject to assessment by the European Commission. In such cases within the time extension period the limit value applies at the level of the limit value + maximum margin of tolerance (35 days at 75µg/m<sup>3</sup> for the daily PM<sub>10</sub> limit value, 48 µg/m<sup>3</sup> for the annual PM<sub>10</sub> limit value).

The Air Quality Directive is introducing additional PM<sub>2.5</sub> objectives targeting the **exposure** of the population to fine particles. These objectives are set at the national level and are based on the average exposure indicator (AEI).

AEI is determined as a 3-year running annual mean PM<sub>2.5</sub> concentration averaged over the selected monitoring stations in agglomerations and larger urban areas, set in urban background locations to best assess the PM<sub>2.5</sub> exposure to the general population.

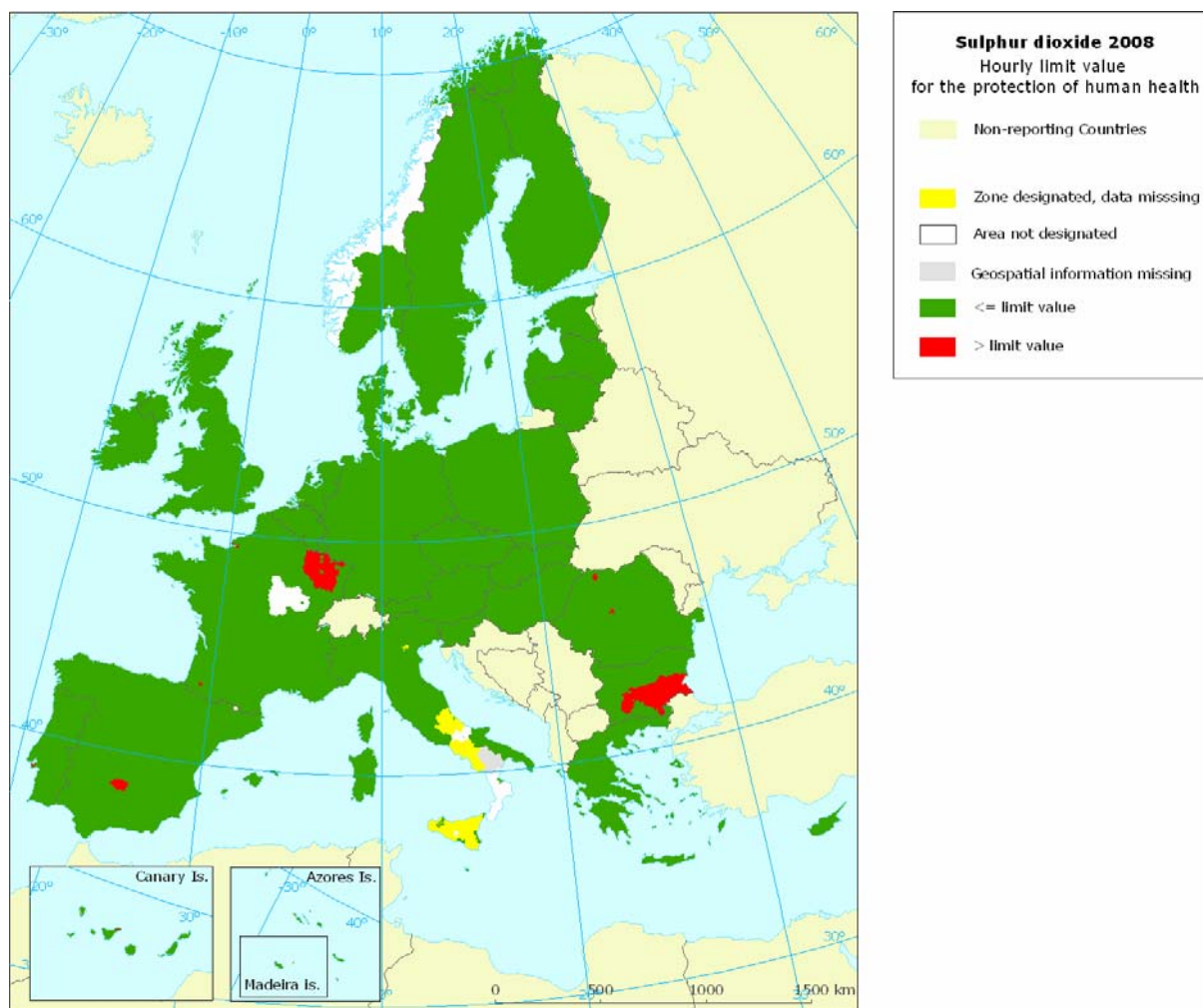
Title	Metric	Averaging period	Legal nature	Permitted exceedences each year
PM <sub>2.5</sub> Exposure concentration obligation	20 µg/m <sup>3</sup> (AEI)	Based on 3 year average	Legally binding in 2015 (years 2013,2014,2015)	n/a
PM <sub>2.5</sub> Exposure reduction target	Percentage reduction* + all measures to reach 18 µg/m <sup>3</sup> (AEI)	Based on 3 year average	Reduction to be attained where possible in 2020, determined on the basis of the value of exposure indicator in 2010	n/a

\* Depending on the value of AEI in 2010, a percentage reduction requirement (0, 10, 15, or 20%) is set in the Directive. If AEI in 2010 is assessed to be over 22 µg/m<sup>3</sup>, all appropriate measures need to be taken to achieve 18 µg/m<sup>3</sup> by 2020.

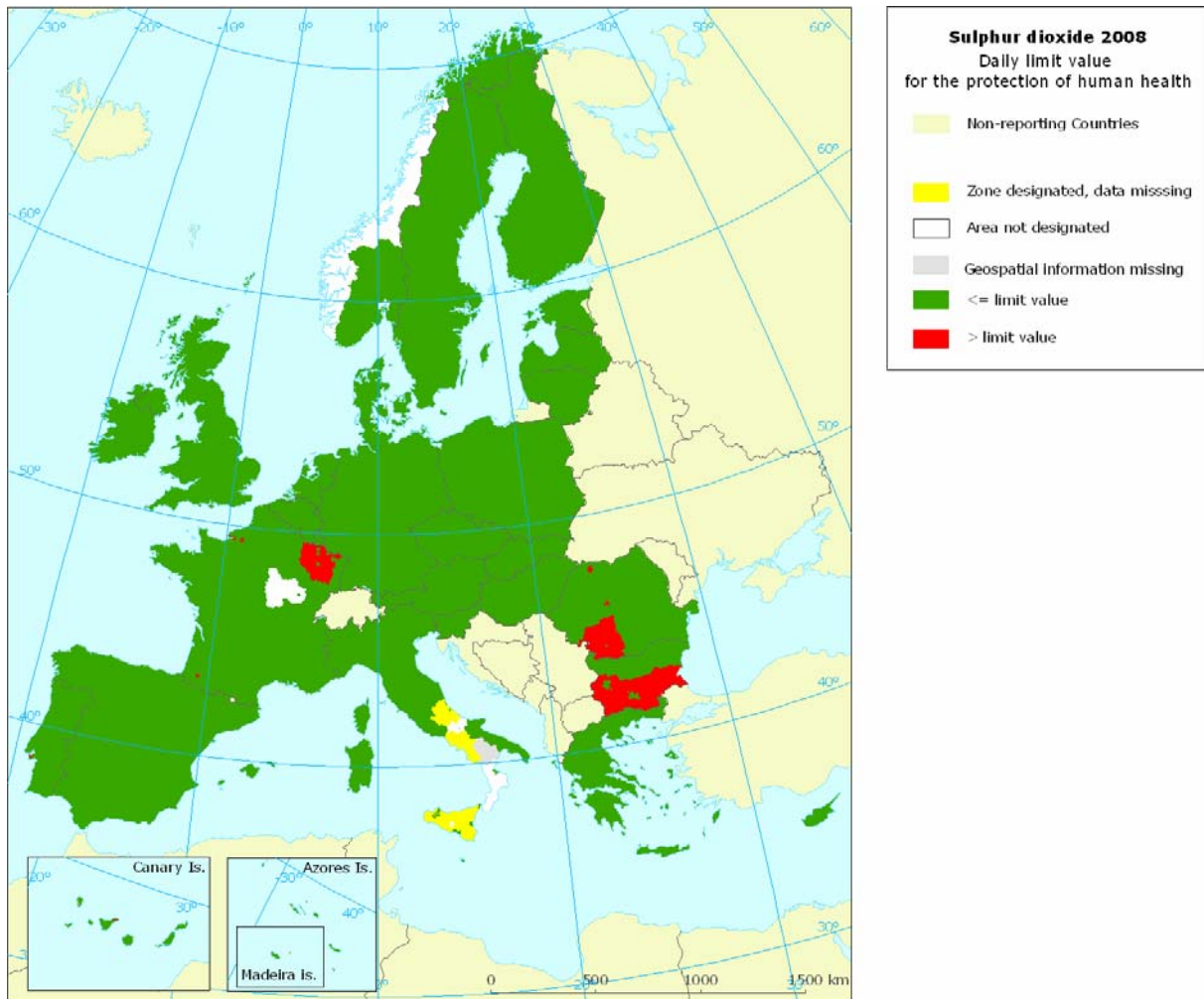
## Annex III Exceedance maps.

Here the zone exceedance maps are shown for all targets, except for the PM<sub>10</sub> day and O<sub>3</sub> health targets which have been included as Figure 4 and 5 in Chapter 3.

The white areas in the maps represent areas in Member States that were not designated into zones. The yellow areas were designated into zones, but air quality status was not reported on. For health related pollutants in both cases Member States did not comply with the Directive as zoning and reporting is mandatory.



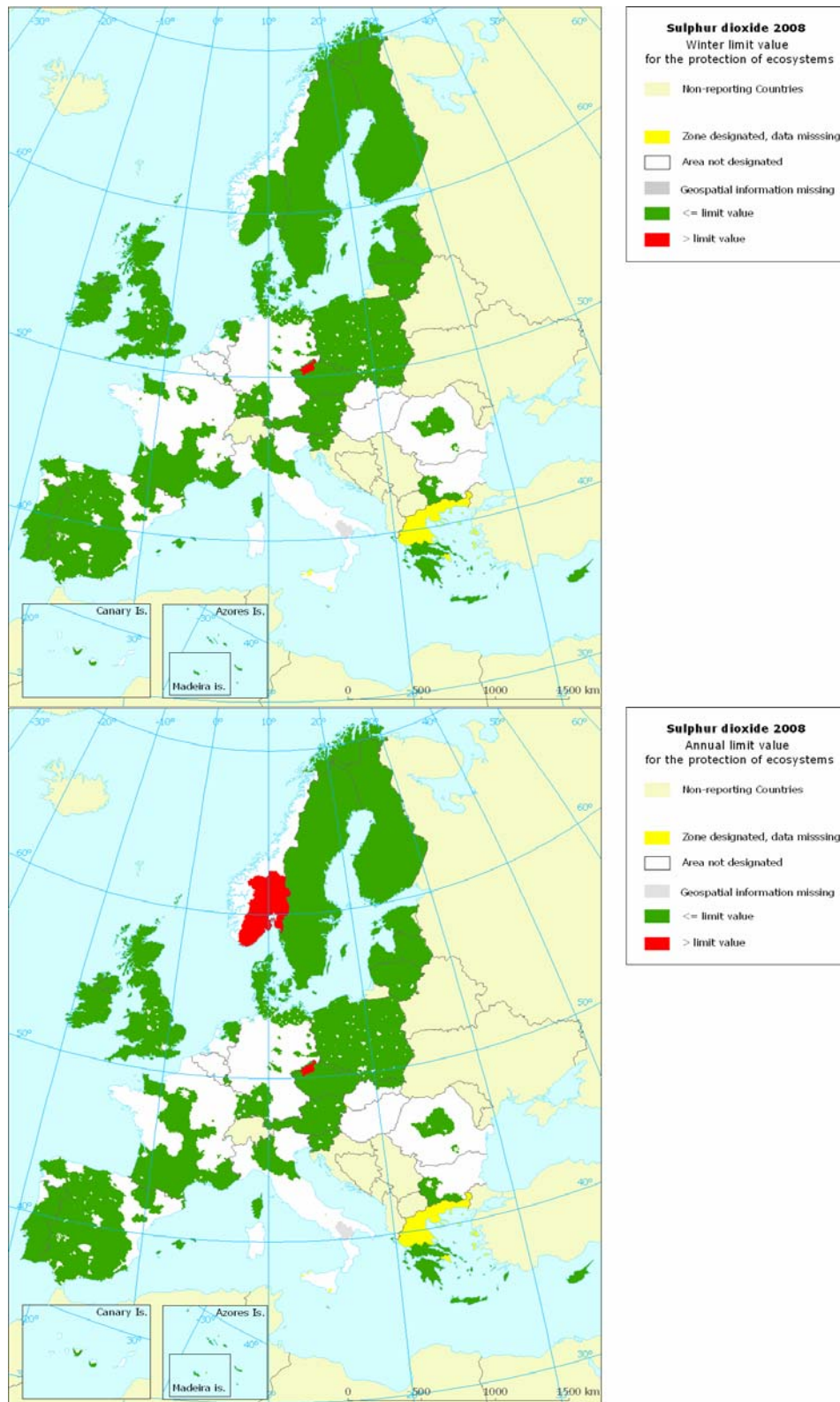
**Figure III.1: Zones in exceedance for the hourly limit value for sulphur dioxide in 2008.** For exceedances of the hourly SO<sub>2</sub> limit value the causes most frequently mentioned are local industry and power generation (56%) and accidental industrial emission (25%). The number of exceedances in Bulgaria and Romania was considerably higher than in Spain and France.



**Figure III.2: Zones in exceedance for the daily limit value for SO<sub>2</sub> in 2008.**

Occurrence of zone exceedances for the daily limit value for SO<sub>2</sub> is highest in France (4), Bulgaria (2) and Romania (3) in 2008. The daily limit value is slightly more frequently exceeded than the hourly limit value.

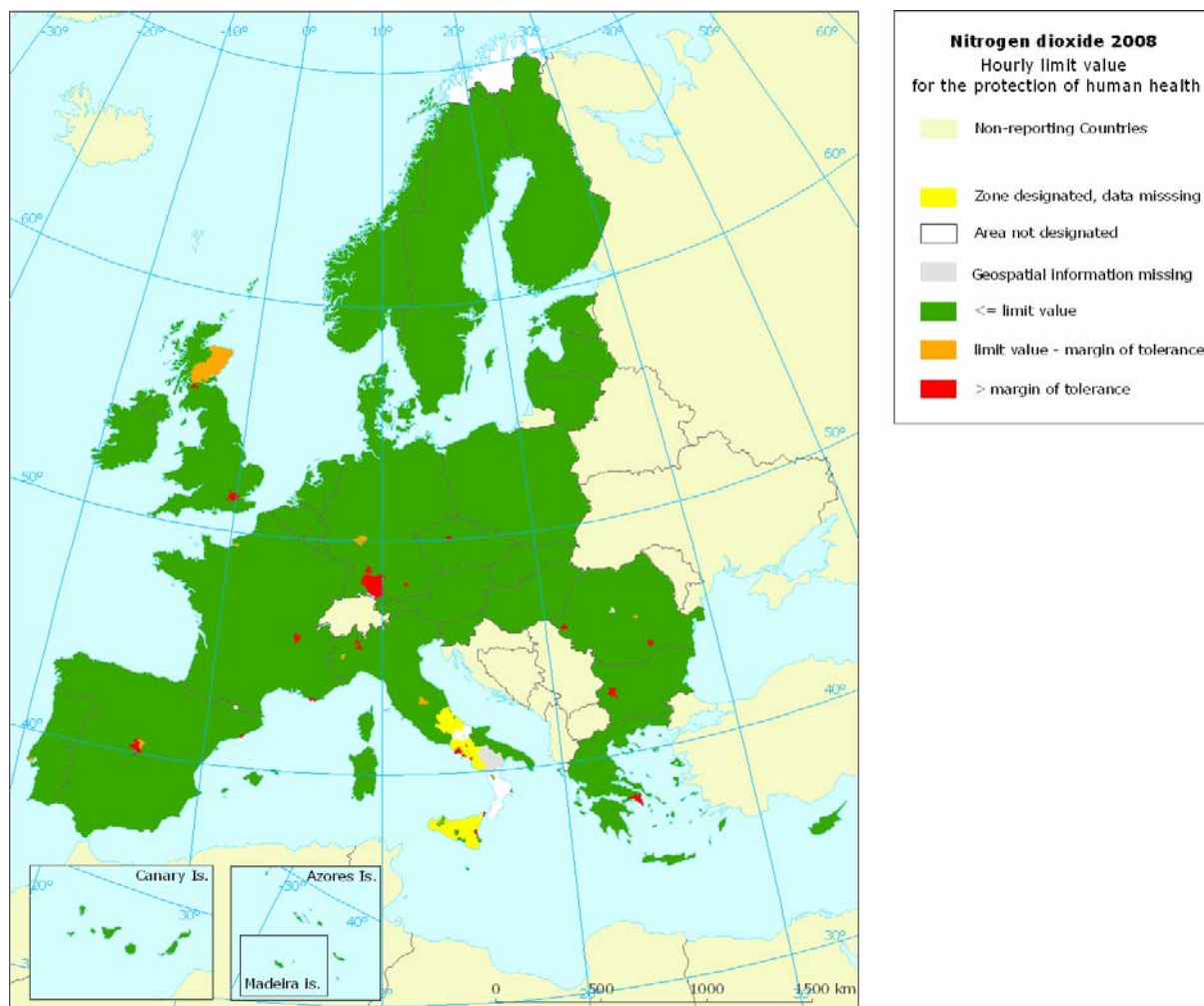




**Figure III.3 Zones in exceedance of the limit values of SO<sub>2</sub> set for the protection of ecosystems.**

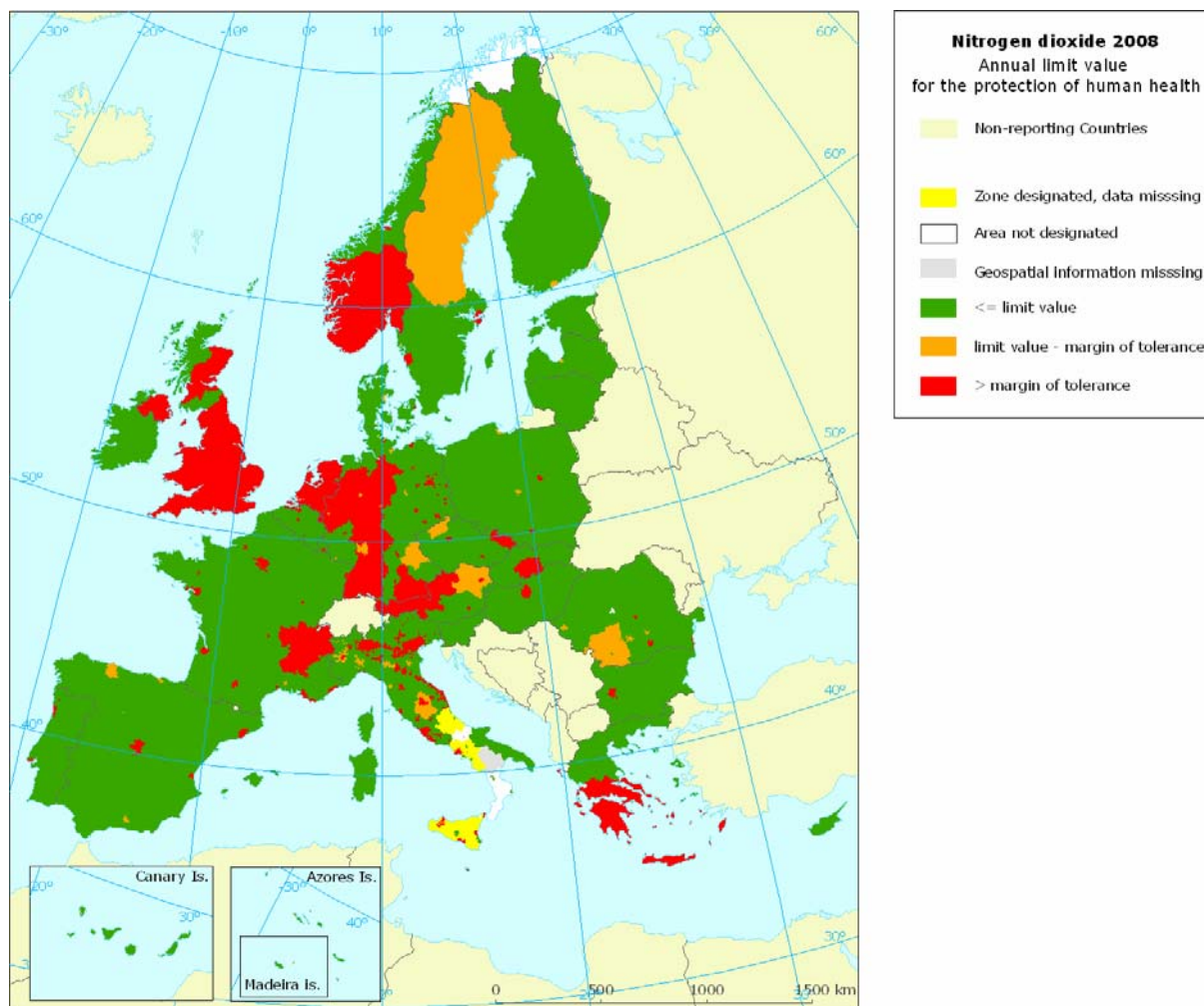
The white areas illustrate that for large parts of Europe no zones have been designated for these limit values. Only a few exceedances have been reported: one in the Czech Republic (both limit values) and one in Norway (annual limit value only).





**Figure III.4: Zones in exceedance for the hourly limit value and margin of tolerance for NO<sub>2</sub> in 2008.**

Italy has 4 exceedances of the limit value plus margin of tolerance. For 10 designated zones data are missing. For France, data are missing for 4 designated zones and 2 zones are in exceedance of the limit value plus margin of tolerance. Further exceedances of the limit value plus margin of tolerance are observed in Germany and Spain (both 3), United Kingdom and Romania (both 2), Bulgaria, Czech Republic and Greece (all 1).



**Figure III.5: Zones in exceedance for the annual limit value for NO<sub>2</sub> in 2008.**

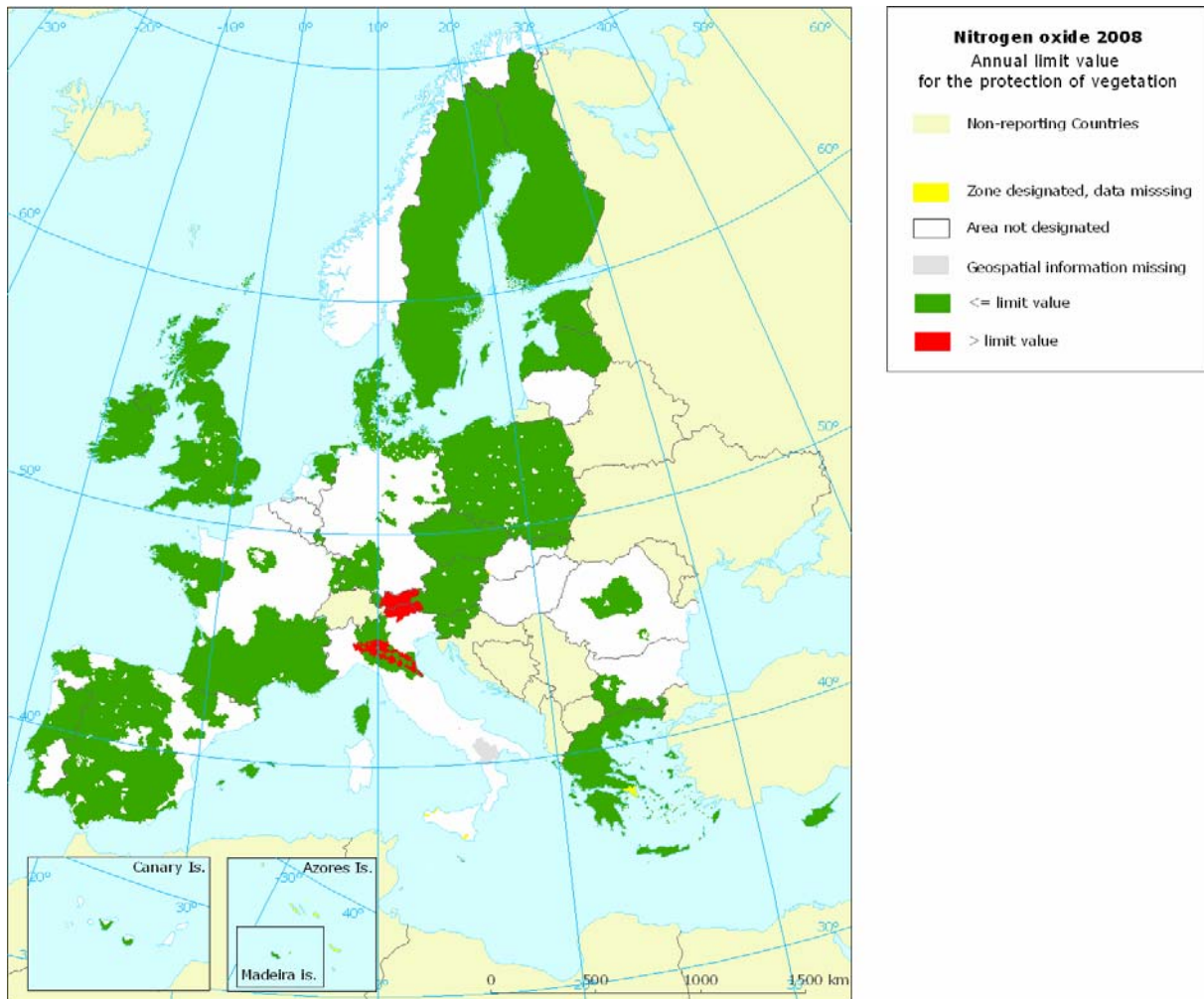
The Netherlands have all their designated zones exceeding the limit value plus margin of tolerance.

Germany, UK and Italy have the highest number of zones in exceedance of LV+MOT.

The most agglomeration exceedances of the MOT also occur in Germany (28), UK (27) and Italy (25).

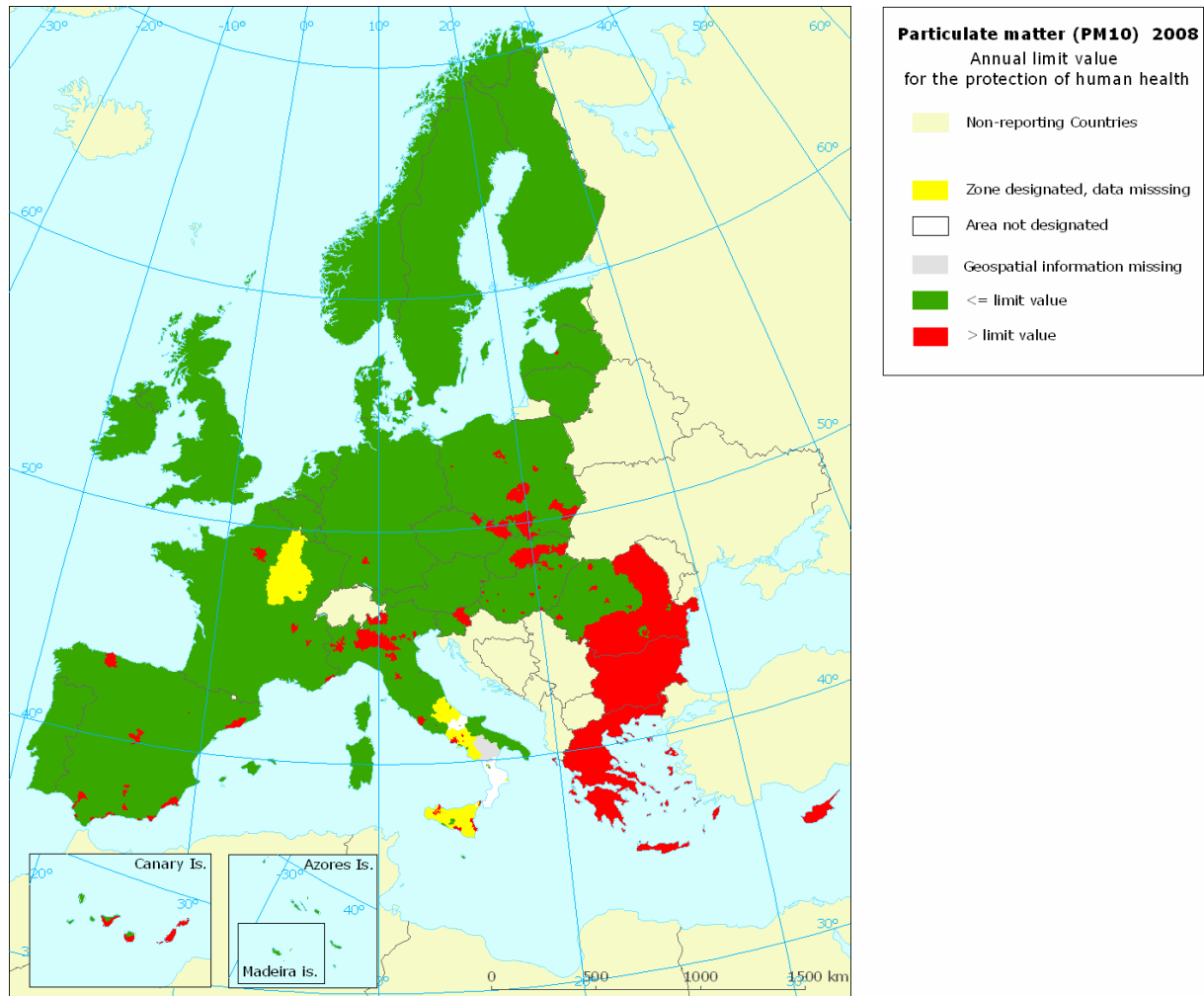
In Austria, the Czech Republic and the Netherlands all designated agglomerations exceed the LV+MOT. The most mentioned cause mentioned for exceedance of the annual limit value of NO<sub>2</sub> is local traffic (85%).

For 33 zones in the United Kingdom and 7 zones in the Netherlands the reported exceedances are based on modelled results.



**Figure III.6: Zones in exceedance for the annual limit value for NO<sub>x</sub> in 2008.**

Italy reported 20 zone exceedances of the limit value of NO<sub>x</sub> set for the protection of vegetation in 2008; 13 of these zones are urban agglomerations.

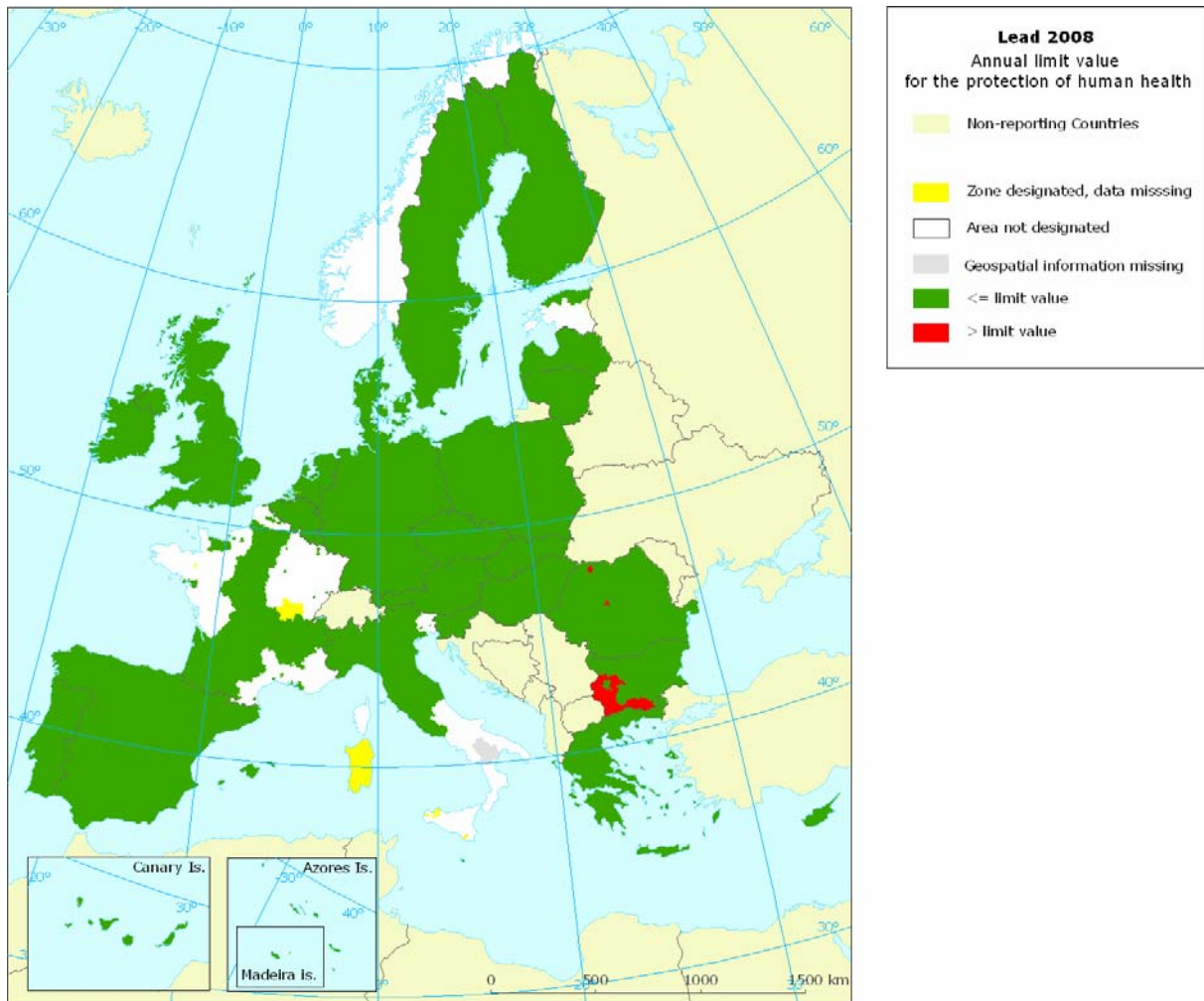


**Figure III.7: EU27 Zones in exceedance for the yearly limit value for PM<sub>10</sub> in 2008.**

Most zones in exceedances of yearly LV of PM<sub>10</sub> occur in Italy (24), Poland (20), Spain (18) and Romania (15). Romania, Bulgaria, Greece and Cyprus have all or nearly all designated zones exceeding the LV.

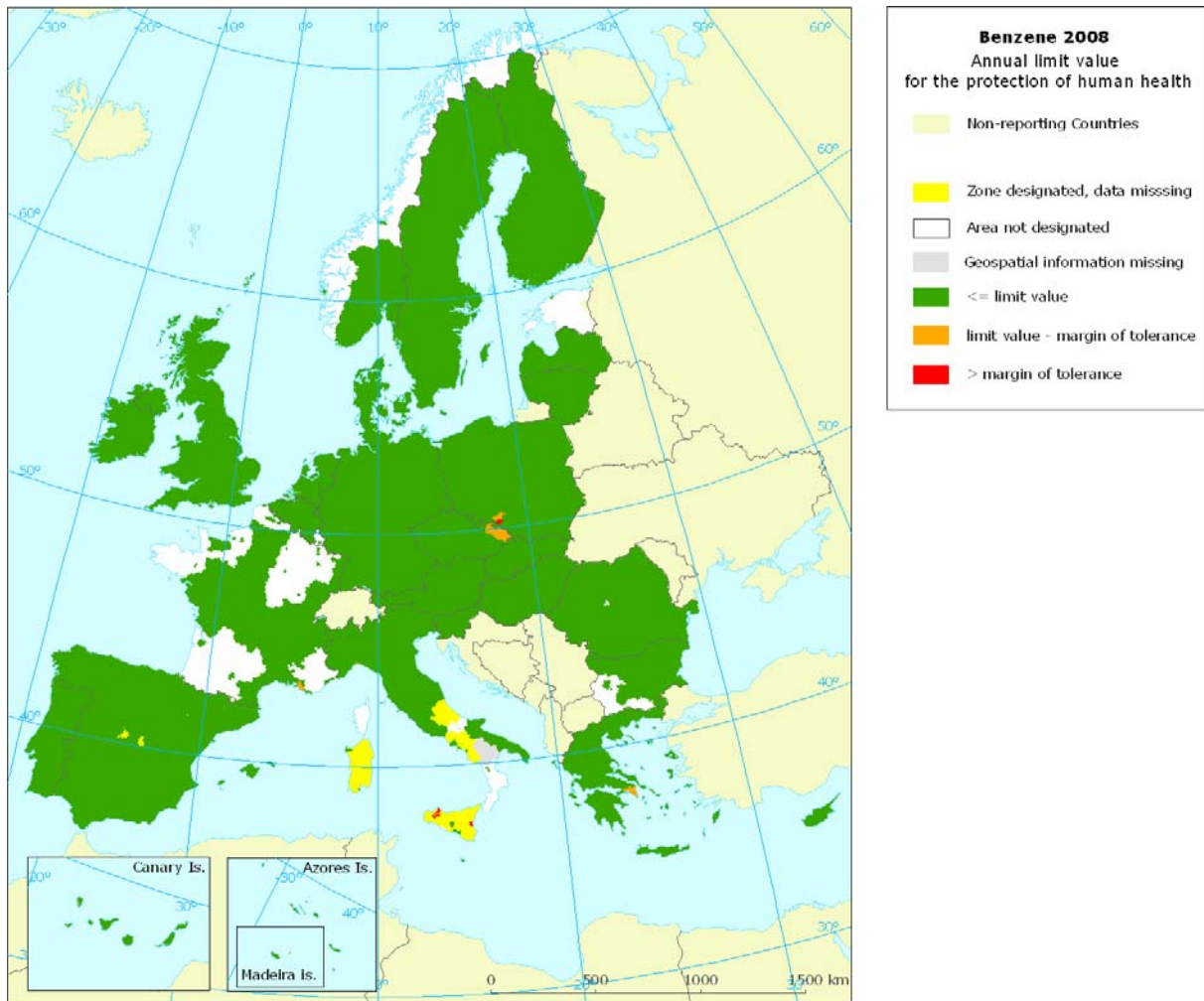
For the annual limit value of PM<sub>10</sub> the most mentioned single reason mentioned exceedance cause is local traffic (35%). From all the yearly PM<sub>10</sub> limit value exceedances, 12 zones in Romania are reported exceedances based on modelled results.





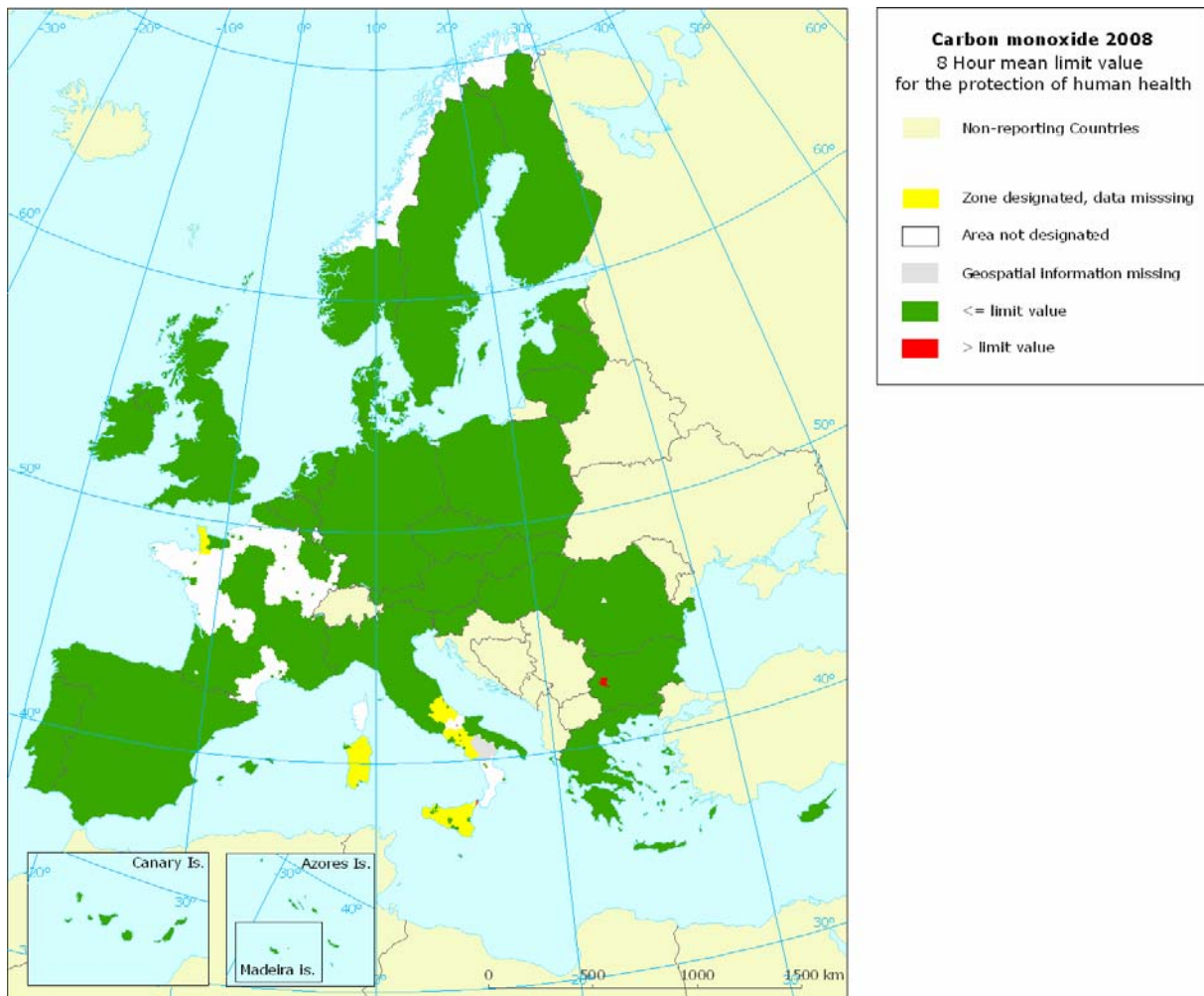
**Figure III.8: Zones in exceedance for the annual limit value for lead in 2008.**

Only in four zones (< 1%) an exceedance of the lead LV is reported. These zones are located in Belgium (1, with an area of 1.4 km<sup>2</sup> this zone is not seen in the map), Bulgaria (1) and Romania (2)



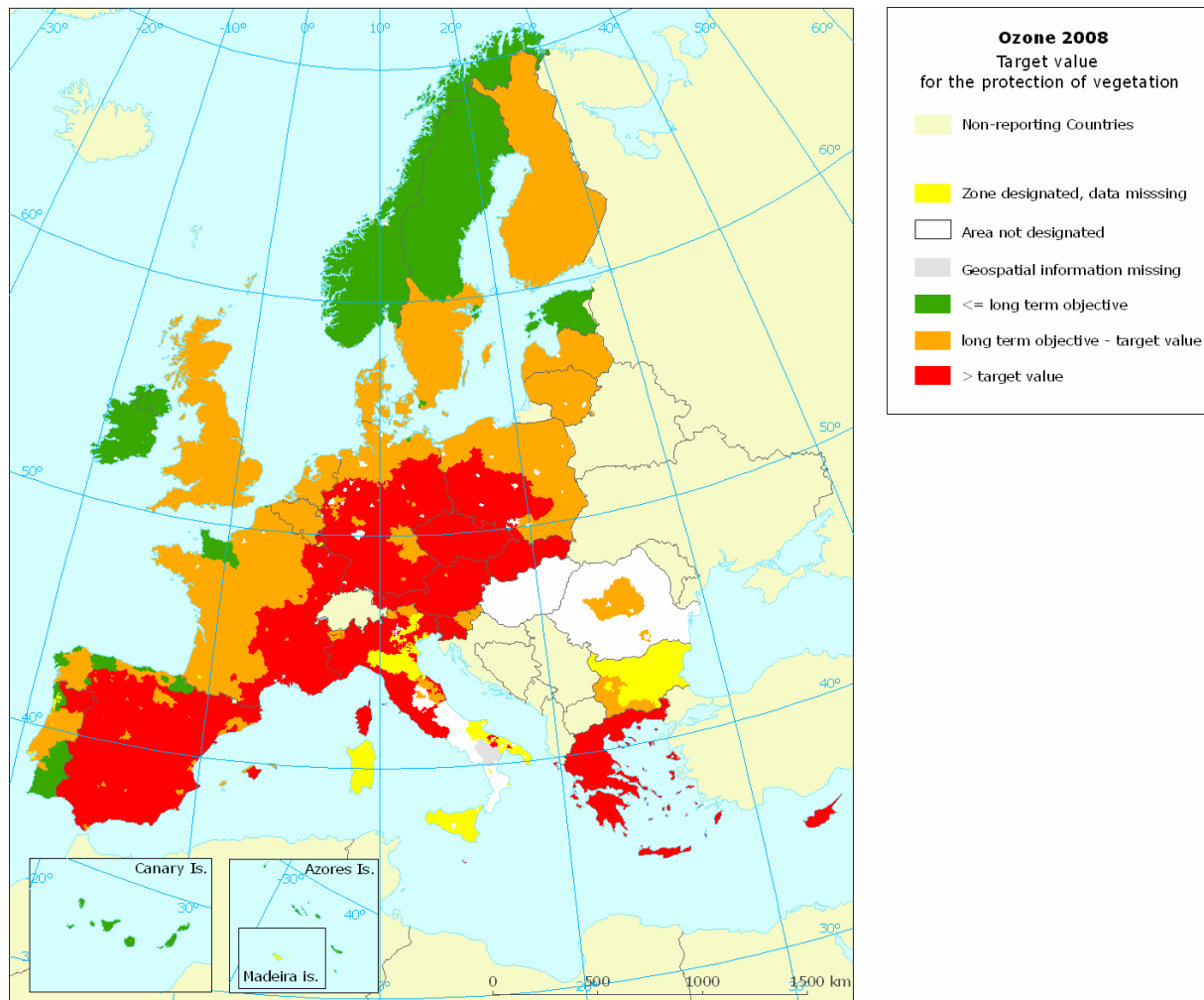
**Figure III.9: Zones in exceedance for the annual limit value for benzene in 2008.**

In 10 zones concentrations are above the limit value of  $5 \mu\text{g}/\text{m}^3$  to be met in 2010; this concerns less than 1.8% of the population in the EU27 (less than 0.2% of the area).



**Figure III.9: Zones in exceedance for the annual limit value for CO in 2008.**

Information on the situation with respect to CO is incomplete in France and Italy. Exceedances have been reported for two zones in Italy and one zone in Bulgaria.



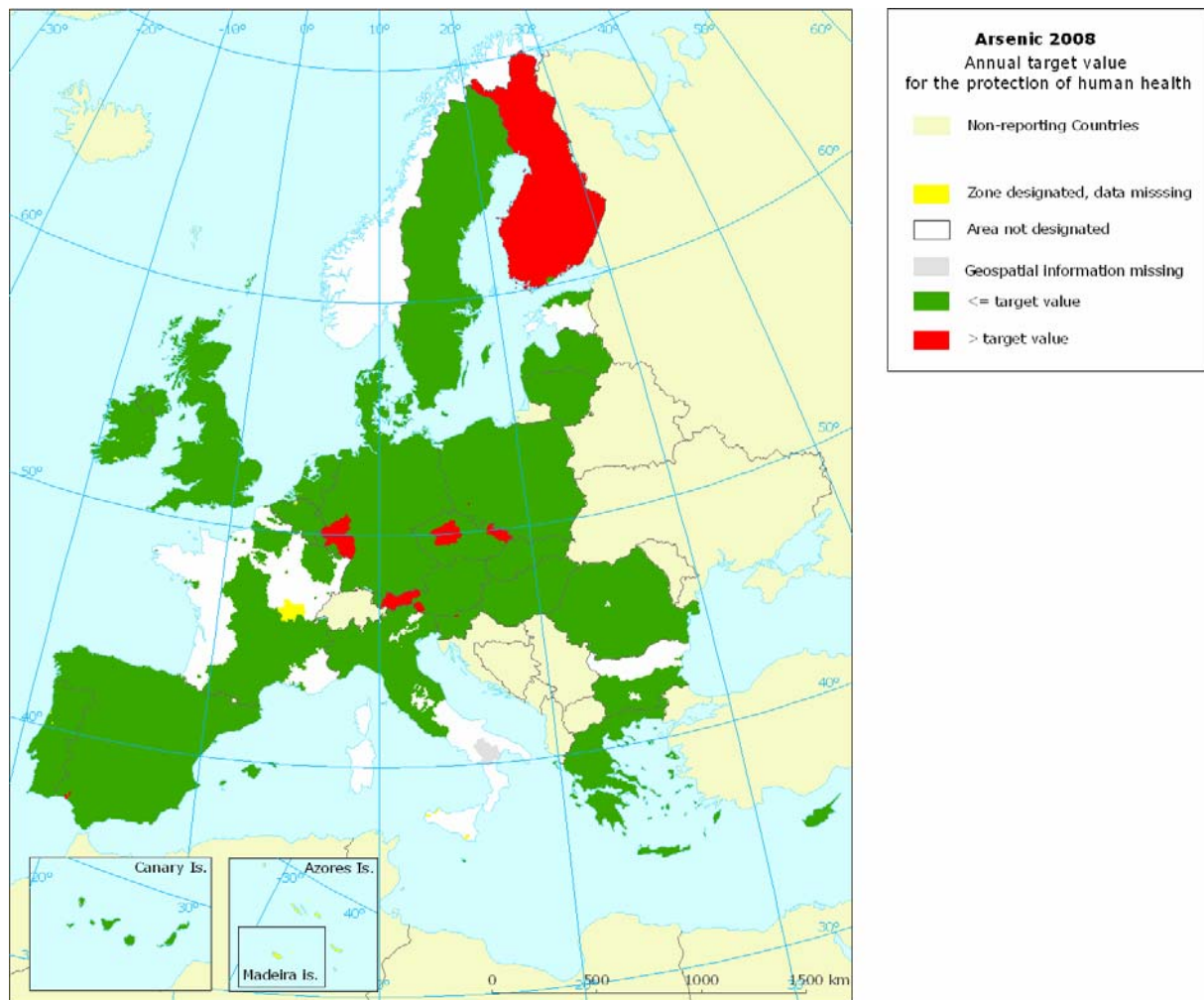
**Figure III.10: Zones in exceedance for the vegetation target value for O<sub>3</sub> in 2008.**

Most zones in exceedances of TV occur in Spain (59), Italy (49), Germany (29) and France (27).

Czech Republic, Austria and Slovakia have all or nearly all designated zones exceeding the MOT.

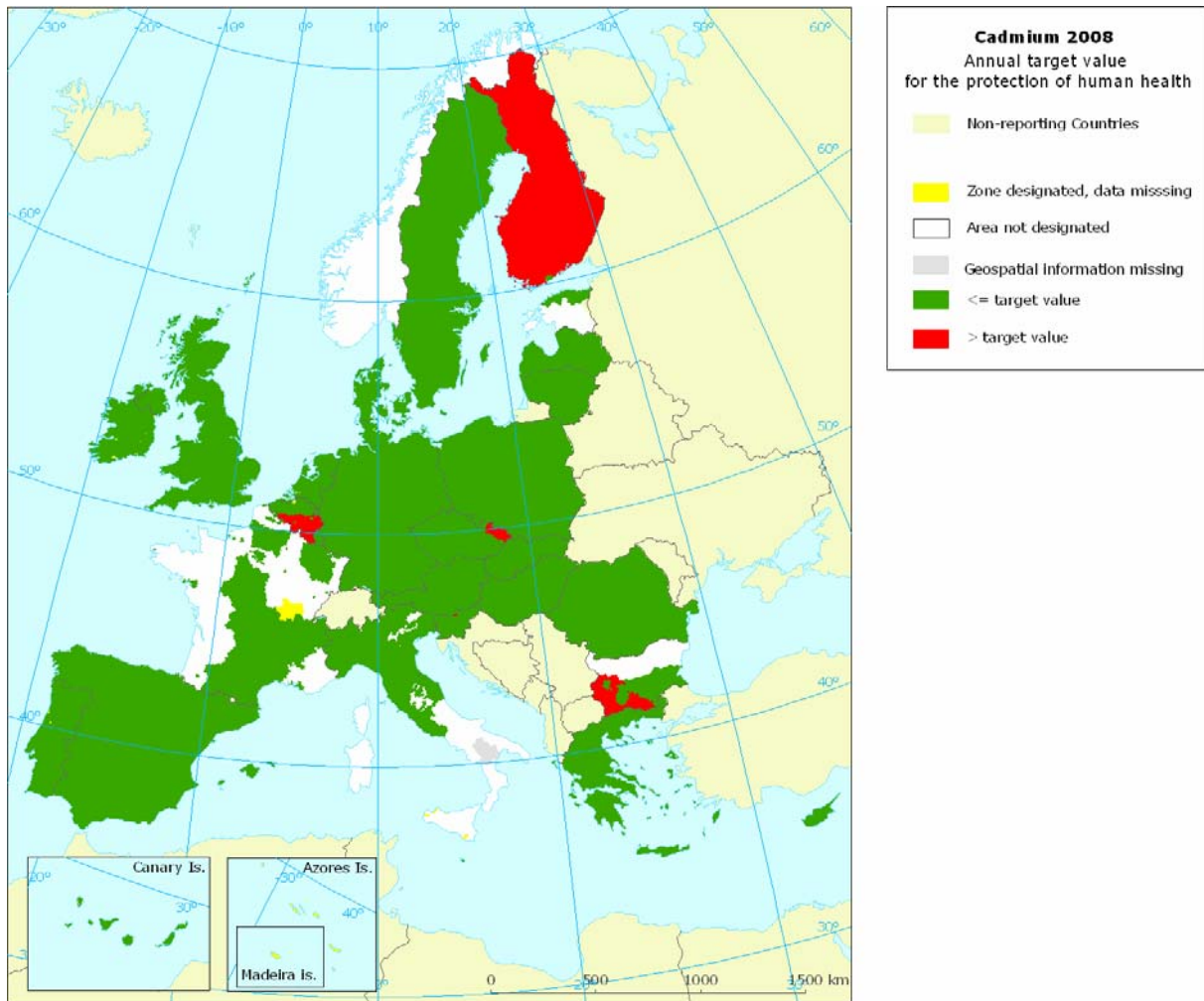
From all the ozone vegetation target value exceedances, 5 zones in Italy and 3 zones in Germany are reported exceedances based on modelled results.





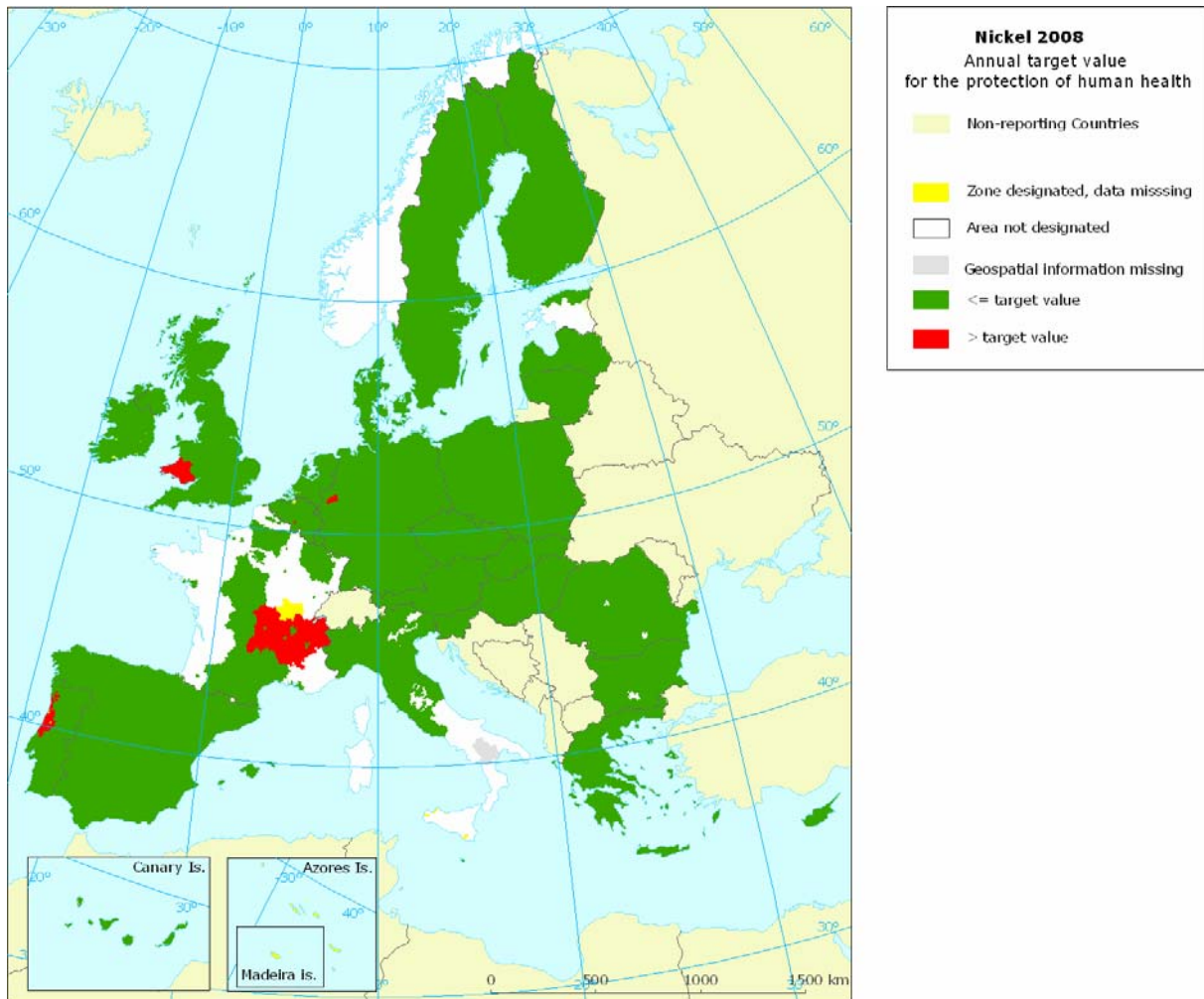
**Figure III.11: Zones in exceedance for the target value for arsenic in 2008.**

In 11 zones the target value of arsenic has been exceeded in 2008. Most remarkable is the situation in Finland. Two zones have been designated for arsenic: (1) the Helsinki metropolitan area where no exceedance is observed and (2) the remaining part of Finland where an exceedance is observed at one station reported to be caused by *local industry including power production*. Unfortunately this station could not be traced in AirBase and no more information can be given.



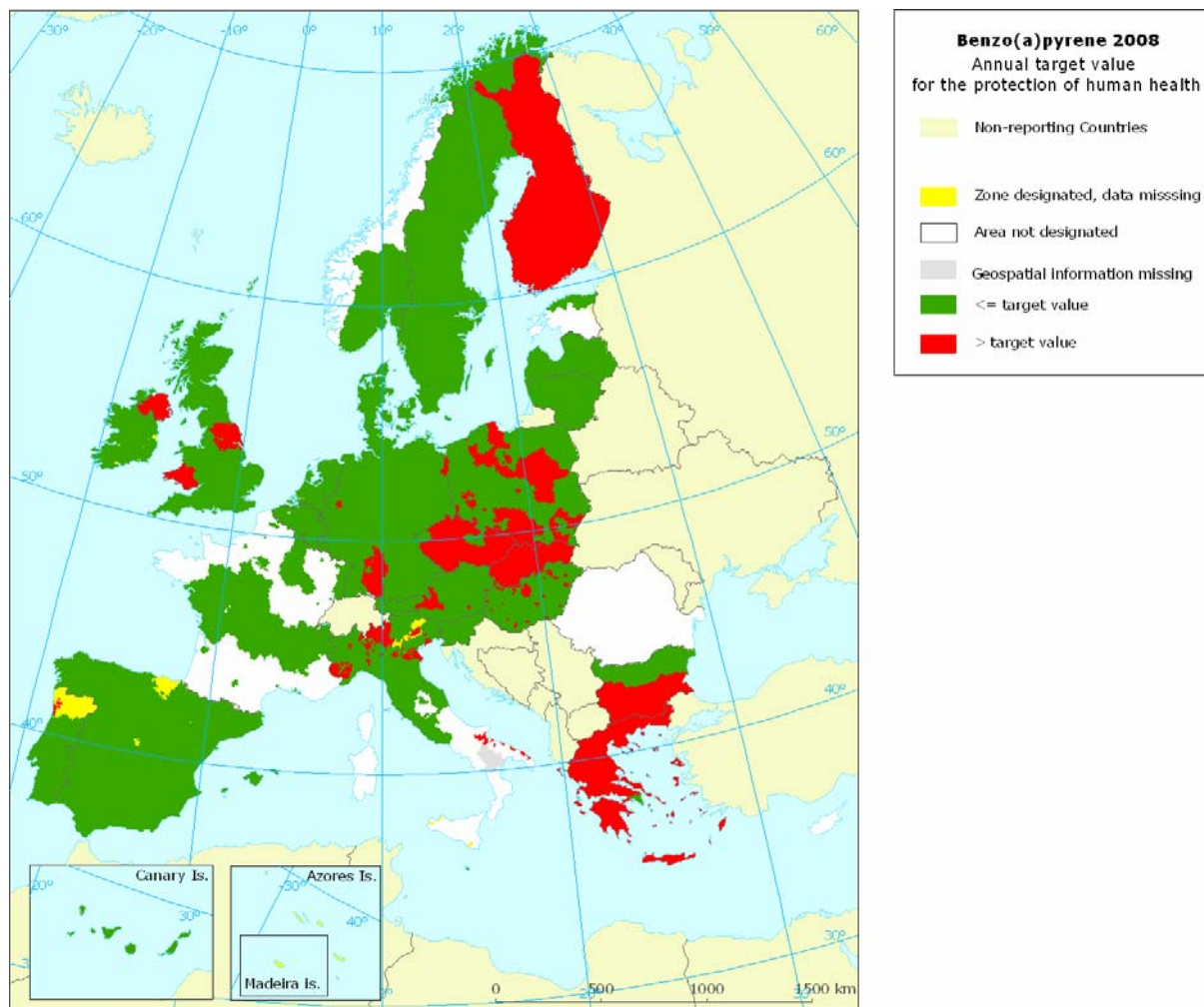
**Figure III.12: Zones in exceedance for the target value for cadmium in 2008.**

The situation for cadmium is very similar to the one for arsenic although the number of exceedances and concentration are slightly lower. The same station in Finland is the reason for the exceedances in Finland.



**Figure III.13: Zones in exceedance for the target value for nickel in 2008.**

In number of zones the exceedances of the nickel TV equals those of arsenic. However, spatially the exceedances are now observed in France and Wales.



**Figure III.9: EU27 Zones in exceedance for the annual target value for benzo(a)pyrene in 2008.**

Finland and Slovakia have just one designated zone for B(a)P which exceeds the health target value. Greece has just two zones for B(a)P, Athens is below TV and rest of Greece is above TV. The Czech Republic has only 3 designated zones, all exceeding the TV.

## Annex IV Statistics per Member State

Summary of air quality status for each pollutant-pollution target combination. Information extracted from form 8 and 9.

MS	SO2 health Hr		SO2 health Day		SO2 eco Yr		SO2 eco Wntr		NO2 Hr			NO2 Yr			NOx	
	lv	lv	lv	lv	lv	lv	lv	lv	↑mot	lv-mot	lv	↑mot	lv-mot	lv	lv	lv
AT	0	11	0	11	0	8	0	8	0	0	11	7	1	3	1	7
BE	0	12	0	12	0	0	0	0	0	0	11	3	0	8	0	0
BG	1	5	2	4	0	1	0	1	1	0	5	1	0	5	0	1
CY	0	1	0	1	0	1	0	1	0	0	1	0	0	1	0	1
CZ	0	15	0	15	1	14	1	14	1	0	14	3	1	11	0	15
DE	0	79	0	79	0	15	0	15	3	1	80	45	8	31	0	15
DK	0	3	0	3	0	3	0	3	0	0	3	1	1	1	0	1
EE	0	4	0	4	0	4	0	4	0	0	4	0	0	4	0	4
ES	2	133	1	134	0	32	0	32	3	1	133	6	5	126	0	32
FI	0	14	0	14	0	1	0	1	0	0	14	0	1	13	0	1
FR	3	73	4	72	0	33	0	30	2	1	73	16	2	58	0	27
GB	0	44	0	44	0	15	0	15	2	1	41	41	0	3	0	15
GR	0	4	0	4	0	1	0	1	1	0	3	3	0	1	0	2
HU	0	11	0	11	0	0	0	0	0	0	11	1	0	10	0	0
IE	0	4	0	4	0	1	0	1	0	0	4	0	0	4	0	1
IT	0	120	0	120	0	37	0	37	6	2	119	39	11	77	20	19
LT	0	3	0	3	0	1	0	1	0	0	3	0	0	3	0	0
LU	0	3	0	3	0	1	0	1	0	0	3	1	0	2	0	1
LV	0	2	0	2	0	1	0	1	0	0	2	0	1	1	0	1
MT	0	2	0	2	0	1	0	1	0	0	2	1	0	1	0	1
NL	0	9	0	9	0	1	0	1	0	0	9	9	0	0	0	1
PL	0	170	0	170	0	125	0	125	0	0	170	2	2	166	0	125
PT	1	19	1	19	0	8	0	8	0	1	24	3	0	22	0	8
RO	2	19	3	18	0	2	0	2	2	1	17	3	4	13	0	2
SE	0	6	0	6	0	6	0	6	0	0	6	2	1	3	0	6
SI	0	9	0	9	0	7	0	7	0	0	6	0	0	6	0	4
SK	0	10	0	10	0	1	0	1	0	0	10	1	0	9	0	1
<b>EU27</b>	<b>9</b>	<b>785</b>	<b>11</b>	<b>783</b>	<b>1</b>	<b>320</b>	<b>1</b>	<b>317</b>	<b>21</b>	<b>8</b>	<b>779</b>	<b>188</b>	<b>38</b>	<b>582</b>	<b>21</b>	<b>291</b>
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO	0	2	0	2	1	1	0	2	0	0	6	5	0	1	0	0
<b>ALL</b>	<b>9</b>	<b>787</b>	<b>11</b>	<b>785</b>	<b>2</b>	<b>321</b>	<b>1</b>	<b>319</b>	<b>21</b>	<b>8</b>	<b>785</b>	<b>193</b>	<b>38</b>	<b>583</b>	<b>21</b>	<b>291</b>

Table IV.1: Zone exceedance per Member State and pollutant (SO<sub>2</sub>, NO<sub>2</sub> and NO<sub>x</sub>) in 2008



MS	PM10 Day		PM10 Yr		PM25		Lead Yr		Benzene Yr			CO Yr	
	↑lv	↓lv	↑lv	↓lv	↑lv	↓lv	↑lv	↓lv	↑mot	lv-mot	↓lv	↑lv	↓lv
AT	5	6	0	11	0	11	0	11	0	0	11	0	11
BE	9	2	0	11	0	0	1	12	0	0	7	0	7
BG	6	0	6	0	3	0	1	5	0	0	5	1	5
CY	1	0	1	0	0	1	0	1	0	0	1	0	1
CZ	9	6	1	14	1	14	0	15	0	1	14	0	15
DE	12	69	1	80	0	0	0	72	0	0	84	0	84
DK	1	2	1	2	0	3	0	3	0	0	3	0	3
EE	0	4	0	4	0	3	0	2	0	0	2	0	4
ES	49	89	18	120	0	0	0	87	0	0	122	0	134
FI	0	14	0	14	0	0	0	14	0	0	3	0	14
FR	17	56	5	68	2	35	0	40	0	2	54	0	54
GB	3	41	1	43	0	1	0	44	0	0	44	0	44
GR	4	0	4	0	0	0	0	4	0	1	3	0	4
HU	3	8	2	9	0	0	0	11	0	0	11	0	11
IE	0	4	0	4	0	1	0	4	0	0	4	0	4
IT	65	62	24	103	0	0	0	97	2	2	114	2	121
LT	0	3	0	3	0	3	0	3	0	0	3	0	3
LU	0	3	0	3	0	1	0	3	0	0	1	0	2
LV	2	0	1	1	0	2	0	2	0	0	2	0	2
MT	1	1	0	2	0	2	0	2	0	0	2	0	2
NL	7	2	0	9	0	0	0	9	0	0	9	0	9
PL	65	105	20	150	0	0	0	170	1	1	168	0	170
PT	5	20	0	25	0	16	0	1	0	0	1	0	1
RO	17	4	15	6	1	0	2	19	0	0	20	0	20
SE	3	3	0	6	0	6	0	6	0	0	6	0	6
SI	4	2	1	5	0	6	0	7	0	0	6	0	6
SK	8	2	2	8	0	0	0	10	0	0	10	0	10
<b>EU27</b>	<b>296</b>	<b>508</b>	<b>103</b>	<b>701</b>	<b>7</b>	<b>105</b>	<b>4</b>	<b>654</b>	<b>3</b>	<b>7</b>	<b>710</b>	<b>3</b>	<b>747</b>
CH	0	0	0	0	0	0	0	0	0	0	0	0	0
NO	0	7	0	7	0	0	0	0	0	0	4	0	5
<b>ALL</b>	<b>296</b>	<b>515</b>	<b>103</b>	<b>708</b>	<b>7</b>	<b>105</b>	<b>4</b>	<b>654</b>	<b>3</b>	<b>7</b>	<b>714</b>	<b>3</b>	<b>752</b>

Table IV.2: Zone exceedance per Member State and pollutant (PM<sub>10</sub>, PM<sub>2.5</sub>, Pb, benzene, CO) in 2008

MS	Ozone Health			Ozone Vegetation			As		Cd		Ni		B(a)P	
	↑tv	lto-tv	lto	↑tv	lto-tv	lto	↑lv	↓lv	↑lv	↓lv	↑lv	↓lv	↑lv	↓lv
AT	10	1	0	10	1	0	1	10	0	11	0	11	2	9
BE	0	6	0	0	6	0	2	9	3	8	2	9	0	6
BG	1	5	0	0	1	0	0	4	2	2	0	5	4	2
CY	0	1	0	1	0	0	0	1	0	1	0	1	0	0
CZ	15	0	0	15	0	0	3	12	1	14	0	15	13	2
DE	26	37	0	29	19	1	1	65	0	66	2	64	3	65
DK	0	2	1	0	3	0	0	3	0	3	0	3	0	3
EE	0	0	4	0	0	4	0	2	0	2	0	2	0	2
ES	44	68	24	59	48	29	1	75	0	76	0	76	0	73
FI	0	2	0	0	2	0	1	1	1	1	0	2	2	0
FR	34	34	7	27	30	8	0	40	0	40	2	38	0	33
GB	1	43	0	0	42	2	0	44	0	44	3	41	6	38
GR	3	1	0	4	0	0	0	4	0	4	0	4	3	1
HU	6	5	0	0	0	0	0	11	0	11	0	11	7	4
IE	0	4	0	0	0	1	0	2	0	2	0	2	0	1
IT	98	11	5	49	4	0	0	97	0	97	0	97	9	87
LT	0	3	0	0	1	0	0	3	0	3	0	3	0	3
LU	1	2	0	1	0	0	0	3	0	3	0	3	0	3
LV	0	0	2	0	1	0	0	2	0	2	0	2	0	2
MT	1	1	0	1	0	0	0	2	0	2	0	2	0	2
NL	2	7	0	0	9	0	0	9	0	9	0	9	0	9
PL	10	17	1	7	9	0	1	169	0	170	0	170	76	94
PT	1	18	0	1	5	3	0	7	0	7	2	5	1	6
RO	9	5	1	0	2	0	0	20	0	21	0	19	0	0
SE	0	6	0	0	3	3	0	6	0	6	0	6	0	6
SI	2	3	1	3	2	1	1	6	1	6	0	7	0	6
SK	2	0	0	2	0	0	0	2	0	2	0	2	1	1
<b>EU27</b>	<b>266</b>	<b>282</b>	<b>46</b>	<b>209</b>	<b>188</b>	<b>52</b>	<b>11</b>	<b>609</b>	<b>8</b>	<b>613</b>	<b>11</b>	<b>609</b>	<b>127</b>	<b>458</b>
CH	4	0	0	0	0	0	0	0	0	0	0	0	0	0
NO	0	5	1	0	0	6	0	0	0	0	0	0	0	3
<b>ALL</b>	<b>270</b>	<b>287</b>	<b>47</b>	<b>209</b>	<b>188</b>	<b>58</b>	<b>11</b>	<b>609</b>	<b>8</b>	<b>613</b>	<b>11</b>	<b>609</b>	<b>127</b>	<b>461</b>

Table IV.3: Zone exceedance per Member State and pollutant (O<sub>3</sub>, As, Cd, Ni, B(a)P) in 2008

## **Annex V List of zones in relation to air quality standards**

The list of zones in EU Member States in relation to the air quality standards as set in the air quality Directive is available as electronic annex from the ETC/ACC website: [http://air-climate.eionet.europa.eu/docs/AQQlist\\_of\\_Zones\\_2008\\_ETC\\_ACC\\_TP\\_2010\\_11.xls](http://air-climate.eionet.europa.eu/docs/AQQlist_of_Zones_2008_ETC_ACC_TP_2010_11.xls)