3. Air quality in the Phare countries

So far, an overview of air quality information from central and east European countries has been difficult to get, partly due to poor availability of data and sometimes low reliability and comparability. Nevertheless, various European and national reports or other information sources highlight the variability in air quality in this area. This corresponds with the large variation in emission density, orography, climate, meteorological conditions and land-use through the territory of the Phare countries. Industrial areas, overloaded with obsolete heavy industry still provide air pollution hot spots. On the other hand, there are large areas of forest and other areas with a very low population — particularly in the northern part of the Phare area. These belong to some of the cleanest areas in Europe.

This chapter focuses on the presentation of the 1997 air quality data transmitted by the Phare countries — predominately from Euroairnet sites — in the first reporting cycle in accordance with the EoI decision (97/101/EC). Implementation of the Euroairnet in the Phare countries will lead to unification of air quality monitoring procedures, which will ensure more objective, reliable and comparable information on air quality across Europe. The extent and completeness of air quality data transmitted has been described in the previous chapter.

Air quality trends in urban areas of the Phare countries are presented in the following subchapter. In order to identify areas and pollutants for which future problems of compliance with the European air quality directives might be expected, the frequency of exceedance of health-related air quality limit values, as defined in the new daughter Directive 99/30/EC, has been evaluated.

The last part of this chapter offers an approach for modelling the spatial pollutant concentration distribution within the Phare countries based upon the relationships between the measured pollutant concentrations and surrogate data (e.g. emissions estimates per unit area or land cover statistics).

3.1. Air quality monitoring results in 1997

Tables 3.1–3.5 summarise air quality in the Phare countries in 1997 on a country-by-country basis and by station type for SO_2, PM, NO_2, CO and ozone respectively. For each country and station type, the arithmetic average concentration from the number of sites given in brackets is presented followed by the range of concentration statistics. Statistics, as described in Decision 97/101/EC are calculated and presented in these tables for sulphur dioxide, particulate matter (BS — black smoke, TSP and PM_{10}), nitrogen dioxide, carbon monoxide and ozone.

For all pollutants, air quality data are also presented in maps (Figures 3.1–3.5) as spots varying in size and colour on a station-by-station basis (rural, urban background, traffic and other stations).

Table 3.6 shows summary statistics for the Phare region as a whole — maximum, 98th percentile, 95th percentile, 90th percentile, 75th percentile, median, 25th percentile, 10th percentile and minimum value are presented. These statistics have been calculated from annual sets of daily concentrations for each type of station in the whole Phare area for sulphur dioxide, particulate matter (PM_{10}, SPM and black smoke), nitrogen dioxide and ozone. As expected, with exception of ozone, the lowest concentrations for all components were measured on rural stations. The highest concentrations of SO_2 are associated with industrial and urban background sites. The 98th percentile of SO_2 is in range from 139 $\mu g.m^{-3}$ at industrial stations to 84 $\mu g.m^{-3}$ at rural stations. Median of SO_2 daily concentrations ranges from 22 $\mu g.m^{-3}$ at traffic to 8 $\mu g.m^{-3}$ at rural sites. The 98th percentile of PM_{10} is in range from 187 $\mu g.m^{-3}$ at industrial stations to 85 $\mu g.m^{-3}$ at rural stations. The median of PM_{10} daily concentrations ranges from 48 $\mu g.m^{-3}$ at traffic to 20 $\mu g.m^{-3}$ at rural sites. The 98th percentile of SPM is in range from 149 µg.m^{-3} at traffic stations to 139 µg.m^{-3} at urban background stations. The median of SPM daily concentrations ranges from 46 µg.m^{-3} at traffic and urban stations to 36 µg.m^{-3} at industrial sites. There were no measurements of SPM at rural type sites. The highest concentrations of NO_2 are associated with traffic and urban background sites according to this analysis. The 98th percentile of NO_2 is in the range 91 µg.m^{-3} at traffic type to 42 µg.m^{-3} at rural stations. The median of NO_2 daily concentrations ranges from 43 µg.m^{-3} at traffic to 10 µg.m^{-3} at rural sites. Although this analysis indicates that the classification of stations is generally correct, the presence of zero concentrations as minimum value, instead of half of measurement method detection limit, indicates that it may be necessary to check QA/QC procedures and improve data verification procedures

SO_2 concentrations by country and by station type Table. 3.1

Annual average: average and range (µg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Bulgaria		65(6). 26–94		
Czech Republic	18(19). 5–37	28(34). 16–43	26(2). 25–28	26(1)
Estonia			5(1)	8(2). 7–9
Hungary	10(4). 5–17	42(3). 38–45	49(4). 46–51	35(1)
Latvia	2(2). 2–2			
Lithuania			8(1)	
FYROM		25(12). 6–83	39(8). 13–69	32(4). 9–70
Poland		25(12). 10–51		
Slovak Republic		29(13). 15–63	24(8). 15–31	31(9). 6–64
Slovenia		39(2). 35–43	23(1)	
Phare	15(25). 1–37	(3 182). 6–94	32(25). 5–69	29(17). 6–70
98th percentile: average and range (µg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Bulgaria		187(1)		
Czech Republic	80(19). 27–164	129(33). 67–220	124(2). 112–135	117(1)
Estonia	1(1)		13(1)	26(2). 24–28
Hungary	49(4). 27–83	100(3). 98–102	100(4). 97–103	86(1)
Latvia	7(2). 6–8			
Lithuania			27(1)	
FYROM		90(11). 17–208	137(7). 46–282	111(4). 30–246
Poland		94(10). 44–170		
Slovak Republic		124(9). 47–263	82(6). 56–137	135(7). 49–292
Slovenia		109(1)	66(1)	
Phare	66(26). 1–164	116(68). 17–263	100(22). 13–282	(10 915). 24–292
24-h maximum: average and range (µg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Bulgaria		242(1)		
Czech Republic	183(19). 64–548	286(33). 128–752	187(2). 158–216	161(1)
Estonia	2(1)		17(1)	54(2). 42–65
Hungary	109(4). 39–204	151(3). 143–158	132(4). 120–146	124(1)
Latvia	8(2). 6–10			
Lithuania			45(1)	
FYROM		245(11). 33–678	346(7). 120–604	209(4). 52–457
Poland		181(10). 92–326		
Slovak Republic		340(9). 75–1 029	149(6). 74–291	410(7) 80–1 159
Slovenia		190(1)	83(1)	
Phare	(26). 2–548	(68). 33–1 029	(22). 17–604	(15). 42–1 159

NB: Figure between brackets = number of stations.

Table 3.2 **PM concentrations by country and by station type**

Annual average: average and range (µg.m^{-3})					
Country	**Rural**	**Urban**	**Traffic**	**Industrial**	**Note**
Estonia			36(1)		TSP
Hungary		55(3). 50–59	53(4) 43–64	68(1)	TSP
Slovak Republic		51(8). 36–74	49(6). 21–65	44(9). 31–90	TSP
Czech Republic	25(19). 13–51	38(34). 24–60	51(2). 50–52	38(1)	PM_{10}
Poland		50(6). 34–59	77(1)	73(1)	PM_{10}
FYROM		23(15). 5–42	29(8). 11–48	25(4). 12–36	BS
Poland		23(6). 10–35			BS
98th percentile: average and range (µg.m^{-3})					
Country	**Rural**	**Urban**	**Traffic**	**Industrial**	**Note**
Estonia			332(1)		TSP
Hungary		127(3). 124–130	120(3). 106–138	162(1)	TSP
Slovak Republic		121(5). 66–162	127(3). 97–153	110(8). 73–221	TSP
Czech Republic	73(19). 34–174	119(33). 67–168	148(2). 146–150	116(1)	PM_{10}
Poland		145(4). 102–188	210(1)	187(1)	PM_{10}
FYROM		90(14). 19–194	107(7). 32–162	107(4). 62–139	BS
Poland		88(6). 42–143			BS
24-h maximum: average and range (µg.m^{-3})					
Country	**Rural**	**Urban**	**Traffic**	**Industrial**	**Note**
Estonia			492(1)		TSP
Hungary		191(3). 181–210	173(3). 165–186	233(1)	TSP
Slovak Republic		188(5). 90–334	173(3). 122–231	164(8). 109–285	TSP
Czech Republic	139(19). 55–330	232(33). 101–502	285(2). 266–303	268(1)	PM_{10}
Poland		208(4). 138–294	279(1)	399(1)	PM_{10}
FYROM		161(14). 31–454	241(7). 106–338	224(4). 100–427	BS
Poland		203(6). 91–326			BS

NO_2 concentrations by country and by station type Table 3.3

Annual average: average and range (μg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Bulgaria		13(4). 3–24		
Czech Republic	14(16). 5–23	33(25). 23–48	46(1)	
Estonia			37(1)	6(2). 5–7
Hungary	8(4). 3–14	53(3). 39–66	50(4). 31–61	25(1)
Latvia	2(2). 2–2			
Lithuania			35(1)	
Poland	21(1)	31(13). 20–46	68(2). 68–68	23(1)
Slovak Republic		27(12). 10–41	38(8). 28–53	23(9). 18–29
Slovenia		17(1)	51(1)	
Phare	12(23). 1–23	31(58). 3–66	45(18). 28–68	21(13). 5–29
98th percentile: average and range (μg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Czech Republic	40(16). 18–66	70(25). 57–85	89(1)	
Estonia			67(1)	31(2). 28–34
Hungary	18(4). 10–26	94(3). 82–104	85(4)67–97	60(1)
Latvia	5(2). 4–6			
Lithuania			59(1)	
Poland	50(1)	61(10). 46–78	112(2). 112–112	
Slovak Republic		79(7). 60–126	74(6). 57–101	53(8). 40–81
Slovenia		47(1)		
Phare	33(23). 2–66	70(46). 47–126	81(15). 57–112	50(11). 2881
24-h maximum: average and range (μg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Czech Republic	72(16). 34–111	114(25). 79–181	142(1)	
Estonia			77(1)	48(2). 47–49
Hungary	27(4). 16–40	120(3). 98–141	103(4). 75–126	73(1)
Latvia	7(2). 6–8			
Lithuania			64(1)	
Poland	85(1)	85(10). 63–123	155(2). 155–155	
Slovak Republic		98(7). 69–152	99(6). 76–137	71(8). 55–104
Slovenia		69(1)		
Phare	59(23). 3–111	105(46). 63–181	106(15). 64–142	67(11). 47–104

Note: Figure between brackets = number of stations.

Table 3.4 **CO concentrations by country and by station type**

Annual average: average and range (µg.m-3)				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Bulgaria		1 336(6). 395–2 542		
Czech Republic	352(2). 308–396	669(21). 368–914	1 174(1)	906(1)
Estonia			1158(1)	
Hungary		2 158(3). 2 116–2 202	2 744(4). 2 494–2 902	2 435(1)
Lithuania			2 230(1)	
Poland		983(1)	2 860(1)	
Slovak Republic			1 100(5). 769–1 462	221(1)
Phare	352(2). 308–396	952(31). 368–2 542	1 838(13). 769–2 902	1 187(3). 221–2 435
98th percentile: average and range (8-hourly moving average) (µg.m-3)				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Bulgaria		2 013(1)		
Czech Republic	807(2). 739–876	1 984(17). 1 381–2 823	3 042(1)	2 275(1)
Estonia			3 185(1)	
Hungary		3 915(2). 3 445–4 385	5 232(4)4 278–5 889	
Lithuania			5 208(1)	
Poland			6 256(1)	
Slovak Republic			3 470(3). 2 359–4 773	
Phare	807(2). 739–876	2 178(20). 1 381–4 385	4 456(11). 2 359–6 256	2 275(1)
8-h maximum: average and range (µg.m-3)				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Bulgaria		3 950(1)		
Czech Republic	1 094(2). 1 036–1 151	3 836(17) 2 031–7 402	4 783(1)	5 531(1)
Estonia			6 137(1)	
Hungary		5 716(2). 5 321–6 110	8 626(4). 6 880–10 894	
Lithuania			11 161(1)	
Poland			11 506(1)	
Slovak Republic			5 354(3). 3 273–7 871	
Phare	1 094(2). 1 036–1 151	4 030(20). 2 031–7 402	7 650(11). 3 273–11 506–	5 531(1)

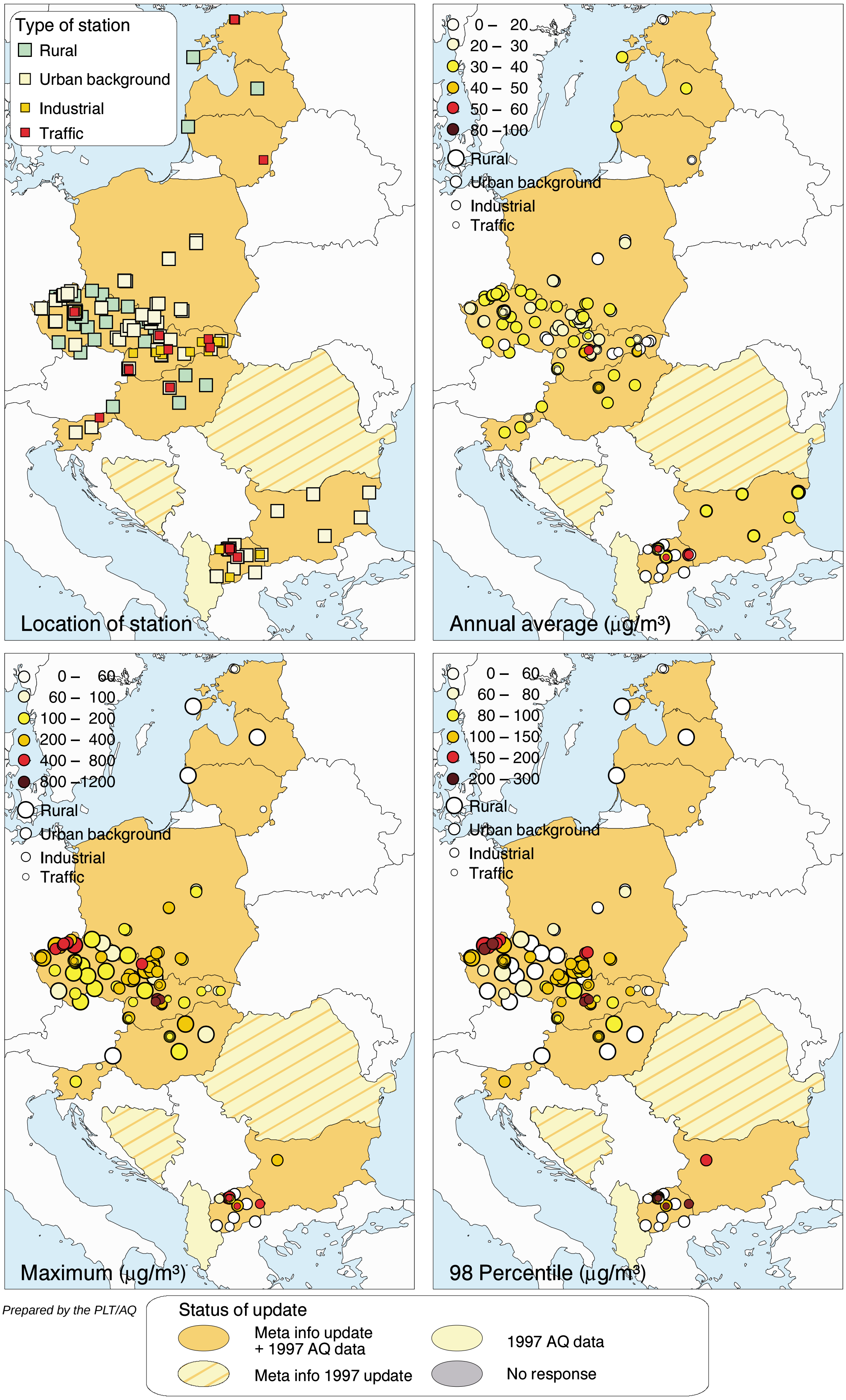
Note: Figure between brackets = number of stations.

Ozone concentrations by country and by station type

Table 3.5

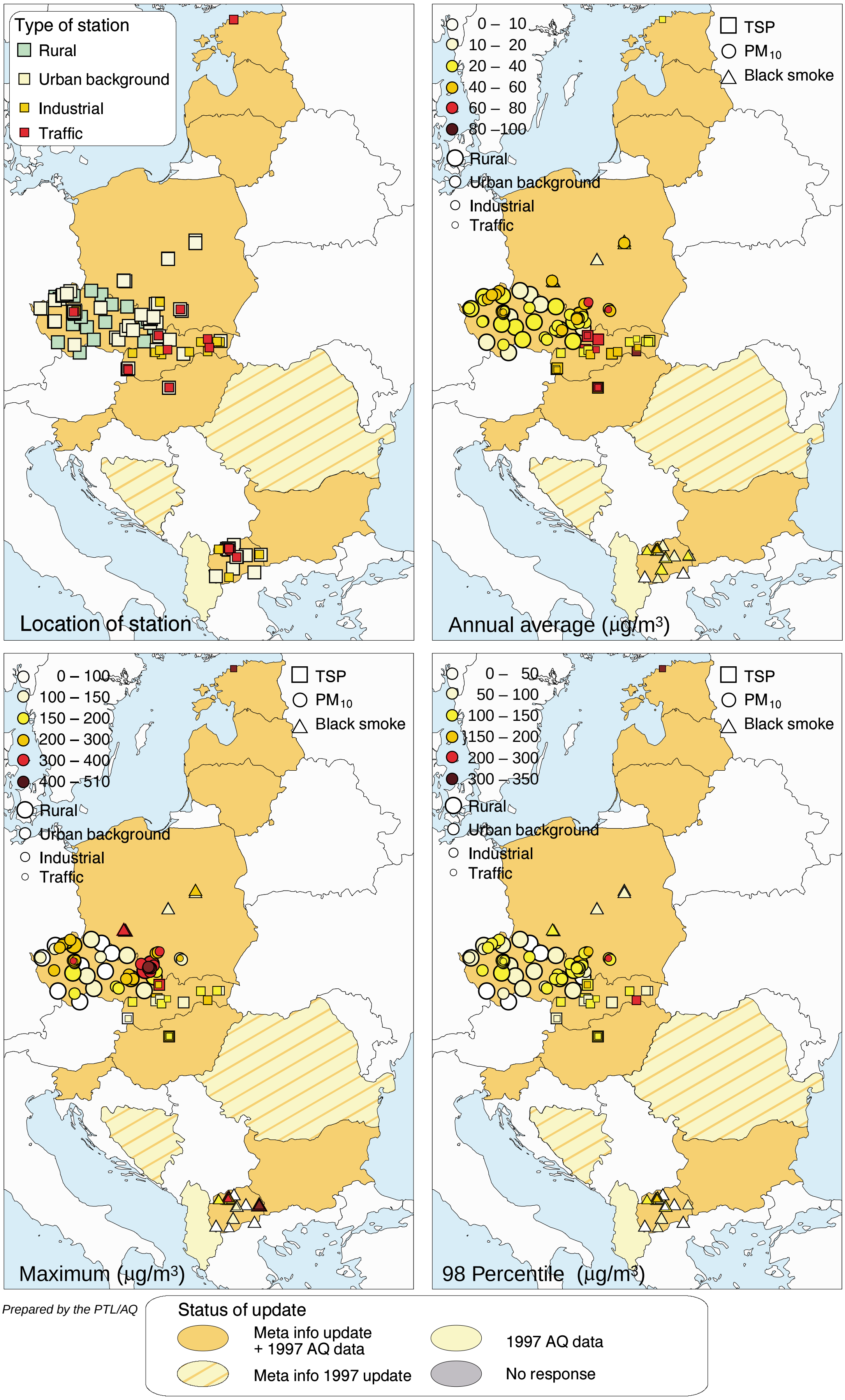
Max. 1-hour: average and range (µg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Czech Republic	167(13).135–200	169(16). 127–200		147(1)
Estonia	166(1)		122(1)	
Hungary	184(4). 165–199	157(1)		
Lithuania		130(3). 122–143	180(1)	
Poland	155(7). 136–175	176(7). 141–222		
Slovak Republic	174(3). 130–232	147(5). 126–172	142(2). 124–159	148(3). 135–166
Slovenia	198(2). 193–203	248(2). 210–285		
Phare	169(30). 130–232	168(34). 126–285	146(4). 122–180	148(4). 135–166
Max. 8-hour (moving average): average and range (µg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Czech Republic	149(13). 121–163	148(16). 107–187		131(1)
Estonia	152(1)		107(1)	
Hungary	165(4). 146–177	136(1)		
Lithuania		120(3).113–127	157(1)	
Poland	146(7). 130–167	148(7). 125–175		
Slovak Republic	123(3). 104–149	128(5). 112–145	116(2). 97–135	132(3). 124–145
Slovenia	174(2). 161–187	179(2). 162–195		
Phare	(30). 104–187	(34). 107–195	(4). 97–157	(4). 131–145
Average: average and range (µg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Bulgaria		53(5). 16–122		
Czech Republic	66(13). 44—81	44(17). 29–57		35(1)
Estonia	65(2). 59–72		34(1)	
Hungary	69(4). 55–77	50(1)		
Latvia	50(1)			
Lithuania		51(4). 48–55	38(1)	
Poland	56(8). 35–81	39(8). 27–51		
Slovak Republic	54(3). 31–80	49(9). 38–80	33(2). 30–36	47(3). 42–51
Slovenia	78(2). 57–99	38(2). 36–39	36(1)	
Phare	(33). 31–81	(46). 16–122	(5). 30–36	(4). 35–51
98th percentile: average and range (µg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Czech Republic	118(13). 93–134	110(16).74–130		99(1)
Estonia	121(1)		72(1)	
Hungary	128(4). 112–143	106(1)		
Lithuania		93(3). 90–97	98(1)	
Poland	109(7). 94–124	101(7).81–116		
Slovak Republic	92(3). 67–118	98(5). 82–109	84(2). 69–99	104(3). 97–108
Slovenia	140(2). 130–151	118(2). 112–123		
Phare	(30). 67–151	(34). 74–130	(4). 69–99	(4). 97–108
24-h maximum: average and range (µg.m^{-3})				
Country	**Rural**	**Urban**	**Traffic**	**Industrial**
Bulgaria		67(1)		
Czech Republic	130(13). 89–156	105(16). 73–141		88(1)
Estonia	134(1)		82(1)	
Hungary	132(4). 115–142	92(1)		
Lithuania		97(3). 90–107		
Poland	113(7). 95–141	95(7). 74–128		
Slovak Republic	99(3). 67–131	98(5). 84–106	83(2). 68–97	99(3). 93–107
Slovenia	160(2). 148–172	143(2). 138–148	87(1)	
Phare	(30). 67–172	(35). 67–148	(4). 68–97	(4). 88–107

Figure 3.1 **Location of stations, annual average, maxima and 98th percentiles in given classes, sulphur dioxide, 1997**



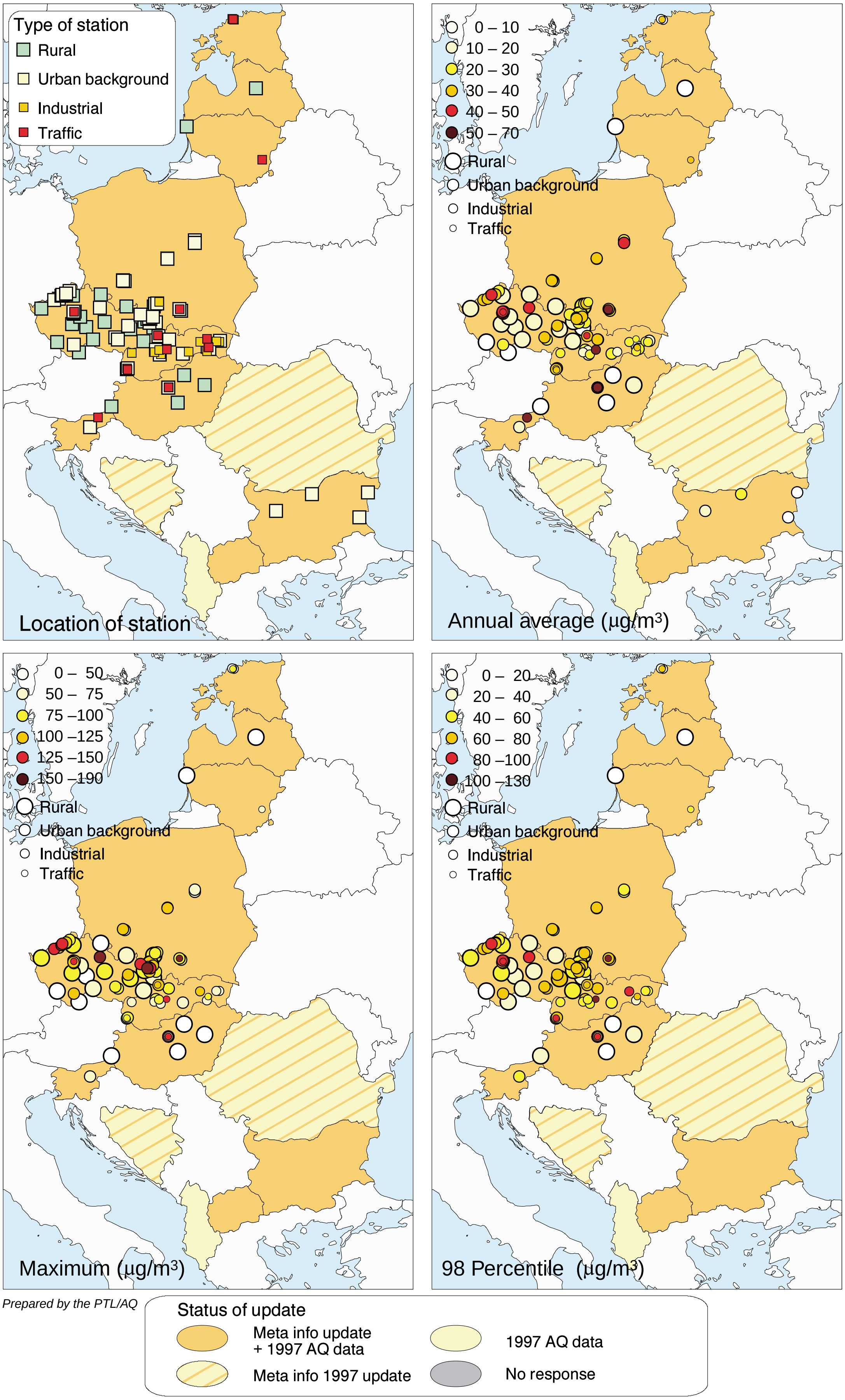
Prepared by the PLT/AQ

Location of stations, annual average, maxima and 98th percentiles in given classes, particulate matter, 1997 Figure 3.2



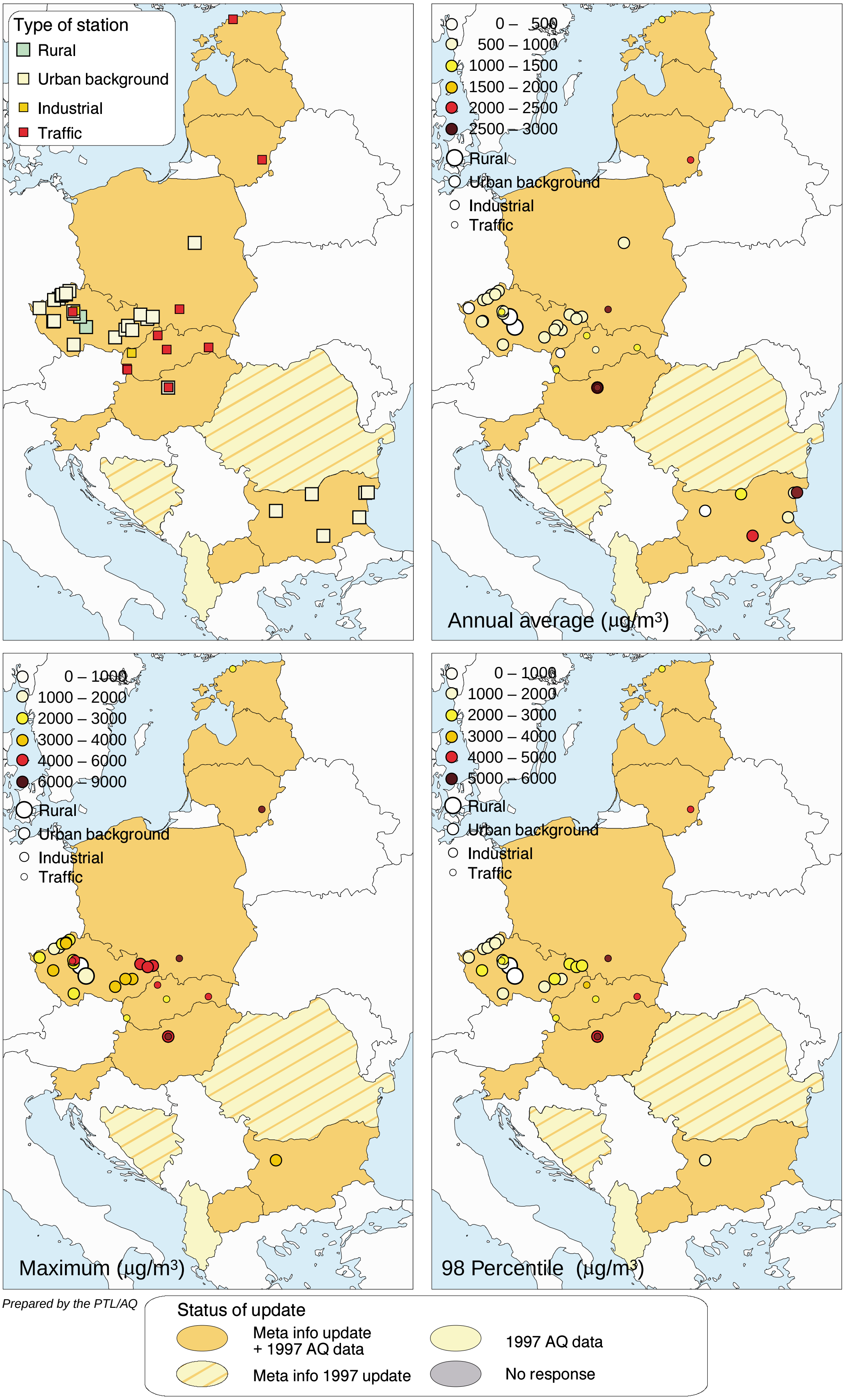
Prepared by the PTL/AQ

Figure 3.3 **Location of stations, annual average, maxima and 98th percentiles in given classes, nitrogen dioxide, 1997**



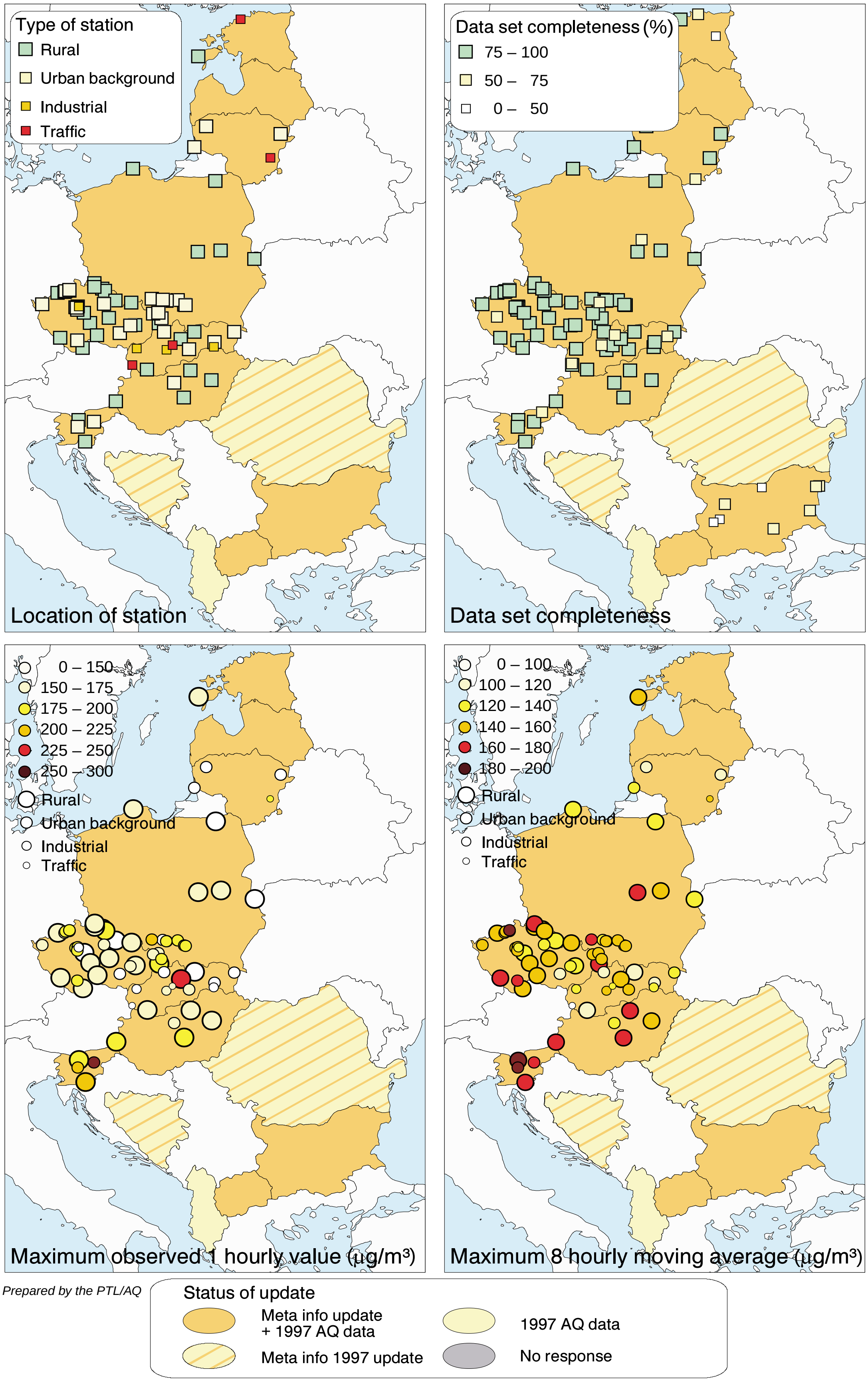
Prepared by the PTL/AQ

Location of stations, annual average, maxima and 98th percentiles in given classes, carbon monoxide, 1997 Figure 3.4



Prepared by the PTL/AQ

Figure 3.5 **Location of stations, data set completeness, maximum 1-hourly value, maximum 8-hourly moving averages in given classes, ozone, 1997**



Prepared by the PTL/AQ

Statistics of daily average concentrations (µg.m-3) of main pollutants per type of station in the Phare region, 1997

Table 3.6

Type of station	Pollutant	Max.	98th percentile	95th percentile	90th percentile	75th percentile	50th percentile	25th percentile	10th percentile	Min.
Urban background	SO_2	1 029	133	93	64	35	18	9	5	0
Traffic		604	122	83	60	41	22	11	5	0
Industrial		1159	139	92	61	33	17	9	5	0
Rural		548	84	50	34	17	8	3	1	0
All		1 159	125	85	58	33	16	8	4	0
Urban background	PM_{10}	502	130	96	73	47	30	20	14	2
Traffic		303	187	147	110	73	48	33	23	7
Industrial		399	170	130	104	68	45	28	18	6
Rural		330	85	60	46	31	20	12	8	1
All		502	128	93	70	44	28	18	12	1
Urban background	SPM	334	139	117	97	67	46	31	21	5
Traffic		492	149	119	95	68	46	30	0	0
Industrials		285	146	110	88	59	36	24	16	0
All		492	146	115	94	64	43	28	17	0
Urban background	BS	454	110	80	56	27	13	7	4	0
Traffic		338	135	102	72	35	16	7	3	0
Industrial		427	121	85	61	29	14	7	3	0
All		454	119	86	60	29	14	7	3	0
Urban background	NO_2	181	80	66	56	42	29	20	14	0
Traffic		155	91	79	70	56	43	31	22	0
Industrial		104	54	45	38	28	19	11	3	0
Rural		111	42	32	24	16	10	5	2	0
All		181	78	65	54	39	24	14	7	0
Urban background	O_3	148	92	82	74	60	43	25	11	0
Traffic		97	68	63	58	47	33	20	11	0
Industrial		107	84	78	70	60	46	27	13	2
Rural		172	119	107	98	82	64	46	29	2
All		172	109	97	86	69	51	32	16	0

3.2. Air quality in cities in the Phare countries

The number of inhabitants in the Phare region is more than 115 million people of which approximately 17 million live in urban areas with more than 500 thousand inhabitants. About 8 million people live in cities with a population in the range 250-500 thousand and 19 million in cities with a population in the range 50-250 thousand. The highest population areas are generally the capital cities (see Table 3.7).

Until the end of the 1980s, the air quality situation in cities in the Phare region was characterised by increasing sulphur dioxide and particulate pollution. At that time, Phare cities were affected by high soot and sulphur dioxide concentrations (London type smog) in the winter season, as was the case in many other cities throughout Europe. Later, due to the reduction of coal- and lignite-based pollution sources, sulphur and soot emissions decreased significantly (see Figure. 2.1). In parallel, the ambient air concentration of sulphur dioxide and particulate matter decreased in most large cities of Phare region (Figures. 3.6 and 3.7). In Budapest, for example, an intensive campaign and technological investment programme has been undertaken to reduce the sulphur content of diesel oil consumed by the public buses, which are the major users of that type of fuel. In addition, individual coal-based heaters are being replaced by central natural gas heating systems in several Phare cities.

Table 3.7 **Population in capitals and other large cities (> = 500 thousand)**

City	Country	Population/1 000
Tirana	Albania	500
Sofia	Bulgaria	1 300
Sarajevo	Bosnia and Herzegovina	341
Prague	Czech Republic	1 220
Tallinn	Estonia	900
Skopje	FYROM	550
Budapest	Hungary	2 100
Riga	Latvia	900
Vilnius	Lithuania	570
Warsaw	Poland	1 500
Silesia conurbation	Poland	2 100
Krakow	Poland	800
Lodz	Poland	850
Poznan	Poland	590
Bucharest	Romania	2 400
Bratislava	Slovak Republic	500
Ljubljana	Slovenia	273
Total		**17 444**

However, the number of vehicles increased rapidly, releasing increasing amounts of nitrogen oxides, hydrocarbons and carbon monoxide; these pollutants lead to photochemical oxidant formation (ozone, PAN, etc.). The trends in nitrogen dioxide annual concentration in large cities of the Phare region in the period 1988–97 (Figure 3.8) suggest that, generally, the dominant source of this pollutant is now traffic in most of the cities of the region. There are no trends evident in the time series of annual average ozone concentrations (Figure 3.9).

The annual time series of 24-hour concentrations of the basic pollutants at selected urban background stations (Figure 3.10) show the seasonal variation of these pollutants and occurrences of episodes of extremely high concentrations of some pollutants. Figure 3.11 and Figure 3.12 depict the annual time series of 24-hour concentrations of the main pollutants at selected traffic and industrial sites. Urban background stations reflect representative levels of air pollution for assessment of population exposure in cities, whereas traffic and industrial sites represent higher exposure levels which can prevail in the central area of the city with dense traffic, or in industrialised zones.

Graphs of ordered 98th percentiles and annual mean concentration of SO_2, PM (TSP or PM_{10}), NO_2 and, for O_3 maximum 8-hour and 1-hour average, show the highest pollutant concentrations and their range at urban background (Figure 3.13) and traffic and industrial sites (Figure 3.14). Figure 3.13 shows that the exceptionally high annual average urban background concentrations of sulphur dioxide, 83 and 80 µg.m^{-3}, were detected in Titov Veles (FYROM) and Vratsa (Bulgaria) respectively. Other urban background stations with annual average concentrations of sulphur dioxide higher than 40 µg.m^{-3} are located in Zabrze (Poland), Prievidza (the Slovak Republic), Gliwice (Poland), Budapest (Hungary), Usti n. L. and Teplice (the Czech Republic). Most of annual average urban background concentrations of sulphur dioxide lie in range of 40–15 µg.m^{-3}.

The highest 98th percentiles of 24-hour SO_2 concentrations were detected in the range 220–185 µg.m^{-3} in Teplice and Chomutov (the Czech Republic), Skopje (FYROM), Vratsa (Bulgaria) and Prievidza (the Slovak Republic). Other urban background stations with 98th percentile of 24-hour SO_2 concentrations higher than 160 µg.m^{-3} are situated in Zabrze and Gliwice (Poland) and Usti n. L. and Most (the Czech Republic).

As regards the nitrogen dioxide concentrations, the levels on urban background stations are only slightly lower then at the traffic sites (Figure 3.14). The highest annual average concentrations of nitrogen dioxide at urban background sites in Budapest (Köbánya and Laborc utca) were 66 and 54 µg.m^{-3} respectively, whereas the highest annual average concentration of nitrogen dioxide at traffic sites were detected in Krakow (Poland), 68 µg.m^{-3}. On the contrary, at traffic sites in Budapest (Baross tér, Kosztolányi tér and Széna tér) the 24-hour average NO_2 concentrations were in the range of 61–51 µg.m^{-3}. The highest 98th percentile of 24-hour NO_2 concentrations at urban sites was detected in Budapest, 103 µg.m^{-3}, whereas the highest 98th percentile of 24-hour NO_2 concentrations at traffic site in Krakow (Poland) was 112 µg.m^{-3}.

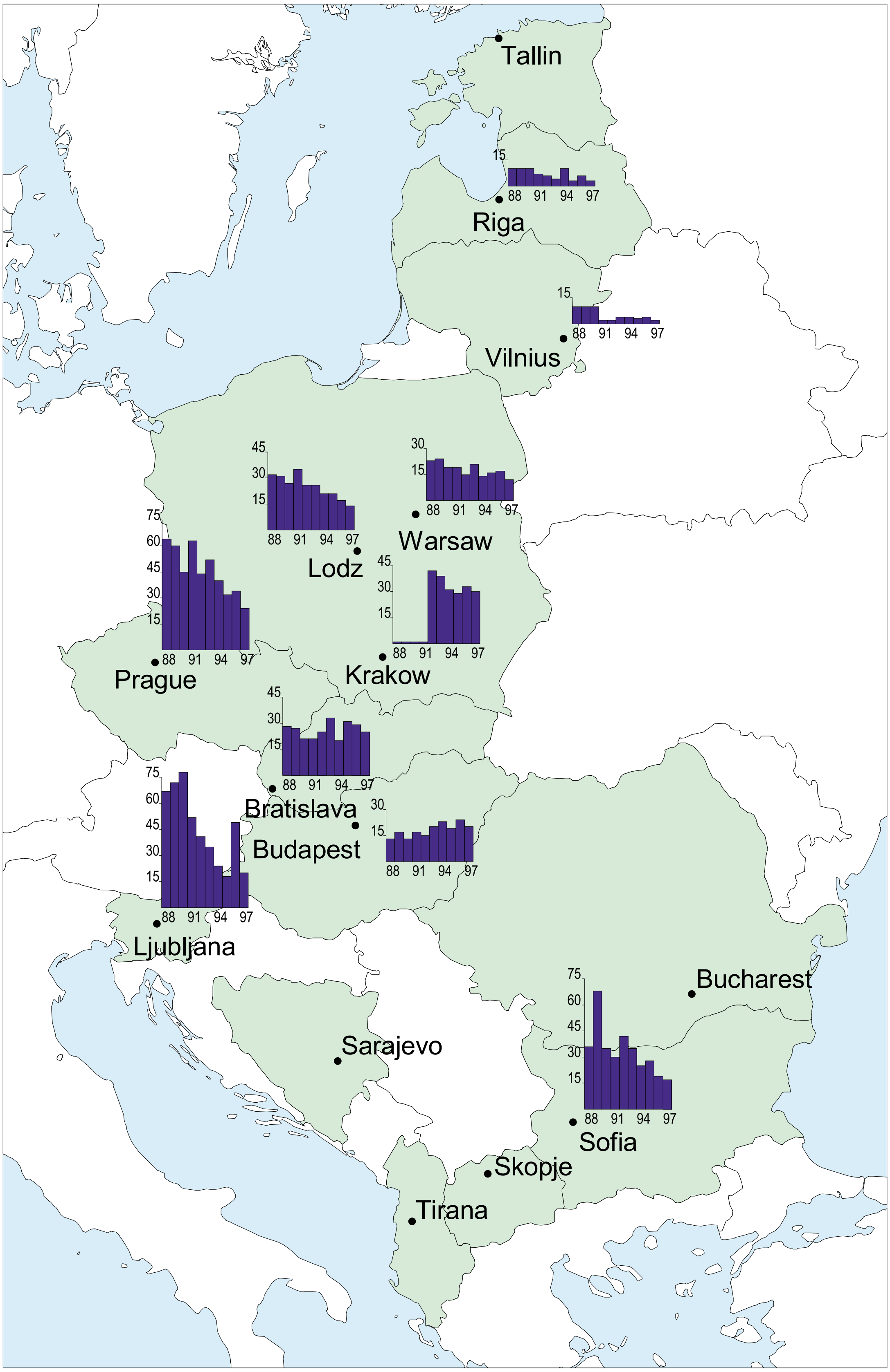
The wide size range distribution of aerosol particles found in the atmosphere makes the sampling difficult. Some countries report TSP or black smoke (BS) while others PM_{10}. For this reason, the comparison of particulate concentration levels is difficult.

Cities in this part of Europe are still coping with the problem of atmospheric lead (Pb) arising mostly from vehicles using leaded gasoline. Older cars can only use leaded gasoline due to their engine construction. However, the number of modern cars equipped with catalytic converters is increasing and hence, an increasing fraction of gasoline consumed in the region is unleaded. During the past decade, the use of unleaded gasoline has become increasingly widespread in the Phare region (Bozó, 1998). In general, it can be stated that although air quality in the Phare region has improved in recent decades, air pollution still represents one of the major environmental issues that authorities at all levels have to cope with. In contrast to the decreasing SO_2, Pb and PM ambient concentrations, pollutants associated with road transport such as NO_x, CO, VOC and indirectly O_3 have increased during the last decades. In this sense, cities in Phare region replicate, to some extent, the development of air pollution in cities of the EU countries.

To identify areas and pollutants for which problems of compliance with new European air quality standards (Directive 99/30/EC) could be expected, the number of days exceeding health-related air quality limit values was evaluated for Phare urban areas. The frequency of exceedance of given limit values are presented in Table 3.8 and depicted on a map (Figure 3.15), which shows sites exceeding limit values. This assessment indicates that the limit values for PM_{10} are likely to cause the greatest problem.

The number of people affected by air pollutant concentrations exceeding limit values is almost 14 % of the total population of the Phare countries which delivered data in 1997.

Figure 3.6 **Annual concentration trends in large cities, sulphur dioxide, 1988–97 (µg/m³)**



Annual concentration trends in large cities, particulate matter, 1988–97 (µg/m³) Figure 3.7