Reporting on ambient air quality assessment in the European region, 2010


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European Topic Centre
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Accidental air pollution episode in the vicinity of the World Horticultural Expo, Venlo, The Netherlands, 20 September 2012 © *Guus Velders (2012) & Frank de Leeuw (2012)*

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Summary

The number of designated zones in 2010 in the EU-27 (784) was lower than in 2009 (925). The zones designated for pollutants having a health related limit or target value is nearly complete for SO_2, NO_2 and PM as the zones cover 90% or more of the population. For lead, benzene, CO and ozone population coverage is still lower: in a number of Member States less than 80%. The situation with respect to the Fourth Daughter Directive reporting has further improved in 2010. However, one Member State has not yet defined zones for BaP and in three other Member States the defined zones cover less than 60% of the population. In three Member States, zones for the other pollutants were not covering more than 90% of the entire population.

In 2010 the percentage of zones in Member States where the limit or target value was exceeded, was highest for the daily limit value of PM_{10} (36%) and the health-related target value of O_3 (34%). For the NO_2 annual limit value this percentage was 33%.
Compared to 2009, the percentage of zones in exceedance of both the PM_{10} daily limit value and PM_{10} annual limit value is about the same in 2010.

The number of $PM_{2.5}$ monitoring stations had still increased in 2010; nearly all stations also reported data under the Exchange of Information Decision. The designation of stations used for the calculation 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. However, at present, the representativeness of the stations for estimating population exposure cannot be judged. Estimates of the exposure concentration obligation (based on all available operational (sub)urban background stations in AirBase) results in levels of more than 20 $\mu g/m^3$ in 8 Member States.

With respect to the annual NO_2 limit value, the number, population and area of zones where the limit value is exceeded, hardly change over the years. Meeting the limit value remains a problem in about 65% of the agglomerations and in about 23% of the non-agglomerations. Compliance with the PM_{10} daily limit value is improving in the urban agglomerations, as the percentage of agglomerations being in non-attainment has changed from 80% in 2006 to 40% in 2010. Moreover, in the more rural non-agglomerations a strong improvement is observed in 2007 compared to 2006. In contrast to the situation in agglomerations which shows a continuously downward tendency, no further improvement is seen in non-agglomeration zones during the more recent years. For ozone, the situation is improving since 2006 although in 2009 an increase in the area of non-attainment agglomerations is noted.

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1. Introduction

This document provides an overview of the annual reports from Member States to the European Commission on the results of the assessment of their air quality in 2010. These national reports have been submitted under the Air Quality Framework Directives[1], following Commission Decision 2004/461/EC[2], which specifies the information to be sent in detail and provides a set of forms to be filled in. This Decision will further be referred to as 'the questionnaire' or, when the context is not directly clear, 'the AQ questionnaire'.

Following the 4th Daughter Directive (4th DD)[3], in 2007 the questionnaire was changed to include relevant forms covering monitoring of arsenic (As), nickel (Ni), cadmium (Cd), mercury (Hg), benzo(a)pyrene (BaP) and other polycyclic aromatic hydrocarbons (PAH) in ambient air and deposition. In 2010 further changes were introduced in the questionnaire to enable the communication of information on the application of Articles 15 (on $PM_{2.5}$) and 22 (on time extension) of Air Quality Directive 2008/50/EC. Forms have been added, enabling the Member States to report on the attainment of the $PM_{2.5}$ target value.

The questionnaire consists of 28 forms (see Annex I) with in total 90 sub-forms. The updated questionnaire and guidance documents have been made available on the website of DG Environment[4]. Assessments of the air quality in zones in the EU Member States based on the questionnaire for the years 2001-2009 are also available on DG Environment's website[4].

DG Environment requested the European Environment Agency to compile this report. The European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM) prepared the document. On the incoming questionnaires the ETC/ACM performed a number of quality checks. These checks mainly relate to completeness and consistency (both within the Questionnaire as with the information submitted under the Exchange of Information Decision). Based on the checks country specific feedback reports have been prepared. The Reporting countries have been asked to react on these reports. A summary of the quality procedure is given in section 1.1; a more extensive description is been given in an ETC/ACM Working Paper[5].

1.1. Member State reports addressed

This document primarily deals with the reports by the EU Member States on the year 2010 submitted under the Air Quality Framework Directives, and the 4th DD. On a voluntary basis Montenegro, Norway and Iceland submitted a questionnaire; Switzerland provided information on the ozone air quality.

All questionnaires have been uploaded by the reporting countries (RC) on Reportnet CDR (http://cdr.eionet.europa.eu/). In October 2011 the ETC/ACM sent out a mailing request to all contact persons in the RC informing on the outcome of a first review of the submitted

1 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 which replaced the former Air Quality Framework Directive 96/62/EC.

2 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.

3 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.

4 http://ec.europa.eu/environment/air/quality/legislation/reporting.htm

5 available from http://acm.eionet.europa.eu/databases/aq-questionnaire/other_info_aqq.html

questionnaires. In this request, several tables summarizing the reporting from the countries were included. In March 2012 a second mailing request was sent to the countries, which focused on possible inconsistencies within the questionnaire itself and within the meta-information as provided under the Exchange of Information decision (see below 1.2).
In both mailing requests the countries were invited to check the summaries which had been provided by the ETC/ACM. A number of countries submitted a revised questionnaire or separate form(s) that had been revised.

1.2. Reporting under the Exchange of Information Decision

The Air Quality Directives focus mainly on compliance checking against the obligations (air quality standards and objectives) they set (see Annex II[6]). In parallel, reporting countries submit detailed information from their monitoring networks under the Exchange of Information Decision (EoI)[7] every year. These reports contain monitoring data for a range of pollutants and measured on different temporal scales. Furthermore, they include extensive complementary information about the monitoring stations (metadata). The ETC/ACM publishes an assessment of these reports (see, for the assessment of the 2010-data: Mol et al., 2012) annually. To avoid double reporting by countries, some of the data necessary for evaluating the reports under the air quality directives are only required under the EoI Decision. This is particularly the case for the meta-information on monitoring stations. 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. The deadline for submitting the EoI information was 1 October 2011. In the assessment of those parts of the questionnaire related to monitoring stations, the information extracted from the EoI has been included.

1.3. Common technical errors in data submission

To facilitate the submission of the required data and information by the countries, the European Commission prepared an AQ questionnaire template in Excel format. This format does not reject erroneous data, and during the processing numerous small errors, e.g. spurious spaces, have to be removed before all reports can be joined in a database. A second form of common errors was the use of other symbols than prescribed in the questionnaire or its guidelines, for example, ticking an “x” or “+” instead of the prescribed “y”; or using a comma as separator while the semi-colon is prescribed. Although in general the information was unambiguous, a time consuming correction of this type of errors was necessary before the data could automatically be processed.
There were also errors in the 2010 data that required more insight in order to correct them. Examples are inconsistent use of zone codes and pollutant codes or use of codes that were not allowed. Another type of error is that reporting countries do not use the same codes for stations in the AQ questionnaire and EoI reports. Reporting countries have always reacted actively on the feedback reports of the ETC/ACM. 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 8 May 2012. Revisions prepared by countries after this date have not been included. In order to enable an automatic processing of the national reports, the ETC/ACM has made a number of (in general editorial) changes in the submitted questionnaires. Mistakes or misinterpretations may have been introduced during

[6] For more details see http://ec.europa.eu/environment/air/quality/standards.htm
[7] 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).

this process. Hence, this report presents an overview of the air quality in the reporting countries but it should not be considered the only source of information for legal compliance checking.

Abbreviations used

Reporting countries have been abbreviated following the ISO3166-1 country alpha-2 code[1]:

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[2], and Switzerland: CH, Iceland: IS ,Norway: NO and Montenegro: ME.

AEI	Average Exposure Indicator ($PM_{2.5}$)
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
EoI	Exchange of Information Decision: Council Decision 97/101/EC, amended by Commission Decision 2001/752/EC
EU27	The 27 EU Member States after accession of 12 new Member States in 2004 and 2007
LAT	Lower assessment threshold
LTO	Long Term Objective (O_3)
LV	Limit value
MOT	Margin of Tolerance
MS	Member State(s)
Ni	Nickel
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
O_3	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PM_{10}	Particulate matter composed of particles smaller than 10 micrometer in aerodynamic diameter
$PM_{2.5}$	Particulate matter composed of particles smaller than 2.5 micrometer in aerodynamic diameter
SO_2	Sulphur dioxide
TV	Target value

Notes

1: see http://www.iso.org/iso/home/standards/country_codes/country_names_and_code_elements.htm

2. Including Gibraltar.

2. Designation of zones

The number of designated zones in 2010 in the EU-27 (784) was considerably lower than in 2009 (925). The 2010 zoning adjustments compared to 2009 are:

- Poland reduced the number of zones from 186 to 46 zones
- Spain increased the number of zones from 153 to 157 zones
- France reduced the number of zones from 81 to 76 zones
- Portugal reduced the number of zones from 29 to 28 zones
- Hungary reduced the number of zones from 11 to 10 zones
- Germany increased the number of zones from 113 to 115 zones

The designation of zones for pollutants having a health related limit or target value is nearly completed for SO_2, NO_2 and PM. For these compounds, the zones cover 90% or more of the population. For lead, benzene, CO and ozone the coverage is lower: in a number of Member States the zones cover less than 80% of the population.
The situation with respect to the Fourth Daughter Directive has further improved this year. However, Romania has not yet defined zones for B(a)P and in Estonia, Italy and Malta the defined zones for B(a)P cover less than 60% of the population. In Bulgaria, France, Greece and Hungary zones for As, Cd, Pb, benzene and/or $PM_{2.5}$ cover less than 90% of the entire population.
Germany, Greece, Hungary, Portugal, Romania, Slovakia and Norway have different zone designations for PM_{10} and $PM_{2.5}$.

The countries 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 countries are free in defining their own zone structure and characteristics (population and area), the designated zones vary widely, depending on the chosen variable(s): size, population, measured individual pollutant and/or types of protection targets. This complicates mutual comparison of final results between countries.

Table 1 gives an overview of the total number of zones defined for 2010 (Form 2). Compared to reporting year 2009 (de Leeuw et al., 2011) there are various changes in the designation of zones (See also Table 2). 6 Member States have indicated a change in the zone definition for one or more pollutants (Form 0). Romania did not designate zones for B(a)P yet. Belgium, Hungary and Latvia did not yet designate zones for the protection of vegetation for SO_2 and NO_x and Lithuania for NO_x.
The lowest number of zones is found for the two objectives related to the protection of vegetation. In relation to the protection of health, the number of zones defined in EU-27 for NO_2 and PM_{10} – the pollutants showing the largest number of exceedances - tends to be higher (about 680) than for the other pollutants (400-600). The number of zones defined for the 4th DD-pollutants is relatively low, 413-422.

Table 1. Number of zones per Member State in 2010, including the designation of the zones for individual pollutants or types of protection targets (data extracted from form 2).

Member State	Total (a)	SO_2		NO_2	NO_x	PM_{10}	Lead	benzene	CO	Ozone	As	Cd	Ni	B(a)P	$PM_{2.5}$
		health	veg												
AT	19	11	8	11	8	11	11	11	11	11	11	11	11	11	11
BE	22	12	0	11	0	11	11	7	7	6	10	10	10	7	11
BG	6	6	1	6	1	6	4	5	6	6	4	4	5	6	6
CY	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CZ	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
DE	115	81	15	87	15	85	74	86	86	66	70	70	70	71	78
DK	3	3	1	3	1	3	3	3	3	3	3	3	3	3	3
EE	4	4	4	4	4	4	2	2	4	4	2	2	2	2	4
ES	157	132	33	134	34	135	81	122	131	135	76	76	76	76	135
FI	18	14	1	14	1	14	14	3	14	2	2	2	2	2	14
FR	76	67	18	72	24	70	38	44	41	71	47	46	46	53	70
GB	44	44	43	44	43	44	44	44	44	44	44	44	44	44	44
GR	4	4	2	4	2	4	4	4	4	4	4	4	4	4	2
HU	10	10	0	10	0	10	10	10	10	10	10	10	10	10	5
IE	4	4	1	4	1	4	4	4	4	4	4	4	4	4	4
IT	142	99	17	135	41	133	57	96	112	84	23	23	23	25	133
LT	3	3	1	3	0	3	3	3	3	3	3	3	3	3	3
LU	4	3	1	3	1	3	3	1	1	3	3	3	3	3	3
LV	2	2	0	2	0	2	2	2	2	2	2	2	2	2	2
MT	2	2	1	2	1	2	2	2	2	2	2	2	2	1	2
NL	9	9	1	9	1	9	9	9	9	9	9	9	9	9	9
PL	46	46	16	46	16	46	46	46	46	46	46	46	46	46	46
PT	28	20	7	20	5	25	1	1	1	19	1	1	1	1	1
RO	21	21	3	21	4	19	19	10	21	11	9	16	15	0	18
SE	6	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	6
SK	11	10	10	10	10	10	2	10	9	2	2	2	2	2	9
EU27	**784**	**638**	**213**	**683**	**239**	**681**	**473**	**553**	**599**	**575**	**416**	**422**	**422**	**413**	**641**
IS	3	2	0	3	0	3	2	2	2	2	0	0	0	0	3
NO	7	7	7	7	7	6	0	6	7	7	7	7	7	6	4
CH	4	0	0	0	0	0	0	0	0	4	0	0	0	0	0
ME	3	1	0	2	0	2	2	2	2	2	2	2	2	2	2
all	**801**	**648**	**220**	**690**	**246**	**692**	**477**	**563**	**609**	**590**	**425**	**431**	**431**	**421**	**650**

For all compounds, the designated zones for 2010 are more or less the same as in 2009, except for a few countries. Poland decimated their number of stations designated for health related components from 170 to 46. A document describing the relation between the old (2009) designation and the new (2010) designation has been provided by Poland; however, a further explanation on the background of this decimation has not been given in the Polish AQ questionnaire. Further changes can be observed in Italy, Romania, France, Germany, Hungary, Portugal and Spain (though the total number of designated zones in the two first countries remains unchanged).
In 2010, the number of zones designated for lead is reduced by 124 for Poland and 26 for Italy. The total number of zones in the EU-27 countries showed a decrease from 898 in 2009 to 784 in 2010. Since 2004 the number of zones has been reduced by 28% (Table 2). This reduction is mainly caused by a stepwise reconstruction of the zoning in Poland in 2007 and 2010 which resulted in a net reduction of 316 zones. Germany has realized a net reduction of 30 zones. The largest increase (+17) in zones is seen in Spain. In the other countries the number of zones is relatively stable.

Table 2. Total number of zones per Member State in 2004-2010 (data extracted from form 2); highlighted boxes indicate that the number of total designated zones differs compared to previous year(s).

Member State	Total zones 2004	Total zones 2005	Total zones 2006	Total zones 2007	Total zones 2008	Total zones 2009	Total zones 2010
AT	19	19	19	19	19	19	19
BE	17	17	17	18	22	22	22
BG			6	6	6	6	6
CY	1	1	1	1	1	1	1
CZ	15	15	15	15	15	15	15
DE	145	118	120	120	111	113	115
DK	10	10	10	3	3	3	3
EE	16	4	4	4	4	4	4
ES	140	140	138	138	153	153	157
FI	18	18	18	18	18	18	18
FR	85	87	88	81	81	81	76
GB	43	43	44	44	44	44	44
GR	4	4	4	4	4	4	4
HU	11	11	11	11	11	11	10
IE	4	4	4	4	4	4	4
IT	137	144	121	143	145	142	142
LT	3	3	3	3	3	3	3
LU			3	3	3	4	4
LV	2	2	2	2	2	2	2
MT	3	2	2	2	2	2	2
NL	9	9	9	9	9	9	9
PL	362	362	362	186	186	186	46
PT	26	26	26	27	34	29	28
RO			4	21	21	21	21
SE	6	6	6	6	6	6	6
SI	9	9	9	10	12	12	12
SK	10	10	10	11	11	11	11
EU27	**1,095**	**1,064**	**1,046**	**882**	**903**	**898**	**784**
ALL			**1,056**	**909**	**930**	**925**	**795**

The designation of zones differs widely between the reporting countries. In the previous report (de Leeuw et al., 2011) this has been discussed showing the PM_{10} zoning as example. As 2010 is the first year that reporting on $PM_{2.5}$ is mandatory, the zoning of PM_{10} and $PM_{2.5}$ has been compared. In general (21 countries) the zoning of PM_{10} and $PM_{2.5}$ is exactly the same. Seven countries have defined a lower number of zones for $PM_{2.5}$ than for PM_{10}: Germany (85 and 78 zones for PM_{10} and $PM_{2.5}$ respectively), Greece (4 and 2 zones), Hungary (10 and 5), Portugal (25 and 1), Romania (19 and 18), Slovakia (10 and 9) and Norway (7 and 5).

The limit values for the protection of human health apply throughout the whole territory of the Member States. Therefore, all areas should belong to a zone related to health protection targets. Consequently, the population living in zones related to those targets should add up to the national total population number. National totals on area and population, provided by Eurostat[8] or the FAO[9],

[8] Eurostat, demographic balance and crude rates, population on 1 January 2009, downloaded on 2 September 2011.
[9] FAO statistical data, total country area in 2009, downloaded on 5 September 2011.

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 the reporting countries. For SO_2, NO_2, PM_{10} and ozone, the designated zones are in good agreement throughout the entire EU-27 with deviations only in France (depending on the pollutant 15-29% of the area is not coveraged) and Italy where the coverage of SO_2 zones is 15% too low. For a number of German zones information on population and area is missing; this might causes the systematic underestimation of about 8% in area coverage seen for all pollutant. For the other components the national area is less well covered, although 19 countries are in good agreement. In France, Italy and Estonia, the coverage is less than 80% for nine, seven and five components, respectively.

In addition to a complete coverage of the area, it is more important to have a full coverage of the total population. Compared to previous years, the situation has slightly improved but a full EU-coverage is not yet met. Figure 1 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_2, NO_2, PM_{10} and ozone. Lower coverages are found in the case of benzene and CO. Lead and the 4th DD pollutants have the least coverage. The population coverage for $PM_{2.5}$ is less than 90% in Greece, Hungary and Romania.

Within the 5% deviation range full population coverage has been attained by 19 reporting countries for all pollutants. In general, a population coverage of less than 90% is found for those pollutants for which exceedances of the limit or target values are rarely observed (for a number of these pollutants, concentrations are even below the lower assessment threshold, for example, lead, benzene, CO). An exception is formed by $PM_{2.5}$; population coverage of 40-85% is found in Greece, Hungary, Romania and Norway. For Estonia and Italy the designated zones for all 4th DD pollutants cover less than 60% of the total population. An apparent covering of less than 70% or less for one or two 4th DD pollutants still exists in Bulgaria, France, Iceland, Malta, Norway and Romania.

Summarizing, 19 out of 30 reporting countries have designated zones for all health related pollutants which apparently meet the EU criteria of a full coverage of the population (i.e. 95% or more). Three countries still have a lack of agreement for one pollutant, and agreement is very poor in five countries for two or more of the health-related pollutants.

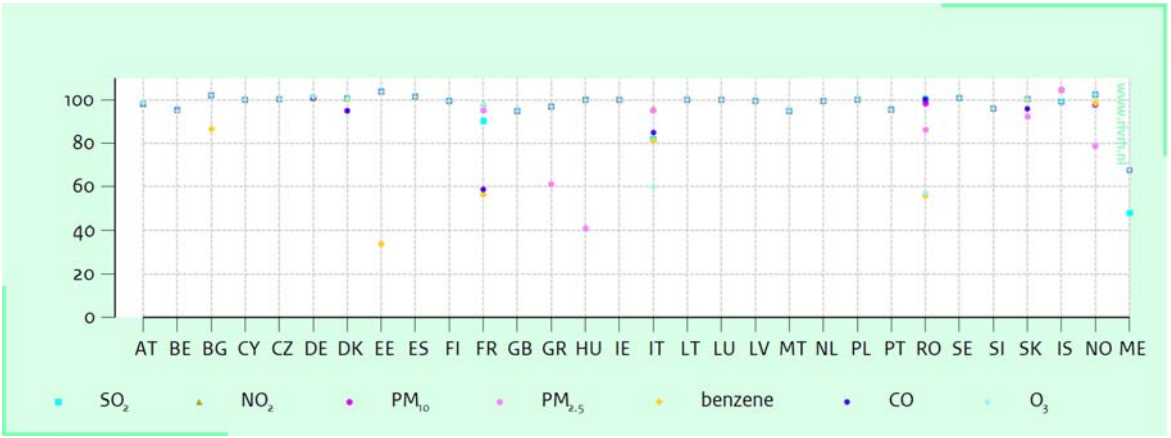

Figure 1a. Total population living in zones designated in relation to health protection targets (SO_2, NO_2, PM_{10}, $PM_{2.5}$, benzene, CO and O_3) as fraction of the national population. Note that Switzerland has designated only zones for ozone (with coverage of more than 99% of the population) and is not included in this graph.

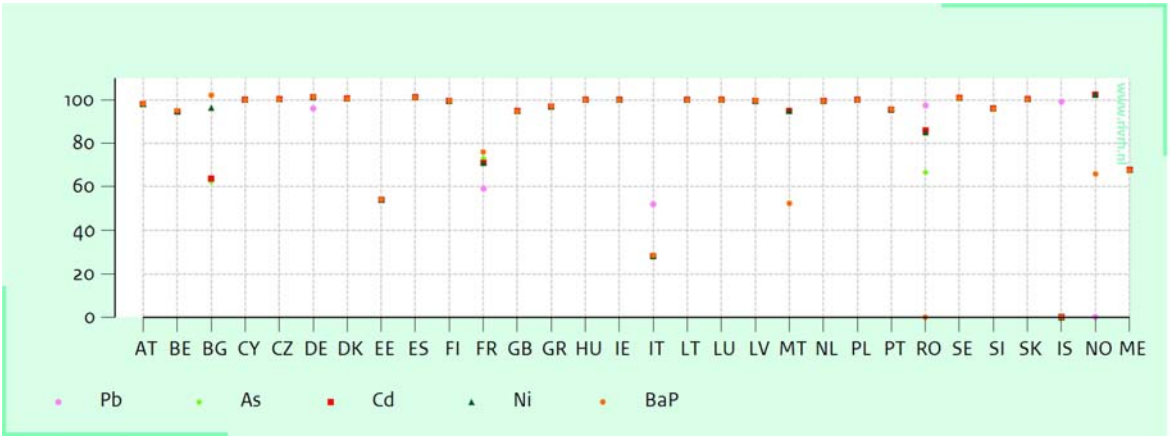

Figure 1b. Total population living in zones designated in relation to health protection targets (Pb, As, Cd, Ni, B(a)P) as fraction of the national population. Note that Switzerland has designated only zones for ozone (with coverage of more than 99% of the population) and is not included in this graph.

3. Air Quality assessments

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

- *Please note: The number or percentage of zones in exceedance is a limited indicator for the actual area in exceedance. First of all, the area in exceedance might be the entire zone or just a few hundred square metres at a hotspot. In addition, some reporting countries have designated a few very large zones for pollutants known to have concentration levels substantially below air quality thresholds in the country. 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 reporting countries or even between regions within a Member State.*

In 2010, the percentage of zones in all reporting countries exceeding the limit or target values set for the protection of human health was highest for the daily limit value of PM_{10} and for the health-related target value of O_3. The percentages were 36% and 34%, respectively. For the NO_2 annual limit value this percentage was 33%.
Looking at the population, the highest fraction potentially exposed to levels above the LV or TV is found for the annual LV of NO_2 (49%), next the daily LV of PM_{10} (47%), followed by the O_3 TV (36%)
In Annex IV there is the link to the list of zones per reporting country and their status in relation to the air quality objectives.

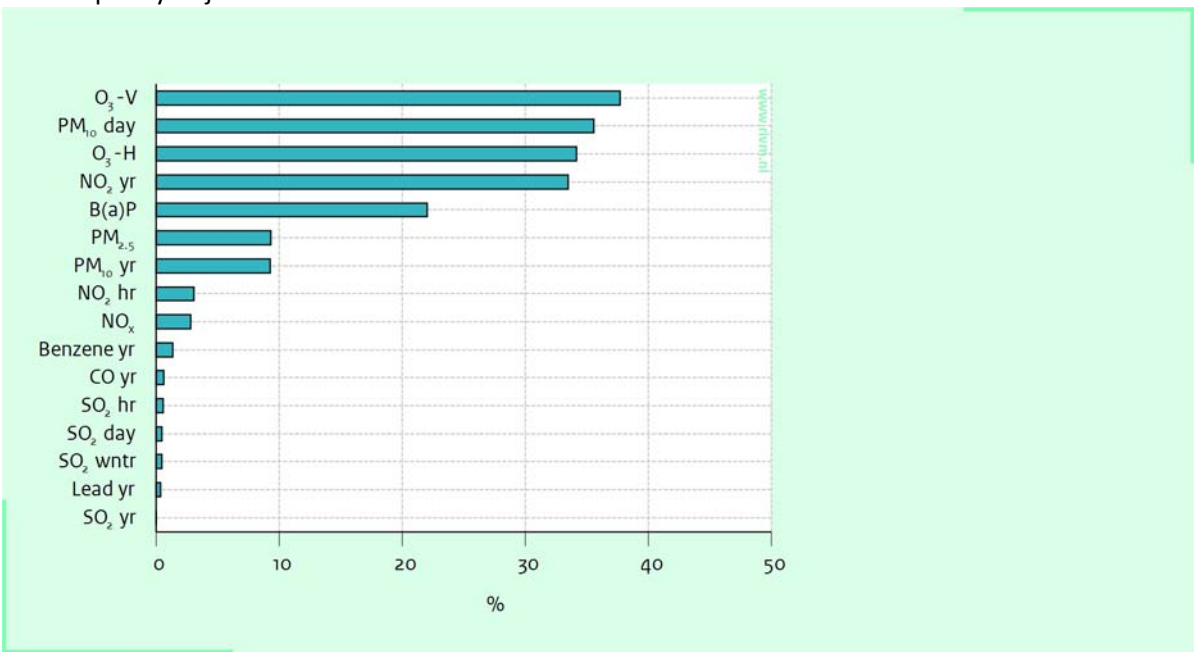

Figure 2a. Fraction of EU-27 zones in exceedance per limit or target value, 2010.

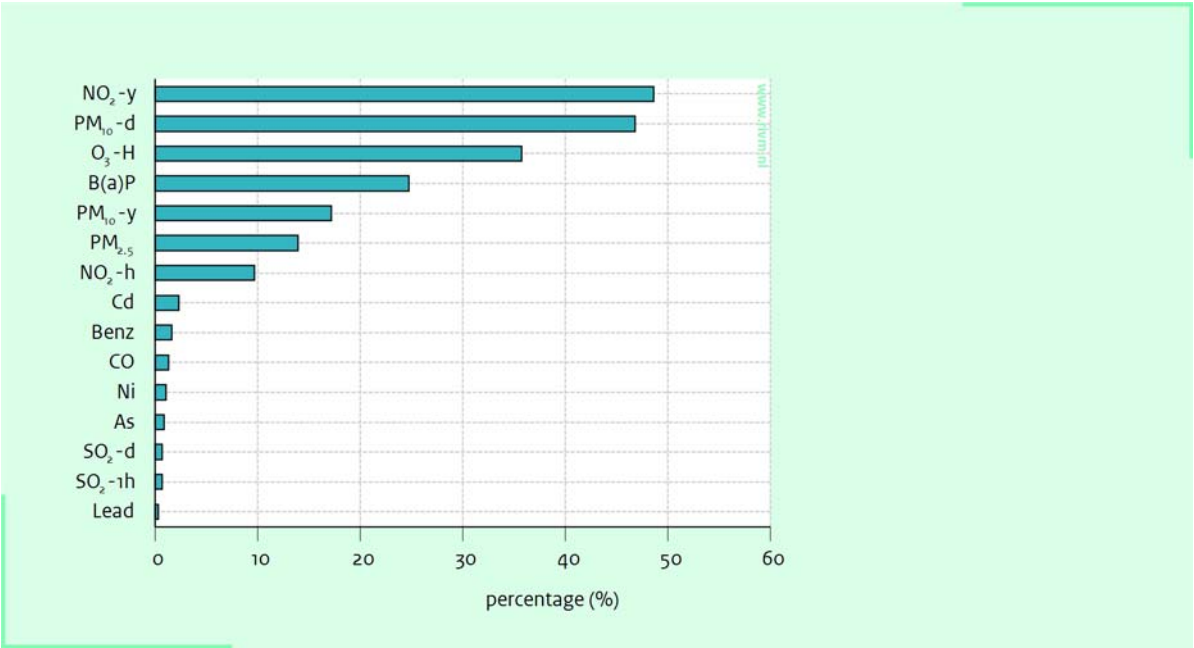

Figure 2b. Fraction of EU-27 population potentially exposed to concentrations above limit or target values in 2010.

3.1. Zones in exceedance maps for PM_{10}, O_3 and NO_2

Figures 3-5 show the reporting countries zones in exceedance maps for the PM_{10} daily limit value, the O_3 health-related target value and the NO_2 annual limit value (see also Annex II). White areas in the maps represent areas in countries where no zones had been designated. Territories marked yellow are areas where zones had been designated, but no information on the air quality status was reported. In both of the abovementioned cases those reporting countries are not fulfilling the criteria of the Directive, as zoning and reporting is mandatory for all health-related pollutants. Red, violet and purple territories are areas where an exceedance occurred:
For zones without time extension (time extension has not been requested or granted):

- no exceedance of the limit value (green);
- exceedance of the limit value (red);

For zones with time extension granted:

- no exceedance of the limit value (green);
- exceedance of the limit value but not of the margin of tolerance (violet);
- exceedance of both the limit value and the margin of tolerance (purple).

Figure 3 shows exceedances of the PM_{10} daily limit value in a number of urban agglomerations and regions where high PM_{10} levels are well documented by measurements. Examples are the Po Valley in Italy, northern Belgium, the Ruhr area, Central and Eastern Europe. However, zones in exceedances can also be found in Iceland (1), south Sweden (1), Latvia (1), south Spain and the Balkans. Here, exceedance might have been reported at one or two hot-spot stations resulting in a whole zone in non-compliance.
NB: the map does not account for substractions of natural contributions and/or of contributions of winter-sanding and salting (please, see sections 3.2.2 and 3.2.3)

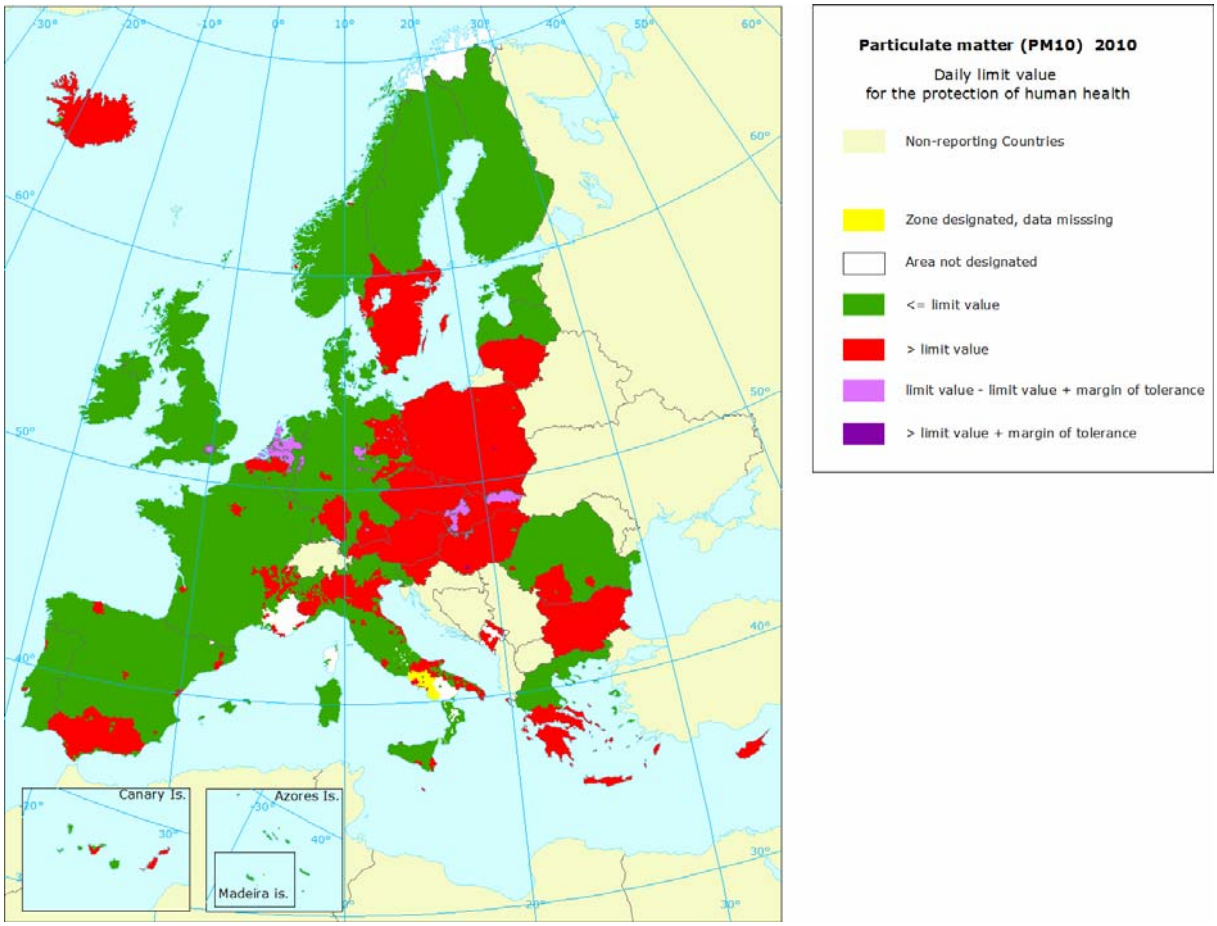

Figure 3. Zones in exceedance of the daily PM_{10} limit value in 2010 (not accounting for subtractions of natural contributions and/or of contributions of winter-sanding and salting, see sections 3.2.2 and 3.2.3).

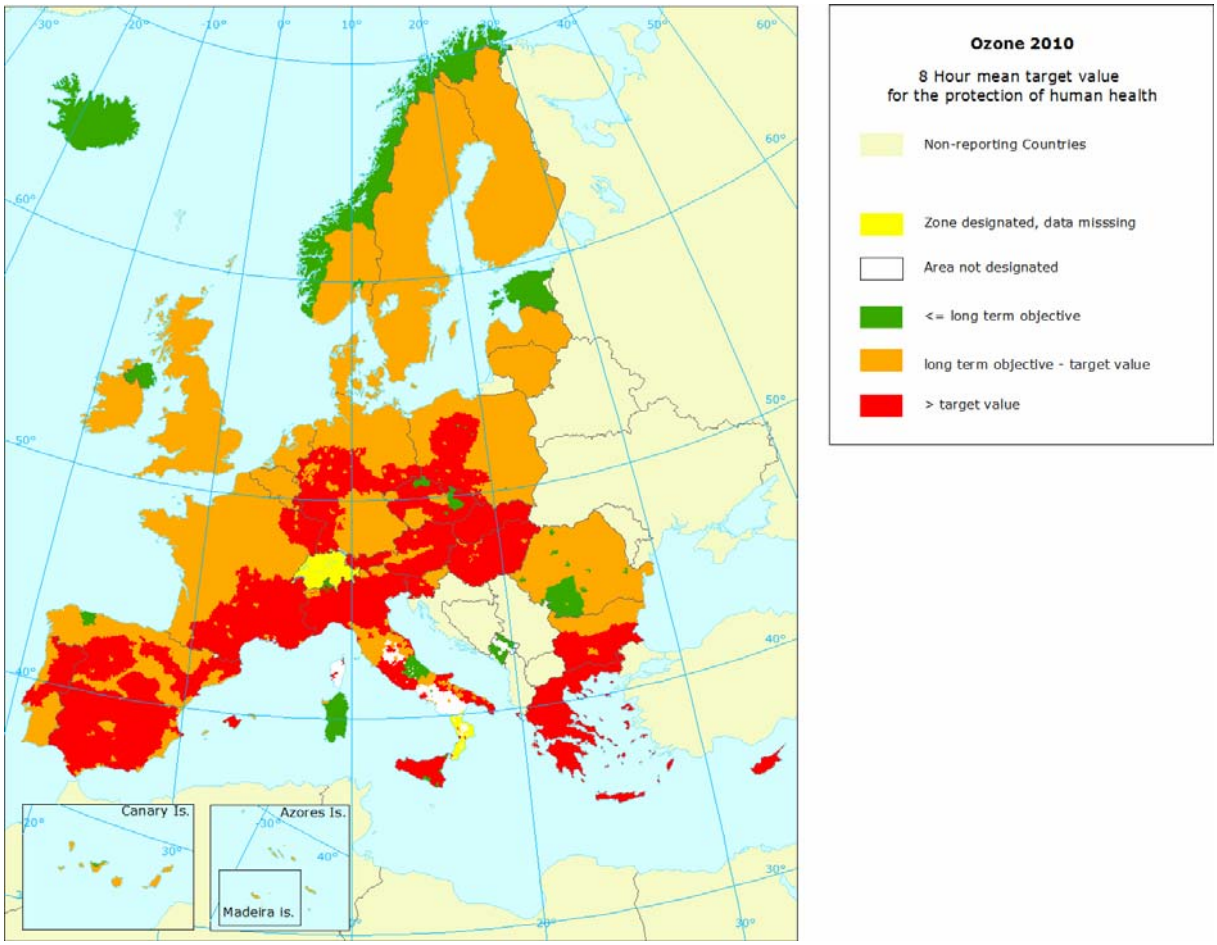

Figure 4. Zones in exceedance of the health-related target value for ozone in 2010.

In EU-27 the O_3 health-related target value was exceeded in a total of 213 zones, see Figure 4. In 10 of those zones reporting was based on modeled results, 9 are located in Italy and 1 in Spain. Similar to previous years, there are few zones in Europe not exceeding the long-term objective of 120 µg ozone/m^3.

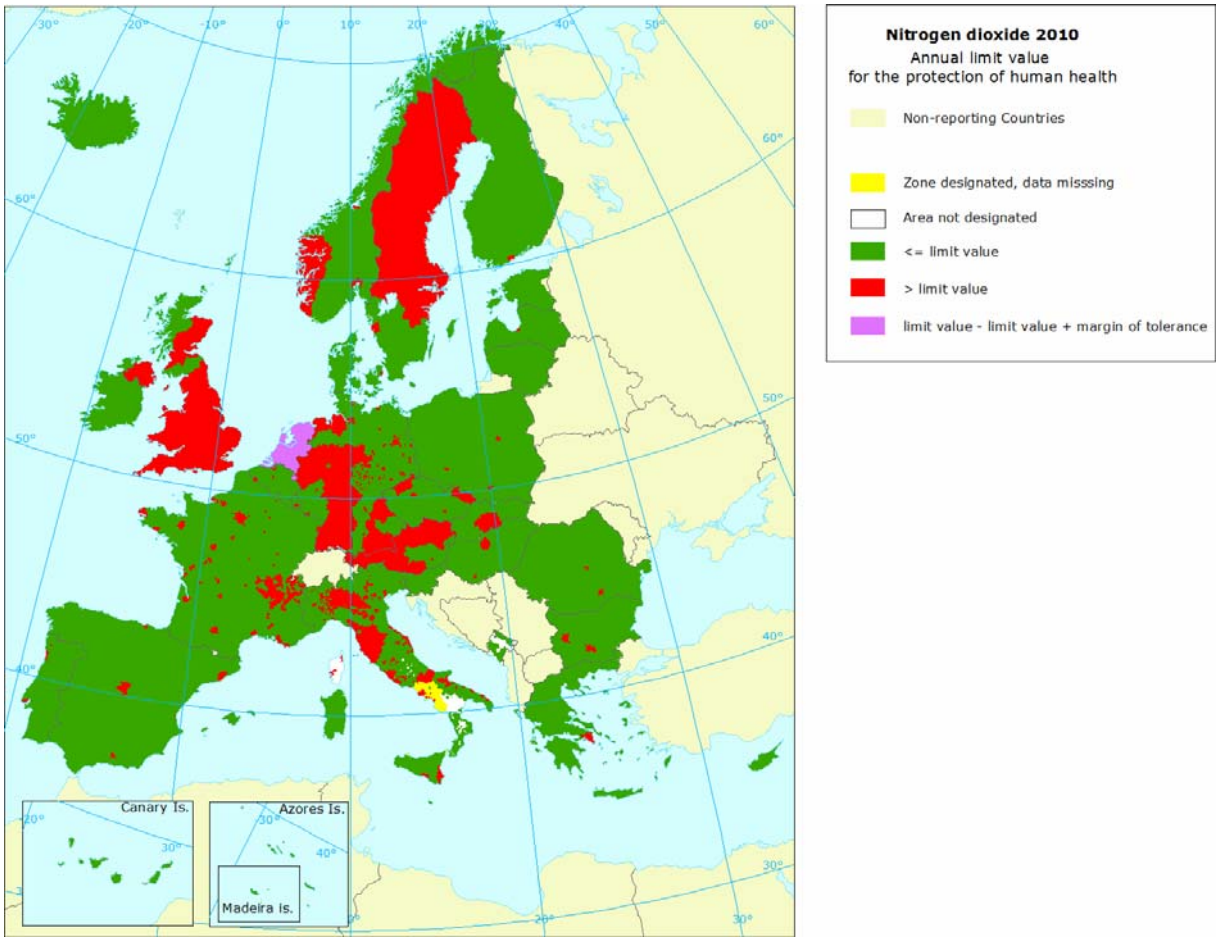

Figure 5. Zones in exceedance of the annual limit value for NO_2 in 2010.

For NO_2 the map looks very similar to last year's. The most agglomeration exceedances of the ALV occur in Germany (59), Italy (47), UK (41) and France (25). For 29 zones in the United Kingdom the reported exceedances are based on modelled results. In the Netherlands all designated zones reported exceedance to the LV, but not the MOT. As the Netherlands were granted time extensions for the annual limit value of NO_2 for all zones, they were still compliant to the AQD.

3.2. Derogation situations

In three situations a (temporally) exceedance of the limit value is permitted, according to the AQ Directive 2008/50/EC:

(i) Art. 22 allows under specific conditions a temporally exceedance of the limit value;

(ii) when exceedances are attributable to natural sources (Art. 20); and

(iii) when exceedances are attributable to winter-sanding or –salting of roads (Art. 21).

3.2.1. Time extensions

Following art. 22 in the AQ Directive, Member States having particular difficulties in achieving compliance with the limit values for particulate matter (PM_{10}), nitrogen dioxide or benzene, may request the Commission for a postponement of attainment by a maximum of five years (NO_2 and benzene) or an exemption of the obligation of appliance up to three years (PM_{10}). During those

periods the limit values continue to apply plus a margin of tolerance. Derogation is given for individual zones; in all other zones compliance with limit values is required.

A table with all air quality zones in the EU for which exceedances of the PM_{10} limit values have been reported can be found on the European Commission's website[10]. The table covers the year 2007 and informs also whether a notification for time extension has been submitted. An updated table, covering the period 2008-2010 for zones for which time extension has been granted is presented in Table 3.

For the daily PM_{10} limit value, time extensions have been granted for 55 zones in the EU Member States. Not in all cases the zone codes given in the derogation requests could be traced in the 2010 questionnaires. Zones in the Czech Republic and Poland were re-numbered in 2008 but a match with the derogation request could be made. Germany provided a separate sheet with information on zones for which exemption has been granted. For the situation in 2008, a few zones in Germany could not be unambiguously matched. Poland provided information on the relations between the "old" 2009 designation and the "new" 2010 designation (see above).
From the 55 zones retrieved in the 2010 questionnaires, 16 zones have reported that PM_{10} levels are in compliance with the daily limit value, see Table 3. Time extension has been granted for 10 zones for the annual PM_{10} limit value. In 8 zones concentrations were reported to be below the annual limit value already in 2010. Once a limit value has been met, air quality should be maintained; this implies that for half of the zones, the granted time extensions for PM_{10} might be withdrawn.

Postponement for the annual limit value of NO_2 has been granted for a total of 23 zones in Latvia, the Netherlands and United Kingdom. In all 23 zones the 2010 concentrations were above the limit value.

[10] http://ec.europa.eu/environment/air/quality/legislation/pdf/pm10_exceedances_2007.pdf

Table 3. *Status in zones for which time extension has been granted for annual (ALV) or daily limit values (DLV) of PM_{10} (nr=AQ status not retrievable) and NO_2 annual limit value (bottom). The grey shaded cells indicate no time extension was granted in the zone for this particular limit value.*

		PM_{10} ALV			PM_{10} DLV		
Zone code	**zone name**	**2008**	**2009**	**2010**	**2008**	**2009**	**2010**
AT_02	Kärnten				<lv	<lv	>lv
AT_03	Niederösterreich				<lv	>lv	>lv
AT_06	Steiermark ohne AG Graz				>lv	<lv	>lv
AT_07	Tirol				<lv	<lv	>lv
AT_09	Wien				>lv	>lv	>lv
AT_40	AG Linz				>lv	<lv	>lv
AT_60	Graz				>lv	>lv	>lv
CY001A	CYPRUS	>lv	>lv	>lv			
CZ031	Jihočeský kraj				>lv	>lv	>lv
CZ0640	Jihomoravský kraj				>lv	>lv	>lv
DEZAXX0006S	Orte erhöhter verkehrsbedingter Schadstoffbelastung im Land Brandenburg ab 2005				>lv	lv-mot	lv-mot
DEZCXX0007A	Ballungsraum Stuttgart	>lv	lv-mot	lv-mot			
DEZCXX0070S	Gebiet (ohne Ballungsräume) mit PM10-Werten > GW				nr	lv-mot	lv-mot
DEZDXX0001A	Ballungsraum München				>lv	lv-mot	lv-mot
DEZDXX0002A	Ballungsraum Augsburg				>lv	<lv	lv-mot
DEZEIX0107A	Ballungsraum Niedersachsen-Bremen				>lv	<lv	<lv
DEZJXX0004A	Köln				<lv	<lv	<lv
DEZJXX0005A	Hagen				<lv	<lv	<lv
DEZJXX0006A	Essen				<lv	lv-mot	<lv
DEZJXX0008A	Dortmund				<lv	lv-mot	<lv
DEZJXX0009A	Düsseldorf				>lv	lv-mot	lv-mot
DEZJXX0011A	Aachen				<lv	lv-mot	<lv
DEZJXX0014S	Warstein				nr	<lv	<lv
DEZJXX0015A	Grevenbroich (Ballungsraum Rheinisches Braunkohlerevier)				nr	<lv	lv-mot
DEZNXX0001A	Leipzig				>lv	lv-mot	lv-mot
DEZOXX0005S	Harz				<lv	<lv	lv-mot
DEZPXX0008S	Gebiet Thüringen 1				>lv	lv-mot	
ES0705	COMARCA DE PUERTOLLANO				>lv	<lv	<lv
FR16A00001	Strasbourg				>lv	>lv	>lv
HU0001	Budapest region	<lv	<lv	<lv			
HU0002	Győr-Mosonmagyaróvár				<lv	<lv	lv-mot
HU0003	Komárom-Tatabánya-Esztergom				<lv	lv-mot	lv-mot
HU0006	Pécs region				<lv	lv-mot	>lv
HU0008	Sajó valley	lv-mot	<lv	<lv			
HU0009	Debrecen region				<lv	<lv	<lv
HU0011	Allotted cities	lv-mot	<lv	<lv			
IT0201	Zona di risanamento				<lv	<lv	<lv
IT1001	Area metropolitana				>lv	lv-mot	<lv

	di Perugia						
IT1101	Zona A	<lv	lv-mot	<lv	>lv	>lv	>lv
IT1203	Z2				<lv	<lv	<lv
IT1504	Zona di risanamento – area beneventana				>lv	lv-mot	<lv
NL0100	Noord				<lv	<lv	<lv
NL0200	Midden	<lv	<lv	<lv	>lv	lv-mot	lv-mot
NL0210	Amsterdam/Haarlem	<lv	<lv	<lv	>lv	lv-mot	lv-mot
NL0220	Utrecht	<lv	<lv	<lv	>lv	lv-mot	<lv
NL0230	Den Haag/ Leiden				>lv	lv-mot	<lv
NL0240	Rotterdam/ Dordrecht	<lv	<lv	<lv	>lv	lv-mot	lv-mot
NL0300	Zuid				>lv	lv-mot	lv-mot
NL0310	Eindhoven				>lv	<lv	lv-mot
NL0320	Heerlen/ Kerkrade				<lv	<lv	lv-mot
PL1404	strefa pruszkowsko-żyrardowska				>lv	lv-mot	>lv
PL1403	miasto Radom				>lv	lv-mot	>lv
PL1602	strefa namysłowsko-oleska				>lv	>lv	>lv
PL1602	powiat kędzierzyńsko-kozielski				>lv	lv-mot	>lv
PL3003	strefa ostrowsko-kępińska				<lv	<lv	>lv
UK0001	Greater London Urban Area				>lv	>lv	lv-mot
SKKO02	Košický kraj				>lv	>lv	>lv
SKPR01	Prešovský kraj				>lv	>lv	lv-mot
SKTN01	Trnavský kraj				>lv	<lv	lv-mot
SKTR01	Trenčiansky kraj				>lv	>lv	lv-mot

Zone code	zone name	NO_2 ALV 2010
LV0001	Riga	>lv
NL0100	Noord	lv-mot
NL0200	Midden	lv-mot
NL0210	Amsterdam/Haarlem	lv-mot
NL0220	Utrecht	lv-mot
NL0230	Den Haag/Leiden	lv-mot
NL0240	Rotterdam/ Dordrecht	lv-mot
NL0300	Zuid	lv-mot
NL0310	Eindhoven	lv-mot
NL0320	Heerlen/Kerkrade	lv-mot
UK0008	Nottingham Urban Area	>lv
UK0011	Leicester Urban Area	>lv
UK0012	Portsmouth Urban Area	>lv
UK0015	Bournemouth Urban Area	>lv
UK0016	Reading/Wokingham Urban Area	>lv
UK0017	Coventry/Bedworth	>lv
UK0021	Southend Urban Area	>lv
UK0025	Edinburgh Urban Area	>lv
UK0026	Cardiff Urban Area	>lv
UK0037	Central Scotland	>lv
UK0042	North Wales	>lv
UK0043	Northern Ireland	>lv
UK(GIB)	Gibraltar	>lv

3.2.2. Reporting of exceedances of the PM_{10} limit values attributable to natural sources

Correction of exceedances attributable to natural sources is possible for PM_{10} and SO_2. None of the reporting countries informed on SO_2 events. France listed one station in Form 21a (exceedance of SO_2 hourly limit value) but the measured number of exceedances was already below the allowed number (24 hours). Information on the estimated number of exceedances after subtraction of the natural contribution (volcanic eruption) has not been given.

Correction of the daily and annual limit value for PM_{10} is applied by a number of reporting countries; contributions by desert dust and/or sea salt were the major natural sources. A large number of exceedances observed in Iceland have been attributed to volcanic eruptions. Greece claimed that a number of exceedances was caused by "transport of natural particles from dry regions outside the Member State" and "wild-land fire outside the Member States"; as justification a link to the web pages of the Finokalia station[11] was given but further details could unfortunately not be found here. The highest number of PM_{10} exceedances per station due to natural sources was reported by Mediterranean Member States (Cyprus, Spain and Greece). Table 4 lists the zones where after subtraction of the natural contributions the air quality assessments changed from "above limit value" to "below limit value". A discussion on the reporting on natural events in 2008-2009 is given by Viana et al (2011).

Table 4. *Subtraction of natural contributions to the annual mean concentrations or to concentrations during exceedances days may result in concentrations which are below the annual or daily limit value. The air quality assessment in the following zones changes from "above limit value" to "below limit value" by correction of the natural contribution*

daily limit value			annual limit value		
reporting country	Zone code	Zone	reporting country	Zone code	Zone
GR	EL0002	Νότια Ελλάδα	CY	CY001A	CYPRUS
ES	ES0103	ZONA INDUSTRIAL DE HUELVA	ES	ES0302	ASTURIAS CENTRAL
ES	ES0115	ANDALUCIA-ZONAS RURALES	FR	FR38N10	REUNION-ZUR
ES	ES0117	BAHÍA DE CÁDIZ	FR	FR04A01	ILE-DE-FRANCE-PARIS
ES	ES0120	SEVILLA Y ÁREA METROPOLITANA	FR	FR20A01	RHONE-ALPES-LYON
ES	ES0504	FUERTEVENTURA Y LANZAROTE	FR	FR39N10	MARTINIQUE-ZUR
ES	ES0513	SUR DE TENERIFE	FR	FR03A02	PROVENCE-ALPES-COTE-D-AZUR-MARSEILLE
ES	ES0601	BAHÍA DE SANTANDER	GB	UK(GIB)	Gibraltar
ES	ES0901	ÀREA DE BARCELONA	GR	EL0002	Νότια Ελλάδα
ES	ES1003	MIJARES-PEÑAGOLOSA . ÁREA COSTERA	GR	EL0003	Οικισμός Αθήνα
ES	ES1407	CIUDAD DE MURCIA	GR	EL0004	Οικισμός Θεσσαλονίκη
FR	FR03A03	PROVENCE-ALPES-COTE-D-AZUR-TOULON	IS	IS1000	Dreifbyli
FR	FR11A01	NORD-PAS-DE-CALAIS-LILLE	LV	LV0001	Riga
IS	IS1000	Dreifbyli	MT	MT0001	Maltese Agglomeration
IS	IS2000	Reykjavik	PT	PT3001	Área Metropolitana de Lisboa Norte
MT	MT0002	Maltese Zone			
PT	PT1001	Braga			
PT	PT2002	Coimbra			
PT	PT3002	Área Metropolitana de Lisboa Sul			

[11] http://finokalia.chemistry.uoc.gr/

3.2.3. Contribution of winter-sanding and -salting

Five countries (Austria, Germany, Lithuania, Latvia and Slovenia) reported on corrections due to winter sanding on PM_{10} exceedances in Form 24. However, after the correction the number of exceedances dropped below the allowed number only in Germany (daily limit value) and in Latvia (annual limit value), see Table 5. .

Table 5. *Subtraction of the contributions of winter sanding and salting to the annual mean concentrations or to concentrations during exceedances days may result in concentrations which are below the annual or daily limit value. The air quality assessment in the following zones changes from "above limit value" to "below limit value" by correction of winter sanding and salting*

daily limit value			annual limit value		
MS	Zone code	Zone	MS	Zone code	Zone
DE	DEZDXX0023S	Oberbayern ohne Ballungsraum München	LV	LV0001	Riga

4. Observing an improvement in air quality.

To evaluate a possible change in the degree of compliance with the limit or target values, the reports of the last five years (2006-2010) have been re-examined. No attempts have been made to extend the time period. In the years 2001-2003 reporting was mandatory for the EU15 Member States for the pollutants listed in the first and second daughter directive. In 2004 mandatory reporting on ozone (third daughter directive) was included in the Questionnaire and the new Member States (EU10) had to report on their air quality status. 2006 is the first reporting year covering all EU27 Member States.

Over the last five years the zoning as defined by reporting countries has shown not to be stable (See Table 2 for the EU-27). Any trend in the number of percentage of zones in compliance with an air quality objective will be confounded by the changes in zone designation. Therefore, starting with the definition of 2010 zones, a consistent set of zones reporting an assessment for each of the five years during the 2006-2010 period has been selected. This selection is not representative for the EU27 (see Figure 6) as over in the selected period zone definitions have been changed in various reporting countries.

Concluding from the above, it is recommended, changes in the zoning should be minimised, in order to favour comparability between zones and trend analysis.

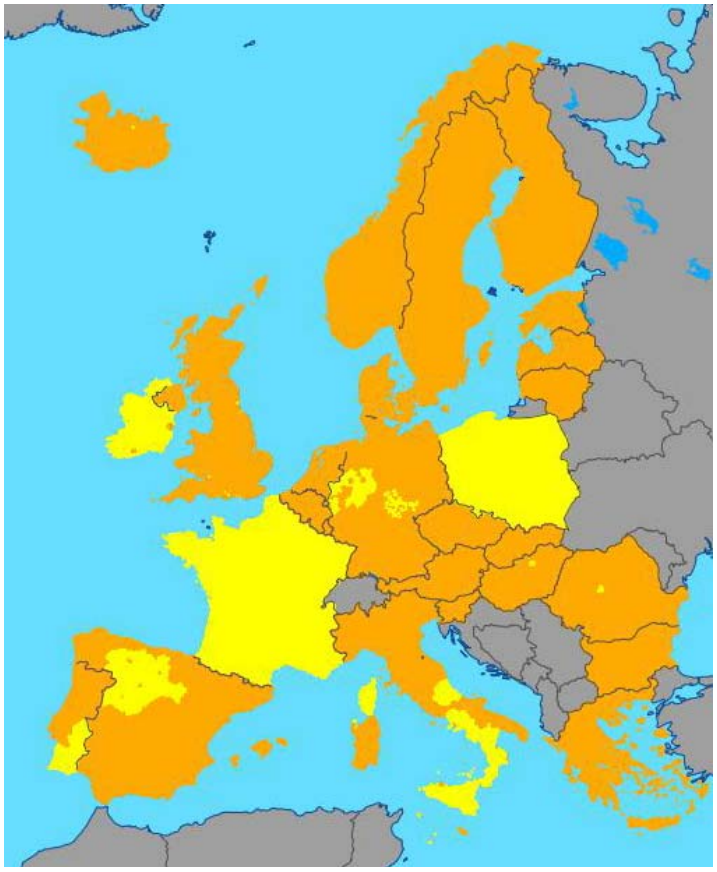

Figure 6. A consistent set of zones, period 2006-2010. The orange areas indicate zones for which information is available for each of the years in the period 2006-2010. The yellow areas indicate where boundaries have been changed in the period 2006-2010 or with insufficient information (Montenegro is not included because only two reporting years are available).

Results, splitted for agglomerations and non-aggglomeration zones are presented in Table 6.
With respect to the annual NO_2 limit value, the number, population and area of zones (both agglomerations as well as non-agglomerations) where the limit value is exceeded, hardly change over the years. Meeting the limit value remains a problem in about 65% of the agglomerations and in about 23% of the non-agglomerations. The hourly limit value of NO_2 is less frequently exceeded (in 15-39 zones on a total of 442 zones). In non-agglomerations compliance is nearly complete since 2007; in agglomerations there is a decreasing tendency, especially in the population living in non-compliance zones.
Compliance with the PM_{10} daily limit value is improving in the urban agglomerations, as the percentage of agglomerations being in non-attainment has changed from 80 % in 2006 to 40 % in 2010. Moreover, in the more rural non-agglomerations a strong improvement is observed in 2007 compared to 2006. In contrast to the situation in agglomerations which show a continuously downward tendency, no further improvement is seen in non-agglomeration zones during the more recent years. The situation with respect to the PM_{10} annual limit value tends to improve over the year on all selected parameters. However, the downward trends seem to level off in the recent years in particular in non-agglomerations.
Whereas NO_2 and PM_{10} form a problem typically in urban areas, ozone is more a rural problem. Since 2006 the situation is improving although in 2009 an increase in the area of non-attainment agglomerations is noted. This increase is not reflected in the number of zones or in the population.

It should be concluded that this analysis does not provide a representative and reliable description of non-attainment areas.

Table 6. Changes in air quality status: number of zones, population and total area of zones (separately for agglomerations (ag) and non-agglomerations (nonag)) where the LV or TV has been exceeded in the period 2006-2010.

type		2006	2007	2008	2009	2010	total set
NO_2 annual limit value							
ag	number of zones	116	123	117	117	115	182
	Population (in M)	97.1	102.6	99.8	100.1	101.5	126.9
	area	63091	66352	59931	61413	84942	210633
nonag	number of zones	67	65	55	60	59	260
	Population (in M)	75.7	75.2	69.2	72.1	70.4	166.6
	area	724410	746866	666097	693706	735895	2382574
PM_{10} daily limit value							
ag	number of zones	137	104	83	75	71	172
	Population (in M)	106.5	88.0	73.2	76.6	66.9	124.6
	area	176567	164273	159419	154293	150396	207648
nonag	number of zones	125	86	75	57	70	259
	Population (in M)	99.8	59.2	53.9	47.9	59.0	168.3
	area	907188	619211	611562	504665	709838	2406189
O_3 health target value							
ag	number of zones	57	51	43	38	34	166
	Population (in M)	40.4	41.9	37.1	38.4	35.2	123.5
	area	72891	71253	67855	87317	86209	205981
nonag	number of zones	121	127	112	108	98	208
	Population (in M)	74.4	82.4	81.9	68.4	64.6	169.6
	area	862595	902157	801403	737068	744574	2387777

It should be stressed that the shortcomings discussed in the current approach (that is, the selected set is not representative for the EU27 and the binary approach (compliance versus non-compliance) in a zone does not reflect the actual exposure of the population) also hamper this discussion on (possible) trends.

5. Overview of available information on AEI/$PM_{2.5}$

This chapter gives a preliminary overview of the $PM_{2.5}$ information reported by the reporting countries in their annual questionnaire and EoI submission. For the first time, $PM_{2.5}$ reporting is mandatory for 2010 data. An overview of the PM monitoring networks in the reporting countries is presented in Table 7 (extracted from Form 3).

Table 7. *Number of PM_{10} and $PM_{2.5}$ stations in reporting countries as reported in the questionnaire, number of stations labelled as being used to determine the AEI, number of PM_{10} and $PM_{2.5}$ stations as reported to AirBase having data for 2010 and the number of (sub)-urban background $PM_{2.5}$ stations.*

country	AQ Questionnaire (form 3)			AirBase		
	PM_{10}	$PM_{2..5}$	Defined as AEI-station	PM_{10}	$PM_{2..5}$	$PM_{2..5}$ UB
AT	143	15		144	15	6
BE	57	32	8	61	38	15
BG	42	9		42	9	6
CY	3	5		3	5	4
CZ	126	35		126	35	20
DE	419	115		451	128	59
DK	8	9	3	8	9	3
EE	7	7		7	7	3
ES	423	180	29	424	179	67
FI	33	13	1	37	19	6
FR	346	84	62	373	88	65
GB	69	78	51	66	77	47
GR	17	4		19	4	3
HU	25	7	4	25	7	5
IE	16	5	2	17	5	3
IT	398	118		522	130	56
LT	14	7	3	14	7	3
LU	6	3		6	3	1
LV	8	5	1	8	5	1
MT	4	3		4	3	1
NL	48	30	13	48	30	15
PL	206	67	32	206	67	60
PT	58	25	5	59	23	9
RO	58	25	24	59	25	22
SE	39	16		39	16	5
SI	17	4		16	4	2
SK	31	27		32	27	19
IS	11	5		12	6	4
NO	25	17		31	19	5
ME	4	1				
Total	2661	951	238	2859	990	515

There is a very good agreement in the number of PM sampling points reported in the AQQ and to AirBase. There is a tendency for a slightly larger number of stations in AirBase. Clearly, not all stations are used for compliance checking; this might be related to parallel measurements (e.g by using

different sampling methods) at one station. Italy forms an exception with 124 additional stations reporting under the EoI. Large differences are found in the PM-networks. Only in Cyprus, Denmark and the United Kingdom the number of $PM_{2.5}$ stations exceeded the number of PM_{10} stations. The criteria set in the directive that the total number of $PM_{2.5}$ and PM_{10} sampling points shall not differ more than by a factor of 2 is fulfilled in twelve reporting countries. The smallest possible majority of MS (14 out of 27) has reported on the set of $PM_{2.5}$ stations used for the assessment of the Averaged Exposure Index (AEI). Compared to the 2009-reporting (de Leeuw et al, 2011) there is a remarkable increase in the number of AEI-stations in France: from 33 to 62. In some other countries minor modifications (1-2 additional stations) are seen. The Directive sets for the density of the AEI-stations a minimal requirement of one station per million city dwellers. At a first glance the defined sets are in agreement with this requirement if the total urban population is estimated either by summing the population in the agglomerations or by taking the data from the World Population Prospect (UN, 2009).

The design of the $PM_{2.5}$ network is more directed towards estimation of population exposure than towards assessment of hotspot situations: 52% of the stations is classified as (sub)urban background while 33% is labelled as traffic or industrial station. The corresponding percentages for the PM_{10} network are 41% and 46%.

Statistical parameters (mean, median, 98-percentile and maximum) have been reported by all reporting countries using Form 18. Information is given for 859 stations, about 100 less than the number of stations defined in Form 3. Six additional stations, not included in Form 3 have been reported. The reported data is summarized in Figure 7. The level of 25 µg/m^3, target value in 2010, limit value in 2015, has been exceeded at one or more stations (in total 81 stations) in 11 reporting countries. The extremely high levels observed in Iceland must be attributed to the eruption of the volcano Eyjafjallajökull in April 2010. The highest observed daily concentration was 4449 ug/m^3 at the rural background statin IS0016A.

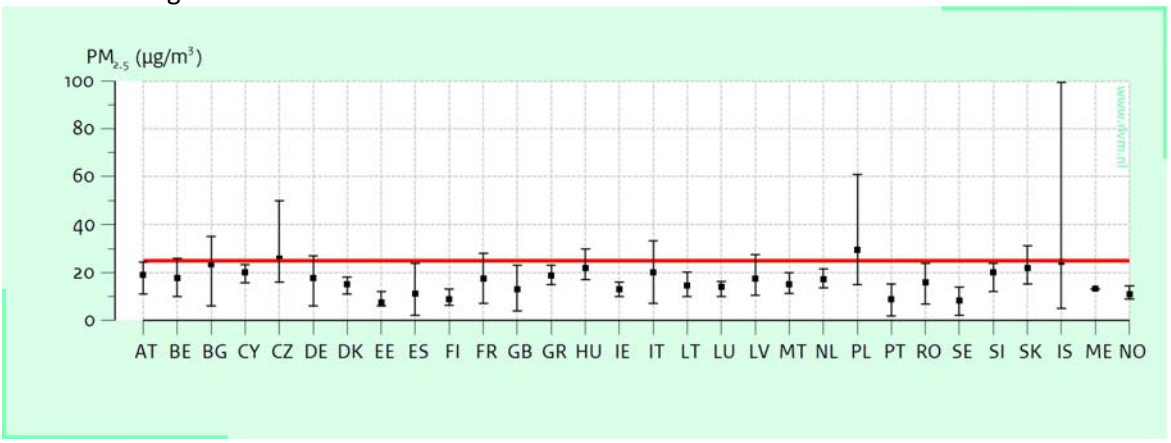

Figure 7. Annual mean (and maximum/minimum value) $PM_{2.5}$ concentrations in 2010 averaged over all stations reported per country. The red line corresponds to the 2010 target value and 2015 limit value.

The AEI reflects the $PM_{2.5}$-exposure of the general (urban) population. 14 reporting countries[12] provided information on stations and measurement configurations selected for determination of the AEI in the AQQ (form3). 10 Member States have reported an AEI for 2010 (5 calculated using years 2008-2010 and 5 using 2009-2010), see Figure 8 (form28). Besides, 4 MS informed they are using years 2009-2011 to calculate the AEI and 13 MS did not provide any information in form 28.

As an alternative estimate of the AEI we have calculated here the three-year running mean (2008-2010) as the mean of the annual averaged concentration over all operational (sub)urban background stations in each individual year (data available from AirBase). The approximated AEI (*Figure 8*) is not

[12] Preliminary data, based on information available per 10 January 2012.

based on a stable set of stations. For a number of countries results are based on two years only. In general, the official reported AEI, based on a dedicated set of (sub)urban station agrees well with the AEI estimated here on the basis of all operational (sub)urban background stations. Figure 8 indicates that in 8 countries the current estimated exposure indicator is above the exposure concentration obligation, the legally binding level in 2015 of 20 µg/m^3.

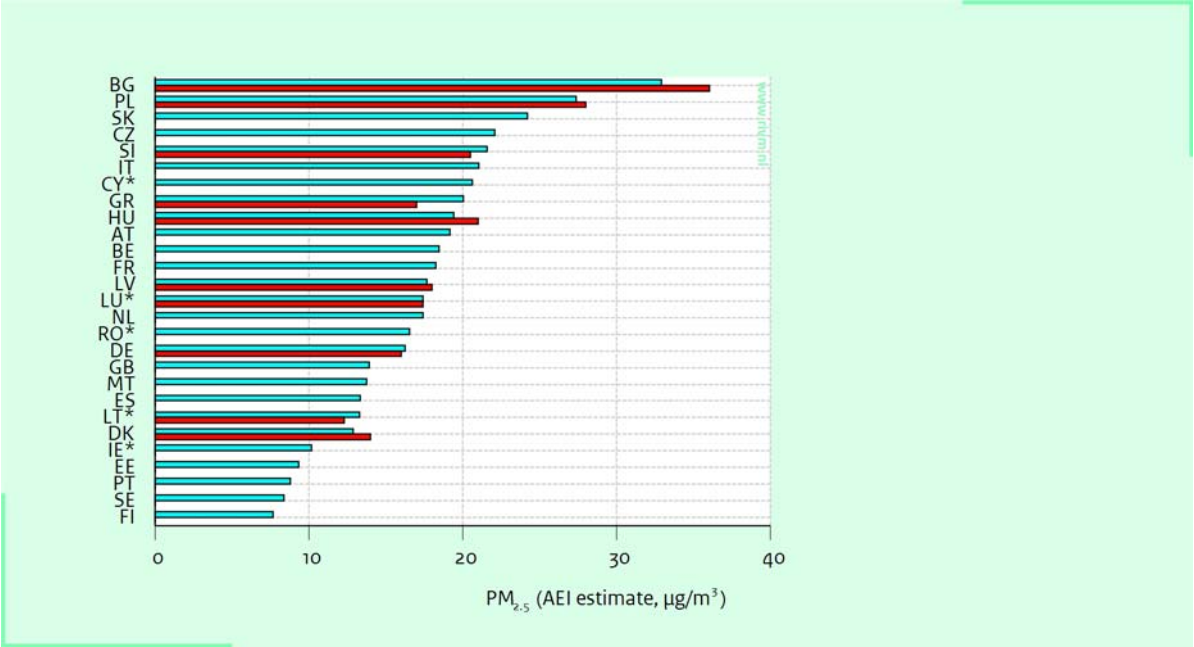

Figure 8. Average Exposure Indicator estimate, three-year running mean (2008-2010) over all operational (sub)urban background stations. Results for countries marked with an asterisk are based on 2009-2010 data only. The AEI as reported in the AQQ (form 28) is given by the red bars.

6. Comparison with EoI information

The Exchange of Information Decision requires that for all stations used for compliance checking (that is, all stations listed in the AQQ) meta-information and concentration data has to be submitted. A comparison of the information in the AQQ and in AirBase shows that for the stations listed in Form 3 almost 99 % can be retrieved from AirBase. The agreement for ozone stations (Form 4) is nearly complete (more than 99.7 %).

When matching at the level of a measurement configuration (that is, checking whether the 2010 concentration data of a station/pollutant combination listed in Form 3 or 4 is available from AirBase) larger differences are found, see Figure 9. For the classical pollutants (SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO, O_3) for nearly all measurement configurations the concentration data are also included in the national EoI submissions (more than 95 %). For benzene and the 4th DD pollutants a positive match between the two data flows could be found in 65 to 91 % of the cases.

For the gaseous pollutants (ozone, SO_2, NO_2, CO) information on the measurement method is not provided in the questionnaire. Based on the EoI submission Mol and van Hooydonk (2011) present an overview: to a large extent the reference method is applied: ozone (UV absorption, 93%), NO_2 (chemiluminescence, 88%), SO_2 (UV fluorescence, 89%) and CO (infrared absorption, 86%). For benzene 23% of the stations do not report the method used. 75% of the stations do report the method, but most of them incomplete (chromatography without further specification). 25% of the stations report gas chromatography followed by mass spectroscopy or flame ionisation for quantification.

For PM_{10} and $PM_{2.5}$ the reference method is gravimetry. According to the information reported in the questionnaire, gravimetric methods are used at 27% of the PM_{10} and 34% of the $PM_{2.5}$ stations. Beta absorption is used in 42% (PM_{10}) and 30% ($PM_{2.5}$) of the cases; TEOM and TEOM-FDMS are used at 28% and 27% respectively. When a non-equivalent method is used information on a correction method is expected. This information has not been given for 44% of the non-equivalent measurement configuration; under the assumption correction is not needed for an TEOM-FDMS, information on the correction method is missing in 27% of the cases. For $PM_{2.5}$ information on correction methods is missing for 47% of the non-equivalent measurement configurations.

Heavy metals and BaP has to be measured on PM_{10} but in 65%, 50%, 50%, 50% and 15% of the cases lead, arsenic, cadmium, nickel and benzo(a)pyrene , respectively, is measured on aerosol with an undefined size fraction.

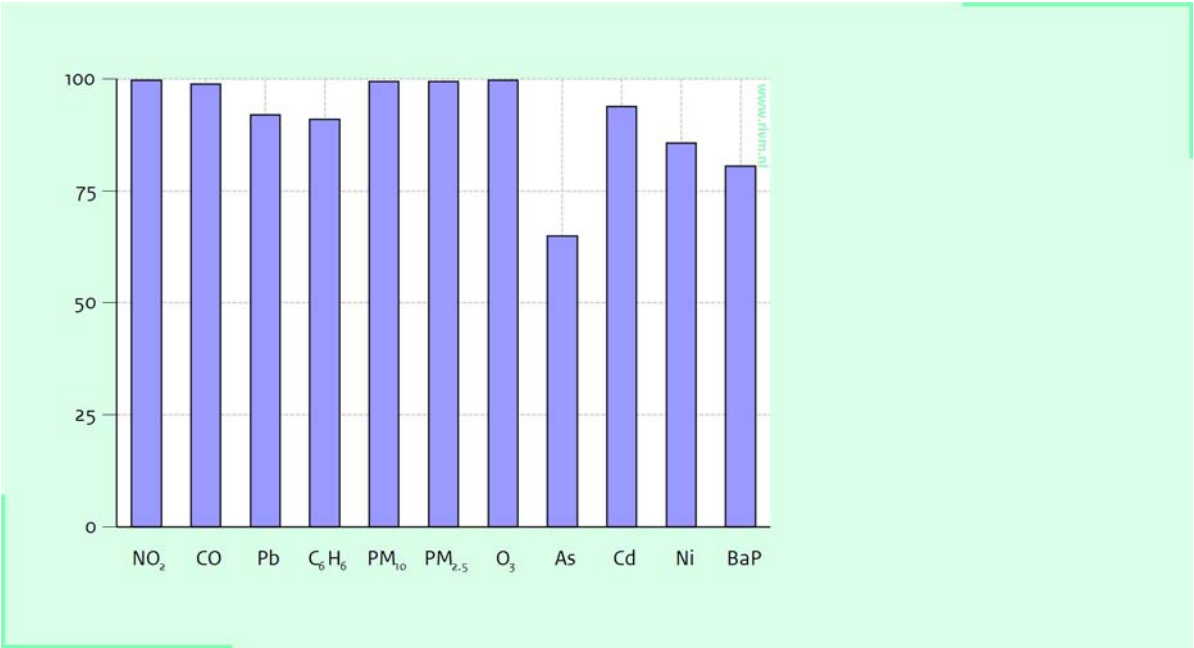

Figure 9. Fraction of measurement configurations listed in Form 3 and 4 for which 2010 monitoring data is available in AirBase.

Reporting of VOCs

Member States report on VOCs measurements by means of the AQQ at an aggregated level and by means of the Exchange of Information Decision at a more detailed level (hourly and/or daily concentrations) (EC, 1997). Some inconsistencies between the two data flows and within the various reporting forms in the AQ Questionnaire are noted; for example, in Table 8 the number of stations for which meta-information is reported in form 5 of the questionnaire is compared with the number of stations for which actual measurement results (Form 16) are given. More attention on the quality of the reporting might be considered.

The number of stations where VOCs are measured differs widely, per Member State and per individual VOC. All Member States report on one or more of the recommended VOCs; Spain is the only country where the full list of recommended VOCs is measured. The aromatic C_6-C_8 hydrocarbons (benzene, toluene, xylenes, ethyl benzene) are measured in nearly all Member States; in a number of MS monitoring is limited to these aromatic VOC. Of the 31 recommended VOC, benzene is the only pollutant for which monitoring is mandatory in order to assess the air quality in relation to the limit value set in the AQ Directive. The other VOCs, in particular the C_2-C_3- VOCs, are measured at a substantially lower number of stations. Formaldehyde is measured in two Member States only.

A more extensive discussion on ozone precursors including an analysis of recent trends is given by de Leeuw (2012).

Table 8. Number of stations (per Member State) where individual VOCs are measured. The number of stations actually reporting annual mean concentrations (2010) is given in parentheses.

	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HU
Ethane						5 (5)			1 (1)		13 (6)	4 (3)		1 (1)
Ethylene						5 (5)			1 (1)		13 (6)	4 (1)		1 (1)
Acetylene						5 (5)			1 (1)		13 (6)	4 (2)		
Propane						5 (5)			1 (1)		13 (6)	4 (3)		1 (1)
Propene						5 (5)			1 ()		13 (6)	4 (2)		1 (1)
n-Butane		24 (24)				5 (5)			5 (5)		13 (6)	4 (3)		1 (1)
i-Butane		8 (8)				5 (5)			4 (3)		13 (6)	4 (3)		1 (1)
1-Butene		24 (24)							1 (1)		13 (6)	4 ()		1 (1)
trans-2-Butene		24 (24)							1 (1)		13 (6)	4 (2)		
cis-2-Butene		24 (24)							1 (1)		13 (6)	4 (1)		
1.3-Butadiene		16 (16)							1 (1)		13 (6)	6 (3)		
n-Pentane		24 (28)				5 (5)			5 (10)		13 (6)	4 (2)		1 (1)
i-Pentane		28 (24)				5 (5)	1 ()		11 (4)		13 (6)	4 (2)		1 (1)
1-Pentene		24 (24)					1 (1)		5 (5)		12 (6)	2 (1)		
2-Pentene		24 (24)					1 (1)		2 (1)		11 (3)	2 (1)		
Isoprene		24 (24)				5 (5)	1 (1)		10 (10)		13 (6)	4 (1)		
n-Hexane		28 (28)				5 (5)	1 (1)		11 (11)		13 (6)	4 (2)		
i-Hexane		24 (24)							4 (4)		3 ()	4 (2)		
n-Heptane		28 (28)				5 (5)	1 (1)		11 (11)		13 (6)	4 (1)		
n-Octane		28 (28)					1 (1)		8 (8)		13 (6)	4 (1)		
i-Octane		24 (24)					1 (1)		4 (4)		12 (6)	4 (1)		
Benzene	5 (5)	39 (39)	19 (19)	1 (1)	21 (26)	5 (5)	1 (1)	2 (2)	144 (144)	5 (5)	98 (100)	6 (4)	2 (2)	12 (12)
Toluene	5 (5)	39 (39)	2 (2)		19 (20)		1 (1)		117 (117)	5 (5)	90 (86)	6 (4)	2 (2)	12 (12)
Ethyl benzene	5 (5)	39 (39)			4 (1)	5 (5)	1 (1)		84 (86)	5 (5)	43 (44)	6 (4)	1 (1)	12 (12)
m+p-Xylene	5 (5)	39 (39)	1 (1)			5 (5)	1 (1)		100 (100)	3 (3)	59 (44)	6 (5)	1 (1)	11 (11)
o-Xylene	5 (5)	39 (39)			3 (1)	5 (5)	1 (1)		80 (80)		59 (40)	6 (4)	1 (1)	11 (11)
1,2,4-Trimeth.benzene		24 (24)					1 (1)		8 (8)		13 (6)	3 (2)		
1,2,3-Trimeth.benzene		8 (8)					1 (1)		2 (2)		13 (6)	3 (2)		
1,3,5-Trimeth.benzene		24 (24)					1 (1)		8 (8)	3 (3)	13 (6)	3 ()		
Formaldehyde									1 (1)		7 (7)			
Total non-methane hydrocarbons			4 (4)			5 (5)			9 (9)					

	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
Ethane			1 (1)				1 (-)	1 (1)			1 (1)			28 (19)
Ethylene			1 (1)				1 (-)	1 (1)			1 (1)			28 (17)
Acetylene							1 (-)	1 (1)			1 (1)			26 (16)
Propane			1 (1)				1 (-)	1 (1)			1 (1)			28 (19)
Propene			1 (1)				1 (-)	1 (1)			1 (1)			28 (17)
n-Butane			1 (1)				1 (-)	1 (1)			1 (1)			56 (47)
i-Butane			1 (1)				1 (-)	1 (1)			1 (1)			39 (29)
1-Butene			1 (1)				1 (-)	1 (1)			1 (1)			47 (40)
trans-2-Butene			1 (1)				1 (-)	1 (1)			1 (1)			46 (41)
cis-2-Butene							1 (-)	1 (1)			1 (1)			45 (39)
1.3-Butadiene			1 (1)				1 (-)	1 (1)			1 (1)			40 (34)
n-Pentane			1 (1)				1 (-)	1 (1)			1 (1)			56 (56)
i-Pentane			1 (1)				1 (-)	1 (1)			1 (1)			67 (45)
1-Pentene			1 (1)				1 (-)	1 (1)			1 (1)			48 (40)
2-Pentene							1 (-)	1 (1)			1 (1)			43 (32)
Isoprene			1 (1)				1 (-)	1 (1)			1 (1)			61 (50)
n-Hexane			1 (1)				1 (-)	1 (1)			1 (1)			66 (56)
i-Hexane							1 (-)	1 (1)			1 ()			38 (32)
n-Heptane			1 (1)				1 (-)	1 (1)			1 (1)			66 (55)
n-Octane							1 (-)	1 (1)			1 (1)			57 (46)
i-Octane							1 (-)	1 (1)			1 (1)			48 (38)
Benzene	- (1)	179 (156)	3 (2)	2 (2)	4 (4)	3 (3)	6 (-)	1 (1)	7 (7)	33 (33)	1 (1)	2 (2)	10 (9)	604 (579)
Toluene	- (1)	113 (96)		2 ()	2 (2)	3 (3)	6 (-)	1 (1)	3 (3)		1 (1)	2 (2)		424 (400)
Ethyl benzene	- (1)	42 (35)		2 ()		2 (2)	6 (-)	1 (1)	3 (3)		1 ()	2 (2)		258 (241)
m+p-Xylene	- (1)	63 (49)	1 (1)	2 ()		2 (2)	6 (-)	1 (1)	3 (3)		1 ()	2 (2)		308 (270)
o-Xylene	- (1)	70 (63)		2 ()		3 (3)	6 (-)	1 (1)	3 (3)		1 ()	2 (2)		296 (257)
1,2,4-Trimeth.benzene			1 (1)				1 (-)	1 (1)			1 ()			53 (54)
1,2,3-Trimeth.benzene			1 (1)				1 (-)	1 (1)			1 ()			31 (21)
1,3,5-Trimeth.benzene			1 (1)				1 (-)	1 (1)			1 (1)			53 (42)
Formaldehyde														8 (8)
Total non-methane hydrocarbons		24 (2)		2 ()			1 (-)							46 (21)

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Mol WJA , van Hooydonk PR (2012) The European exchange of information in 2011 (2012) ETC/ACM Technical Paper 2012/1.

de Leeuw F, Jimmink B, Ostatnicka J, Schreiberova M, Viana M (2011) Reporting on ambient air quality assessment in the EU Member States, 2009. ETC/ACM Technical Paper 2011/7

de Leeuw F (2012) AirBase: a valuable tool inair quality assessments at an European and local level. ETC/ACM Technical Paper 2012/4.

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 5a-5c	Stations and measuring methods used for the assessment of recommended volatile organic compounds (3rd DD, form 5a) and other relevant PAH and metals (4th DD) in ambient air (form 5c) and deposition (form 5c)
Form 6	Stations and measurement methods used for the assessment of other ozone precursor substances
Form 7	Methods used to sample and measure PM_{10} and $PM_{2.5}$, ozone precursor substances, arsenic, cadmium, nickel, mercury, PAH: optional additional codes to be defined by the Member State
Form 8a-8g	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 9a-9c	List of zones and agglomerations where levels exceed or do not exceed target values or long term objectives for ozone (form 9a) and arsenic, cadmium, nickel, B(a)P (form 9b) and $PM_{2.5}$ (form 9c)
Form 10a-10l	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 11a-11m	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 13a-13c	Individual exceedances of ozone information and alert thresholds and of the long term objective for health protection
Form 14a-14d	List of stations where target values of ozone, arsenic, cadmium, nickel, benzo(a)pyrene and $PM_{2.5}$ are exceeded.
Form 15a-15b	Annual statistics of ozone, arsenic, cadmium, nickel, and benzo(a)pyrene
Form 16a-16d	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_2 levels
Form 18	Monitoring data on 24hr mean $PM_{2.5}$ levels
Form 19a-19l	Tabular results of and methods used for supplementary assessment
Form 20	List of references to supplementary assessment methods referred to in Form 19
Form 21a-21d	Exceedance of limit values for SO_2 due to natural sources
Form 22	Natural SO_2 sources: optional additional codes to be defined by Member State
Form 23a-23b	Exceedance of limit values of PM_{10} due to natural events
Form 24a-24b	Exceedance of limit values of PM_{10} 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
Form 28	$PM_{2.5}$ Average Exposure Indicator

Annex II. Air Quality 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 standards.

Pollutant	Concentration	Averaging period	Legal nature	Permitted exceedances each year
Fine particles ($PM_{2.5}$)	25 µg/m^3 20 µg/m^3	1 year	Target value entered into force 1.1.2010 Limit value enters into force 1.1.2015 Indicative limit value enters into force 1.1.2020 (to be confirmed)	n/a
Sulphur dioxide (SO_2)	350 µg/m^3	1 hour	In force	24
	125 µg/m^3	24 hours	In force	3
Nitrogen dioxide (NO_2)	200 µg/m^3	1 hour	Limit value entered into force 1.1.2010	18
	40 µg/m^3	1 year	Limit value entered into force 1.1.2010*	n/a
PM_{10}	50 µg/m^3	24 hours	In force**	35
	40 µg/m^3	1 year	In force**	n/a
Lead (Pb)	0.5 µg/ m^3	1 year	In force	n/a
Carbon monoxide (CO)	10 mg/ m^3	Maximum daily 8 hour mean	In force	n/a
Benzene	5 µg/ m^3	1 year	Limit value enters into force 1.1.2010*	n/a
Ozone	120 µg/ m^3	Maximum daily 8 hour mean	Target value enters into force 1.1.2010	25 days averaged over 3 years (2010 to 2012)
Arsenic (As)	6 ng/ m^3	1 year	Target value enters into force 31.12.2012	n/a
Cadmium (Cd)	5 ng/ m^3	1 year	Target value enters into force 31.12.2012	n/a
Nickel (Ni)	20 ng/ m^3	1 year	Target value enters into force 31.12.2012	n/a
Benzo(a)pyrene	1 ng/ m^3	1 year	Target value enters into force 31.12.2012	n/a

**Under the Directive 2008/50/EC the Member State can apply for a postponement 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 (18 hours at 300 µg/m^3 for the hourly NO_2 limit value, 48 µg/m^3 for annual NO_2 limit value and 10 µg/m^3 for the benzene limit value).*

***Under the Directive 2008/50/EC the Member State can apply for an exemption of the obligation of appliance 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^3 for the daily PM_{10} limit value, 48 µg/m^3 for the annual PM_{10} limit value).*

The Air Quality Directive has introduced additional $PM_{2.5}$ 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 $PM_{2.5}$ concentration averaged over the selected monitoring stations in agglomerations and larger urban areas, set in urban background locations to best assess the $PM_{2.5}$ exposure to the general population.

Title	Metric	Averaging period	Legal nature	Permitted exceedances each year
$PM_{2.5}$ Exposure concentration obligation	**20 µg/m^3 (AEI)**	**Based on 3 year average**	**Legally binding in 2015 (years 2013,2014,2015)**	**n/a**
$PM_{2.5}$ Exposure reduction target	**Percentage reduction* + all measures to reach 18 µg/m^3 (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^3, all appropriate measures need to be taken to achieve 18 µg/m^3 by 2020

AQ objectives set for the protection of vegetation:

Title	Metric	Averaging period	Legal nature
SO2	**20 µg/m^3**	**Calendar year and winter (1 October to 31 March)**	**Critical levels *. In force**
NOx	**30 µg NOx/m^3**	**Calendar year**	**Critical level **. In force**
O3	**AOT40 18000 (µg/m^3).h** **AOT40 6000 (µg/m^3).h**	**Period May to July averaged over 5 years** **Period May to July**	**Target value to be met by 1-1-2010 (*2010 will be the first year in the five years row)*** **Long term objective (Date by which the LTO should be met is not defined)**

*: Previously, limit values for the protection of ecosystems

**: Previously, limit value for the protection of vegetation.

Annex III. Exceedance maps

This section shows exceedance maps for all AQ objectives, except for the PM_{10} daily limit value, O_3 health target value and NO_2 annual limit value, which have been included in Figures 3 to 5 in Chapter 3.

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

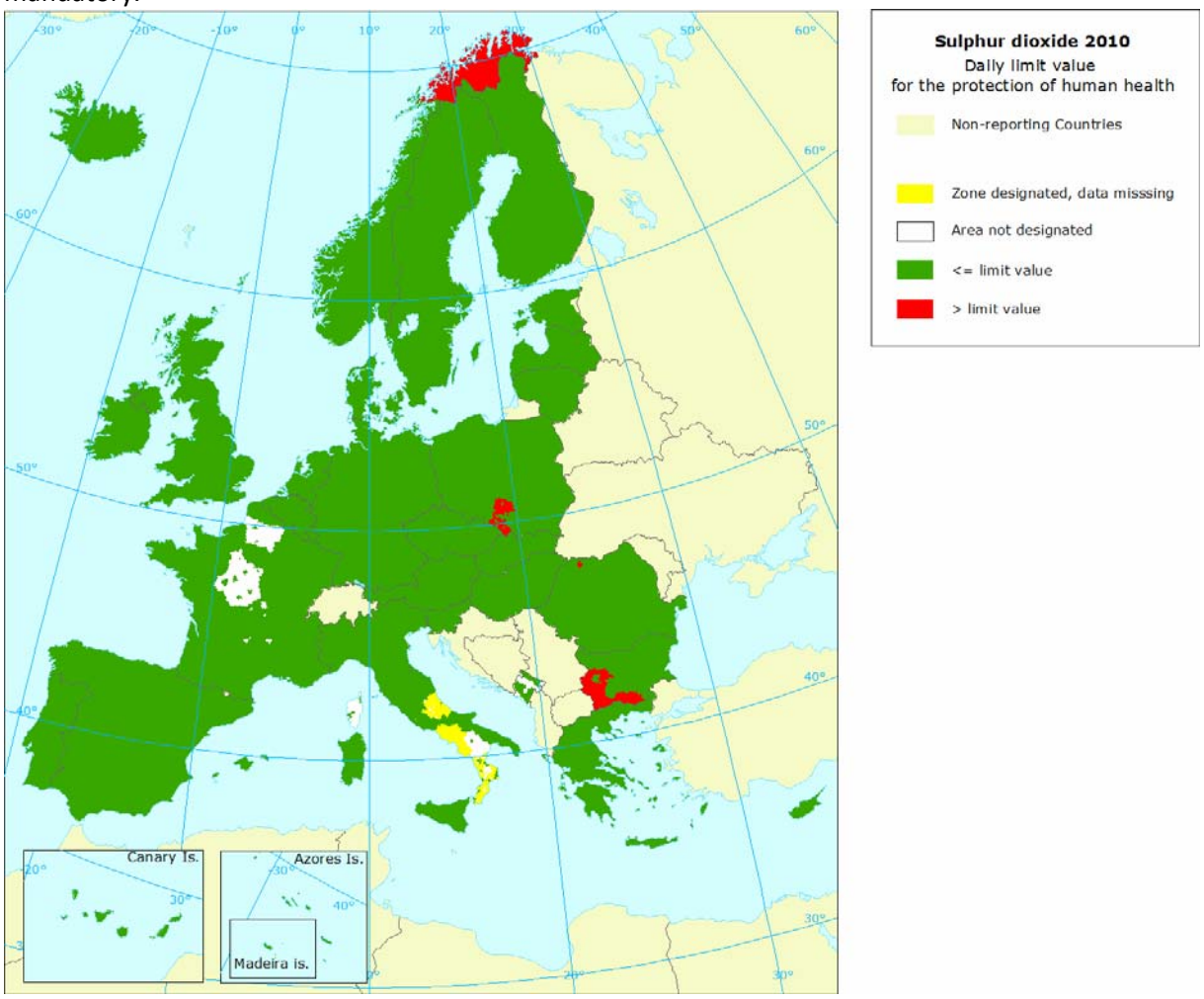

Figure III.1. Zones in exceedance for the daily limit value for SO_2 in 2010.

Zone exceedances for the daily limit value for SO_2 occurred in Norway, Poland, Romania and Bulgaria in 2010. In comparison to 2009, new exceedances appeared in Norway and Poland, whereas in 2010 no exceedance occurred in the Czech Republic anymore.

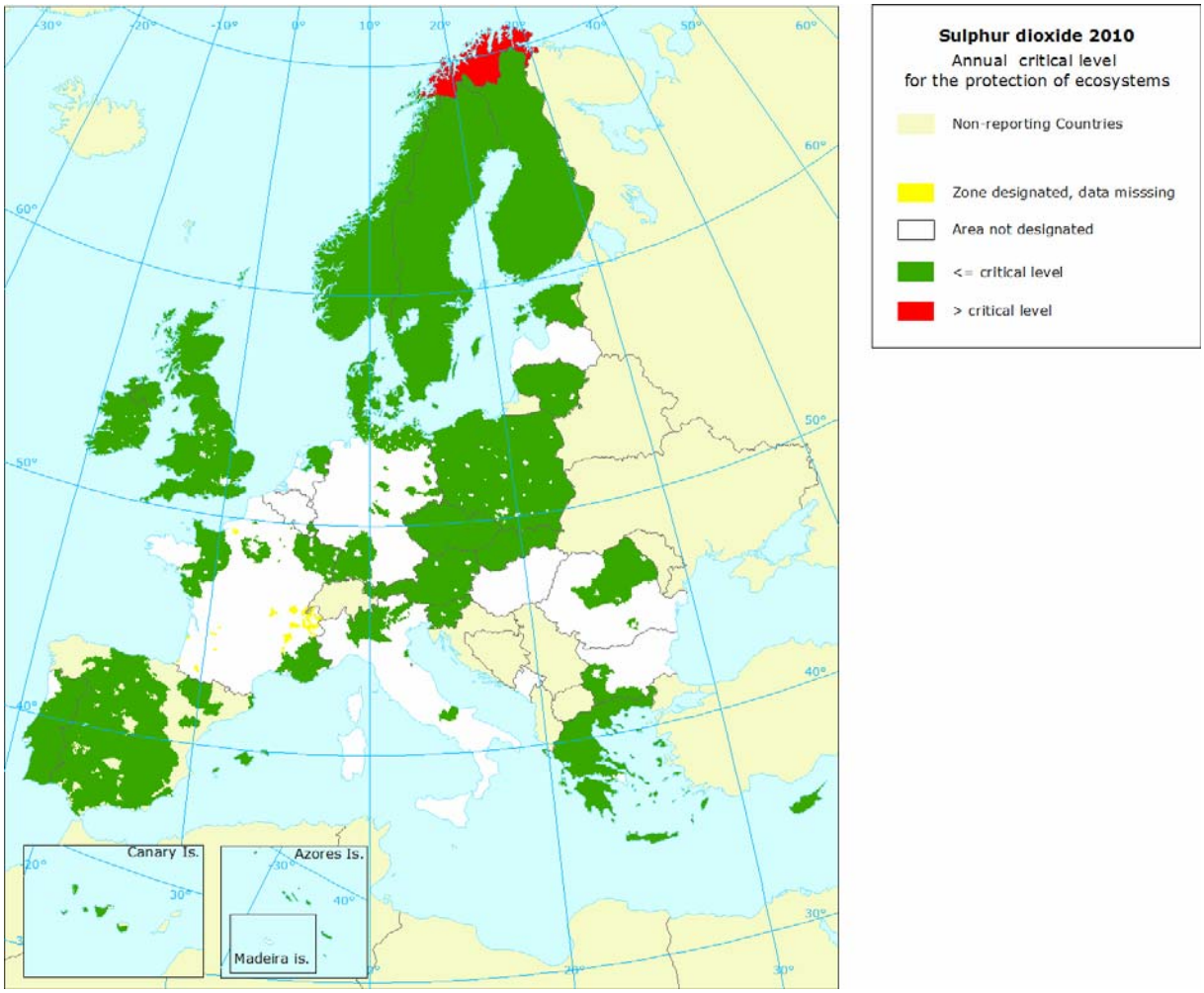

Figure III.2. Zones in exceedance for the annual critical level for SO_2 set for the protection of vegetation (former annual limit value for the protection of ecosystems) in 2010.

Zone exceedance for the annual critical level (CL) for SO_2 for protection of vegetation occurred in Norway in 2010. Compared to 2009, the exceedance in Norway appears “new”and no exceedance of the SO_2 CL occurred in the Czech Republic in 2010 anymore.

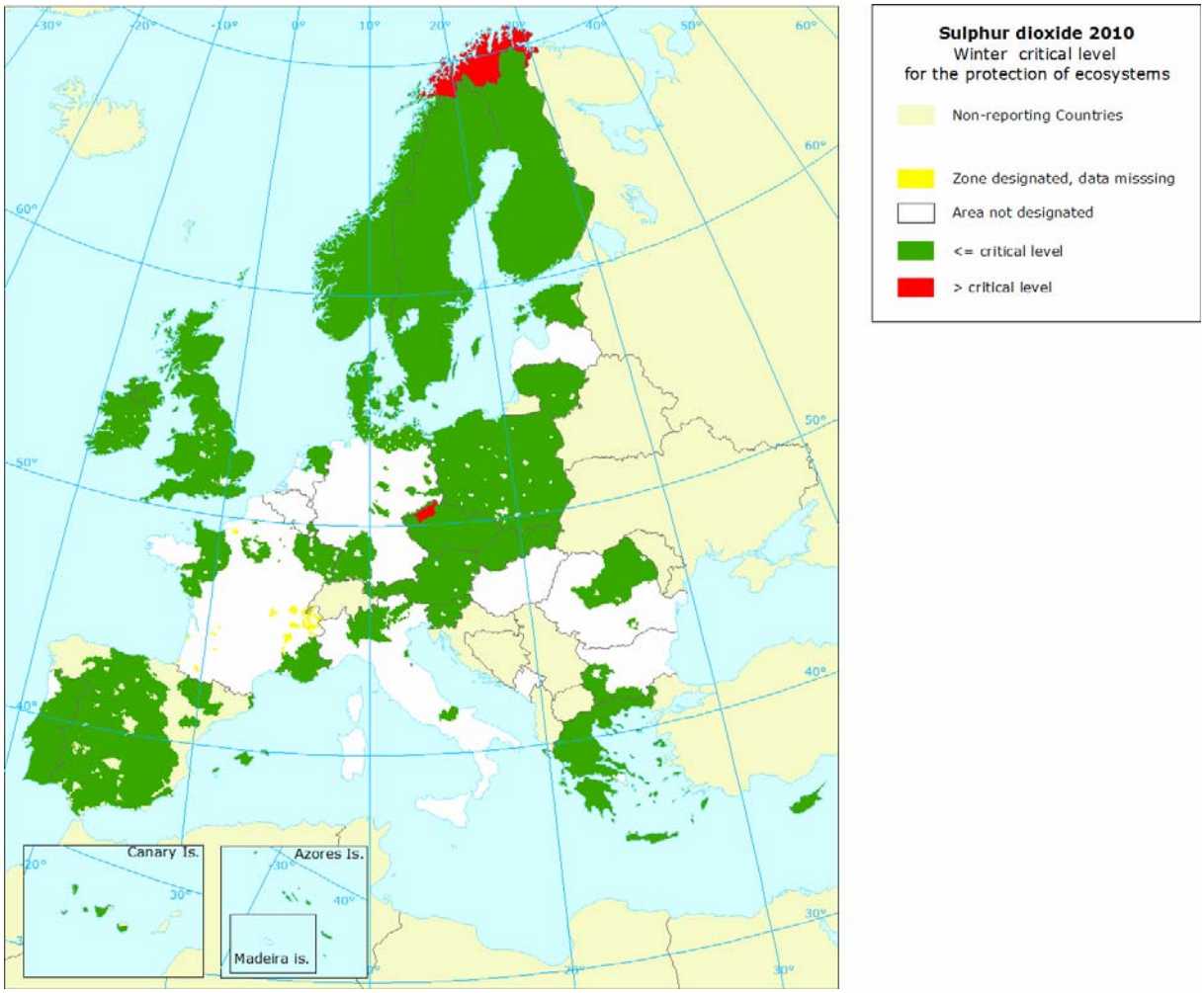

Figure III.3. Zones in exceedance for the winter critical level for SO_2 set for the protection of vegetation (former winter limit value for the protection of ecosystems) in 2010.

Zone exceedances for the winter critical level for SO_2 for protection of vegetation occurred in the Czech Republic and Norway in 2010. In the Czech Republic the number of zones in exceedance of the winter limit value for SO_2 for protection of ecosystems has halved from 2 to 1.

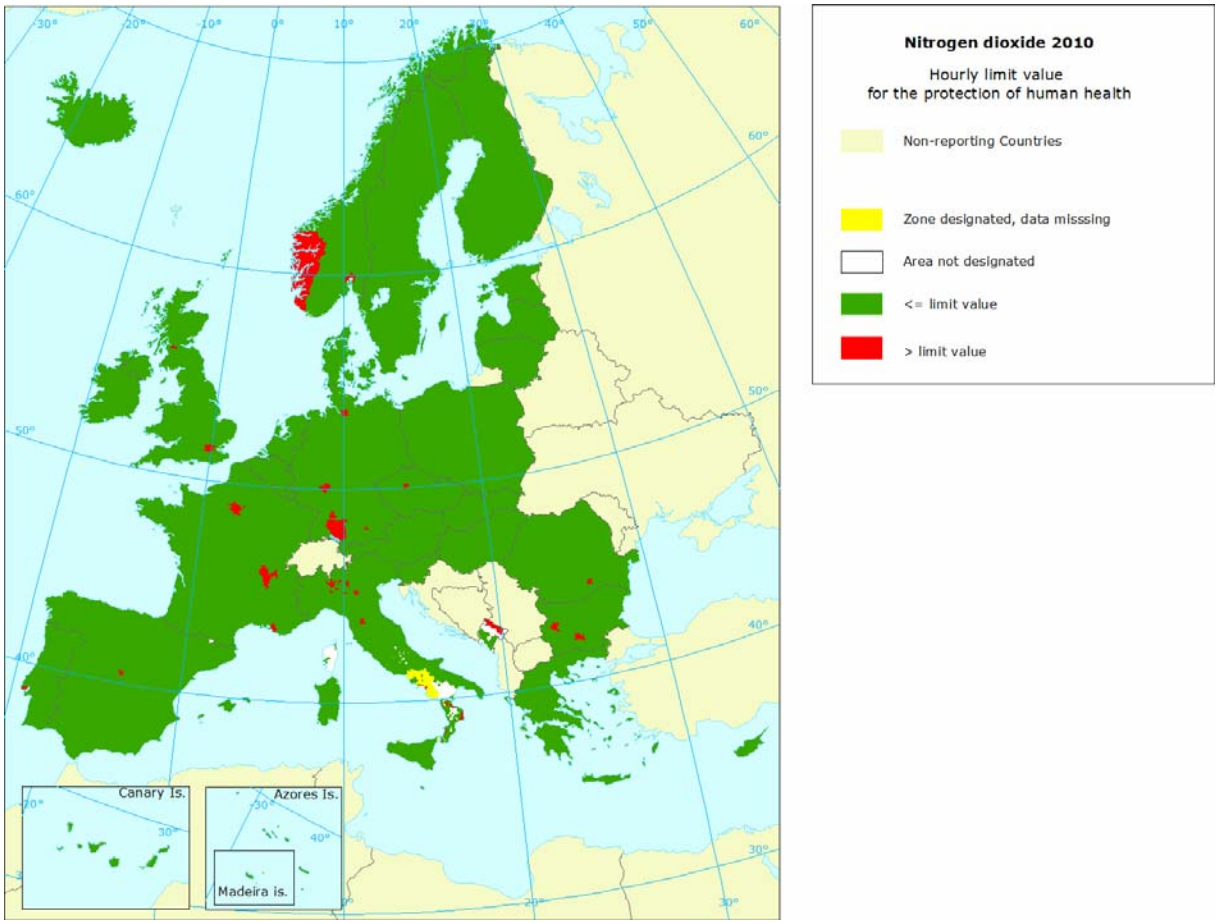

Figure III.4. Zones in exceedance for the hourly limit value for NO_2 in 2010.

Italy has 4 exceedances of the limit value and for 7 designated zones data are missing. Further exceedances of the limit value are observed in Germany (5), France, Norway and United Kingdom (all 3), Bulgaria (2), Czech Republic, Iceland, Montenegro, Portugal, Romania and Spain (all 1).

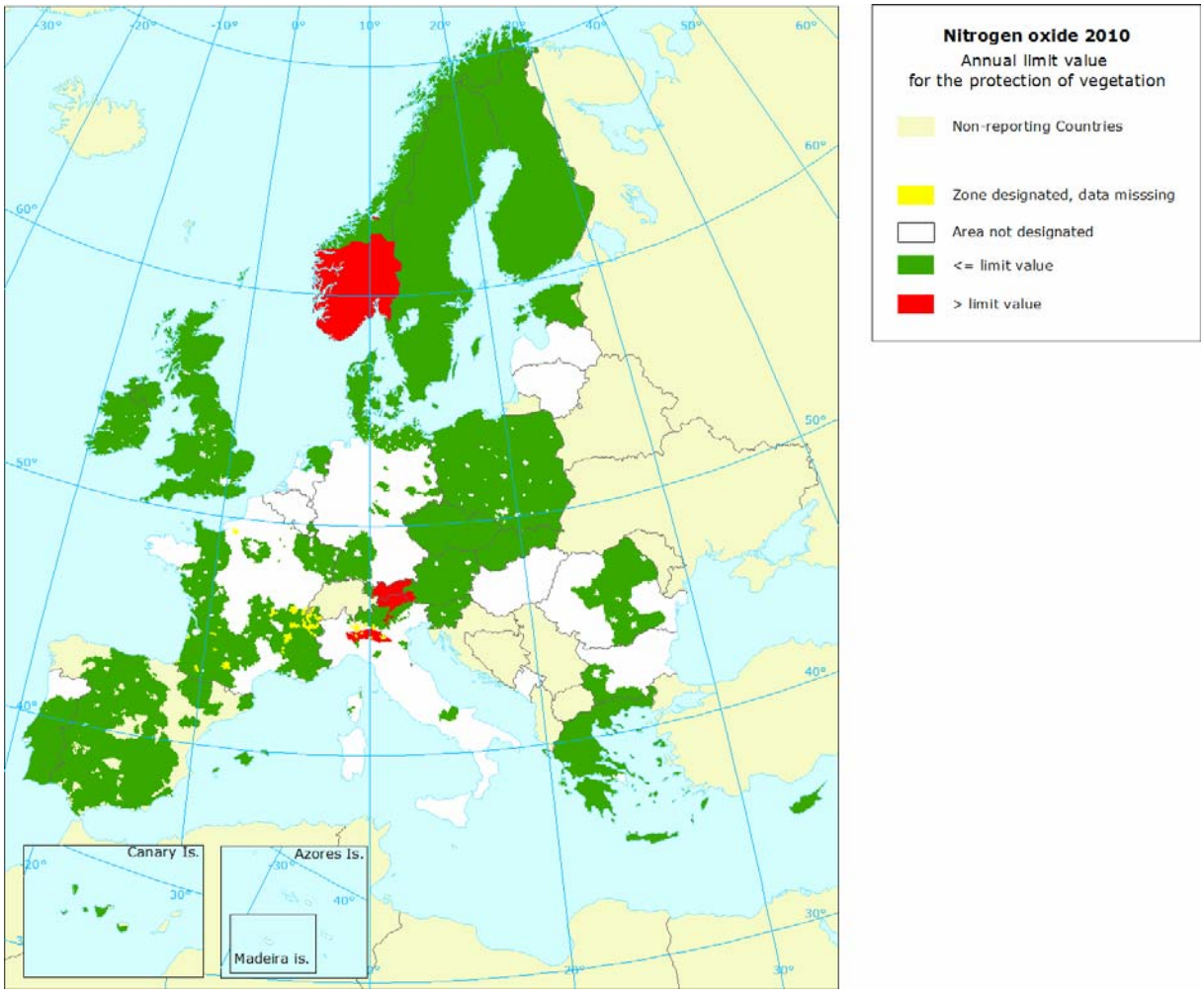

Figure III.5. Zones in exceedance for the critical level (former limit value) for NO_x set for the protection of vegetation in 2010.

In 2010, Austria, Norway and Italy reported 1, 5 and respectively 4 zone exceedances of the critical level of NO_x set for the protection of vegetation (30 µg/m^3/year).

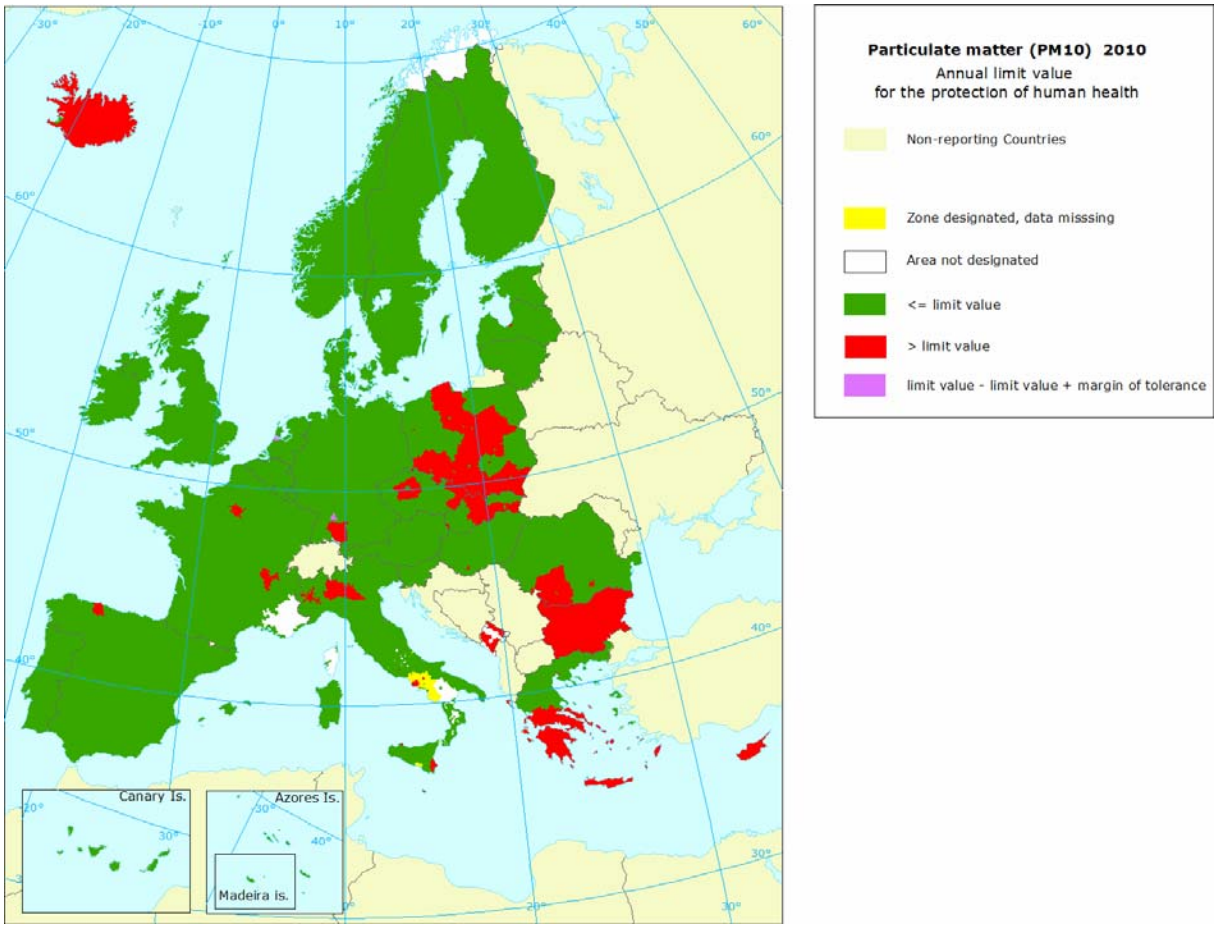

Figure III.6. Zones in exceedance for the annual limit value for PM_{10} in 2010 (not accounting for subtractions of natural contributions and/or of contributions of winter-sanding and salting, see sections 3.2.2 and 3.2.3).

Most zones in exceedances of yearly LV of PM_{10} occur in Italy (11) and Poland (21). Bulgaria, Greece Iceland, Montenegro and Cyprus have all or nearly all designated zones exceeding the LV.

For the annual limit value of PM_{10} the most mentioned single reason exceedance cause is local traffic (32%). From all the yearly PM_{10} limit value exceedances, 12 zones in Romania are reported exceedances based on modelled results.

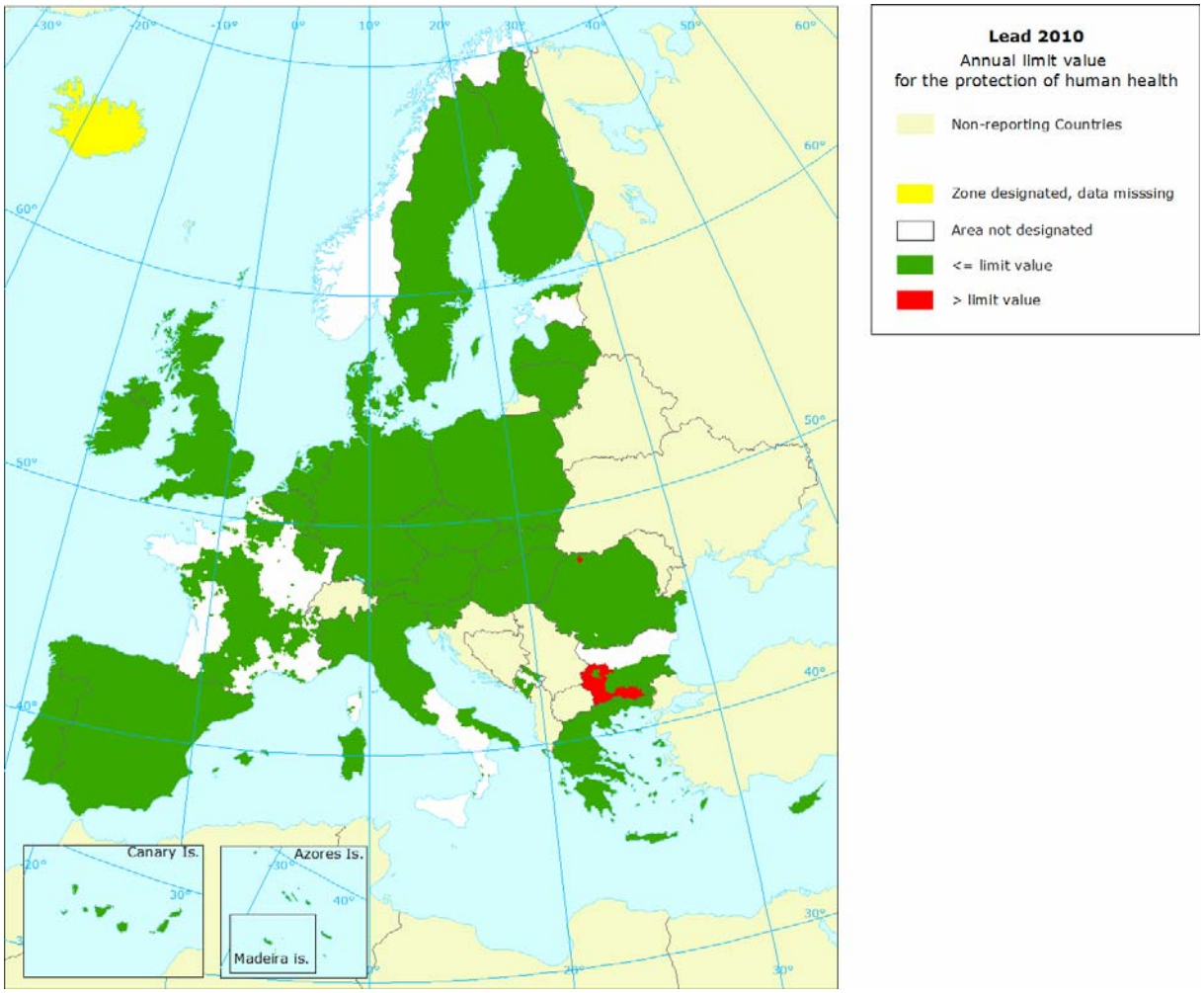

Figure III.7: Zones in exceedance for the annual limit value for lead in 2010.

Only in two EU27 zones (< 1%) an exceedance of the limit value for lead is reported. These zones are located in Bulgaria and

Romania.

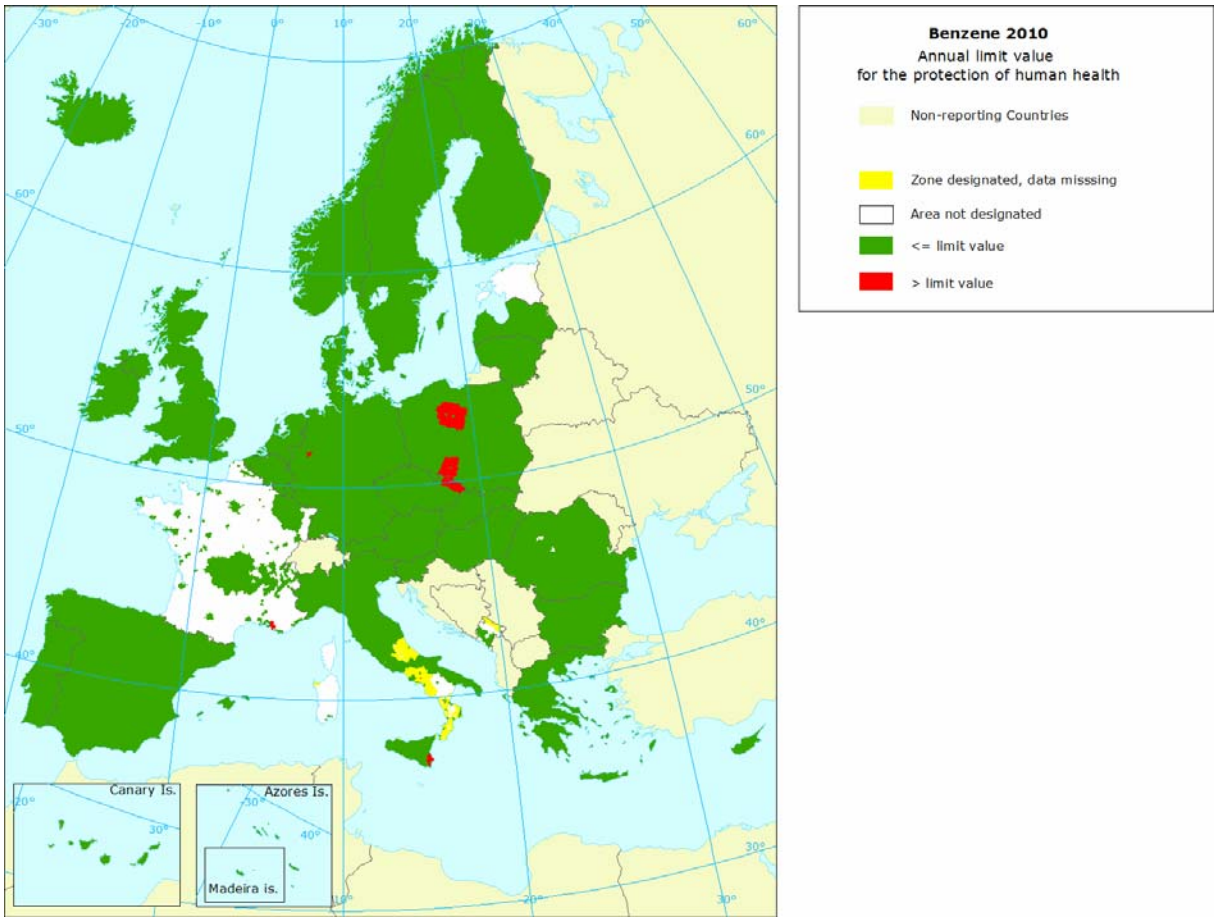

Figure III.8: Zones in exceedance for the annual limit value for benzene in 2010.

The Czech Republic, France, Germany, Italy (2) and Poland (3) reported 8 zones exceeding the limit value of 5 µg/m^3 to be met in 2010; this concerns less than 1.5% of the population in the EU27 (less than 1% of the area).

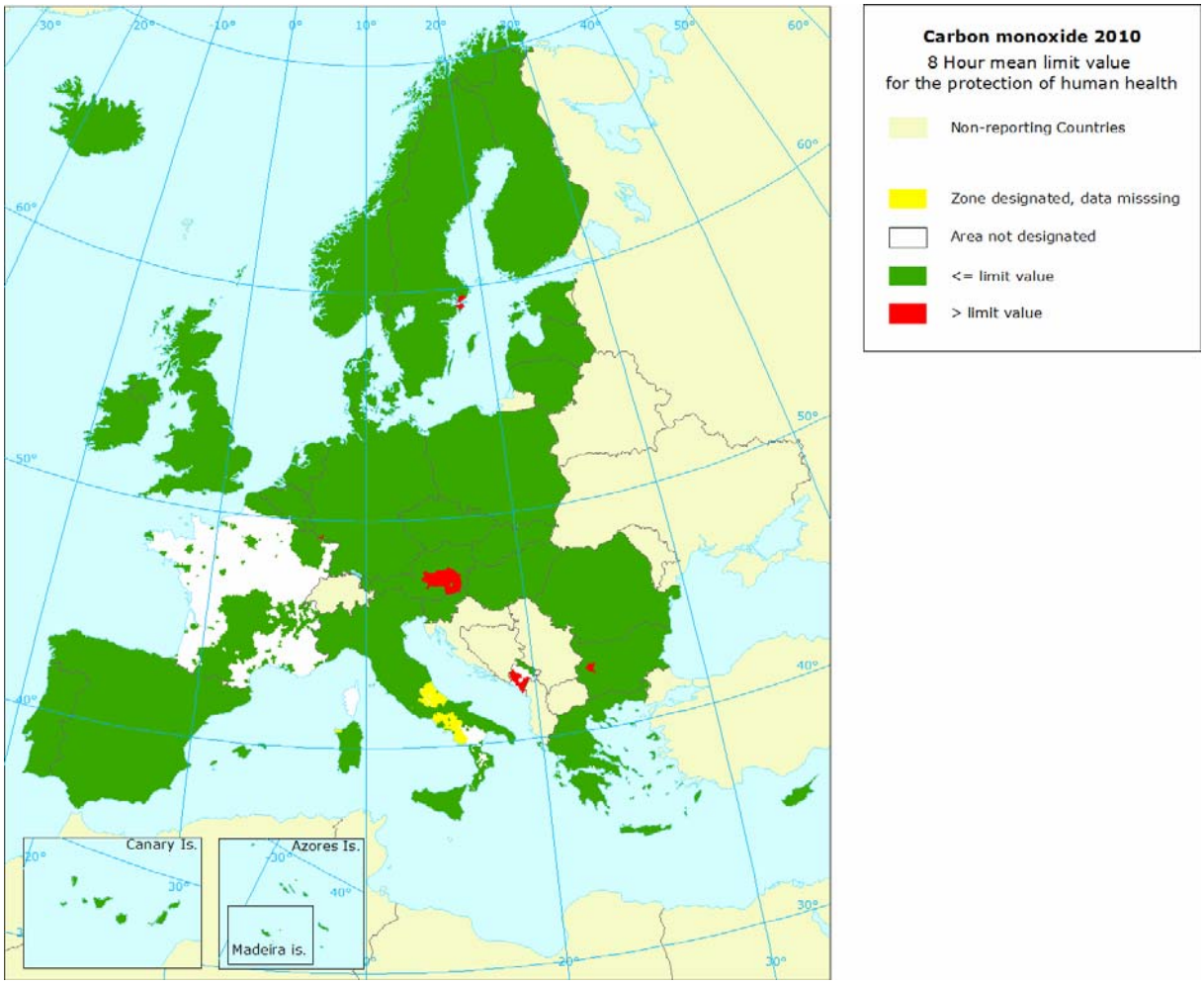

Figure III.9: Zones in exceedance for the annual limit value for CO in 2010.
Information on the situation with respect to CO is incomplete in France and Italy. Exceedance has been reported for zones in Austria, Bulgaria, Germany, Montenegro and Sweden (all 1 zone).

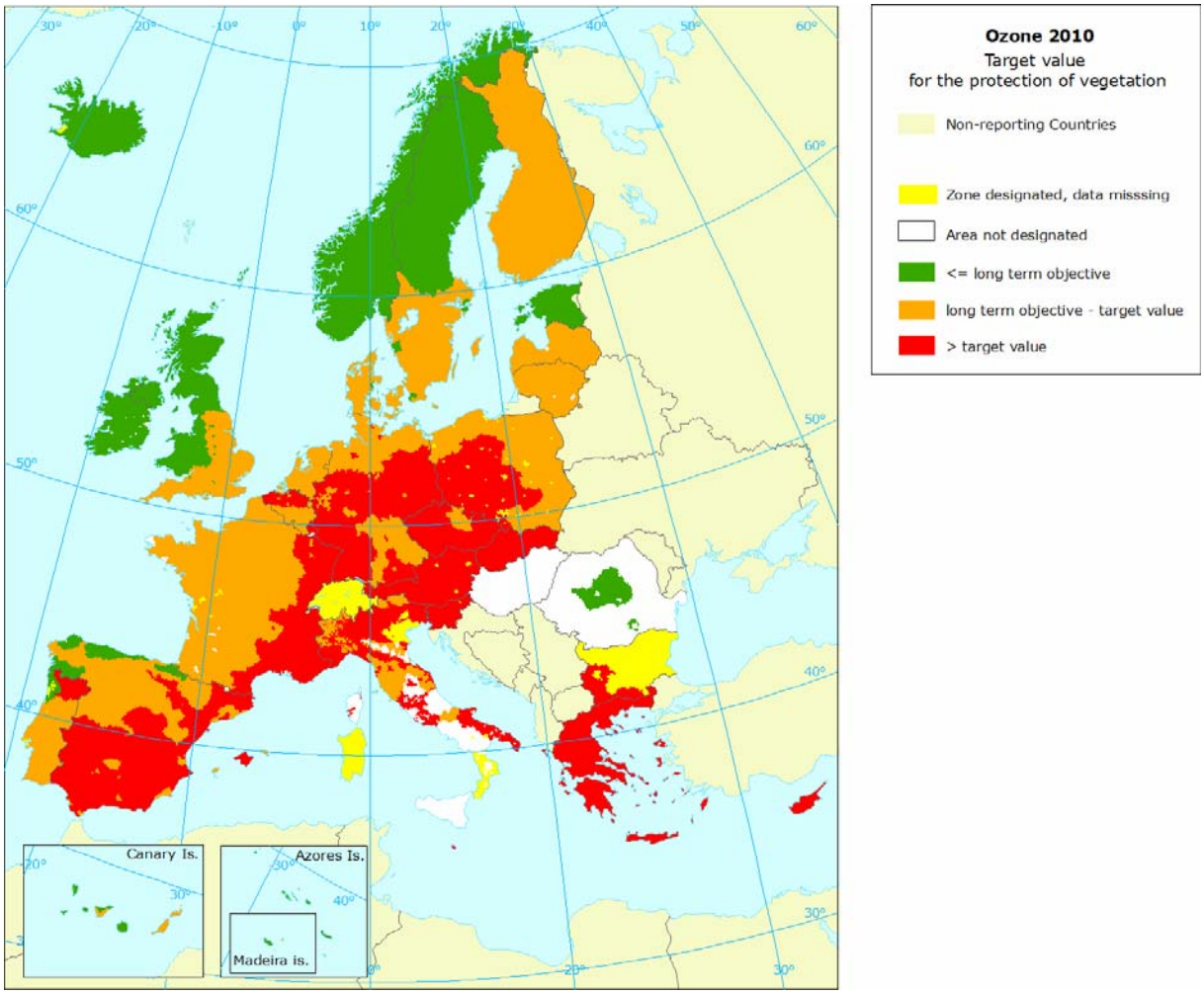

Figure III.10: Zones in exceedance for the vegetation target value for O_3 in 2010.

Most zones in exceedance of TV occur in Spain (51), Italy (50), Germany (38) and France (22). Austria, Cyprus, Czech Republic, Greece, Malta, Slovakia and Slovenia have all or nearly all zones exceeding the TV.

From all the ozone vegetation target value exceedances, 14 zones in Italy, 1 zone in Spain and 1 zone in Slovenia are reported exceedances based on modelled results.

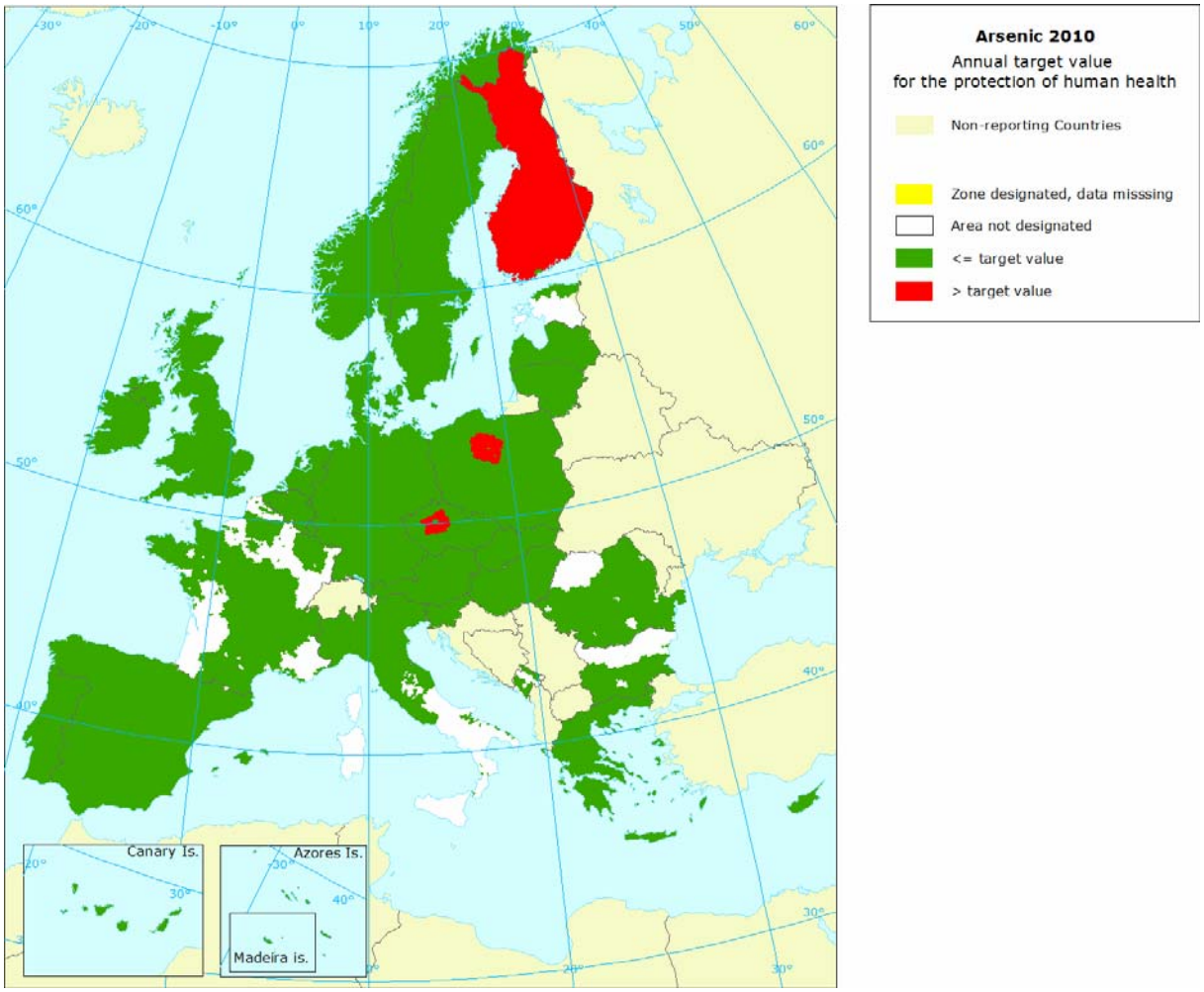

Figure III.11: Zones in exceedance for the target value for arsenic in 2010.

In 6 zones in Belgium, the Czech Republic, Finland, Germany and Poland (2) the target value of arsenic has been exceeded in 2010. Most remarkable is the situation in Finland, where 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.

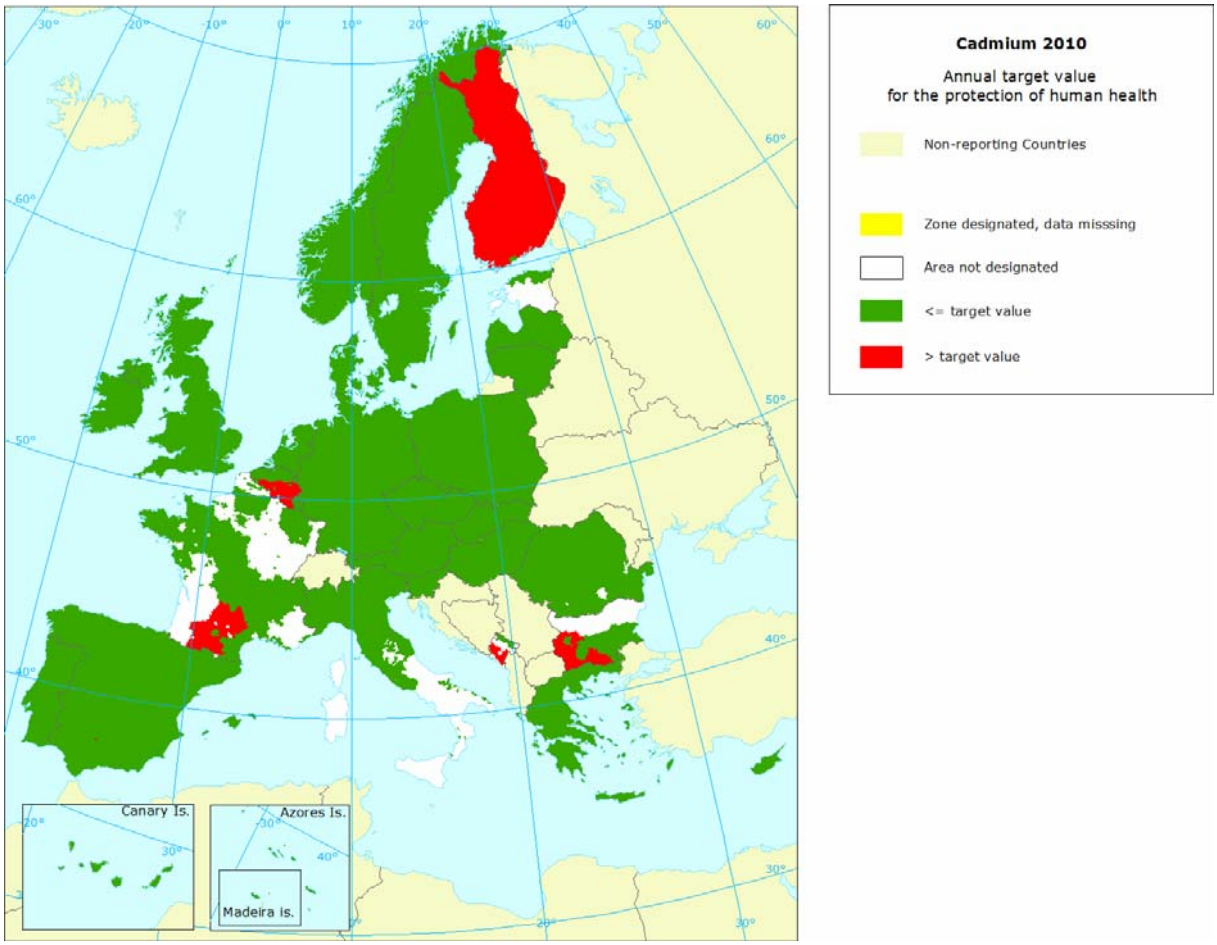

Figure III.12: Zones in exceedance for the target value for cadmium in 2010.

In 8 zones the target value of cadmium has been exceeded in 2010. Belgium and Bulgaria (2), Finland, France, Montenegro and Spain (all 1) reported exceedance of the TV.

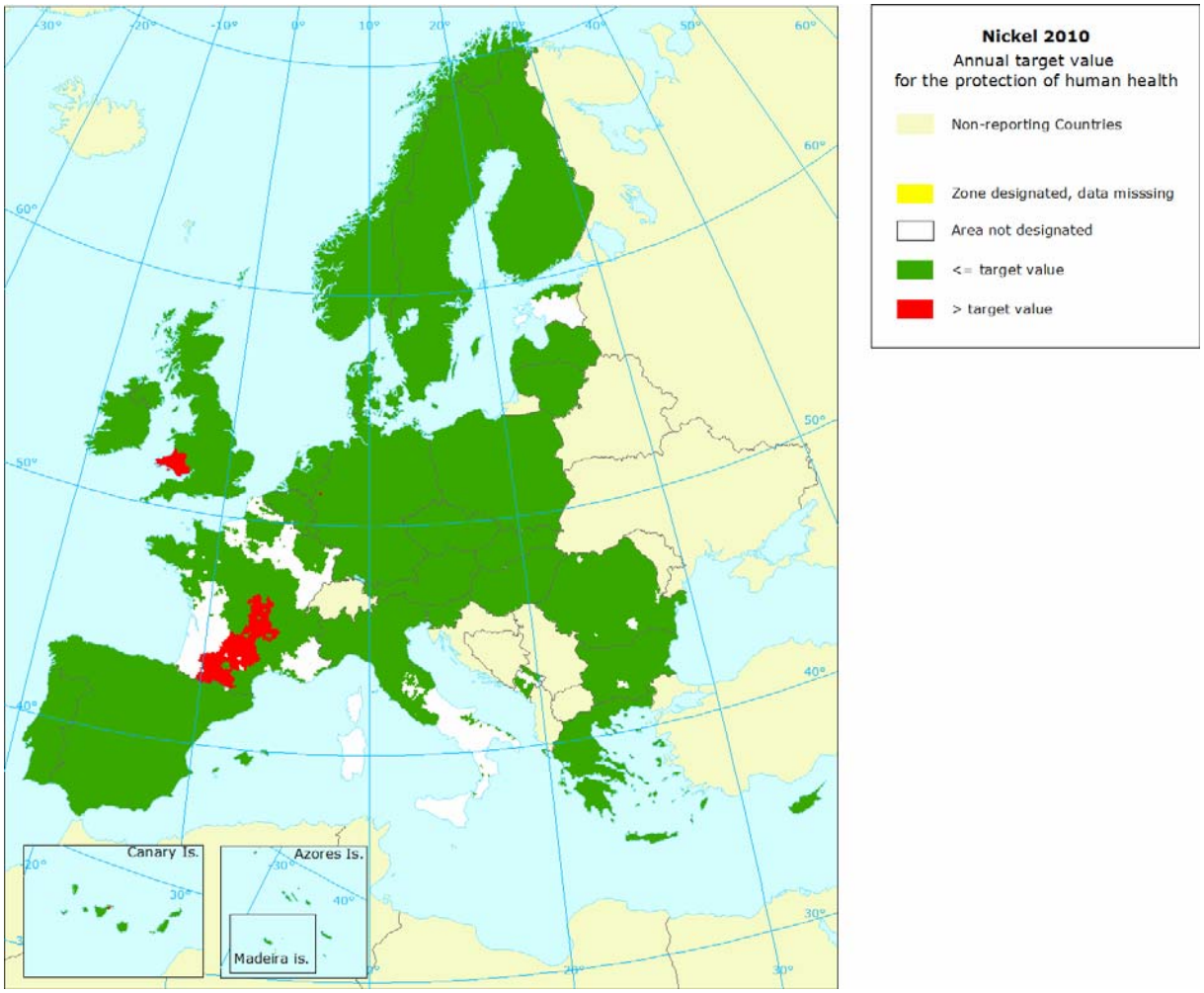

Figure III.13: Zones in exceedance for the target value for nickel in 2010.

In 7 EU27 zones the target value of nickel has been exceeded in 2010. The exceedances are observed in Belgium, Germany, Spain (all 1 zone), United Kingdom and France (2 zones).

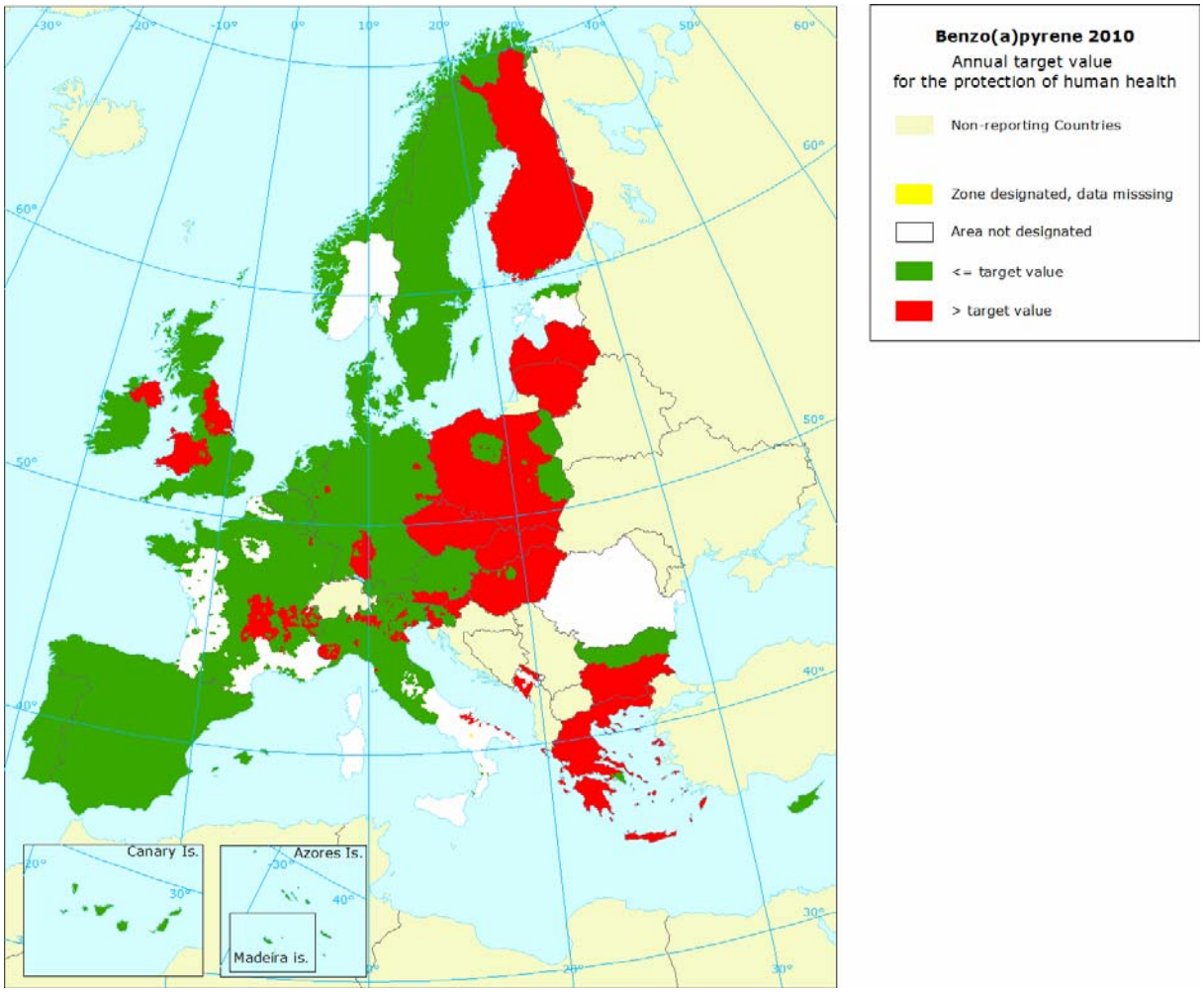

Figure III.14: Zones in exceedance for the annual target value for benzo(a)pyrene in 2010.

In total 110 zones exceed the health target value for B(a)P. In The Czech Republic, Slovakia, Latvia, Lithuania and Montenegro all designated zones exceed the TV. In addition, Finland, Greece, Hungary, Poland and Slovenia have most their designated zones for B(a)P exceeding the TV.

Annex IV. List of zones in relation to AQ standards

This annex presents a summary of air quality status for each pollutant-pollution target combination at the national level.
A full 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 List_of_zones_2010.xls from the ETC/ACC website: http://acm.eionet.europa.eu/reports/docs/AQQlist_of_Zones_2010_ETC_ACM_TP_2012_7.xls
Information extracted from forms 8 and 9.

	SO2 health 1h			SO2 health day			SO2 year			SO2 wntr			NO2-h				NO2-y				NOx-y		
MS	undef	<LV	>LV	undef	<LV	>LV	undef	<LV	>LV	undef	<LV	>LV	undef	<LV	LV - MOT	>MOT	undef	<LV	LV - MOT	>MOT	undef	<LV	>LV
AT	0	11	0	0	11	0	0	8	0	0	8	0	0	11	0	0	0	2	9	0	0	7	1
BE	0	12	0	0	12	0	0	0	0	0	0	0	0	11	0	0	0	8	3	0	0	0	0
BG	0	4	2	0	5	1	0	1	0	0	1	0	0	4	2	0	0	4	2	0	0	1	0
CY	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0
CZ	0	15	0	0	15	0	0	15	0	0	14	1	0	14	1	0	0	11	4	0	0	15	0
DE	0	81	0	0	81	0	0	15	0	0	15	0	0	82	5	0	0	28	59	0	0	15	0
DK	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	0	0	2	1	0	0	1	0
EE	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	0	4	0	0	0	4	0
ES	0	132	0	0	132	0	0	33	0	0	33	0	0	133	1	0	0	125	9	0	0	34	0
FI	0	14	0	0	14	0	0	1	0	0	1	0	0	14	0	0	0	13	1	0	0	1	0
FR	0	69	0	0	69	0	4	16	0	6	14	0	0	70	3	0	0	48	25	0	5	20	0
GB	0	44	0	0	44	0	0	15	0	0	15	0	0	41	3	0	0	3	41	0	0	15	0
GR	0	4	0	0	4	0	0	2	0	0	2	0	0	4	0	0	0	3	1	0	0	2	0
HU	0	10	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	8	2	0	0	0	0
IE	0	4	0	0	4	0	0	1	0	0	1	0	0	4	0	0	0	4	0	0	0	1	0
IT	10	123	0	10	123	0	0	9	0	0	9	0	7	124	4	0	7	81	47	0	1	7	4
LT	0	3	0	0	3	0	0	1	0	0	1	0	0	3	0	0	0	3	0	0	0	0	0
LU	0	3	0	0	3	0	0	1	0	0	1	0	0	3	0	0	0	2	1	0	0	1	0
LV	0	2	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	1	1	0	0	0	0
MT	0	2	0	0	2	0	0	1	0	0	1	0	0	2	0	0	0	2	0	0	0	1	0
NL	0	9	0	0	9	0	0	1	0	0	1	0	0	9	0	0	0	0	9	0	0	1	0
PL	0	46	0	0	45	1	0	16	0	0	16	0	0	46	0	0	0	43	3	0	0	16	0
PT	0	20	0	0	20	0	0	7	0	0	7	0	0	19	1	0	0	17	3	0	0	5	0
RO	0	20	1	0	20	1	0	3	0	0	3	0	0	20	1	0	0	19	2	0	0	4	0
SE	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	0	2	4	0	0	6	0
SI	0	9	0	0	9	0	0	7	0	0	7	0	0	6	0	0	0	6	0	0	0	4	0
SK	0	10	0	0	10	0	0	10	0	0	10	0	0	10	0	0	0	8	2	0	0	10	0
EU27	10	661	3	10	661	3	4	177	0	6	174	1	7	656	21	0	7	448	229	0	6	172	5
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IS	0	2	0	0	2	0	0	2	0	0	2	0	0	2	1	0	0	3	0	0	0	0	0
ME	0	1	0	0	2	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0
NO	0	6	1	0	6	1	0	6	1	0	6	1	0	4	3	0	0	3	4	0	0	2	5
total	10	670	4	10	671	4	4	185	1	6	182	2	7	663	26	0	7	456	233	0	6	174	10

	PM10-d			PM10-y			Lead			Benzene				CO		
MS	undef	<LV	>LV	undef	<LV	>LV	undef	<LV	>LV	undef	<LV	LV - MOT	>MOT	undef	<LV	>LV
AT	0	1	10	0	11	0	0	11	0	0	11	0	0	0	10	1
BE	0	4	7	0	11	0	0	11	0	0	7	0	0	0	7	0
BG	0	0	6	0	0	6	0	3	1	0	6	0	0	0	5	1
CY	0	0	1	0	0	1	0	1	0	0	1	0	0	0	1	0
CZ	0	1	14	0	12	3	0	15	0	0	14	1	0	0	15	0
DE	0	60	25	1	82	2	0	74	0	0	85	1	0	0	85	1
DK	0	3	0	0	3	0	0	3	0	0	3	0	0	0	3	0
EE	0	4	0	0	4	0	0	2	0	0	2	0	0	0	4	0
ES	0	118	17	0	134	1	0	81	0	0	122	0	0	0	131	0
FI	0	14	0	0	14	0	0	14	0	0	3	0	0	0	14	0
FR	0	56	16	0	68	4	0	39	0	0	43	1	0	0	41	0
GB	0	42	2	0	43	1	0	44	0	0	44	0	0	0	44	0
GR	0	1	3	0	1	3	0	4	0	0	4	0	0	0	4	0
HU	0	1	9	0	9	1	0	10	0	0	10	0	0	0	10	0
IE	0	4	0	0	4	0	0	4	0	0	4	0	0	0	4	0
IT	6	74	54	7	116	11	0	109	0	10	120	2	0	8	127	0
LT	0	0	3	0	3	0	0	3	0	0	3	0	0	0	3	0
LU	0	3	0	0	3	0	0	3	0	0	1	0	0	0	1	0
LV	0	1	1	0	1	1	0	2	0	0	2	0	0	0	2	0
MT	0	0	2	0	1	1	0	2	0	0	2	0	0	0	2	0
NL	0	3	6	0	8	1	0	9	0	0	9	0	0	0	9	0
PL	0	4	42	0	25	21	0	46	0	0	43	3	0	0	46	0
PT	0	23	2	0	25	0	0	1	0	0	1	0	0	0	1	0
RO	0	17	4	0	19	2	0	18	1	0	18	0	0	0	21	0
SE	0	3	3	0	6	0	0	6	0	0	6	0	0	0	5	1
SI	0	1	5	0	6	0	0	7	0	0	6	0	0	0	6	0
SK	0	0	10	0	6	4	0	2	0	0	10	0	0	0	10	0
EU27	6	438	242	8	615	63	0	524	2	10	580	8	0	8	611	4
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IS	0	2	1	0	2	1	2	0	0	0	2	0	0	0	2	0
ME	0	0	2	0	0	2	0	2	0	1	1	0	0	0	1	1
NO	0	4	2	0	6	0	0	0	0	0	7	0	0	0	7	0
total	6	444	247	8	623	66	2	526	2	11	590	8	0	8	621	5

	O3-H				O3-V				PM2.5 limit value				As			Cd			NI			B(a)P		
MS	undef	<LTO	LTO - TV	>TV	undef	<LTO	LTO - TV	>TV	undef	<LV	LV - MOT	>MOT	undef	<TV	>TV	undef	<TV	>TV	undef	<TV	>TV	undef	<TV	>TV
AT	0	0	2	9	3	0	0	8	2	9	0	0	0	11	0	0	11	0	0	11	0	0	9	2
BE	0	0	6	0	0	0	5	1	0	11	0	0	0	9	1	0	8	2	0	9	1	0	7	0
BG	0	0	3	3	5	0	0	1	0	2	0	4	0	4	0	0	2	2	0	5	0	0	2	4
CY	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0
CZ	0	3	3	9	0	0	2	13	0	11	3	1	0	14	1	0	15	0	0	15	0	0	0	15
DE	0	0	53	13	0	0	28	38	1	76	1	0	0	69	1	0	70	0	0	69	1	0	66	6
DK	0	0	3	0	0	1	2	0	0	3	0	0	0	3	0	0	3	0	0	3	0	0	3	0
EE	0	4	0	0	0	4	0	0	0	4	0	0	0	2	0	0	2	0	0	2	0	0	2	0
ES	0	3	89	43	0	28	56	51	0	135	0	0	0	76	0	0	75	1	0	75	1	0	76	0
FI	0	0	2	0	0	0	2	0	0	14	0	0	0	1	1	0	1	1	0	2	0	0	1	1
FR	0	6	44	24	1	6	41	22	18	50	2	0	0	48	0	0	46	1	0	46	2	0	50	4
GB	0	2	42	0	0	37	7	0	0	44	0	0	0	44	0	0	44	0	0	42	2	0	36	8
GR	0	0	0	4	0	0	0	4	0	2	0	0	0	4	0	0	4	0	0	4	0	0	1	3
HU	0	0	4	6	0	0	0	0	0	4	0	1	0	10	0	0	10	0	0	10	0	0	3	7
IE	0	0	4	0	0	1	0	0	1	3	0	0	0	4	0	0	4	0	0	4	0	0	4	0
IT	2	12	18	87	17	0	20	50	116	11	6	0	0	99	0	0	99	0	0	99	0	1	91	8
LT	0	0	3	0	0	0	1	0	0	3	0	0	0	3	0	0	3	0	0	3	0	0	0	3
LU	0	0	2	1	0	0	0	1	0	3	0	0	0	3	0	0	3	0	0	3	0	0	3	0
LV	0	0	2	0	0	0	1	0	0	1	1	0	0	2	0	0	2	0	0	2	0	0	0	2
MT	0	0	1	1	0	0	0	1	2	0	0	0	0	2	0	0	2	0	0	2	0	0	1	0
NL	0	0	9	0	0	0	9	0	0	9	0	0	0	9	0	0	9	0	0	9	0	0	9	0
PL	0	5	36	5	30	0	8	8	0	18	12	16	0	44	2	0	46	0	0	46	0	0	8	38
PT	0	0	16	3	9	4	5	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0
RO	0	8	13	0	0	2	0	0	18	0	0	0	0	9	0	0	16	0	0	15	0	0	0	0
SE	0	0	6	0	0	4	2	0	0	6	0	0	0	6	0	0	6	0	0	6	0	0	6	0
SI	0	0	4	2	0	0	1	5	0	6	0	0	0	7	0	0	7	0	0	7	0	0	1	5
SK	0	0	0	2	0	0	0	2	9	0	0	0	0	2	0	0	2	0	0	2	0	0	0	2
EU27	2	43	365	213	65	87	190	207	167	427	25	22	0	487	6	0	492	7	0	493	7	1	381	108
CH	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IS	0	2	0	0	1	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ME	0	2	0	0	2	0	0	0	2	0	0	0	0	2	0	0	1	1	0	2	0	0	0	2
NO	0	6	1	0	0	7	0	0	0	6	0	0	0	7	0	0	7	0	0	7	0	0	6	0