

EUROPEAN TOPIC CENTRE ON AIR QUALITY

RIVM NILU NOA DNMI



EUROPEAN AIR QUALITY IN 1998

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FINAL REPORT

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Preface

The European Community (EC) Exchange of Information Decision on ambient air pollution 97/101/EC is a revision of earlier Decisions 75/441/EEC and 82/459/EEC for mutual information of the Member States and the Commission. The latest decision is designed to provide background information relevant to monitoring and reporting under the EC Air Quality Directives.

The European Environment Agency (EEA) was asked by the Commission to implement and operate the information system for the Decision, and to prepare annual reports on the submission of data and information, and on the air quality in Europe on the basis of this information. Pilot reports on 1996 and 1997 data and information were presented to Member States and Commission for comments and feedback. The present report provides a presentation of the data for 1998. The report was prepared by the European Topic Centre on Air Quality (ETC/AQ) and the Phare Topic Link on Air Quality (PTL/AQ) in collaboration.

While this report is a summary of the data and information, all information as contained in the European air quality database AIRBASE is accessible in full detail on the Internet (<http://etc-acc.eionet.eu.int/databases/airbase.html>) This report and the AIRBASE internet access facility can be seen as steps forward in a process to facilitate improving accessibility of air quality information.

Essential to this process is intensive interaction with the European countries, both with experts managing and running monitoring and information systems and reporting data, and with those that use the information in support of air quality management. This interaction has been taking place in EC meetings - Air Quality Steering Group, Exchange of Information Expert Group and Working Group- and in EEA meetings, particularly in the series of EIONET Air Quality workshops. EIONET is the Environmental Information and Observation Network co-ordinated by EEA. These meetings have been complemented by numerous formal and informal contacts between national experts and EEA and its European Topic Centre on Air Quality, where the compilation of information provided under the decision was mainly carried out.

Major ongoing developments in the EoI information system include:
Establishment of the European air quality database AIRBASE, where quality assured data is combined with information on networks and stations
Making available and further developing an Air Quality Data Exchange Module allowing countries to update network and station information and to transmit data which is checked and inserted in AIRBASE and assigned to the proper monitoring station
Providing public access through the Internet to all information in AIRBASE.

EEA has, in close collaboration with 31 European countries, developed EUROAIRNET, a European air quality monitoring network selected from existing stations in each country with sufficient coverage and quality and relatively short reporting cycles to satisfy the information needs of EEA and its clients. The formulation of explicit monitoring goals and criteria for representativeness and

quality for this network and the subsequent site selection with each country have been recognized as useful to the EoI framework and the revision of the Decision which is now underway.

The enlargement of EU provides a valuable opportunity to extend the current exchange to a wider range of European countries. Given the importance of long-range transport for many air pollutants, and the need for accession countries to comply with EU legislation, it is natural to include air quality information from those countries in EoI reporting, as is already the case in the reports also prepared by EEA under the Ozone Directive. Hence, the Phare Topic Link on Air Quality, under funding from the EC Phare-EEA co-operation, prepared the accession country data included in this report.

This extension to pan-Europe enhances the need for harmonization and streamlining of air quality reporting in Europe, in order to avoid unnecessary duplication and reducing the reporting burden by the countries. These now face many reporting obligations and requirements (EC, EEA, UNECE-EMEP, OECD, WMO, WHO....) often with different reporting procedures and deadlines. Recognizing that all international organisations work on the basis of mandates from their member countries, EEA and the Commission are co-operating to increase compatibility and connectivity in reporting procedures and databases, and to collaborate with other international organisations in European air quality reporting.

Good air quality information is an essential basis for air quality management, particularly if air quality can be related to sources and sectors. The success of policies to reduce air pollution levels and related impacts on human health, ecosystems and materials, while ultimately to be evaluated on exactly these reductions, can often be monitored more closely by looking at the trends in emissions. An obvious example is ozone, where precursor emission reductions are much easier to monitor than the trends in ozone concentrations and exceedances of thresholds or guide values, which are subject to large year-to-year variations obscuring the relatively small trends. In line with the Commission's combined proposal for a new Ozone Directive and a National Emission Ceilings Directive, it would be appropriate to present in future versions of this report air quality and air emission trends together and discuss their interrelations.

It is evident that the usefulness of these EoI reports and the information can benefit from better coverage in space and time. An additional challenge is to report available data for those pollutants for which legislation is in preparation. This could be valuable for instance for EC Working Groups preparing position papers for such pollutants.

Finally, EEA highly appreciates receiving comments and suggestions on the present report and the AIRBASE information system, and on ways to meet the challenges as presented in this foreword.

Further documentation on issues referred to in this foreword is available at the EEA web site www.eea.eu.int

Executive Summary

This report is based on air quality data for the year 1998 transmitted by countries in the framework of the 'Exchange of Information' Council Decision (97/101/EC). According to Article 5.7 of this Decision, a general report is to be prepared for the public, summarising the collected data and outlining the underlying trends in air quality in the European Union. This report presents summarised air quality data, supplemented by maps showing the location of the monitoring stations and the concentrations measured within selected ranges. The report also presents concentration time trends for SO₂, NO₂ and O₃; for these pollutants the reporting is now extensive enough for a first trend analysis.

1998 Air Quality

The available air quality data have been compared with the limit values and guide values in the EU air quality Directives which were in force in 1998 for SO₂, TSP, Black Smoke, NO₂ and ozone, and also the new Directives for SO₂, NO₂, PM₁₀, Pb, CO, Benzene and Ozone, which shall be complied with by 2005 or 2010.

Comparison with the EU limit and guide values presently in force:

For all these compounds, there are stations in many countries with concentrations exceeding the limit and guide values, both in EU countries and in non-EU countries. The *limit* values are exceeded at few stations only. At the most exposed stations, concentrations are up to 50-100 % above the limit values. The *guide* values for SO₂, Black Smoke and NO₂ are exceeded to a much larger extent (eg. at many stations), with concentrations up to 2-4 times higher than the guide values.

For ozone, the *1-hour population warning* value was exceeded at one station, while the *1-hour population information* value was exceeded at many stations in most countries. The highest concentration was more than two times the population information level. The *health protection* threshold value was exceeded at most stations; with the highest value about three times the protection value. The *vegetation protection* level was also exceeded at many stations in most countries.

Comparison with limit values in the new Directives:

In general these limit values are stricter than those presently in force, and consequently concentrations measured in 1998 were above these limits at more stations and on more occasions.

Benzene is reported only for 14 stations in two countries, an exceedance overview is not included here (see details in section 3.7).

Compound	Limit value (year of compliance)	Exceedance, all countries, at:	Exceedance, Member States, at:
SO ₂	daily average (2005)	16 stations in 7 countries	3 stations in 3 M.S.
	hourly average (2005)	3 stations in 3 countries	2 stations in 2 countries
NO ₂	annual average (2005)	274 stations in 11 countries	27 stations in 8 M.S.
	hourly (2005)	about 39 stations in 5 countries	about 39 stations in 5 M.S.
PM ₁₀	annual average (2005)	20 stations in 6 countries	10 stations in 3 M.S.
	daily average (2005)	1)	1)
	annual average (2010)	most urban and some rural stations in most of 10 countries	
	daily average (2010)	most stations in most of 10 countries	
O ₃	8-hour daily max (2010)	about 310 stations in 12 countries reported more than 25 exceedances	260 stations in 7 M.S.
	AOT40	<i>not evaluated</i>	<i>not evaluated</i>
CO	8-hour average (2005)	a few stations in 3 countries	a few stations in 2 EU M.S.

1) There is exceedance at many stations, but an exact number cannot be given, since the necessary statistic was not available from AIRBASE.

Changes in Air Quality during the last years

Data in the EoI database AIRBASE has become rather fragmented during the period of voluntary data transmissions. AIRBASE now contains, however, relatively long time series for some compounds from a number of stations in several countries. This has allowed a first analysis of air quality tendencies to be made for SO₂ and NO₂. There is a strong downward tendency in SO₂, consistent with trends in sulphur emissions data. For NO₂, there has been a small downward tendency in the first half of the 1990s, but since then NO₂ concentrations in example cities in the EU area have been rather unchanged, which is also consistent with NO_x emissions data.

A larger set of data is needed for trend analysis and to be representative of the EU area, or of Europe as a whole. It is recommended that those Member States which have not done so, transmit data for the years between 1989 in accordance with Article 5.4 of Decision 97/101/EC1996 to enable a more complete trend analysis.

The 1998 dataset

Information on the reporting of 1998 air quality data and meta information under Decision 97/101/EC is reported in a companion report 'European air quality and monitoring information in 1998' (Sluyter et al, 2001). About 5600 time series were

reported by 22 European countries including 12 EU Member States. All countries except one used the Air Quality Data Exchange Module (DEM) provided by EEA.

A two-step data validation procedure was carried out by ETC/AQ, using the objective EoI requirements for time coverage of the data as well as manual checking of calculated statistics. This resulted in the exclusion of some 750 time series from further presentation and analysis in this report. In total 4 821 component-station combinations from 19 European countries, 4 361 of which from 10 EU Member States, were accepted after data validation. Most data is available for SO₂ (1 098 stations, including 977 in EU) and NO₂ (1 075 stations, including 986 in EU). PM₁₀ data is available from 237 stations, 173 in EU.

The amount of data provided under the Decision, after a very significant increase from 1996 to 1997, continued to increase in 1998: the database contains 33 % more annual time series for EU countries than in 1997. The increase in reporting from 1997 to 1998 is mainly due to Italy and Spain reporting data in 1998. A few countries reporting 1997 data did not report 1998 data. Data from France could not be processed by ETC/AQ for inclusion in the report since it was provided in a different format which has not yet been processed by ETC/AQ.

In the preamble of Decision 97/101/EC it is stated that the information collected should be sufficiently representative to enable pollution levels to be mapped throughout the European Union. Although reporting has improved significantly, no validated 1998 data is available in AIRBASE from 5 EU Member States. For the 10 Member States reporting, the data included most of the larger cities and also many rural stations. When all EU Member States would report with similar coverage, the spatial coverage would be sufficient for a first assessment of the pollution and exposure situation of SO₂ and NO₂ in the EU. However, for PM₁₀, ozone and other compounds, spatial coverage of the stations as currently reported under EoI is insufficient. All countries are invited to report in accordance with Articles 3 and 5 of the Decision and to consider extension of their station selection, also with a view to the station selection for EUROAIRNET.

For proper assessment of air quality, characterisation of the stations' emission environment is essential. However, information of this kind also remains incomplete: on average this information was not reported for close to 20 % of the component-station combinations. Countries are invited to complete the meta data input and classification of their stations.

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EUROPEAN AIR QUALITY IN 1998

1 Introduction

EU countries have a long tradition of exchanging air quality data. The reciprocal exchange between countries and the Commission is based on a series of Council Decisions. The latest Decision (97/101/EC 'establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States', in short 'EoI') was adopted by the European Council in 1997.

According to Article 1.2 of Decision 97/101/EC, the Commission will call upon the European Environment Agency (EEA) as regards the operation and practical implementation of the EoI information system. The European Topic Centre on Air Quality (ETC/AQ), under contract to EEA, is managing the database system AIRBASE. The information submitted under EoI is stored in AIRBASE and is made publicly available on the Internet:

<http://etc-acc.eionet.eu.int/databases/airbase.html>.

According to Article 5.7 of Decision 97/101/EC, the Commission is to prepare annually a general report for the public, summarising the data collected and outlining the general trends in air quality European Union. For 1996 data, ETC/AQ produced a pilot version of this report, with the aim to present such a report to Member States and receive feedback on structure and contents. A full report based on the 1997 data was presented in February 2000 at the Air Quality Steering Group with a format based upon the pilot report and feedback and comments received from the EU Member States.

The present report presents in a similar form summaries of data available for the year 1998. A new chapter 2 has been added, showing an overview of the data, main changes from the previous year, and comments on the data validation procedure.

Also, the number of countries and stations with data reported for five or more years is now large enough for a first trend analysis of air quality in Europe to be made. In this report, examples for SO₂, NO₂ and ozone are shown (chapter 4).

Iceland, Liechtenstein, Norway, Switzerland and Phare countries exchange air quality information in the framework of EEA's EUROAIRNET according to a set of criteria for site selection and using the same reporting procedures as EU Member States. In order to improve on coverage at the European level, air quality data from these countries was included in these reports, where made available and accepted after validation.

Information in this report relates to data received by December 1999, covering the reporting of 1998 data. For some cases, data received after December 1999 could also become included. For technical information on the data transmitted, refer to

the report 'European air quality and monitoring information in 1998' (Sluyter et al, 2000).

The minimum requirements for temporal data coverage lead to the exclusion of some stations. This is for instance the case for stations operating only during the winter half-year, as is the case e.g. for some stations in Sweden and Norway. Further validation procedures may lead to additional time series not being accepted.

Throughout this report, presented air quality data is grouped by the following 'station types': rural, urban (background) and street. This classification was based on station meta information available from AIRBASE. Stations that could not be classified are summarised under the heading 'other' or 'undefined'.

Results are summarised in tables and on maps. In some cases, due to current map formats and scales, the level of pollution in cities are not shown clearly, especially for cities situated closely together. The maps presented in this report are intended to give a visual indication of the extent of air pollution problems at the scale of countries and regions in Europe, as this appears from the reported data. In later reports it will be considered to improve these maps. It is also noted that the coordinates are not reported correctly for all stations. As a result, station locations on the map may be slightly different from their real location. This is especially visible where stations appear to be located offshore. National experts are asked to scrutinise their station coordinates, and correct these through future reports using their DEM.

Although data reported in the framework of Decision 97/101/EC should not, and will not, be used in this report to assess compliance of countries with limit, guide and threshold values set in specific air quality Directives, these values will be used for reference in general terms where appropriate, while describing the pollution concentrations reported.

2 Data and data validation

Information on the reporting of 1998 air quality data and meta information under Decision 97/101/EC is reported in a companion report 'European air quality and monitoring information in 1998' (Sluyter et al, 2000). About 5600 time series were reported by 22 European countries including 12 EU Member States, covering mainly SO₂, NO/NO₂, Total Suspended Particles (TSP)/Black Smoke/ PM₁₀, Pb, CO and O₃. Other compounds are reported only to a small extent (see next page). All countries except one used the Data Exchange Module (DEM). All countries except for Italy reported raw data (annual, or in some few cases, winter time series of data based on hourly or daily average concentrations).

In addition to this, France reported an extensive amount of time series for a number of components. The new ISO-7168 (revised) 'extended' file format was used for the exchange. Unfortunately, at the time of processing the data and writing this report, no software was available at the ETC/AQ to process the French files. Moreover, the data files deviated from the ISO standard. ETC/AQ has developed an ISO-7168 import module in the Data Exchange Module version 3, so it is to be expected that French data can be processed in the future. Corrected 1998 French data files will be processed and documented in next year's EoI report.

Processing and validation of data reported to AIRBASE in preparation of the present report, however, revealed errors in some of the time series, which resulted in non-acceptance of some of them.

Validation of the data series is carried out first and foremost by the data providers, first at the network level, then at the level of the central data provider for each country, at least as part of the process when loading the data into the DEM).

Additional validation of the data series is carried out by ETC/AQ, on the basis of requirements set for data in the EoI Decision, as well as by checking data statistics for obvious mistakes and/or unexplainable or seemingly suspect results. The following two-step procedure was used:

- The data series are checked automatically for time coverage: series which do not fulfil the time coverage requirements of the EoI, are not included in the presentations in this report.
- The statistics tables printed out from the AIRBASE statistics calculation routines are checked manually for results that subjectively seem unexplainable or suspect, or obviously reflect errors in the raw data or result from other reasons.

Examples of errors found in checking the 1998 data:

- Statistics values (average, 98-percentile, maximum) which were reported 0 (zero) or negative.
- Some extremely high values (e.g. several 1000 µg/m³, for pollutants other than CO), which were re-checked and not accepted.

Such errors may originate either from errors in the raw data, or during the process of transferring data via DEM to AIRBASE. The process for the 1998 EoI data resulted in the need to re-programme certain parts of the statistics calculation module of AIRBASE to handle reported inconsistencies.

More details of the data validation by ETC/AQ are given in Annex A.

In summary, the results from the data validation process are: In the first validation step, a total of 635 time series were not accepted (most for O₃, NO₂, Strong acidity and SO₂), mostly because the EoI time coverage requirement for calculation of annual averages was not fulfilled. During calculation of 98 percentiles and maximum values, more time series were rejected, because the requirements on time coverage for these statistics are more restrictive. In the second validation step, a total of about 121 additional time series were rejected.

The non-acceptance of some data series due to non-fulfilment of EoI criteria may result in discrepancies between statistics reported here and those found in national reports.

Please note then that the reason for such discrepancies is the strict compliance with the EoI criteria followed when preparing the data background for this report.

Table 1 shows the number of stations per compound for which 1998 data is presented in this report.

The 1998 validated data set covers 19 countries, 10 of which are EU Member States. For comparison, 1997 data covered a total of 21 countries.

The largest data sets are available for the compounds SO₂, PM (PM₁₀, TSP and BS) and NO₂ (more than 1100 stations for EU and non-EU countries together). Ozone is available for 837 stations and CO for 465 stations. Strong acidity and Lead are currently available for only two countries. The total number of 1998 time series in the dataset is 4,361 for EU countries, and 460 for non-EU countries.

Table 2 shows the total amount of data for EU and non-EU countries for 1996, 1997 and 1998. The amount increased very substantially from 1996 and 1997. For 1998 the number of time series for the EU countries continued to increase (33 % more time series), while it decreased somewhat (17 %) from non-EU countries.

In addition to these main compounds, some data on other compounds were also report:

Benzene:	14 stations in 2 countries (Belgium and the Netherlands).
Heavy metals (Cd, Ni, As, Cr, Mn):	Up to 43 stations in up to 3 countries (Belgium, Denmark, Bulgaria).
Toluene:	4 stations in the Netherlands
Ammonia:	17 stations in the Netherlands and Bulgaria
H ₂ S:	2 stations in Slovenia
T-VOC and CH ₄ :	Up to 32 stations in Spain
NM-VOC:	3 stations in Bulgaria
S deposition:	1 station in UK

The spatial and time coverage of these data is very small, and can in no way give a representative picture for the EU or Europe. Still, the benzene data have been presented in a separate chapter.

The main changes in the reporting from 1997 to 1998 are:

Italy and Spain reported data for 1998 from a substantial number of stations; for 1997 no data was reported;

Greece, Ireland, Portugal and Switzerland did not report 1998 data, but reported on 1997;

The large increase in number of PM₁₀ stations results from extended reporting from Germany and Spain;

Czech and Slovak Republics reported O₃ from an increased number of stations.

Table 1: Number of stations for which 1998 data was accepted, based on the annual mean statistics (except for O₃, which is based on the 1-hour time series statistics).

	SO ₂	SA	PM ₁₀	TSP	BS	PM ₁₀ , TSP, BS	NO ₂	Pb	CO	O ₃
<i>EU countries</i>										
Austria	145			116		116	132		59	96
Belgium	58	16	14		27	41	33	42	5	20
Denmark	7			5		5	8		4	7
Finland	15		6			6	16		5	11
Germany	417		61	328		389	430			338
Italy	144			98		98	152		202	110
The Netherlands	39		17		14	31	44		21	37
Spain	81		22	61		83	82		67	74
Sweden	9		3			3	7		1	3
United Kingdom	62	164	50		165	215	82		60	69
EU countries	977	180	173	608	206	987	986	42	424	765
<i>Non EU countries</i>										
Bulgaria	10		1	29		30	7	5	8	3
Czech Republic	56		56			56	48		25	31
Estonia	6			1		1	6		1	2
F.Y.R.O.M.	22				25	25				
Hungary	1						1			1
Latvia	2						2			1
Poland	12		7		6	13	14		2	17
Slovak republic	9			7		7	9		5	12
Slovenia	3						2			5
Non-EU countries	121	0	64	37	31	132	89	5	41	72
All countries	1098	180	237	645	237	1119	1075	47	465	837

- 1) Only one of the benzene time series comply with the EoI time coverage requirement (> 50% for calculation of statistics parameters).

Table 2: Number of stations for which data was reported, for 1996, 1997 and 1998 data.

Component	1996 data	1997 data		1998 data	
	No. of stations	No. of countries	No. of stations	No. of countries	No. of stations
<i>EU countries</i>					
Sulphur dioxide	69	9	776	10	977
Strong acidity	23	2	211	2	180
Black smoke	21	5	244	3	206
TSP	29	3	460	5	608
PM ₁₀	-	4	72	7	173
Nitrogen dioxide	40	11	730	10	986
Lead	7	2	51	1	42
Carbon monoxide	32	8	148	9	424
Ozone	30	9	580	10	765
Total, EU countries	251		3272		4361
<i>Non-EU countries</i>					
Sulphur dioxide	4	10	161	9	121
Strong acidity	-	-	-	-	-
Black smoke	-	2	33	2	31
TSP	-	4	33	3	37
PM ₁₀	7	3	73	3	64
Nitrogen dioxide	8	9	135	8	89
Lead	-	-	-	1	5
Carbon monoxide	4	7	58	5	41
Ozone	4	6	61	8	72
Total, non-EU countries	27		554		460
Total, all countries	278		3826		4821

3 Air Quality in 1998

3.1 Sulphur dioxide and strong acidity

3.1.1 Sulphur dioxide

Table 3 presents annual average SO₂ concentrations by country and by station type, Table 4 the 98 percentile of 24-hour average concentrations and Table 5 the maximum observed 24-hour average concentrations. Data is included for 977 stations in 10 EU countries and from 121 stations in 9 non-EU countries.

Maps 1-4 on pages 19-22 show the geographical distribution of stations and selected statistics.

High SO₂ concentrations are still measured in some countries. Comparisons with EU limit and guide values are summarized below.

Comparison with limit values currently in force (EU Directive 80/779/EC)

Limit value, annual average: 80-120 µg/m³:

Exceedance at one station in F.Y.R. of Macedonia (81 µg/m³).
One station in Italy had an annual average of 78 µg/m³.

Limit value, 98 percentile (daily values): 250-350 µg/m³:

No exceedances.

Guide value, annual average: 40-60 µg/m³:

Reported annual average SO₂ concentrations at almost all stations in EU countries are below the lower limit of the EU guide value of 40 µg/m³. Average concentrations above the upper limit of the EU guide value of 60 µg/m³ are reported from some stations in Eastern Europe.

Guide value, maximum daily: 100-150 µg/m³:

Exceedance at many stations both in EU and non-EU countries.

Comparison with limit values under the new Directives (EU Directive 1999/30/EC)

Limit value, maximum daily: 125 $\mu\text{g}/\text{m}^3$, may be exceeded up to 3 days per year (to be complied with by 2005):

The statistics presented here in Table 5 give only the highest daily value in 1998. Evaluating the daily values at the 811 stations reporting hourly or daily SO_2 data, the new limit value was exceeded (i.e. more than 3 days exceeding 125 $\mu\text{g}/\text{m}^3$) at a number of stations as indicated below:

Belgium:	one station; 6 exceedance days
Spain:	one station; 5 exceedance days
UK:	one station; 6 exceedance days
Bulgaria:	one station; 12 exceedance days
Czech Rep.:	five stations; 4 - 7 exceedance days
F.Y.R. of Macedonia:	five stations; 4 - 41 exceedance days
Poland:	two stations; 11-23 exceedance days

There is no *Margin of Tolerance (MOT)* connected to this 24 hour limit value for SO_2 . The starting year for MOT for the other compounds of the 1st Daughter Directive (NO_2 , PM_{10} , Lead) is 1999, the year of the Directive's Entry into force.

Limit value, maximum hourly: 350 $\mu\text{g}/\text{m}^3$, may be exceeded up to 24 hours per year):

3 of the about 710 stations reporting hourly SO_2 data have reported more the 24 hours of exceedance of 350 $\mu\text{g}/\text{m}^3$ in 1998:

- one station in Portugal::	35 exceedance hours
- one station in Bulgaria:	31 exceedance hours
- one station in Spain:	27 exceedance hours

In addition, there are 6 stations with 10-24 exceedance hours, and 53 stations with 1-10 exceedance hours.

Table 3: Average over stations and range in SO₂ annual average concentration (µg/m³) in 1998. Figures between brackets refer to the number of stations

Annual average including range					
Station type Country	Rural	Urban	Street	Other	Non- defined
<i>EU Countries</i>					
Austria	6 1-11(55)	8 4-13(43)	9 4-13(31)	8 5-18(16)	
Belgium	9 4-15(13)	13 6-21(27)	15 9-23(11)	26 15-40(7)	
Denmark	2 1-2(3)		3 2-4(4)		
Finland	2 1-3 (7)		4 3-4(5)	2 2-2(3)	
Germany	6 3-15(23)	8 0-16(78)	8 3-21(98)	9 6-14(11)	7 1-24(207)
Italy	8 6-11(4)	8 1-25(25)	12 1-29(84)	14 3-79(29)	8 7-9(2)
The Netherlands	4 1-12(23)	8 4-17(11)	7 4-14(5)		
Spain	6 3-8(3)	15 5-38(6)	16 4-46(53)	16 10-34(19)	
Sweden	1 0-1(5)	4 3-4(3)	5(1)		
United Kingdom	5 4-9(6)	12 5-34(47)	17 5-40(6)	14 10-16(3)	
<i>Non-EU Countries</i>					
Bulgaria		35 4-72(10)			
Czech republic	10 2-19(19)	16 9-27(34)	13 11-15(2)	15(1)	
Estonia	1 1-2(3)	5(1)	5(1)	9 (1)	
F.Y.R. of Macedonia		23 7-81(11)	21 16-28(7)	22 10-48(4)	
Hungary	8 (1)				
Latvia	1 1-1(2)				
Poland		16 6-40(10)		45 43-47(2)	
Slovak republic		26 21-32(3)	19 17-24(6)		
Slovenia		25 24-27(2)	18(1)		

Table 4: Average over stations and range in 98-Percentile of 24 hour average concentrations, SO₂ (µg/m³) in 1998. Figures between brackets refer to the number of stations

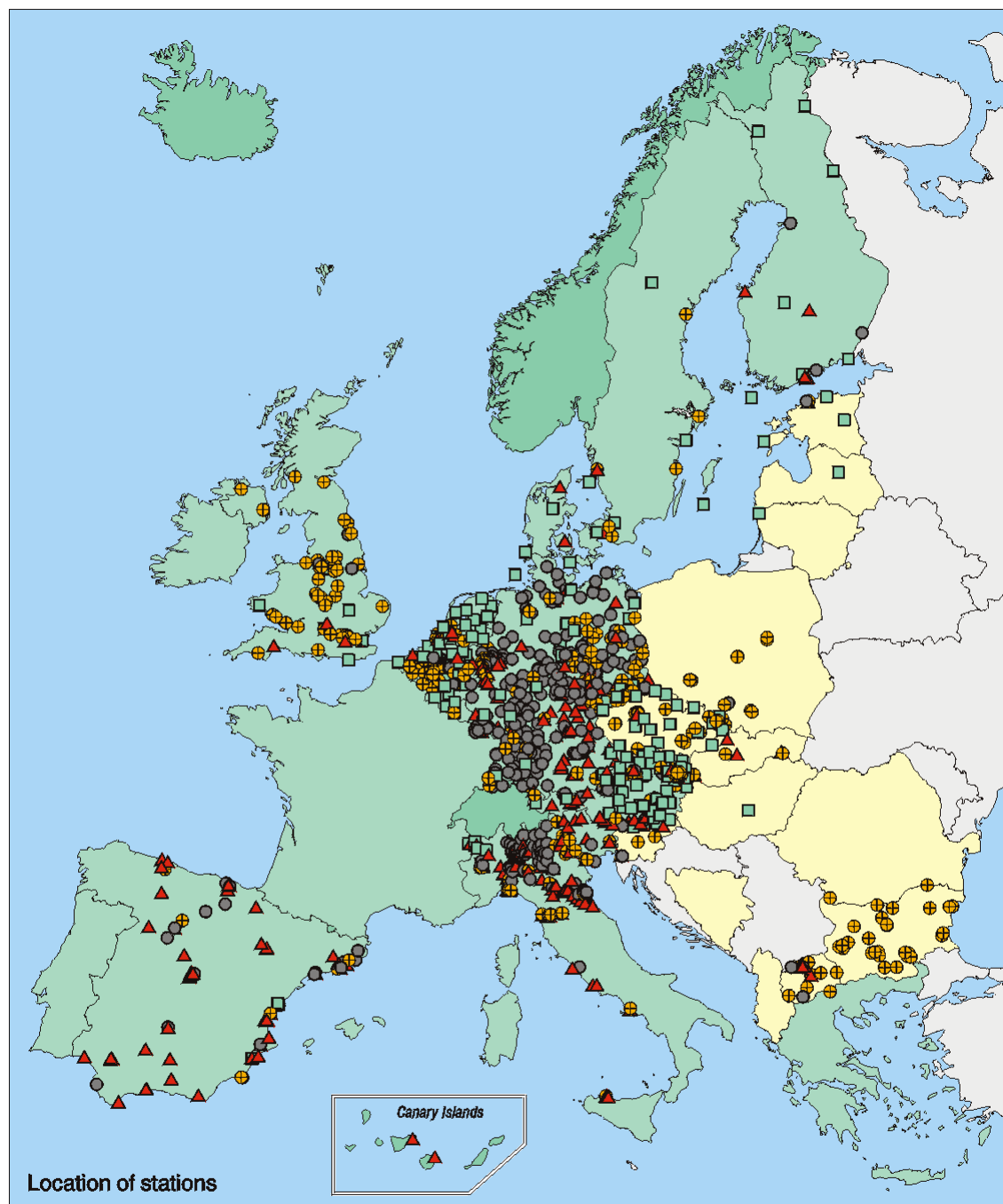
98 Percentile of 24 hour values including range					
Station type Country	Rural	Urban	Street	Other	Non- defined
<i>EU Countries</i>					
Austria	23 7-46(43)	26 14-36(41)	23 10-52(28)	28 13-48(16)	
Belgium	18 10-28(13)	35 12-85(27)	39 28-62(10)	72 36-136(7)	
Denmark	8 6-9(3)		12 10-16(4)		
Finland	10 5-21(3)		15 11-23(5)	11 9-13(3)	
Germany	24 7-72(23)	30 9-86(76)	27 7-73(98)	30 19-49(11)	24 3-103(202)
Italy	21 14-30(4)	23 4-72(22)	34 2-80(78)	38 11-178(23)	31 10-59(42)
The Netherlands	13 5-38(20)	29 13-54(10)	22 10-47(4)		
Spain	15 5-20(3)	23 10-65(4)	39 8-107(50)	38 20-84(15)	
Sweden	5 1-10(5)	13 10-14(2)			
United Kingdom	22 12-42(6)	40 12-147(43)	47 14-123(5)	48 40-57(3)	
<i>Non-EU Countries</i>					
Bulgaria		180 146-239(3)			
Czech republic	40 14-85(19)	62 31-114(34)	50 43-56(2)	53(1)	
Estonia	7 3-10(2)	24(1)	14(1)	29(1)	
FYROM		80 21-189(10)	88 59-118(6)	75 34-159(4)	
Hungary	34(1)				
Latvia	6 5-7(2)				
Poland		57 28-157(10)		153 136-169(2)	
Slovak Republic		72 56-86(3)	55 43-70(6)		
Slovenia		93 89-96(2)	49(1)		

Table 5: Average over stations and range in maximum observed 24 hourly SO₂ concentrations (µg/m³) in 1998. Figures between brackets refer to the number of stations included

Maximum 24 hour values including range					
Station type Country	Rural	Urban	Street	Other	Non-defined
<i>EU Countries</i>					
Austria	38 8-76(43)	41 18-66(41)	36 11-84(28)	45 16-82(16)	
Belgium	31 14-60(13)	53 20-125(27)	60 41-90(10)	118 51-245(7)	
Denmark	14 8-17(3)		24 13-43(4)		
Finland	24 12-61(7)		25 17-28(5)	20 16-25(3)	
Germany	51 10-196(23)	54 17-191(76)	48 11-145(98)	53 31-82(11)	43 8-193(202)
Italy	26 16-43(4)	25 5-150(22)	42 15-139(78)	46 17-142(23)	46 17-104(42)
The Netherlands	22 8-53(20)	50 18-108(10)	41 17-88(4)		
Spain	55 7-121(3)	70 15-206(4)	60 11-336(51)	69 26-247(15)	
Sweden	11 4-21(5)	15 12-20(3)			
United Kingdom	43 26-73(6)	70 13-217(43)	76 26-201(5)	78 64-93(3)	
<i>Non-EU Countries</i>					
Bulgaria		278 188-344(3)			
Czech republic	69 29-145(19)	115 46-422(34)	67 66-67(2)	62(1)	
Estonia	16 7-24(2)	38(1)	42(1)	38(1)	
FYROM		137 79-249(10)	163 129-207(6)	124 79-238(4)	
Hungary	54(1)				
Latvia	8 7-9(2)				
Poland		89 32-229(10)		236 229-242(2)	
Slovak republic		93 74-126(3)	95 64-135(6)		
Slovenia		141 117-164(2)	68(1)		

Map 1: Sulphur dioxide: location of stations and station type, 1998.

Sulphur dioxide

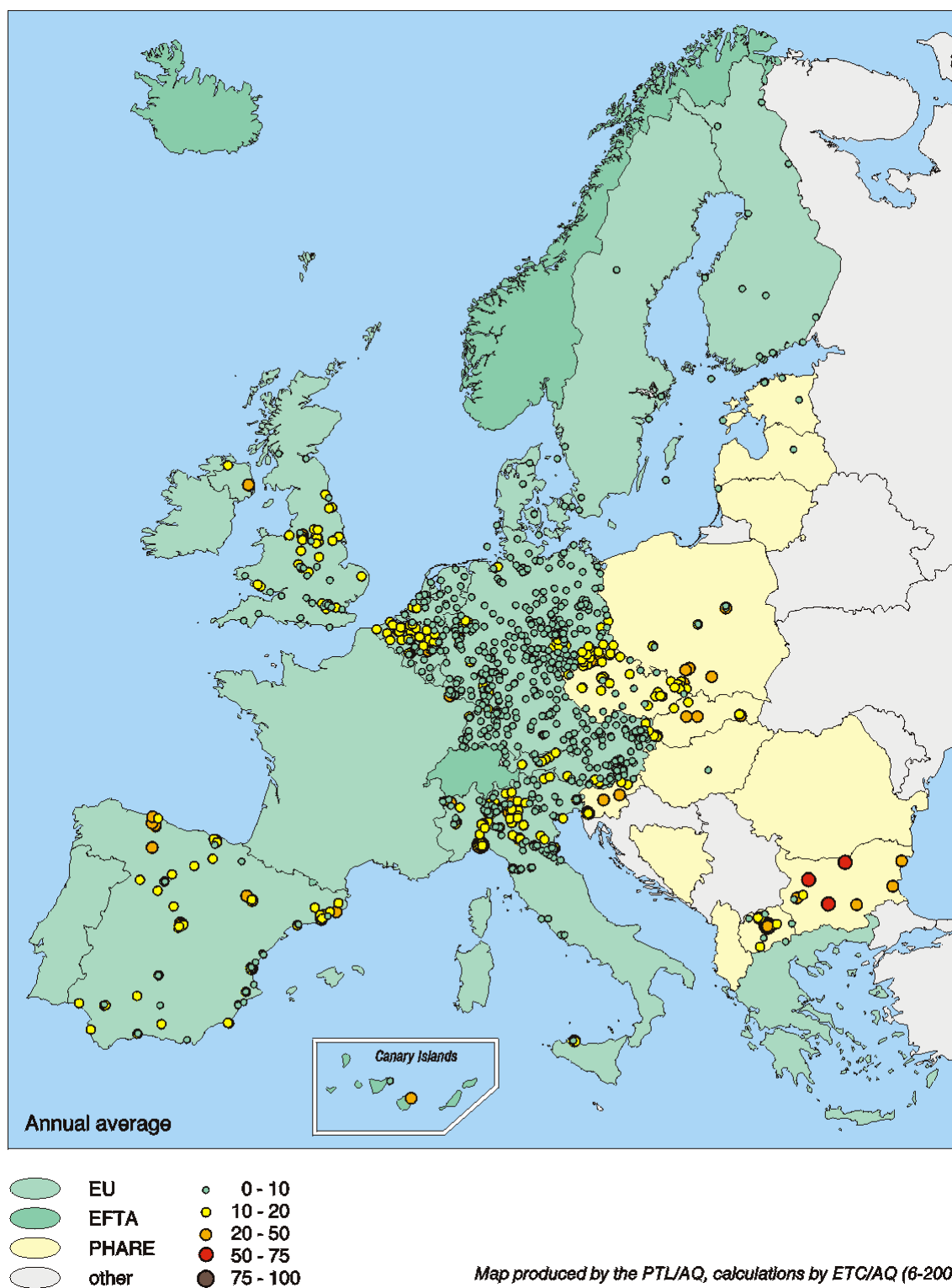


- | | |
|-------|--------|
| EU | rural |
| EFTA | urban |
| PHARE | street |
| other | other |

Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

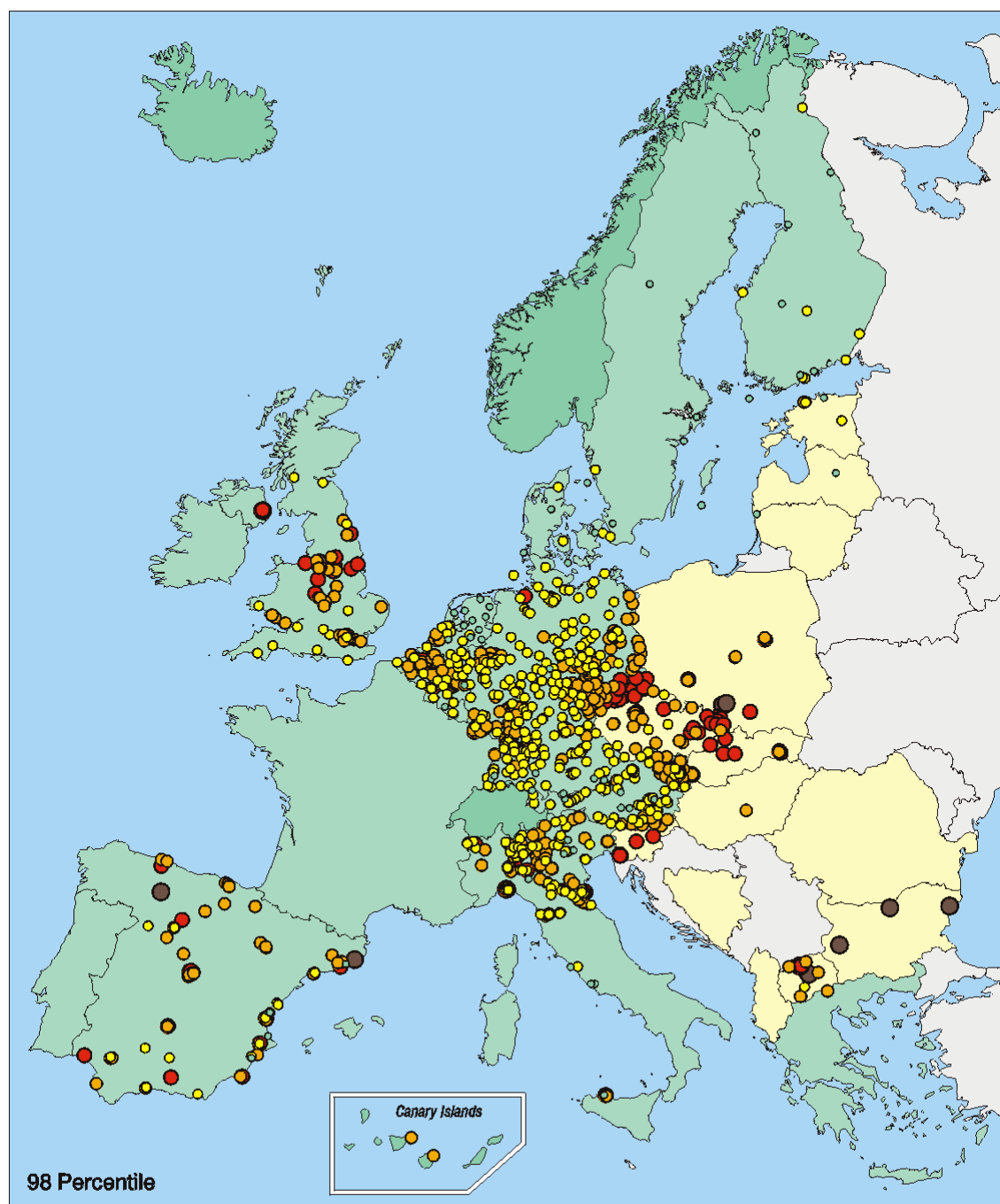
Map 2: Sulphur dioxide: annual average of 24-hour concentrations ($\mu\text{g}/\text{m}^3$), 1998.

Sulphur dioxide



Map 3. Sulphur dioxide; 98 percentile of 24-hour concentrations ($\mu\text{g}/\text{m}^3$), 1998.

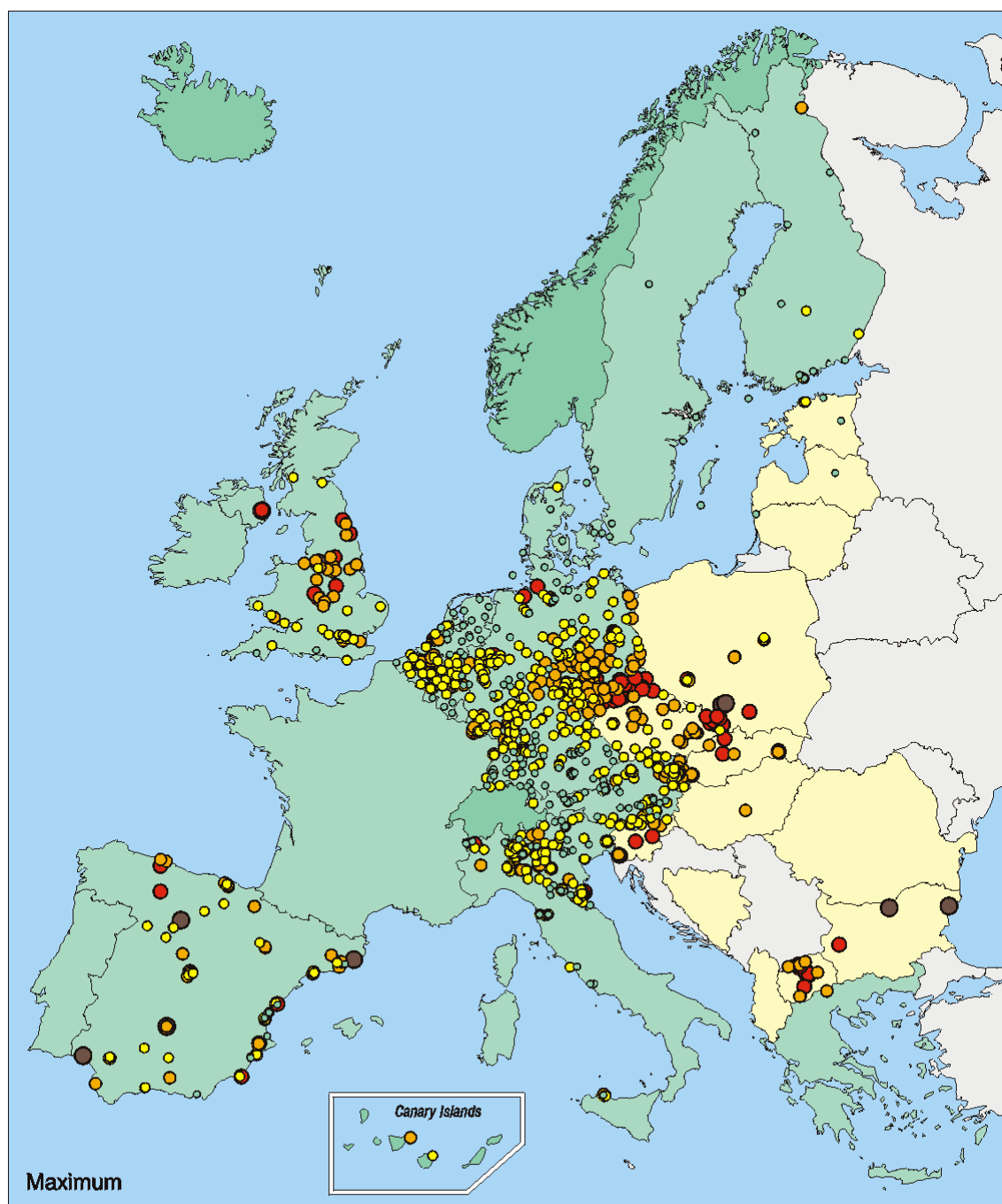
Sulphur dioxide



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

Map 4: Sulphur dioxide; maximum observed 24 hour concentrations ($\mu\text{g}/\text{m}^3$), 1998.

Sulphur dioxide



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

3.1.2 Strong acidity

Strong acidity monitoring is still carried out in some countries. Two EU countries reported data for 180 stations. Tables 6, 7 and 8 present the annual average, 98 percentile of 24 hour and maximum 24-hour concentrations reported for strong acidity, respectively.

Maximum daily values reported from some stations in Belgium and United Kingdom are high if compared to the EU SO₂ guide value currently in force: 100-150 µg/m³.

Table 6: Average over stations and range in annual average strong acidity concentrations (µg/m³) in 1998. Figures between brackets refer to the number of stations.

Annual average including range					
Station type Country	Rural	Urban	Street	Other	Non-defined
Belgium		11 5-18(14)		34 19-49(2)	
United Kingdom		20 5-53(162)		19 17-20(2)	

Table 7: Average over stations and range in 98-Percentile of 24 hour concentrations strong acidity (µg/m³) in 1998. Figures between brackets refer to the number of stations.

98-Percentile of 24 hour values including range					
Station type Country	Rural	Urban	Street	Other	Non-defined
Belgium		40 22-71(14)		87 56-117(2)	
United Kingdom		51 13-154(131)		61 55-66(2)	

Table 8: Average over stations and range in maximum observed strong acidity concentrations (µg/m³) in 1998. Figures between brackets refer to the number of stations.

Maximum 24 hour values including range					
Station type Country	Rural	Urban	Street	Other	Non-defined
Belgium		72 31-126(14)		145 140-149(2)	
United Kingdom		86 25-282(131)		85 83-87(2)	

3.2 Particulate matter

Particulate matter concentrations are reported either as PM₁₀, total suspended particulate (TSP) or black smoke. PM₁₀ data is given for 173 stations in 7 EU countries and from 64 stations in 3 non-EU countries according to the annual average statistics. TSP data is given for 608 stations in 5 EU countries and from 37 stations in 3 non-EU countries. Black smoke data is given for 206 stations in 3 EU countries and from 31 stations in 2 non-EU countries. All together particulate matter data was reported from 987 stations in 10 EU countries and from 132 stations in 6 non-EU countries.

Table 9 presents annual average concentrations by country and station type, Table 10 presents 98 percentile concentrations based on 24-hour values and Table 11 presents maximum observed 24-hour concentrations.

Maps 5-8 on pages 29-32 shows the geographical distribution of stations and the selected statistics.

Comparisons with EU limit and guide values are summarized below.

Comparison with directives currently in force (EU Directive 80/779/EC for TSP and Black smoke)

EU Directive 80/779/EC (on SO₂ and suspended particulates) sets limit and guide values for concentrations measured as black smoke or TSP (but not for PM₁₀).

Limit value, TSP, annual average: 150 µg/m³:

Exceedance at a few stations in Bulgaria.

Limit value, TSP, 95 percentile (daily values): 300 µg/m³.

Spain, Bulgaria and Estonia reported TSP 98 percentile value above 300 µg/m³ at some stations. At these stations and possibly a few more, the 95-percentile limit value is thus exceeded.

Limit value, black smoke, annual average: 80 µg/m³:

No exceedances.

Limit value, black smoke, 98 percentile (daily values): 250 µg/m³:

Exceedance at a few stations in F.Y.R. of Macedonia.

Guide value, black smoke, annual average: 40-60 µg/m³:

Concentrations were in general below the lower limit of the EU guide value of 40 µg/m³, with the exception of one station in the Netherlands and a few stations in F.Y.R. of Macedonia.

Guide value, black smoke, daily maximum: 100-150 µg/m³:

Exceedance at stations in all the countries which have reported Black Smoke (Belgium, the Netherlands, UK, F.Y.R. of Macedonia, Poland).

Comparison with limit values under the new Directives (EU Directive 1999/30/EC for PM₁₀)

Limit value, annual average: 40 µg/m³ (to be complied with by 2005):

Exceedance at the following number of stations:

Germany:	1 station (52 µg/m ³)
The Netherlands:	3 stations (Maximum: 44 µg/m ³)
Spain:	6 stations (Maximum: 58 µg/m ³)
Bulgaria:	1 station (62 µg/m ³)
Czech Rep.:	5 stations (Maximum: 66 µg/m ³)
Poland:	4 stations (Maximum: 69 µg/m ³)

The starting year of the *Margin of Tolerance (MOT)* is 1999, allowing a 20% higher value (i.e. 48 µg/m³) against which the measured levels in that year should be compared.

Limit value, daily average: 50 µg/m³, may be exceeded up to 35 days per year (to be complied with by 2005):

The presented statistics only give the maximum daily value at each station. The ratio between maximum daily value and the 35th highest value varies within a wide range from station to station.

Based on statistics from the Netherlands, Austria and Norway, the range of values for this ratio is at least 1.7–4.5. From the statistical parameters available in AIRBASE, as summarised in Table 9, it is not possible to state at how many of the stations the limit value for daily average is exceeded, but it is clear that it is exceeded at many stations.

MOT starting year, and allowed level: 1999, 75 µg/m³.

Measurement methods:

It is well known that the measurement method for PM may have an influence on the measured value. About 87 % of the time series reported are measured with automatic monitors giving hourly values, while the rest is non-automatic methods requiring laboratory analysis, giving 24-hour averages.

The distribution of methods related to *all* PM₁₀ stations in AIRBASE is as follows:

Automatic methods:

- | | |
|---------------------------------|--------------|
| - beta absorption | 174 stations |
| - oscillating microbalance | 5 stations |
| - gravimetry | 106 stations |
| - laser scattering spectrometry | 2 stations |
| - unknown | 7 stations |

Non-automatic methods:

- | | |
|--------------|-------------|
| - gravimetry | 23 stations |
| - unknown | 2 stations |

The "gravimetry" category under automatic methods most probably represents either of the two main automatic methods: oscillating microbalance or beta absorption.

Table 9: Average over stations and range in annual particulate matter concentrations ($\mu\text{g}/\text{m}^3$) in 1998. Figures between brackets refer to the number of stations.

Annual average including range						
Station type	Measured as:	Rural	Urban	Street	Other	Non-defined
Country						
<i>EU countries</i>						
Belgium	PM ₁₀		28 23-34(6)	25 16-31(4)	34 28-40(4)	
Finland	PM ₁₀			22 20-26(5)	12(1)	
Germany	PM ₁₀	13(1)	20 16-25(16)	42(1)		20 12-50(43)
The Netherlands	PM ₁₀	35 27-42(7)	38 33-44(6)	38 36-40(4)		
Spain	PM ₁₀		58(1)	39 13-61(20)	50(1)	
Sweden	PM ₁₀		13 13-14(3)			
United Kingdom	PM ₁₀	13 10-17(3)	20 15-27(37)	25 21-32(7)	19 16-21(3)	
Austria	TSP	26 13-37(29)	33 21-51(44)	37 20-74(30)	36 19-82(13)	
Denmark	TSP	22(1)		45 39-51(4)		
Germany	TSP	19 8-37(20)	33 18-54(60)	40 20-75(93)	36 23-53(10)	30 12-70(145)
Italy	TSP		49 15-85(14)	56 25-102(49)	50 21-69(12)	47 25-76(23)
Spain	TSP	57 35-82(3)	60 40-75(7)	65 10-115(34)	56 4-120(17)	
Belgium	Black S.		15 8-23(21)	24(1)	14 10-17(5)	
The Netherlands	Black S.	8 6-12(8)	11 10-12(3)	27 18-41(3)		
United Kingdom	Black S.		10 2-24(163)		6 4-8(2)	
<i>Non-EU countries</i>						
Bulgaria	PM ₁₀		62(1)			
Czech Republic	PM ₁₀	20 11-32(19)	29 19-43(34)	58 50-66(2)	28(1)	
Poland	PM ₁₀		46 40-52(4)	69(1)	53 47-60(2)	
Bulgaria	TSP		119 3-260(29)			
Estonia	TSP			40(1)		
Slovak Republic	TSP		41 32-49(2)	49 39-58(5)		
F.Y.R. of Macedonia	Black S.		24 7-39(14)	36 5-56(7)	33 11-54(4)	
Poland	Black S.		17 9-25(6)			

Table 10: Average over stations and range in particulate matter 98 percentile 24 hour concentrations ($\mu\text{g}/\text{m}^3$) in 1998. Figures between brackets refer to the number of stations.

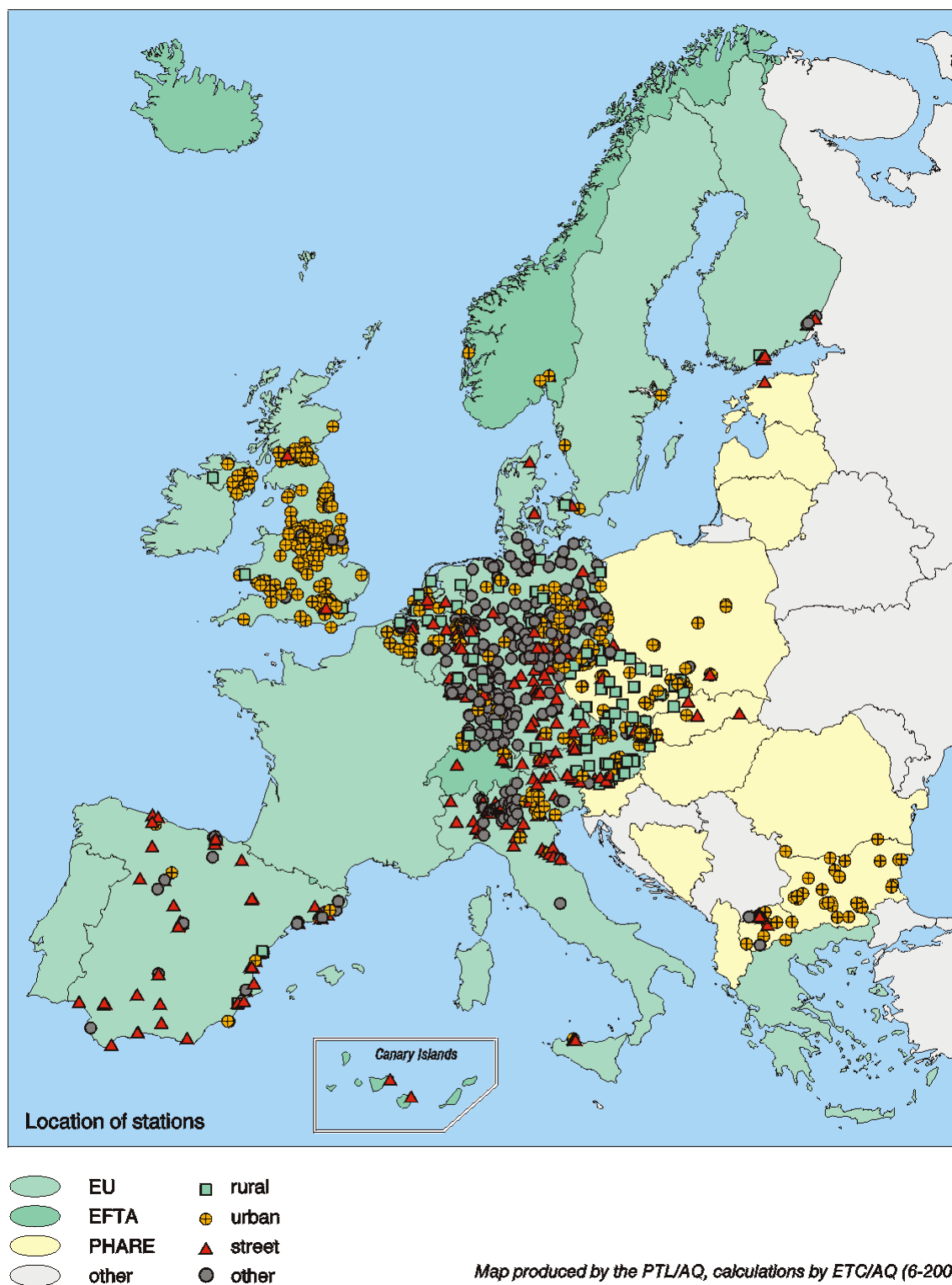
98 percentile 24 hour values including range						
Station type	Measured as:	Rural	Urban	Street	Other	Non-defined
Country						
<i>EU countries</i>						
Belgium	PM ₁₀		68 53-84(6)	63 50-73(4)	77 67-96(4)	
Finland	PM ₁₀			75 51-95(5)	32(1)	
Germany	PM ₁₀	34(1)	55 47-68(16)	99(1)		52 30-126(43)
The Netherlands	PM ₁₀	89 73-116(7)	85 76-93(6)	87 81-93(4)		
Spain	PM ₁₀		107(1)	89 30-111(19)		
Sweden	PM ₁₀		34 31-37(3)			
United Kingdom	PM ₁₀	33 26-37(3)	46 32-71(36)	53 43-72(7)	47 39-54(3)	
Austria	TSP	71 37-114(26)	89 54-127(42)	94 54-166(27)	95 48-227(12)	
Denmark	TSP	56(1)		109 88-132(4)		
Germany	TSP	55 23-89(18)	82 42-121(58)	99 57-214(93)	92 68-121(10)	78 36-161(141)
Italy	TSP		96 31-150(12)	127 65-226(40)	114 52-171(10)	108 71-173(22)
Spain	TSP	123 100-157(3)	122 83-141(4)	141 34-372(28)	111 19-300(13)	
Belgium	Black S.		45 24-75(18)		42 36-48(2)	
The Netherlands	Black S.	35 24-45(8)	43 39-48(3)	69 51-98(3)		
United Kingdom	Black S.		41 6-81(134)		22 18-27(2)	
<i>Non-EU countries</i>						
Bulgaria	PM ₁₀		239(1)			
Czech Republic	PM ₁₀	55 30-105(19)	91 55-168(34)	228 176-280(2)	78(1)	
Poland	PM ₁₀		168 141-194(2)	245(1)	168 163-173(2)	
Bulgaria	TSP		192 48-455(3)			
Estonia	TSP			416(1)		
Slovak republic	TSP		94 75-112(2)	116 95-143(5)		
F.Y.R. of Macedonia	Black S.		122 52-196(13)	181 21-271(6)	155 55-237(4)	
Poland	Black S.		71 37-104(6)			

Table 11: Average over stations and range in maximum 24 hour particulate matter concentrations ($\mu\text{g}/\text{m}^3$) in 1998. Figures between brackets refer to the number of stations.

		Average maximum 24 hour concentrations including range				
Station type	Measured as:	Rural	Urban	Street	Other	Non-defined
Country						
<i>EU countries</i>						
Belgium	PM ₁₀		103 67-118(6)	94 67-108(4)	119 91-153(4)	
Finland	PM ₁₀			120 79-181(5)	39(1)	
Germany	PM ₁₀	48(1)	83 59-156(16)	149(1)		79 45-195(43)
The Netherlands	PM ₁₀	131 112-159(7)	135 103-160(6)	131 113-156(4)		
Spain	PM ₁₀		179(1)	134 40-215(14)		
Sweden	PM ₁₀		47 43-51(2)			
United Kingdom	PM ₁₀	46 34-54(3)	67 40-120(36)	72 51-113(7)	65 56-79(3)	
Austria	TSP	111 59-214(26)	133 73-212(42)	133 67-208(27)	143 63-286(12)	
Denmark	TSP	94(1)		220 125-346(4)		
Germany	TSP	86 30-132(18)	125 75-209(58)	144 81-349(93)	129 95-166(10)	118 51-383(141)
Italy	TSP		132 35-224(12)	169 81-347(40)	151 72-222(10)	142 91-236(22)
Spain	TSP	157 126-194(3)	160 110-188(4)	202 104-642(28)	160 78-388(13)	
Belgium	Black S.		84 52-119(18)		82 73-90(2)	
The Netherlands	Black S.	72 46-124(8)	72 57-79(3)	105 80-126(3)		
United Kingdom	Black S.		80 15-225(134)		68 62-74(2)	
<i>Non-EU countries</i>						
Bulgaria	PM ₁₀		245(1)			
Czech Republic	PM ₁₀	90 39-212(19)	166 69-311(34)	371 331-410(2)	109(1)	
Poland	PM ₁₀		251 225-277(2)	348(1)	263 232-293(2)	
Bulgaria	TSP		526 83-1343(3)			
Estonia	TSP			700(1)		
Slovak republic	TSP		136 110-161(2)	177 125-237(5)		
F.Y.R. of Macedonia	Black S.		277 130-437(13)	297 79-385(6)	395 143-725(4)	
Poland	Black S.		116 71-178(6)			

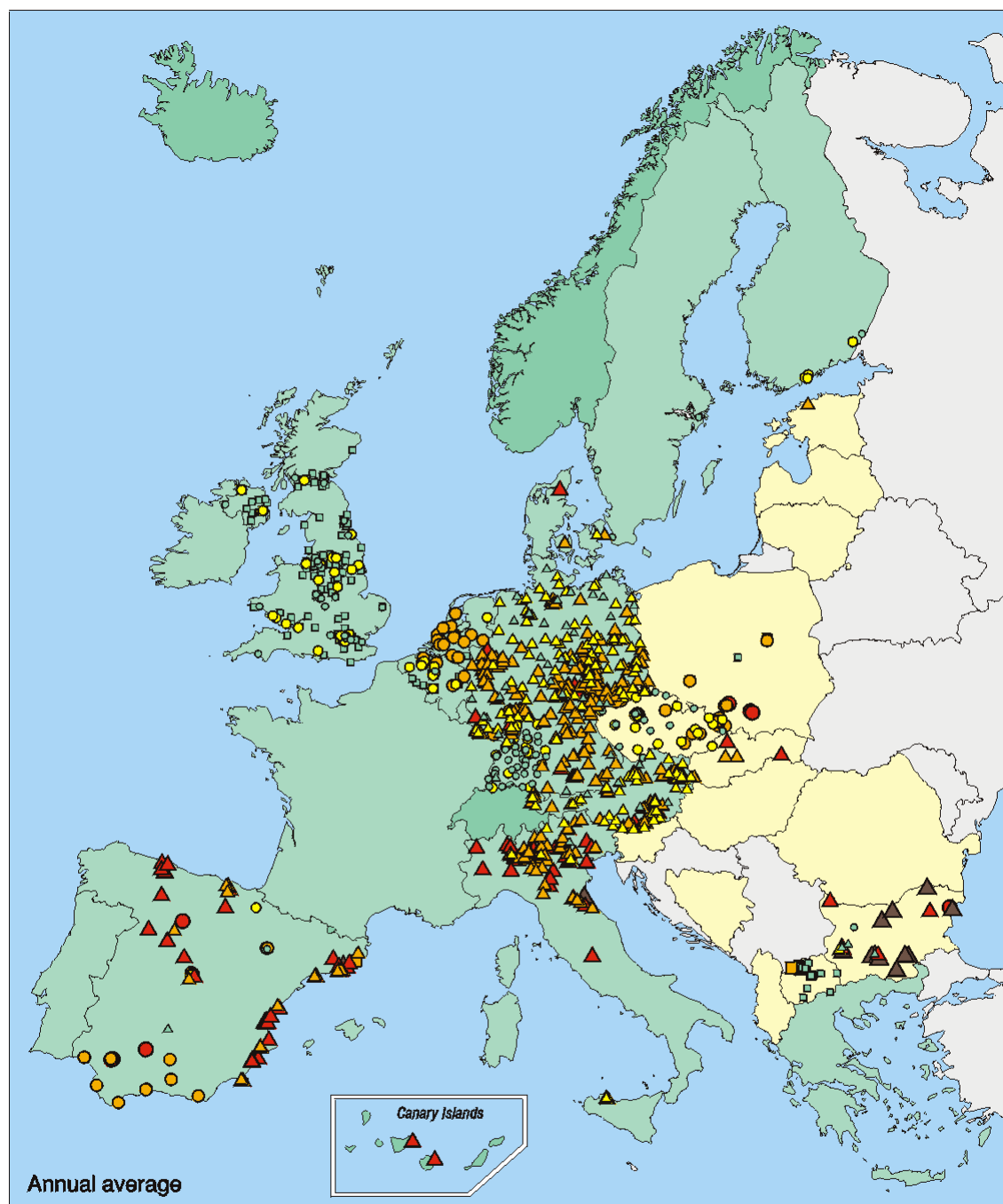
Map 5: Particulate matter: location of stations and station type, 1998.

Particulate matter



Map 6: Particulate matter: annual average of 24-hour concentrations ($\mu\text{g}/\text{m}^3$), 1998.

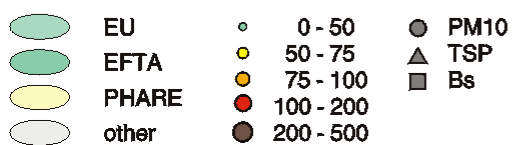
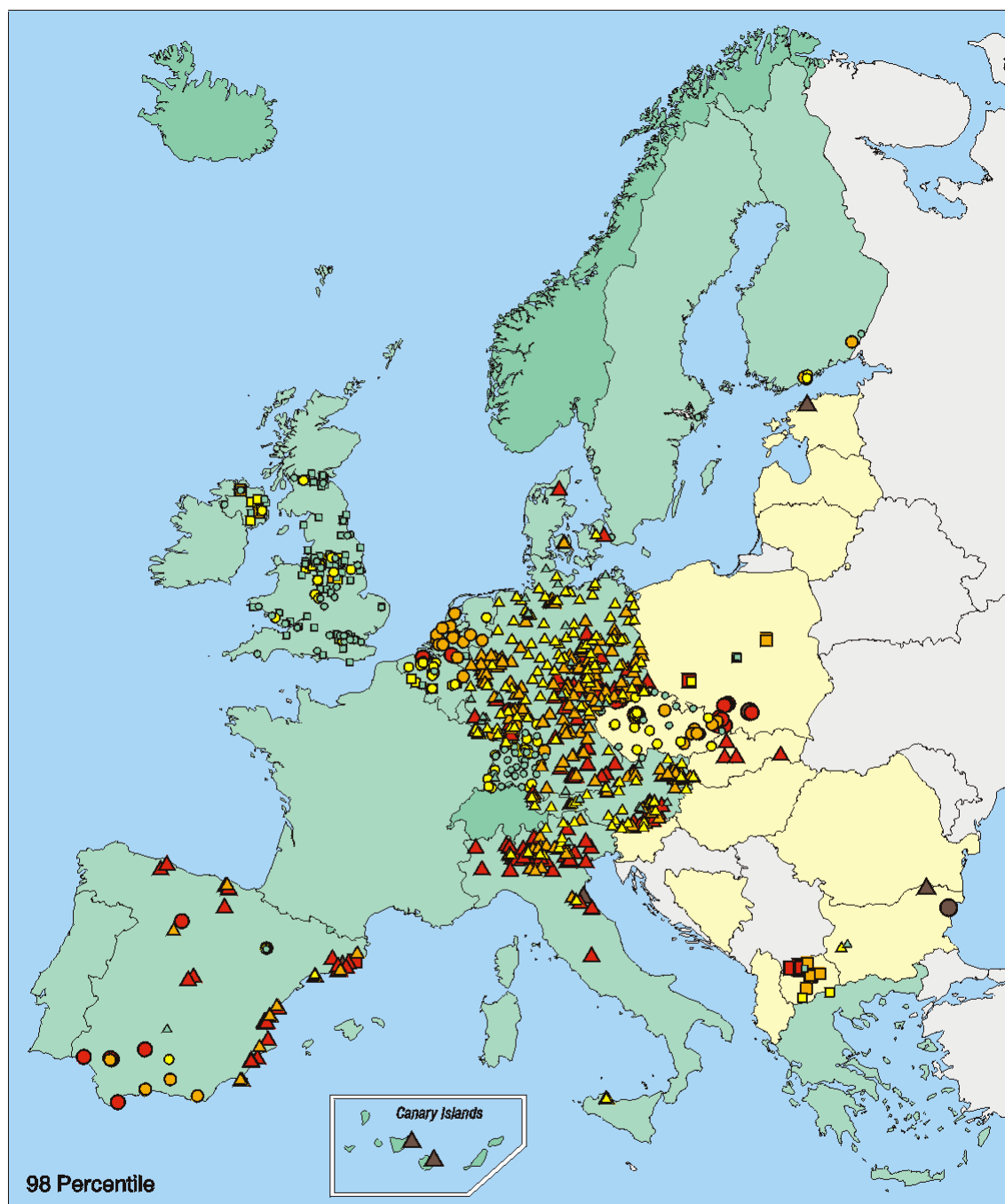
Particulate matter



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

Map 7: Particulate matter: 98 percentile of 24-hour concentrations ($\mu\text{g}/\text{m}^3$), 1998.

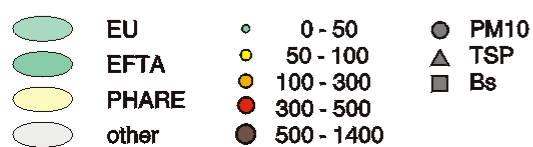
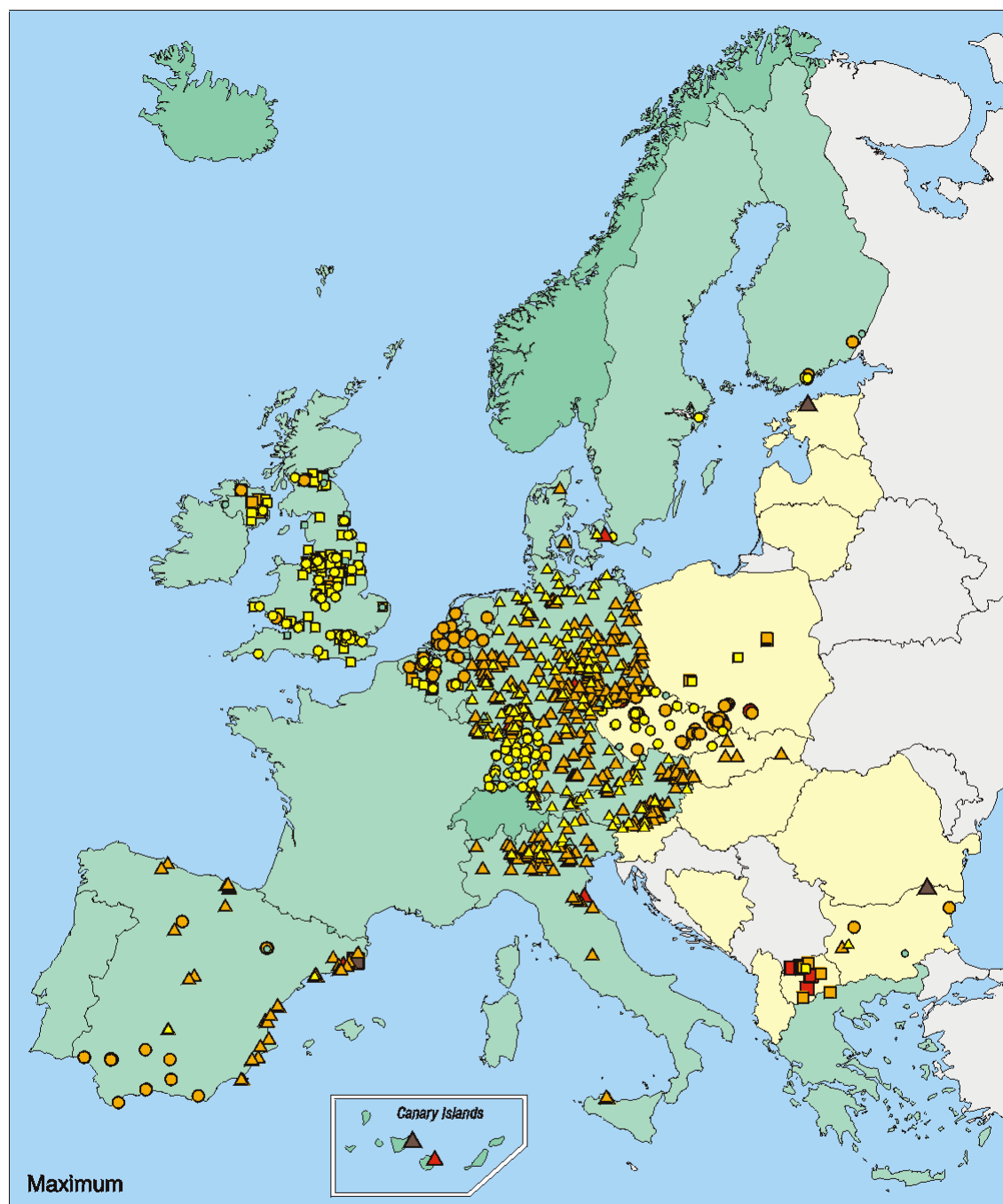
Particulate matter



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

Map 8: Particulate matter; maximum observed 24 hour concentrations ($\mu\text{g}/\text{m}^3$), 1998.

Particulate matter



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

3.3 Nitrogen dioxide

Table 12, and Table 14 present the 1998 reported annual average concentrations, the 98 percentile of 1-hour NO₂ concentrations and the maximum 24-hour NO₂ concentrations, respectively. Data is included for 986 stations in 10 EU countries and from 89 stations in 8 non-EU countries.

Maps 9-12 on pages 38-41 show the geographical distribution of stations and the reported statistics.

Comparisons with limit and guide values in EU Directives are summarized below.

Comparison with limit and guide values currently in force (EU Directive 85/203/EC)

Limit value, 98 percentile (hourly values): 200 µg/m³:

Exceedance at 2 stations in Italy. Stations in other countries approach 200 µg/m³.

Guide value, annual average: 50 µg/m³:

Exceedance at some stations in 7 EU countries and at one station in a non-EU country (Poland).

Guide value, 98 percentile (hourly values): 135 µg/m³:

Exceedance at some stations in 5 EU countries (Belgium, Germany, Italy, Spain, UK).

Comparison with limit values under the new directives (EU Directive 1999/30/EC (to be complied with by 2010))

Limit value, annual average: 40 µg/m³:

Exceedance at the following number of stations:

Austria:	6 stations (Maximum: 67 µg/m ³)
Denmark:	1 station (42 µg/m ³)
Germany:	81 stations (Maximum: 77 µg/m ³)
Italy:	84 stations (Maximum: 158 µg/m ³)
The Netherlands:	13 stations (Maximum: 59 µg/m ³)
Spain:	48 stations (Maximum: 101 µg/m ³)
Sweden:	1 station (47 µg/m ³)
UK:	37 stations (Maximum: 92 µg/m ³)
Bulgaria:	1 station (43 µg/m ³)
Czech Rep.:	1 station (42 µg/m ³)
Poland:	1 station (60 µg/m ³)

MOT starting year, and allowed level: 1999, 60 µg/m³.

Limit value, hourly average: 200 µg/m³ may be exceeded up to 18 hours per year:

At 22 stations reporting hourly NO₂ concentrations the limit value of 200 µg/m³ has been exceeded during more than 18 hours in 1998:

Germany	4 stations, 27-95 exceedance hours
Portugal	4 stations; 19-74 exceedance hours
Spain	10 stations; 20-163 exceedance hours
UK	3 stations; 411-79 exceedance hours

For Italian stations no hourly data but only statistical information is available. Based upon an indicative ratio between the 18th highest value and the 98 percentile of 1.4-1/5, it is estimated that at approximately 18 stations in Italy the limit value is exceeded.

MOT starting year, and allowed level: 1999, 300 µg/m³.

Table 12: Average over stations and range in annual NO₂ concentrations (µg/m³) in 1998. Figures between brackets refer to the number of stations.

Station type Country	NO ₂ annual average including range				
	Rural	Urban	Street	Other	Non-defined
<i>EU Countries</i>					
Austria	14 2-29(42)	27 15-46(45)	34 13-67(32)	24 11-35(13)	
Belgium	20 9-33(7)	31 15-43(12)	47 37-73(7)	29 19-42(7)	
Denmark	11 11-11(2)	19 17-23(3)	36 31-42(3)		
Finland	5 1-9(5)	16(1)	28 18-38(7)	12 8-15(3)	
Germany	14 6-36(25)	28 9-68(81)	42 19-77(106)	31 13-39(10)	26 3-67(208)
Italy	28 10-67(8)	31 14-49(25)	55 20-158(92)	31 7-60(14)	40 13-64(13)
The Netherlands	22 13-35(22)	35 24-45(9)	46 35-59(13)		
Spain	19 14-25(3)	35 23-53(7)	52 18-101(54)	32 12-57(18)	
Sweden	4 1-6(5)	25(1)	47(1)		
United Kingdom	14 6-23(6)	39 13-65(52)	58 33-92(20)	39 27-51(4)	
<i>Non-EU Countries</i>					
Bulgaria		24 3-43(7)			
Czech republic	12 5-18(18)	27 19-42(28)	41(1)	33(1)	
Estonia	2 2-3(3)	6(1)	33(1)	9(1)	
Hungary	6(1)				
Latvia	2 2-2(2)				
Poland	20(1)	25 15-35(10)	60(1)	8 7-9(2)	
Slovak Republic		28 19-33(3)	36 32-38(6)		
Slovenia		27(1)	39(1)		

Table 13: Average over stations and range in NO₂ 1 hour 98 percentile concentrations (µg/m³) in 1998. Figures between brackets refer to the number of stations.

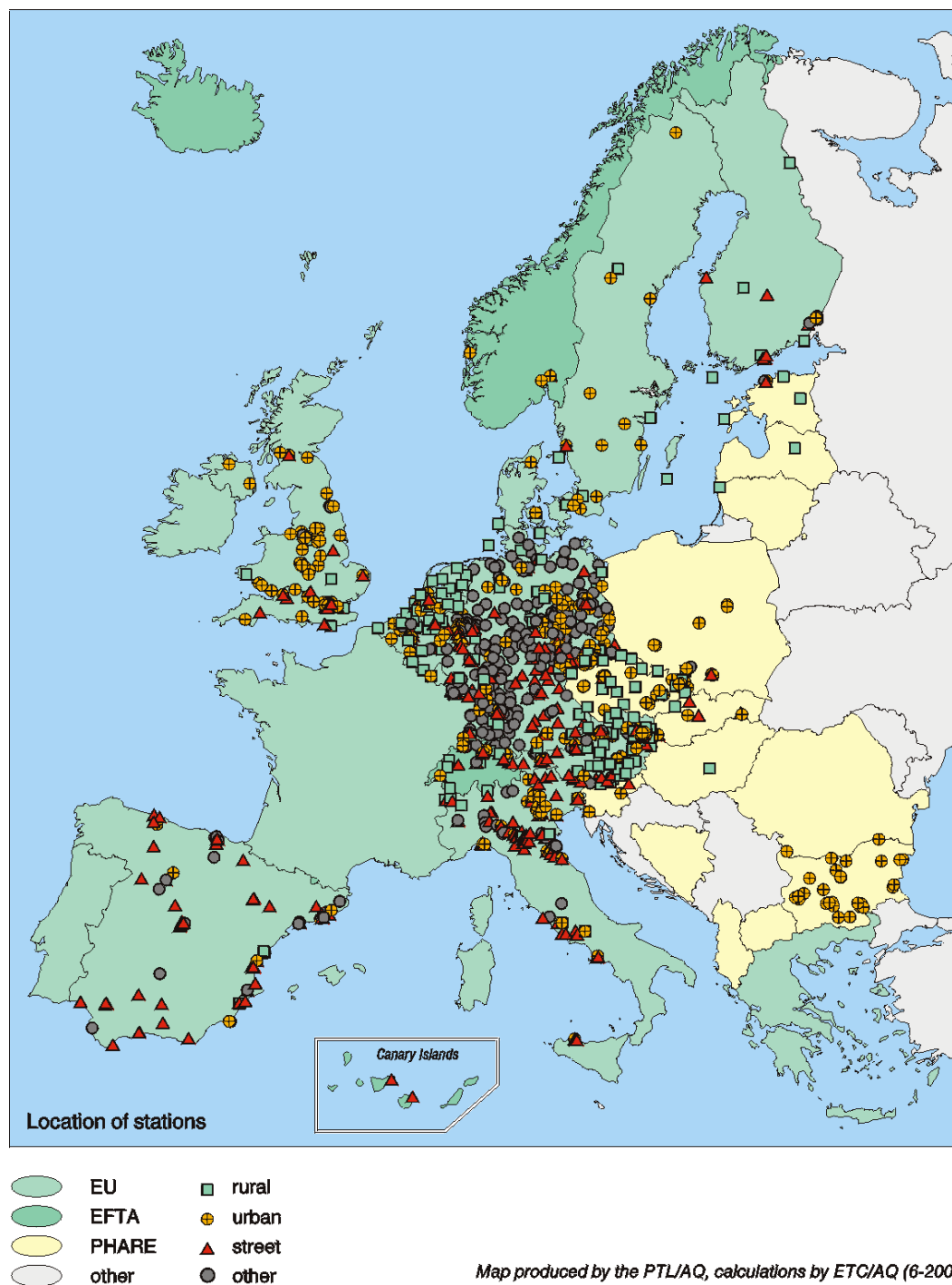
	NO₂ 98 percentile based on hourly concentrations, including range				
Station type Country	Rural	Urban	Street	Other	Non-defined
<i>EU Countries</i>					
Austria	48 7-94(37)	75 48-117(44)	82 45-135(29)	63 37-85(10)	
Belgium	54 37-72(7)	77 49-93(8)	100 81-142(5)	75 74-75(2)	
Denmark	42 42-43(2)	56 54-60(3)	87 82-90(3)		
Finland	17 5-38(5)	73(1)	79 62-89(7)	47 33-65(3)	
Germany	48 18-87(23)	72 45-132(79)	92 54-184(106)	83 56-139(9)	70 9-137(202)
Italy	80 30-162(7)	77 44-120(24)	120 56-244(80)	78 27-98(6)	101 59-148(13)
The Netherlands	62 51-85(22)	79 59-88(9)	92 72-119(13)		
Spain	84 64-110(3)	85 76-98(3)	123 63-200(47)	81 35-139(14)	
Sweden		65 59-73(3)	103(1)		
United Kingdom	50 25-67(6)	86 44-118(48)	127 76-183(15)	91 69-103(4)	
<i>Non-EU Countries</i>					
Bulgaria		7(1)			
Czech republic	39 15-61(18)	72 55-90(28)	88(1)	80(1)	
Estonia	11 10-13(2)		83(1)		
Poland		86(1)	120(1)		
Slovak Republic		79 65-93(2)	83 75-100(4)		

Table 14: Average over stations and range in NO₂ 24 hour maximum concentrations (µg/m³) in 1998. Figures between brackets refer to the number of stations.

	NO₂ 24 hour maximum including range				
Station type Country	Rural	Urban	Street	Other	Non-defined
<i>EU Countries</i>					
Austria	55 9-87(37)	84 46-121(44)	87 44-153(30)	73 41-101(10)	
Belgium	64 46-84(7)	86 53-128(8)	105 76-152(5)	86 86-87(2)	
Denmark	46 44-47(2)	69(1)	85 78-98(3)		
Finland	24 9-36(4)	70(1)	83 77-95(6)	52 36-71(3)	
Germany	60 24-88(23)	78 50-148(79)	95 66-184(106)	98 63-211(9)	77 11-160(202)
The Netherlands	67 59-86(17)	84 60-105(9)	100 75-126(11)		
Spain	80 44-119(3)	89 60-122(4)	118 54-313(49)	84 51-160(15)	
Sweden	24 5-40(5)	121(1)	101(1)		
United Kingdom	60 49-71(5)	93 43-131(49)	124 84-161(16)	99 78-131(4)	
<i>Non-EU Countries</i>					
Bulgaria		89(1)			
Czech republic	53 25-114(17)	86 64-153(28)	90(1)	81(1)	
Estonia	14 9-17(3)	40(1)	87(1)	54(1)	
Hungary	41(1)				
Latvia	12 11-13(2)				
Poland		84 53-134(10)	96(1)	80 65-94(2)	
Slovak Republic		88 74-101(2)	84 78-88(4)		

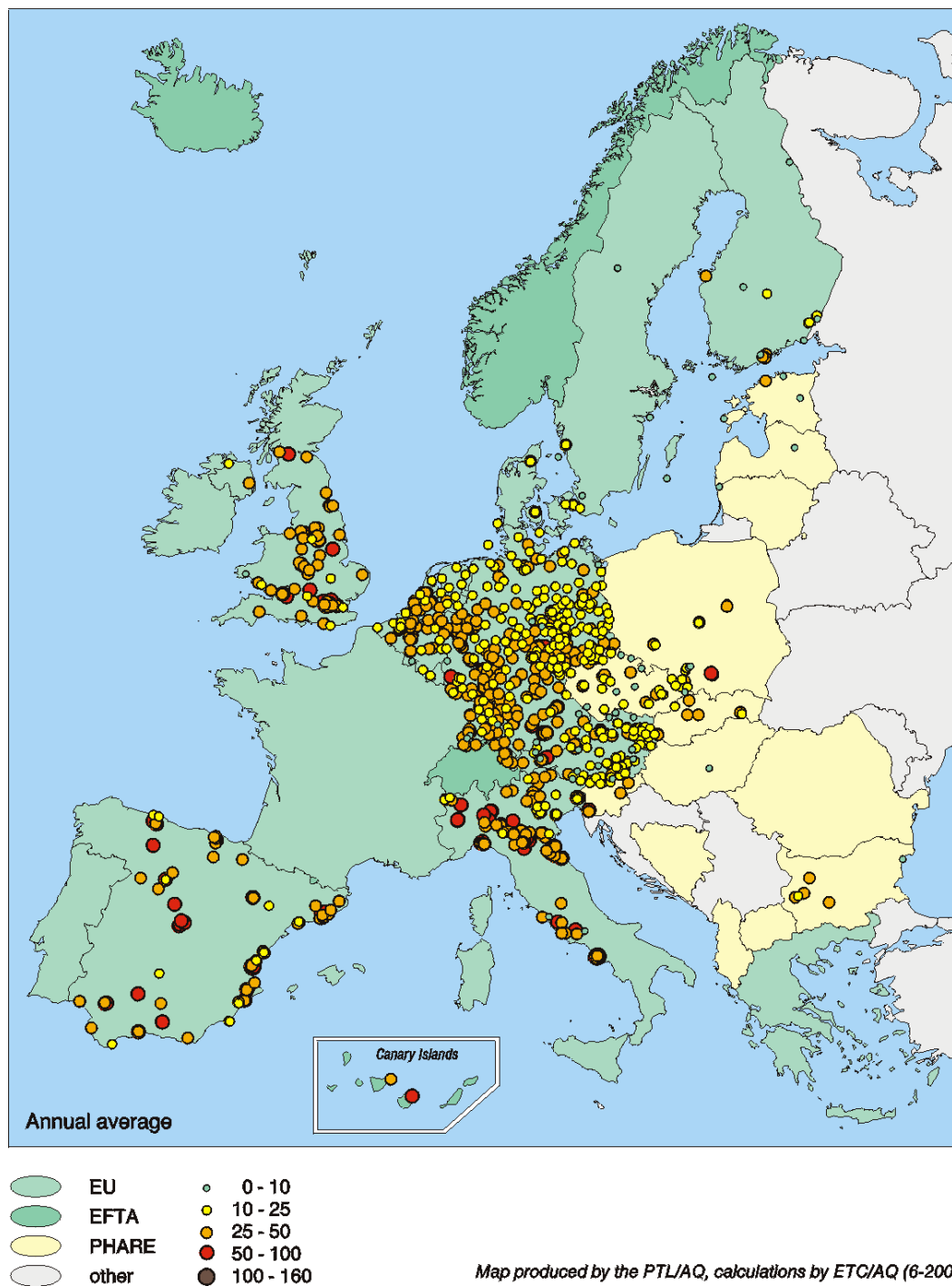
Map 9: Nitrogen dioxide: location of stations and station type, 1998.

Nitrogen dioxide



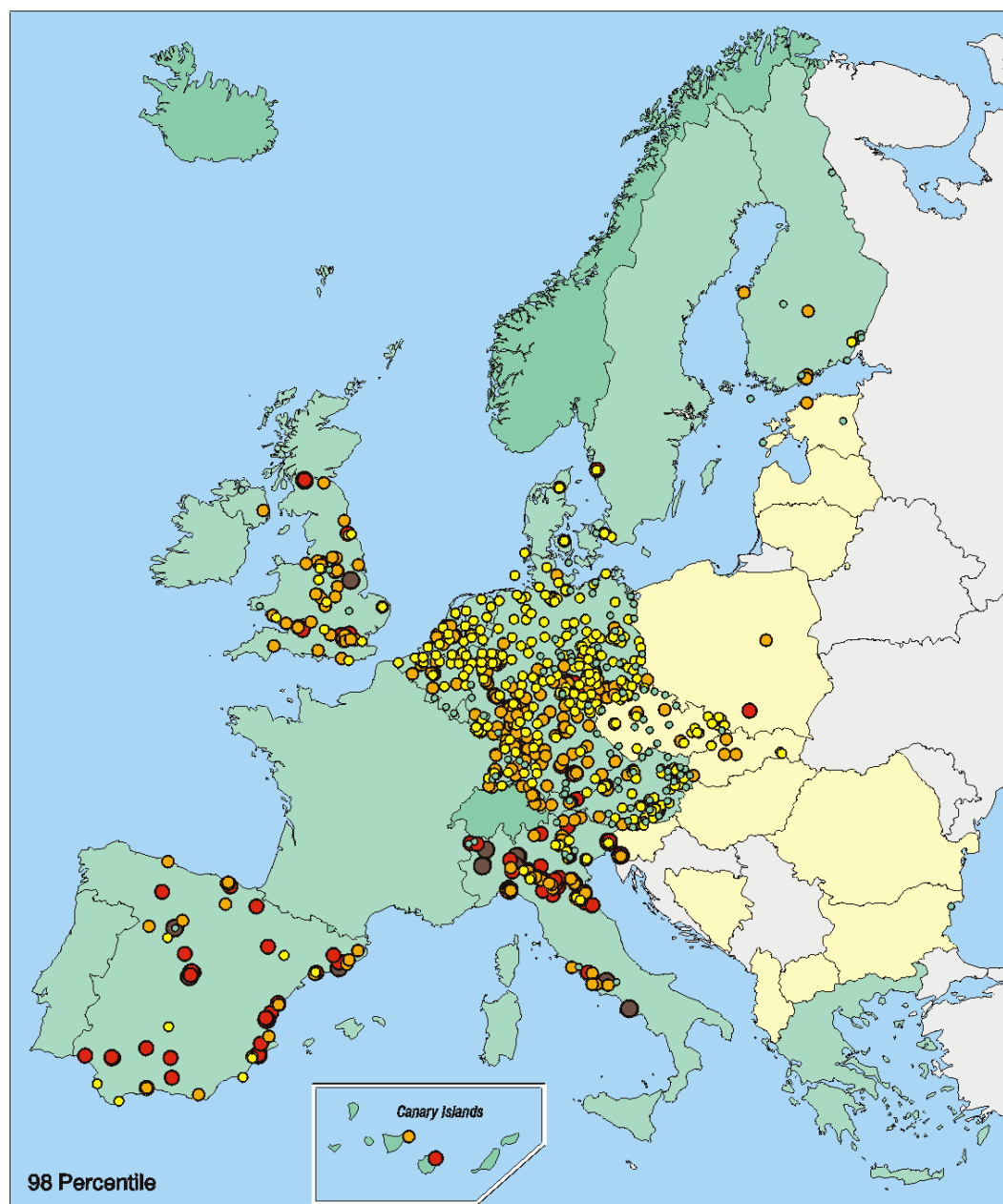
Map 10: Nitrogen dioxide: annual average concentrations ($\mu\text{g}/\text{m}^3$), 1998.

Nitrogen dioxide



Map 11: Nitrogen dioxide; 98 percentile concentrations ($\mu\text{g}/\text{m}^3$) based on hourly values, 1998.

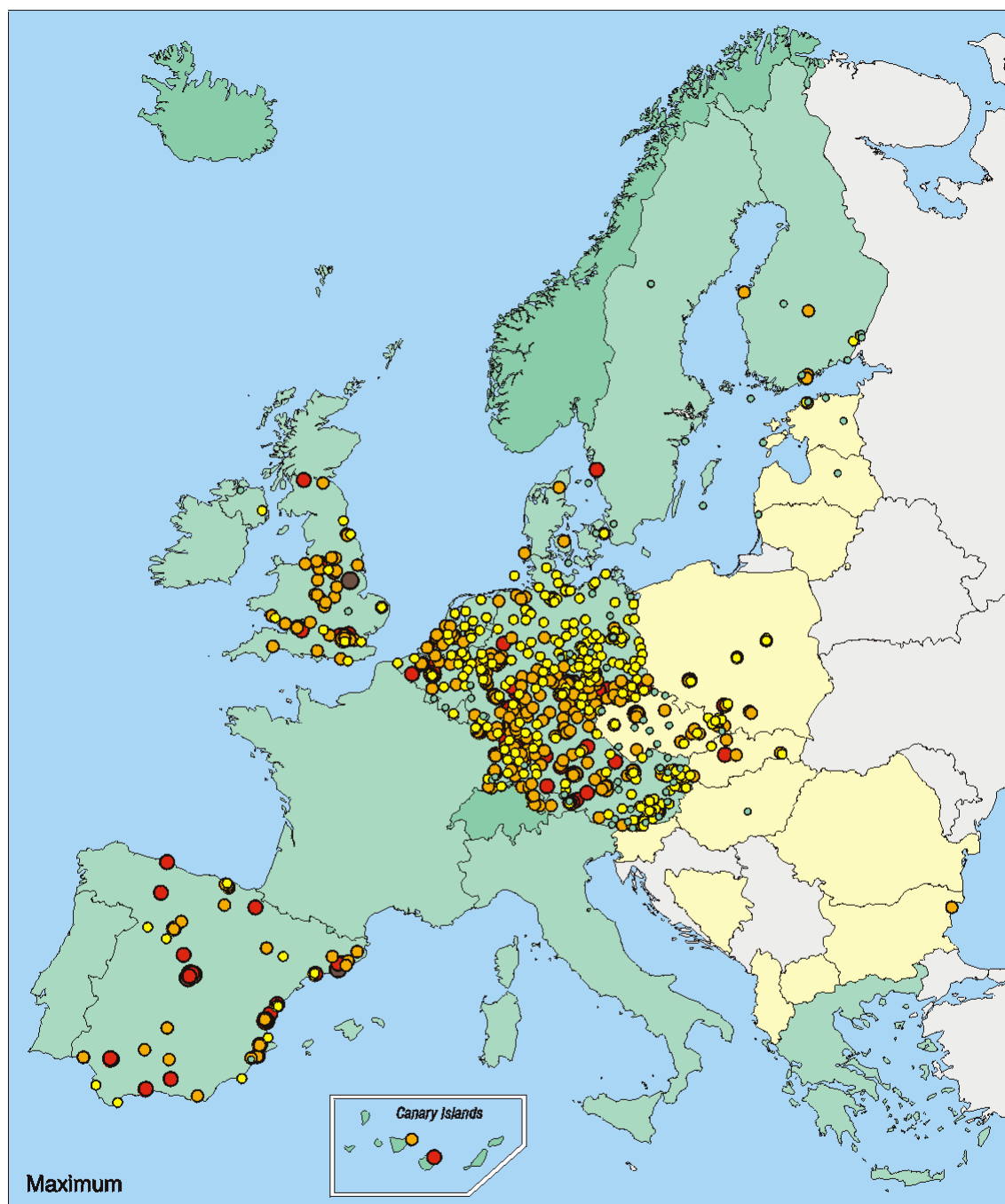
Nitrogen dioxide



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

Map 12: Nitrogen dioxide; maximum observed 24 hour concentrations ($\mu\text{g}/\text{m}^3$), 1998.

Nitrogen dioxide



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

3.4 Lead

Table 15 presents the annual average lead concentrations for 1998 reported from two countries (47 stations). All values are well below the EU limit value of $2 \mu\text{g}/\text{m}^3$ currently in force (EU Directive 82/884/EEC).

Some stations in Bulgaria reported annual average lead concentrations above the limit value of $0.5 \mu\text{g}/\text{m}^3$ set in the new directive (EU Directive 1999/30/EC), to be complied with by 2005.

Table 15: Average over stations and range in Pb annual average concentrations ($\mu\text{g}/\text{m}^3$) in 1998. Figures between brackets refer to the number of stations.

Station type Country	Pb annual concentrations including range			
	Rural	Urban	Street	Other
Belgium	0.034 0.022-0.046(7)	0.116 0.044-0.221(9)	0.095 0.047-0.116(8)	0.274 0.045-1.177(18)
Bulgaria		0.421 0.076-0.717(5)		

3.5 Carbon monoxide

Table 16, Table 17 and Table 18 present the 1998 reported CO annual average concentrations, the 98 percentile and the maximum concentrations (the two latter statistics based on 8 hour moving averages), respectively. Data is included for 424 stations in 9 EU countries and from 41 stations in 5 non-EU countries based on the statistics for annual averages. As can be seen from the tables, Italy has reported annual average (and also 1-hour statistics) for many stations, while the 8-hour statistics is reported for only some of those stations.

Maps 13-16 show the geographical distribution of stations and the reported statistics.

The new EU Directive 2000/69/EC sets a limit value for the maximum 8-hour average concentration of $10 \text{ mg}/\text{m}^3$. This value was exceeded at some stations in two EU countries, Italy and Spain and one non-EU country, Poland. A few other countries reported values close to $10 \text{ mg}/\text{m}^3$.

The MOT for CO, 8 hour moving average, is $6 \text{ mg}/\text{m}^3$, allowing a level of $14 \text{ mg}/\text{m}^3$, with 13 December 2000 as starting date.

Table 16: Average over stations and range in CO annual concentrations (mg/m³) in 1998. Figures between brackets refer to the number of stations.

Station type Country	Annual average including range				
	Rural	Urban	Street	Other	Non-defined
<i>EU Countries</i>					
Austria	0.46 0.19-0.72(8)	0.66 0.35-1.25(17)	0.93 0.40-1.48(25)	0.61 0.29-1.08(9)	
Belgium		0.24(1)	0.82 0.31-1.50(4)		
Denmark		0.34(1)	1.07 0.85-1.18(3)		
Finland			0.61 0.51-0.74(5)		
Italy	1.00(1)	1.10 0.50-2.15(24)	1.97 0.71-4.25(146)	1.07 1.00-1.35(5)	1.60 0.68-3.00(26)
The Netherlands	0.34 0.28-0.38(5)	0.54 0.47-0.59(4)	0.88 0.51-1.27(12)		
Spain	0.57 0.47-0.67(2)	1.04 0.62-1.33(6)	1.65 0.71-7.89(51)	0.93 0.53-1.39(8)	
Sweden		0.66(1)			
United Kingdom		0.56 0.32-0.83(42)	1.25 0.75-2.35(15)	0.41 0.31-0.49(3)	
<i>Non-EU Countries</i>					
Bulgaria		2.05 0.90-3.73(8)			
Czech Rep.	0.38 0.35-0.40(2)	0.58 0.32-0.97(21)	0.99(1)	0.87(1)	
Estonia			0.99(1)		
Poland	0.77(1)		2.37(1)		
Slovak Republic			0.78 0.34-1.22(5)		

Table 17: Average over stations and range in CO 98-percentile concentrations (mg/m³) in 1998 (based on 8 hourly moving average concentrations). Figures between brackets refer to the number of stations.

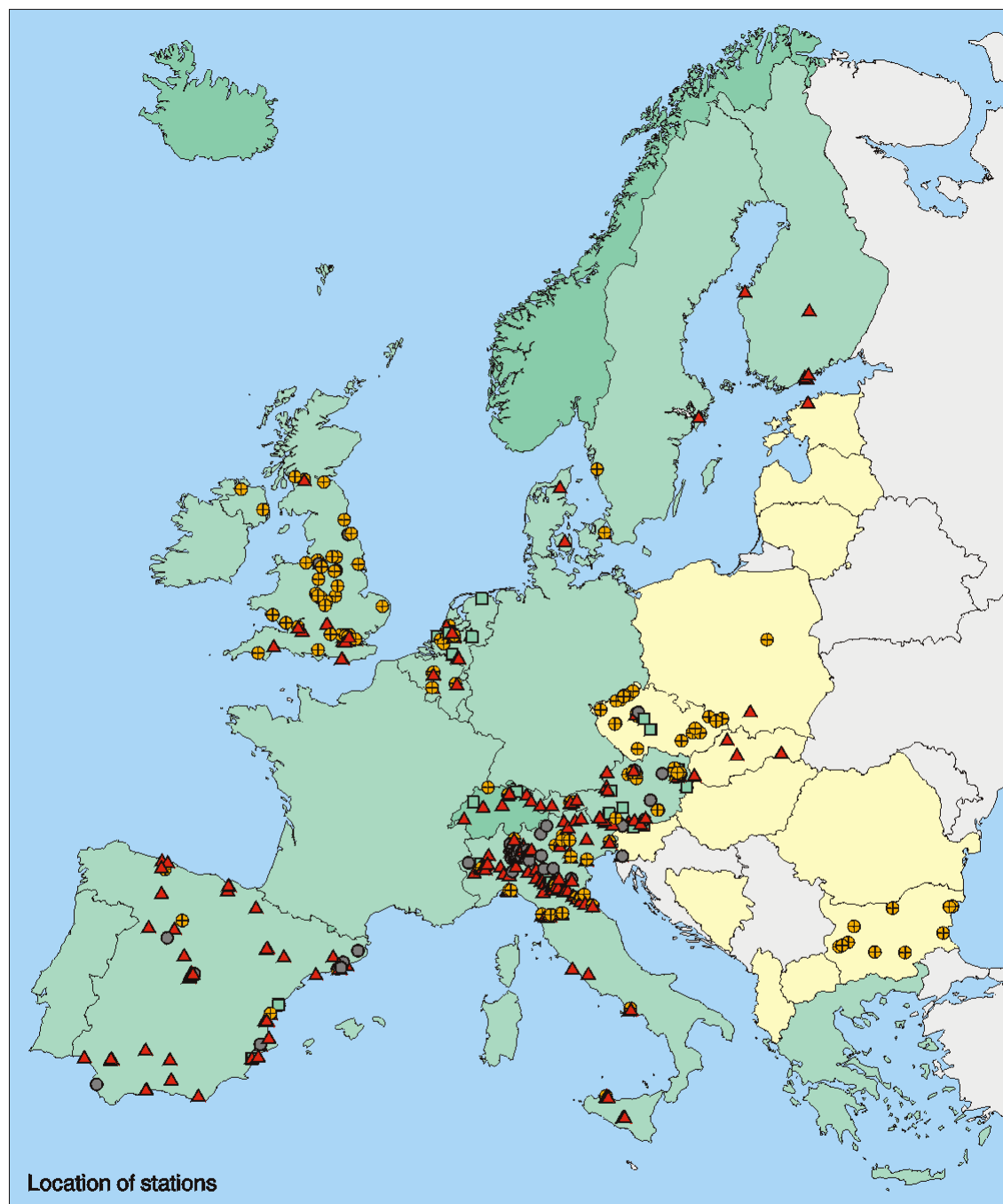
	98 percentile 8 hour moving average including range				
Station type Country	Rural	Urban	Street	Other	Non-defined
<i>EU Countries</i>					
Austria	1.24 0.38-2.14(7)	1.93 1.14-3.21(17)	2.26 1.16-3.49(24)	1.90 1.01-2.94(9)	
Belgium		0.70(1)	2.32 1.11-3.64(4)		
Denmark		0.87(1)	3.09 2.88-3.32(3)		
Finland			1.86 1.54-2.36(5)		
Italy		2.79 1.70-3.40(11)	6.76 3.30-10.20(24)		
The Netherlands	0.73 0.59-0.85(5)	1.22 1.01-1.36(4)	2.13 0.95-2.72(11)		
Spain	1.13 0.91-1.34(2)	1.80 1.39-2.25(3)	4.05 1.48-11.25(38)	2.42 1.50-4.79(6)	
Sweden		1.19(1)			
United Kingdom		1.72 0.99-2.60(41)	3.27 2.32-5.18(13)	1.51 0.99-1.90(3)	
<i>Non-EU Countries</i>					
Bulgaria		7.35 3.09-18.39(5)			
Czech Republic	0.68 0.66-0.71(2)	1.51 0.79-2.13(21)	2.56(1)	2.21(1)	
Estonia			2.64(1)		
Poland		1.72(1)	6.00(1)		
Slovak Republic			2.60 1.56-3.24(4)		

Table 18: Average, minimum and maximum CO maximum 8 hour concentrations (mg/m³) (based on moving average) in 1998. Figures in brackets refer to the number of stations.

Station type Country	Maximum 8 hour moving average including range				
	Rural	Urban	Street	Other	Non-defined
<i>EU Countries</i>					
Austria	2.21 0.59-3.56(7)	3.83 2.21-5.88(17)	3.97 1.68-6.79(24)	3.95 2.12-6.65(9)	
Belgium		1.74(1)	4.65 2.21-6.54(4)		
Denmark		2.31(1)	5.13 4.97-5.34(3)		
Finland			4.61 3.64-5.66(5)		
Italy		4.7 2.9-6.3(4)	9.9 7.2-17.0(4)		
The Netherlands	1.24 0.91-1.50(5)	4.18 2.70-6.09(4)	5.23 1.47-9.25(11)		
Spain	2.18 1.71-2.65(2)	3.87 2.05-6.31(3)	7.25 2.90-19.12(38)	5.39 2.00-9.20(6)	
Sweden		7.61(1)			
United Kingdom		4.45 2.16-8.79(41)	6.58 4.42-9.37(13)	3.47 1.74-5.24(3)	
<i>Non-EU Countries</i>					
Bulgaria		12.53 4.20-36.04(5)			
Czech Republic	1.05 1.00-1.10(2)	3.18 1.17-5.80(21)	4.43(1)	3.85(1)	
Estonia			3.89(1)		
Poland		4.46(1)	10.86(1)		
Slovak Republic			5.27 3.37-7.40(4)		

Map 13: Carbon monoxide: location of stations and station type, 1998.

Carbon monoxide

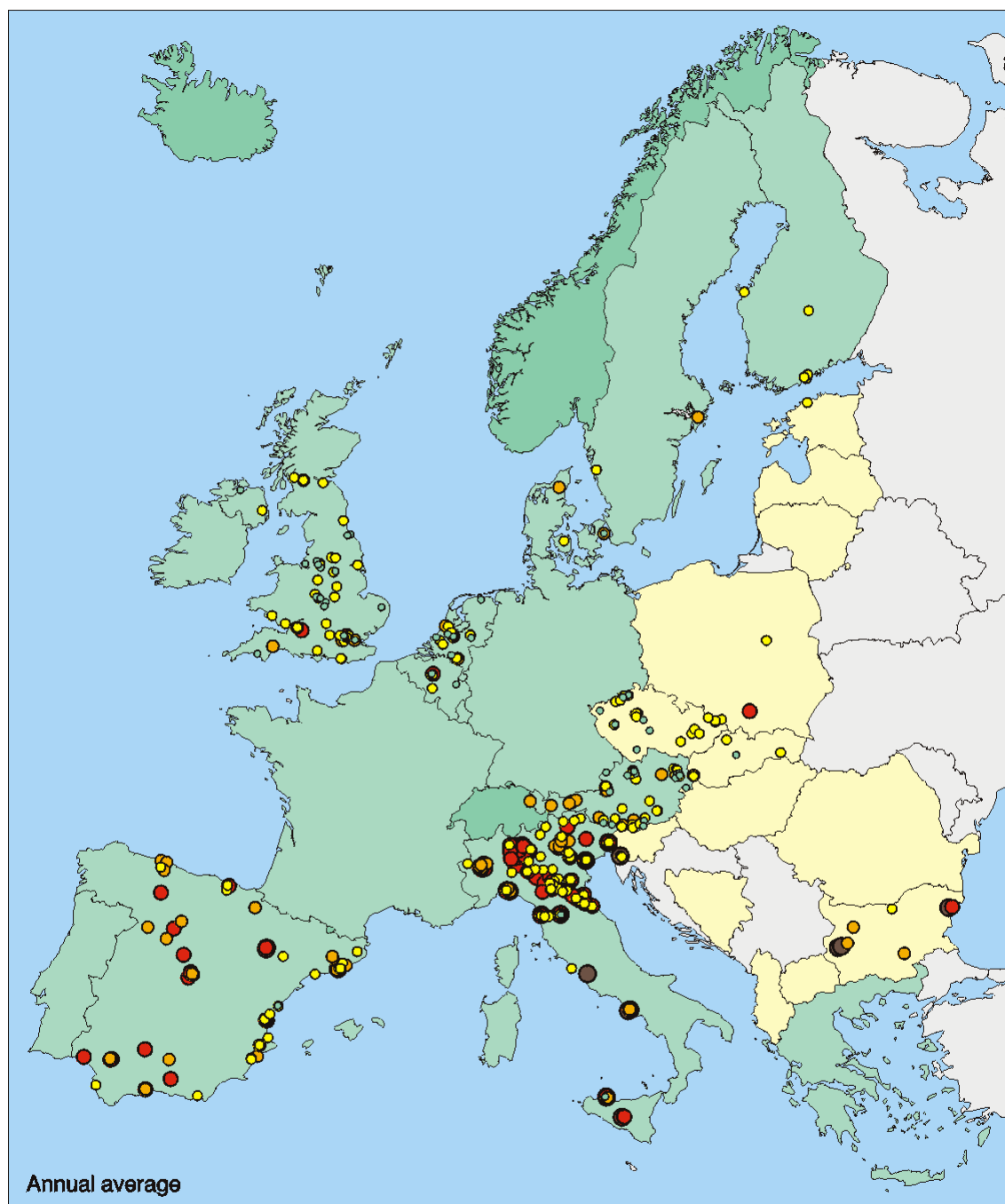


- | | |
|--|---|
| ■ EU | ■ rural |
| ■ EFTA | ⊕ urban |
| ■ PHARE | ▲ street |
| ■ other | ● other |

Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

Map 14: Carbon monoxide: annual average of 1-hour concentrations (mg/m^3), 1998.

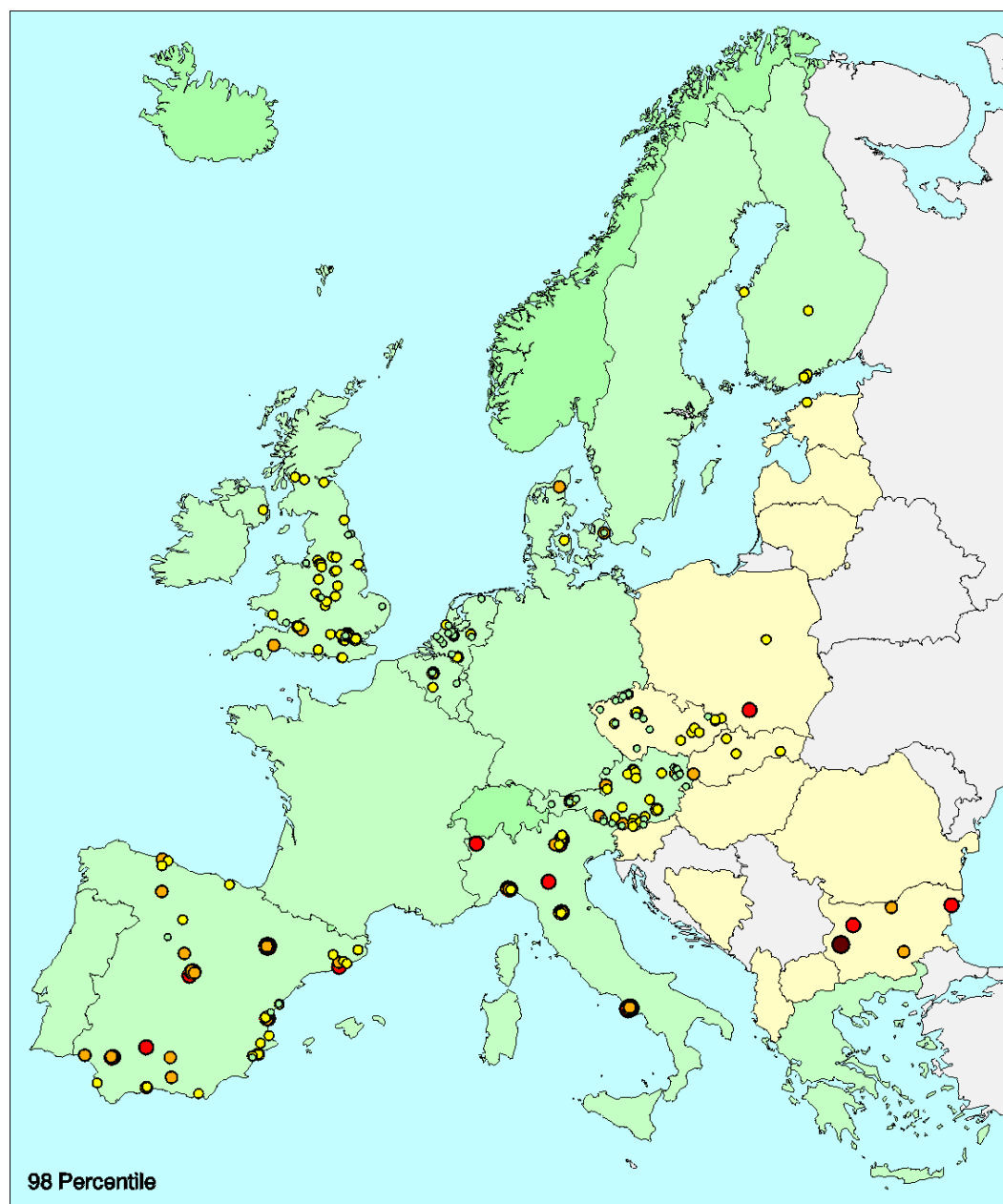
Carbon monoxide



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

Map 15: Carbon monoxide: 98 percentile of 8 hourly moving average concentrations (mg/m^3), 1998.

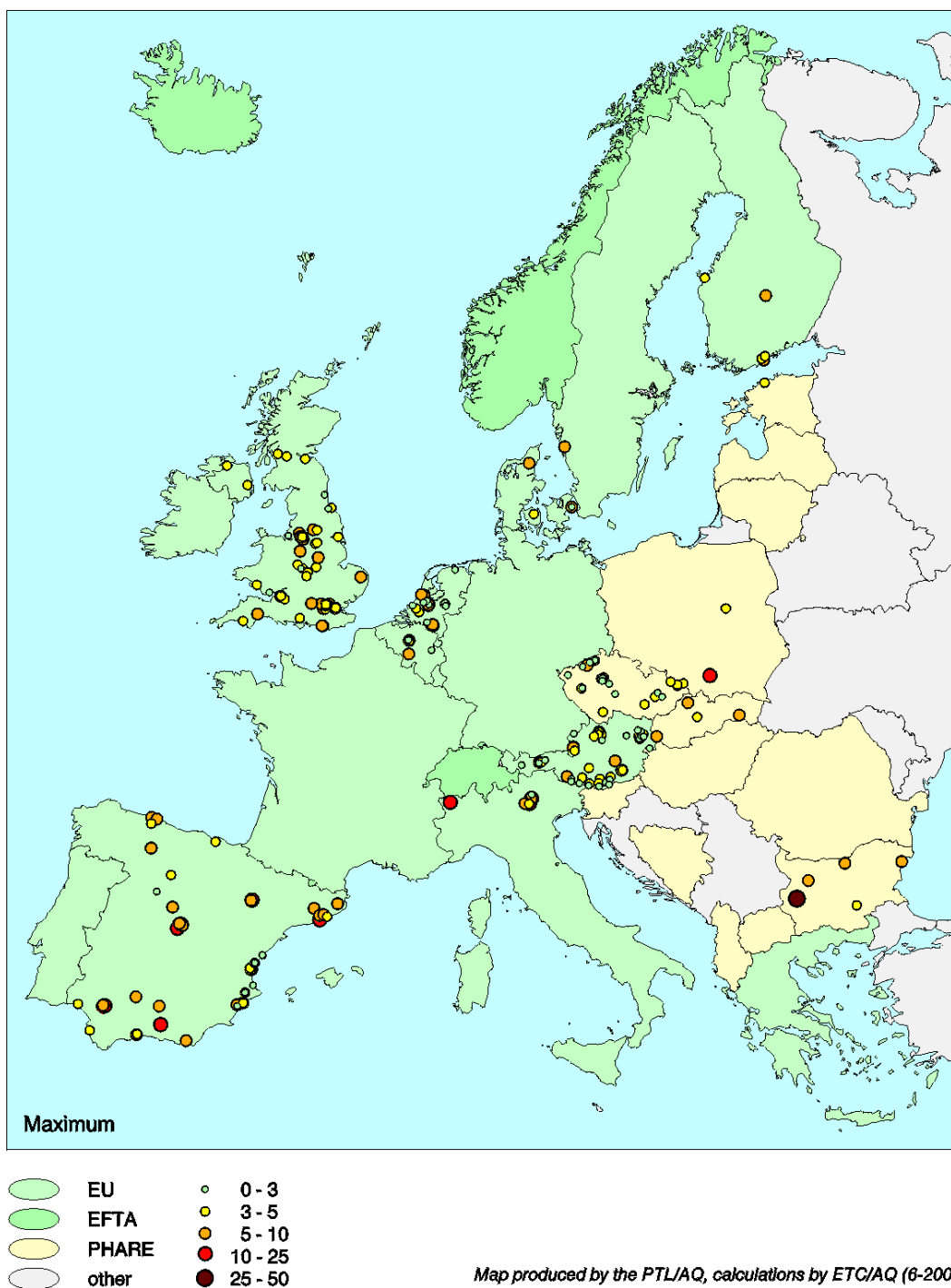
Carbon monoxide



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

Map 16: Carbon monoxide: maximum 8-hour average concentrations (mg/m³), 1998.

Carbon monoxide



3.6 Ozone

Tables 19 and 20 present average maximum 1-hour O₃ concentrations and average maximum 8-hour O₃ concentrations (based on moving average), respectively. Data is included for 765 stations in 10 EU countries and from 72 stations in 8 non-EU countries.

The EU 1 hour population warning value of 360 µg/m³ was exceeded in one EU country. The highest value in a EU country was 397 µg/m³ reported by Italy. In Bulgaria it was 357 µg/m³, very close to the warning value. The population information value of 180 µg/m³ was exceeded at many stations in most countries. Similarly, the 1-hour vegetation protection threshold value of 200 µg/m³ was exceeded at many stations in most countries. Maximum 1-hour values tend to be lower in northern European countries than in countries further south.

The EU health protection 8-hour threshold value of 110 µg/m³ was exceeded at most reported stations in all countries. Maximum 8-hour values were generally 150-200 µg/m³ at most stations. Italy reported above 300 µg/m³ at one station.

The EEA Report 'Air pollution by ozone in Europe in 1998 and summer 1999' (EEA Topic Report No. 10/2000) provides a more detailed discussion of exceedances of ozone threshold values in Europe, based upon information from 1540 stations.

Table 19: Average over stations and range in O₃ 1 hour maximum concentrations (µg/m³) in 1998. Figures in brackets refer to the number of stations.

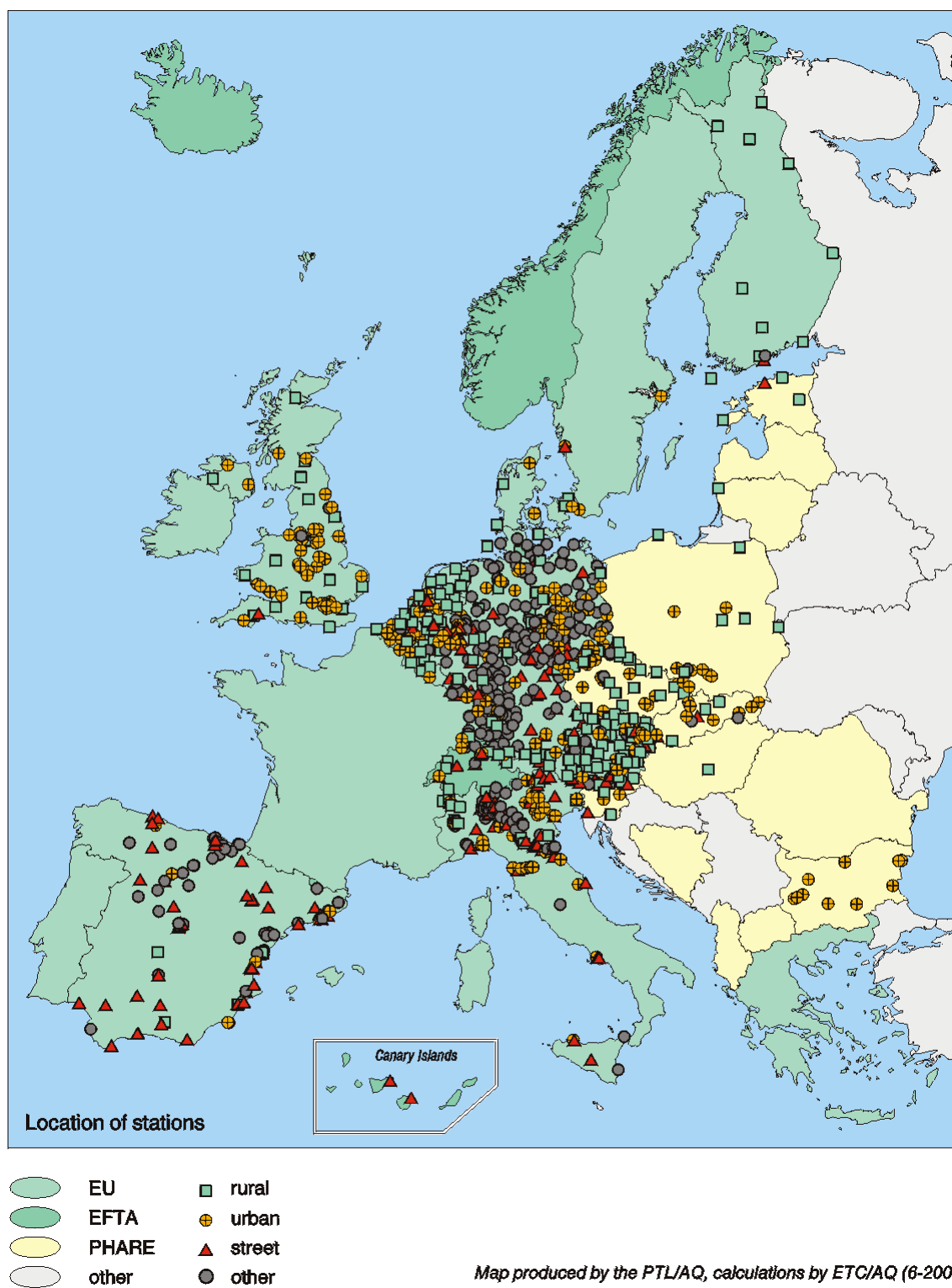
Station type Country	Maximum 1 hour concentrations including range				
	Rural	Urban	Street	Other	Non-defined
<i>EU countries</i>					
Austria	182 131-269(54)	198 139-283(23)	165 129-219(13)	188 168-195(6)	
Belgium	212 189-243(7)	208 173-238(9)	224 204-244(2)	218 216-220(2)	
Denmark	153 147-156(4)	150 144-156(3)	120(1)		
Finland	146 128-169(10)		116(1)		
Germany	212 163-270(27)	199 160-272(72)	188 102-255(50)	198 174-212(4)	207 128-286(185)
Italy	205 155-246(7)	237 125-358(32)	213 84-326(40)	269 194-397(8)	270 200-370(23)
The Netherlands	206 159-262(22)	196 152-235(7)	194 155-244(8)		
Spain	162 146-189(5)	161 132-208(6)	151 72-316(45)	179 76-328(18)	
Sweden		142 127-157(3)			
United Kingdom	162 132-240(16)	148 104-218(49)	90 88-92(2)	137 132-142(2)	
<i>Non-EU countries</i>					
Bulgaria		205 96-357(3)			
Czech Republic	191 167-208(12)	203 165-246(18)		240(1)	
Estonia	154(1)		109(1)		
Hungary	256(1)				
Latvia	144(1)				
Poland	179 158-196(8)	184 160-205(8)		140(1)	
Slovak Republic	133(1)	155 123-192(7)	182 169-195(2)	171 157-184(2)	
Slovenia	185 183-187(2)		151(1)		

Table 20: Average over stations and range in O₃ 8 hour maximum concentrations (µg/m³) in 1998 (based on moving 8h average). Figures in brackets refer to the number of stations.

	Maximum 8 hour concentrations including range				
Station type Country	Rural	Urban	Street	Other	Non-defined
<i>EU countries</i>					
Austria	164 114-209(56)	168 120-208(24)	142 119-179(12)	170 151-184(7)	
Belgium	186 168-214(8)	182 139-212(11)	191 181-201(2)	191 188-193(2)	
Denmark	138 134-144(4)	128 113-146(3)	92(1)		
Finland	139 125-161(10)		98(1)		
Germany	187 140-234(27)	173 129-232(72)	160 82-212(50)	174 157-185(4)	180 107-241(185)
Italy	190 145-226(7)	203 114-389(31)	172 58-257(38)	191 160-245(6)	224 174-287(21)
The Netherlands		163 116-183(7)	158 136-198(7)	171 140-231(12)	
Spain	151 134-174(5)	141 118-163(5)	123 53-181(42)	154 71-222(18)	
Sweden		115 112-117(3)			
United Kingdom	141 112-203(16)	123 81-188(49)	76 68-85(2)	117 115-118(2)	
<i>Non-EU countries</i>					
Bulgaria		230 130-330(2)			
Czech Republic	178 155-192(12)	180 148-209(18)		207(19)	
Estonia	135(1)		85(1)		
Hungary	197(1)				
Latvia	131(1)				
Poland	161 145-182(8)	166 133-185(8)		123(1)	
Slovak Republic	127(1)	141 104-176(7)	169(1)	149 134-165(2)	
Slovenia	166 156-176(2)	162 148-176(2)	135(1)		

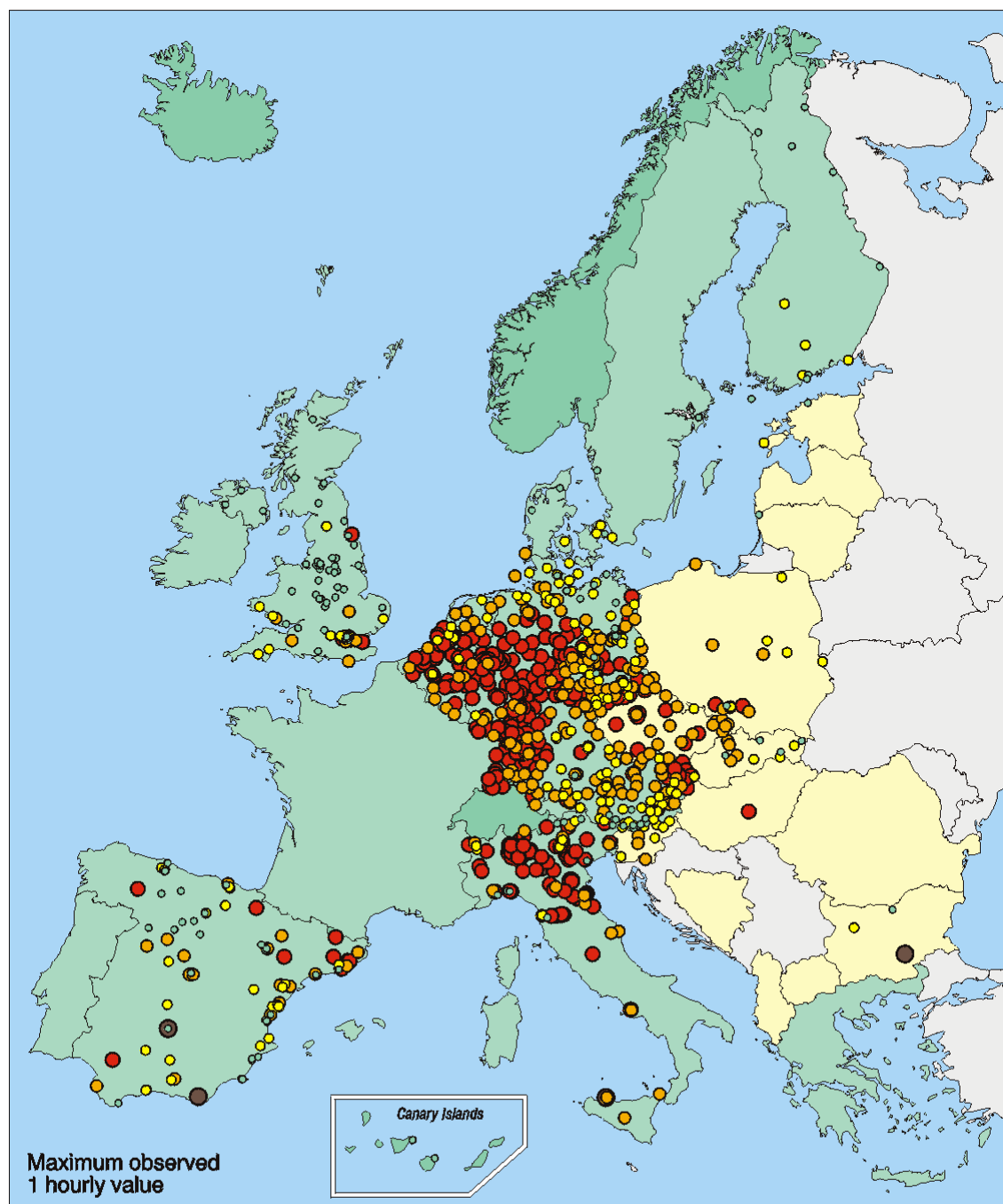
Map 17: Ozone: location of stations and station type, 1998.

Ozone



Map 18: Ozone: maximum 1-hour concentrations ($\mu\text{g}/\text{m}^3$), 1998.

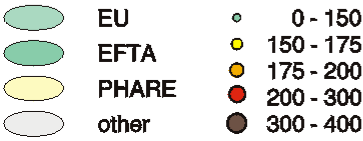
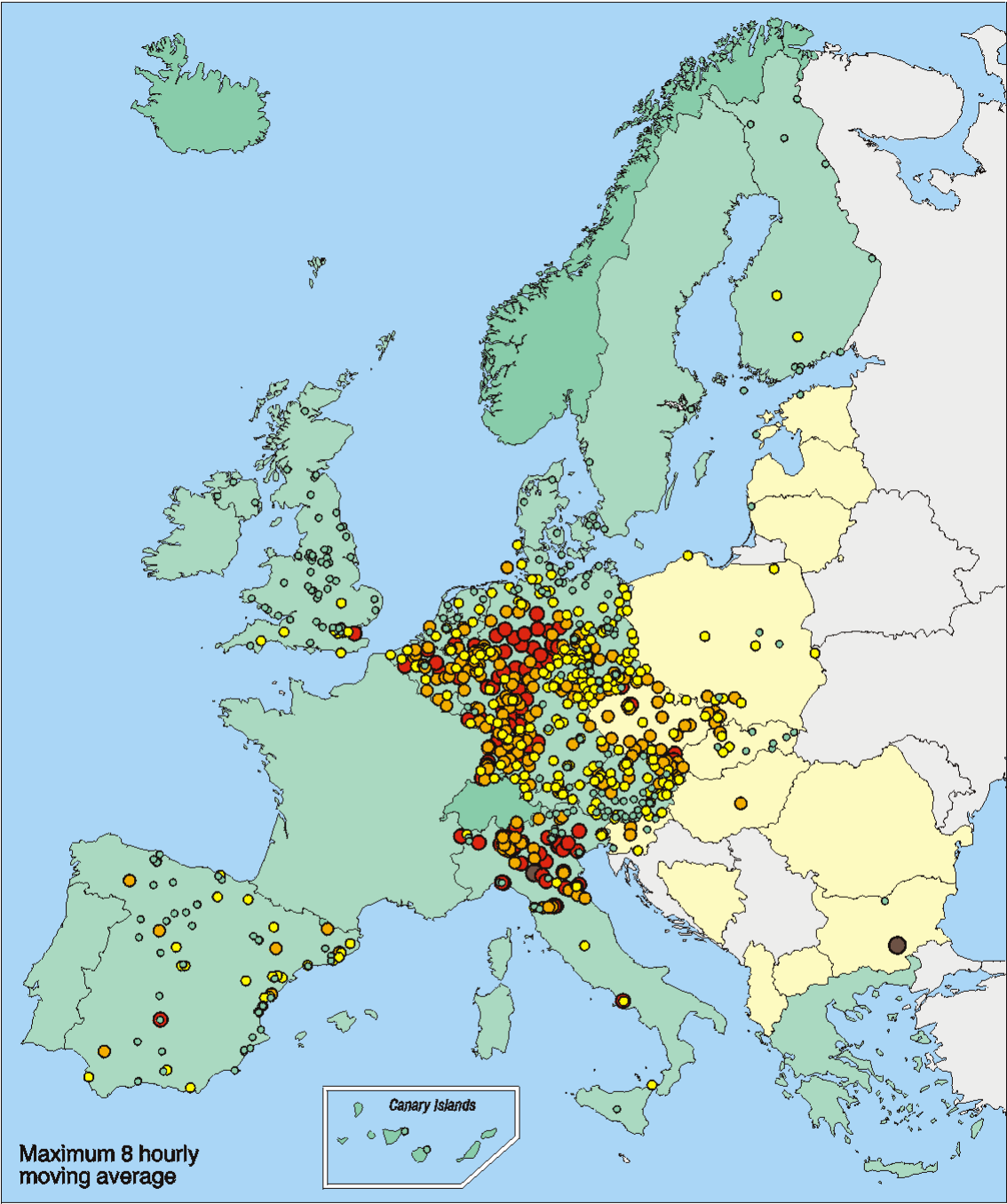
Ozone



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

Map 19: Ozone: maximum 8 hourly moving average concentrations ($\mu\text{g}/\text{m}^3$), 1998.

Ozone



Map produced by the PTL/AQ, calculations by ETC/AQ (6-2000)

3.7 Benzene

Table 21 presents reported annual average benzene concentrations. Data were reported by Belgium and the Netherlands only, for a total of 14 stations.

Only one station (the Dutch rural station) has time coverage above 50%, which is required for statistics calculations in the EoI Decision 97/101/EC. The new Daughter Directive for benzene (and CO) (2000/69/EC) requires a minimum time coverage of 35% (and that the distribution over the year is representative). Five of the 14 stations have more than 35% time coverage. Table 21 presents all the data reported, including those stations with too low time coverage (the range of time coverage for those stations is 22-34.8 %).

The new benzene directive gives a limit value of 5 µg/m³ as annual average. This value was exceeded at one street station in Belgium (in Brussels, with a time coverage of 34.8 %).

The extent of benzene data reporting is still very small. The data summary presented here can only give a very first indication of benzene levels in Europe.

Table 21. Average, minimum and maximum Benzene annual average concentration (µg/m³) in 1998. Figures in brackets refer to the number of stations.

Annual average including range				
	Rural	Urban	Street	Other
Time coverage > 35 % only				
Belgium			3.32 (1)	
The Netherlands	0.95 (1)	1.43 1.34-1.52 (2)	3.30 (1)	
Incl. also < 35 %				
Belgium	1.23 1.15-1.23 (2)	1.46 1.30-1.63 (3)	4.36 2.59-7.17 (3)	1.87 1.66-2.09 (2)
The Netherlands	(no additional stations with < 35 % coverage)			

4 Changes in Air Quality in Europe over the last years

4.1 Trends based on available data

Article 7 of the EoI Decision states that in its report the Commission will outline underlying trends in air quality in the European Union. AIRBASE now contains time series of five or more years of data for some components (SO₂, NO₂, O₃) for a number of stations in several (up to 10) countries. For other compounds, the number of stations with long time series is more limited.

The bulk of data in AIRBASE covering many years is from monitoring stations in urban areas, except for ozone, where rural stations dominate.

The number of stations with time series covering most years since 1989, or even the more recent period since e.g. 1995, is still fairly limited, seen in relation to the full EU area. Some data for non-EU countries has also been included in the trend analysis.

There are also time series in AIRBASE from before 1989 (going back as far as 1976 for SO₂, and even before that for Black Smoke and Strong Acidity for a few countries). Since the number of stations with consistent time series diminishes as one goes back in years, it was decided to use 1989 as the starting year for the trend information presented in this report.

This limited availability of time series from many countries and years precludes the calculation of statistically significant trends. In the following, the changes in air quality that the available time series show, are termed changes or tendencies, as measured. As a larger number of long time series become available, the basis for calculating statistically significant trends will improve.

The change information has been extracted as follows:

Annual statistical parameters have been extracted for all available time series (for individual stations), and transferred to tables in Excel format.

The stations in each country with data series covering most years of the period since 1989, or since 1993 or 1995 (depending upon availability of data), have been aggregated for each country, sometimes for each station type. To produce these national curves, the station selection is as far as possible the same for all years. (To be able to present some change curves, it was necessary to accept that a few stations might not have data for all of the years included in the series).

The change curves are presented on the following pages.

SO₂

Figure 1 shows changes in annual average SO₂ concentrations for 7 countries (total 73 stations) for the period 1993-1998, all types of stations included.

The figure shows the downward tendency in average SO₂ concentrations for all countries shown, except Spain where there appears to be a noticeable deviation, to a very high value for Spain in 1998.

NO₂

Figure 2 shows changes in NO₂, annual average, for 7 countries (total 79 stations) for some countries since 1989, and in addition for some since 1995, all types of stations included.

The figure shows a tendency towards reduced NO₂ concentrations for some countries, although not as large a relative reduction as for SO₂. For Austria and UK, there is not much reduction.

Figure 3 shows the 98-percentile for the period 1995-1998 for 7 countries (total 82 stations), all types of stations. In Figures 4 and 5 respectively, urban background (3 countries, 33 stations) and traffic stations (5 countries, 24 stations) are shown separately.

In these figures the picture is variable, with countries showing moderate increases or decreases or little change.

Ozone

The number of ozone stations in AIRBASE with long time series were, at the time of this assessment (autumn 2000), so limited that no change curves of any European significance could be produced.

4.2 Evaluation of the tendencies in AIRBASE data

Although the available data allows change curves to be produced from data at up to about 80 stations (per compound) at up to 7 countries, one must be careful in presenting conclusions on tendencies in air quality representative for the EU area, or indeed for Europe, based upon such limited data.

For SO₂, however, the downward tendency in all the 7 countries with enough data in AIRBASE, is clear. This also reflects the documented SO₂ emission reductions in EU countries (EMEP data, in EMEP MSC-W Note 1/00, Norwegian Meteorological Institute, Oslo, 2000). EU SO₂ emissions were reduced by about 38 % from 1993 to 1998. The corresponding reduction in Phare countries is 34 %. The reduction in the largest EU countries varied, e.g. 50 % in Germany, about 30 % in Italy, 20 % in France, and 49 % in the UK.

For the three countries in Figure 1 with SO₂ data covering the full period, comparison of reductions (1993-1998) in emissions, and concentrations as given by AIRBASE data, is as follows:

Denmark:	50 % reduced emissions, and 74 % reduced concentrations.
The Netherlands:	31 % reduced emissions, and 45 % reduced concentrations.
UK:	49 % reduced emissions, and 54 % reduced concentrations.

For **NO₂**, the three countries with long time series in AIRBASE (1989-98), Greece, Denmark and the Netherlands all have some reduction in NO₂ concentrations over that period, i.e. 20-30 %. This is rather consistent with the reported NO_x emission reductions for these countries (in particular Denmark and the Netherlands).

For the later period in the time series (1995-1998), NO_x emissions in the EU area were almost unchanged. This is also reflected in Figures 3-5. Interannual variations, especially for the 98th percentile, reflect the effects of meteorological variations from year to year.

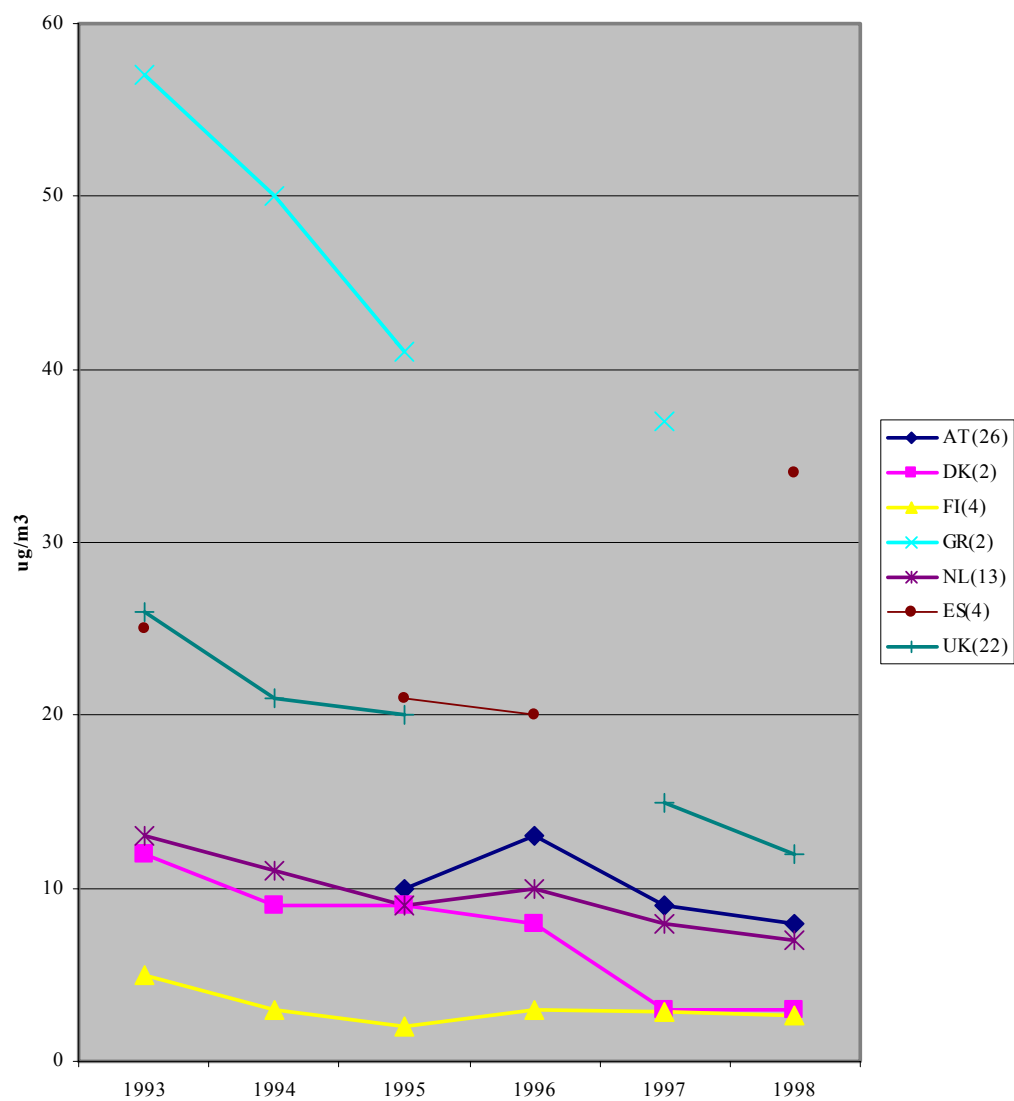


Figure 1: SO₂ change curves from AIRBASE: Nationally averaged curves for annual average SO₂ concentrations, all types of stations.

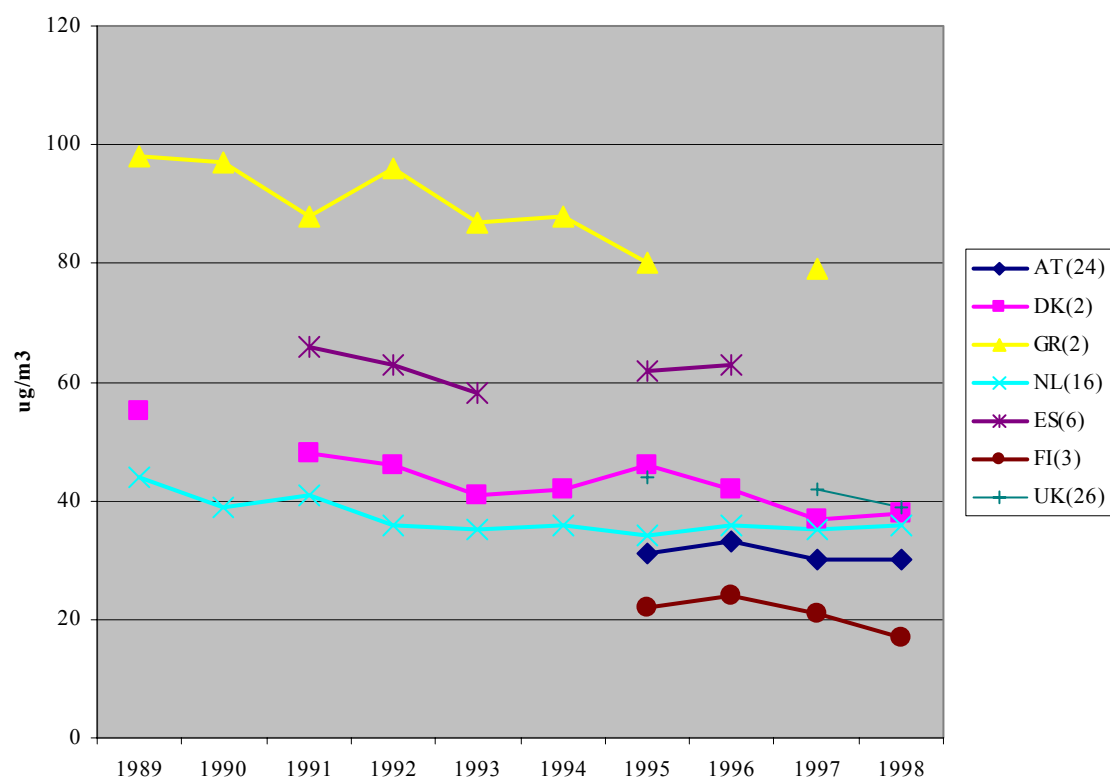


Figure 2: NO₂ change curves for AIRBASE: Nationally averaged curves for annual average NO₂ concentrations, all types of stations.

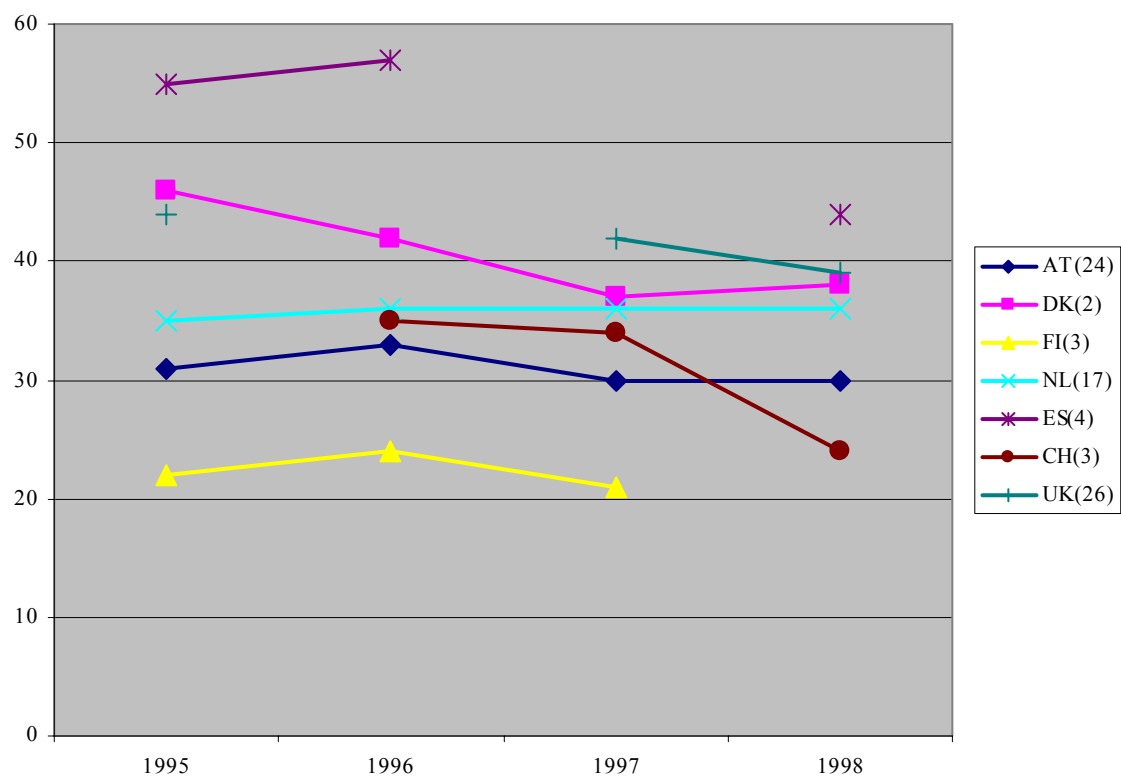


Figure 3: NO₂ change curves from AIRBASE: Nationally averaged curves for 98-percentile of hourly NO₂ concentrations, all types of stations.

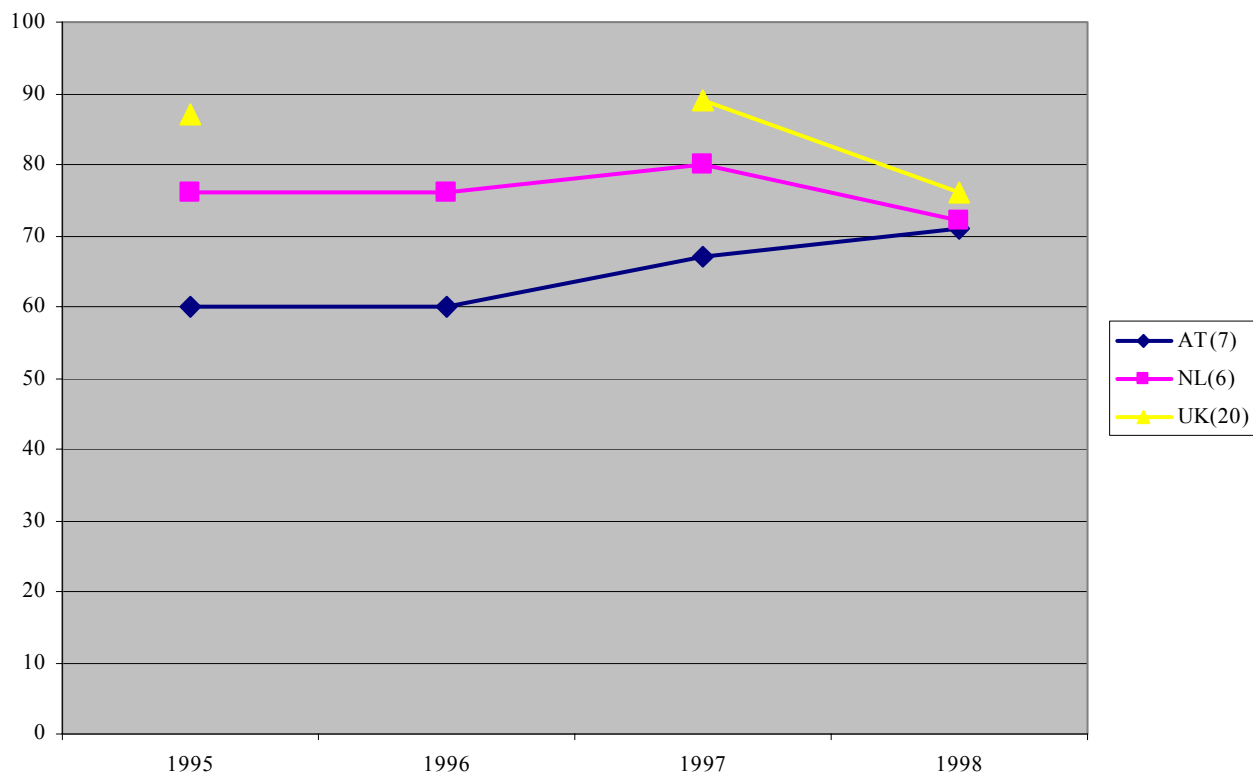


Figure 4: NO₂ change curves from AIRBASE: Nationally averaged curves for 98-percentile of hourly NO₂ concentrations, urban background stations.

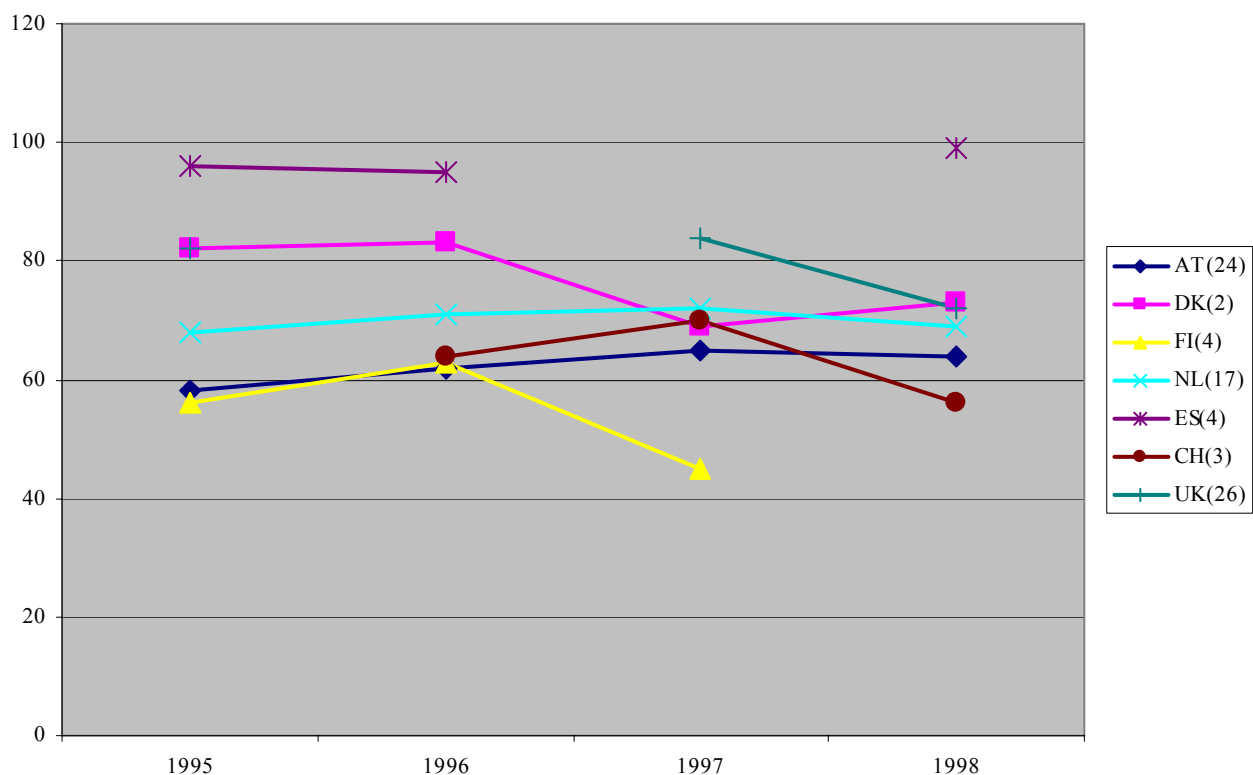


Figure 5: NO₂ change curves from AIRBASE: Nationally averaged curves for 98-percentile of hourly NO₂ concentrations, traffic stations.

5 Discussion, conclusions and recommendations

In the preamble of Decision 97/101/EC it is stated that the information collected should be sufficiently representative to enable pollution levels to be mapped throughout the Community. Articles 3 and 5 set requirements for the selection of stations and data to be reported under the Decision. Although 1998 data was reported for more than 1000 stations for some compounds, the maps show that the reporting under EoI still does not cover all of the EU area, and that the spatial density of stations varies greatly. Four EU Member States did not report 1998 data, and in addition, data reported by France could not be processed due to a data format issue. For the 10 countries for which data have been processed, most data originates from stations in the larger cities, and also from many rural stations. Should all EU Member States report to a similar high extent, the spatial coverage will be sufficient for a first full assessment of the pollution and exposure situation of SO₂ and NO₂ in the Community. For PM₁₀, ozone and other compounds, the spatial coverage of the stations reported under EoI still need to be improved in most (if not all) countries. Therefore, all Member States are urged to report data. It is also recommended that the Member States evaluate their station selection, in accordance with Articles 3 and 5.1 of the Decision. In this process, it is recommended to see this selection also in connection with selected EUROAIRNET stations.

The maps show that for some of the non-EU countries, which have reported data, spatial coverage is fairly substantial. This offers a promising basis for extending the pollution assessment to a larger part of the European population.

Article 5.1 states that data shall be transmitted under the EoI Decision, unless they have been made available to the Commission under existing legislation on air quality. At present, ETC/AQ does not have the specific information on the extent to which data (time series and statistics) or information (in the form of exceedances and statistics) already reported under the Air Quality Directives, was also submitted under the framework of EoI.

Article 7 of the EoI Decision states that in its report the Commission will outline underlying trends in air quality in the European Union. AIRBASE now contains fairly long time series (several years) of data for certain components (e.g. SO₂, BS, NO₂, O₃) for a number of stations in several (up to 10) countries.

The information on changes and tendencies that can be extracted from AIRBASE is still not complete enough to allow calculation of representative trends in air quality for the EU area or Europe as a whole. However, for SO₂ and NO₂, fairly long time series are available for up to 7 countries for up to a total of almost 80 stations (dependent upon the compound). There is a significant downward tendency in SO₂ consistent with reported sulphur emissions reductions, of the order of 40-50 % for the period 1993-1998. For NO₂ the reductions are smaller, and for the later years (1995-1998) there is no significant tendency in NO₂ in the EU area, and this is also consistent with reported emission data.

For NO₂, as well as for PM, ozone and other compounds, a larger basis of data is needed to calculate trends that are representative for the EU area, or for Europe as a whole. It is recommended that those Member States which have not done so, transmit data collected between 1989 (the last year of mandatory reporting under Decision 82/459/EEC) and 1996 (and also fill in gaps in the reporting since then) to enable a trend analysis, in accordance with Article 5.4 of Decision 97/101/EC.

In order to enable proper assessment of air quality based upon reported air quality data, it is often necessary to group stations according to their emission environment. Decision 97/101/EC presents a station type classification (traffic, industrial, background) and type of zone classification (urban, suburban, rural). For this report, ETC/AQ has attempted to classify the stations according to station types (rural, urban, street). Many stations could not be classified because meta information on stations was (partly) missing. This concerns about 19 % of the component-stations on average over all components (up to about 26 % for TSP and O₃). This also limits the use of the air quality data for assessments. Countries therefore are urged to complete their meta data and classification of stations.

Annex A

Validation of Eol data for 1998 by ETC/AQ

Validation of EoI data for 1998 by ETC/AQ

Validation of data series is carried out first and foremost by the data providers themselves (at the network level first, then at the central data provider in each country, at least as part of the process when loading the data into the DEM).

Additional validation is carried out by ETC/AQ, on the basis of the requirements set for data in the EoI Decision, as well as by checking data statistics for obvious mistakes. A 2-step procedure is followed:

Data series are checked automatically for time coverage; series that do not fulfil the time coverage requirements of the EoI are removed from further presentations in this report.

The statistics tables printed out from the AIRBASE statistics calculations routines are checked manually for results that obviously seem erroneous.

Examples of such errors found while checking the 1998 data:

statistics values (average, 98-percentile, maximum) which are reported as 0 (zero) or negative.

some extremely high values (e.g. several 1000 $\mu\text{g}/\text{m}^3$, except for CO), which were re-checked and subsequently rejected.

Such errors may originate either from errors in the raw data, or during the process of transferring data via DEM to AIRBASE. For the 1998 EoI data this process resulted in the need to re-programme certain parts of the statistics calculation module of AIRBASE, to handle reported inconsistencies. Some NRCs were contacted to discuss and evaluate the issue of 'questionable results'. After these consultations most of the questionable results were explained, re-calculated using the modified statistics module, or resulted in the additional rejection of several raw data series.

Table A1 shows the number of raw data series that were not accepted as a result of the two-step data validation, per country and compound.

In the first validation step, a total of about 370 time series were not accepted (most for O₃, NO₂ and SO₂), mostly because the EoI time coverage requirement to calculation of annual average was not fulfilled. During calculation of 98 percentiles and maximum values, more time series were rejected, because the requirements to time coverage for these statistics are more restrictive.

In the second validation step, a total of about 140 additional time series were removed from this EoI reporting.

Table A1: Number of 1998 time series of raw data transferred using DEM, which were *not accepted* under the Eol data validation procedure carried out by ETC/AQ, based on the annual average statistics. For 98-percentile and maximum value statistics, some more data series were not accepted.

	SO ₂		Strong A		BS		TSP		PM ₁₀		CO		NO ₂		O ₃		Pb	
	1.val.	2.val.	1.val.	2.val.	1.val.	2.val.	1.val.	2.val.	1.val.	2.val.	1.val.	2.val.	1.val.	2.val.	1.val.	2.val.	1.val.	2.val.
<i>EU Member States</i>																		
Austria								5			5	2	6		4	9		
Belgium	3							4		3			4		4	4	4	
Denmark																		
Finland							11		2									
Germany	17	1					15		2				13		12	13		
Italy	25						18				13		6		144			
The Netherlands	1																	
Spain	23	1			1		16		12		3	11	23	3	8	2	2	
Sweden													10		1			
United Kingdom	3		60		59						3		3		1			
<i>non-EU countries</i>																		
Bulgaria	3	37					10				3		42		7			19
Czech Rep.												1		8	2			
Estonia																		
F.Y.R. of Macedonia	1				1										2			
Hungary																		
Latvia																		
Norway									5				5					
Poland	1								1				1					
Slovak Rep.															1	2		
Slovenia																		
Total	77	39	60	0	61	0	70	5	26	0	30	14	113	11	186	30	6	19

