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Air pollution in Europe 1990–2004

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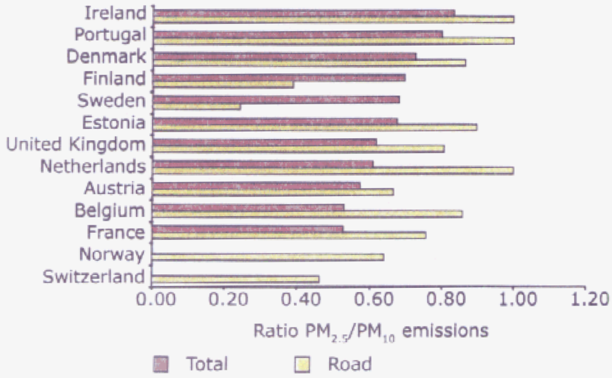
Figure 3.13 $PM_{2.5}/PM_{10}$ emissions ratios, total and for road transport



Source: EEA (ETC/ACC).

fraction of coarse particles from the road caused by increased wear of the road surface.

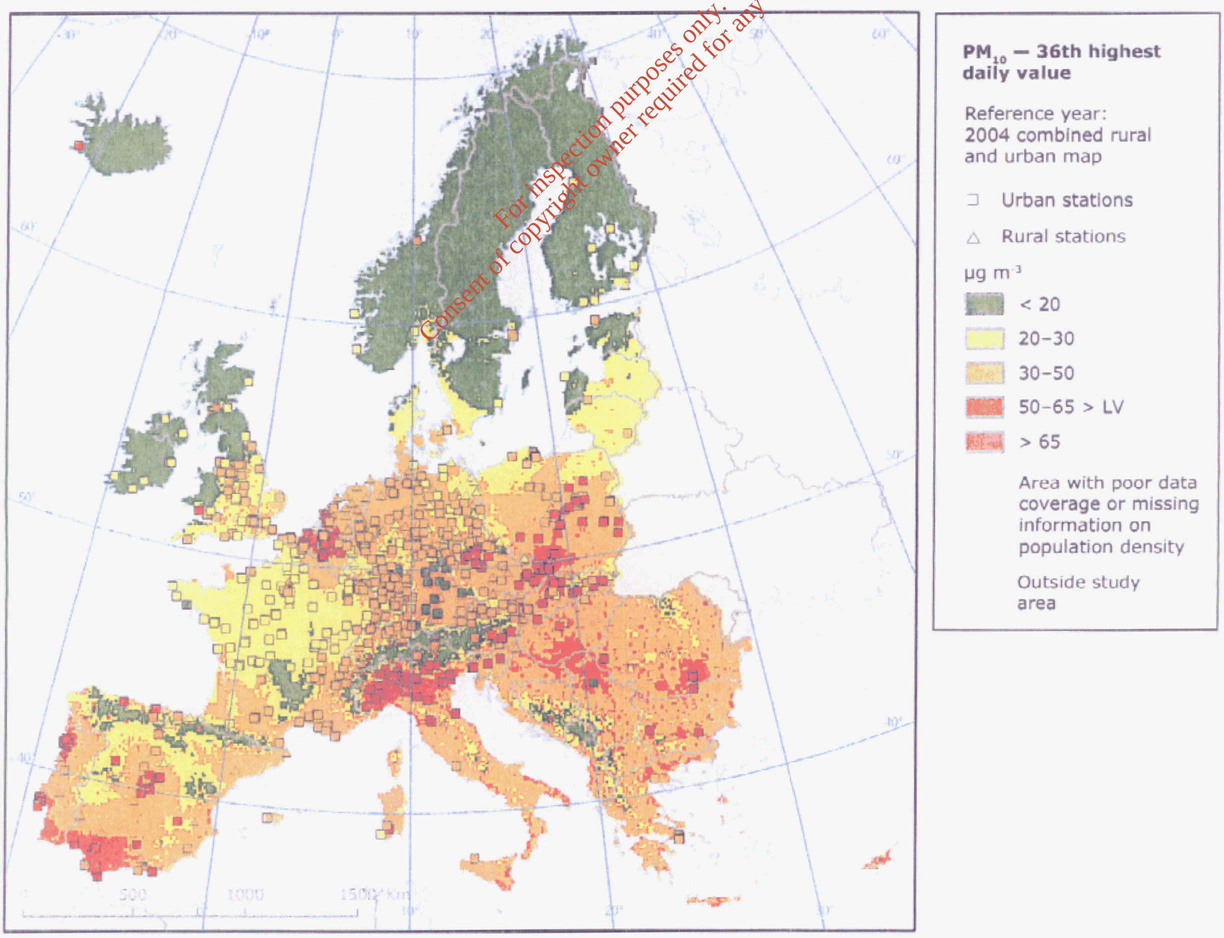
3.3.2 *PM_{10} concentrations in Europe in 2004*

Reporting of PM_{10} data to AirBase has improved steadily. In 2004, over 87 % of the 1 815 reporting stations (1 587) could boast 70 % data coverage or better. There were 180 stations in rural areas and 742 sub/urban background stations. From hot spot stations, there were 483 traffic and 190 industrial stations. Remaining stations were not type classified. This section compares average daily concentrations on:

1. 36th highest day in the year with the daily limit value of 50 μg/m³ on no more than 35 days (Figure 3.14);
2. annual average concentrations with the annual limit value of 40 μg/m³ (Figure 3.15).

Rural PM_{10} concentrations in 2004 were higher than limit values in some areas. Many locations

Figure 3.14 PM_{10} concentrations in Europe 2004 showing the 36th highest daily value



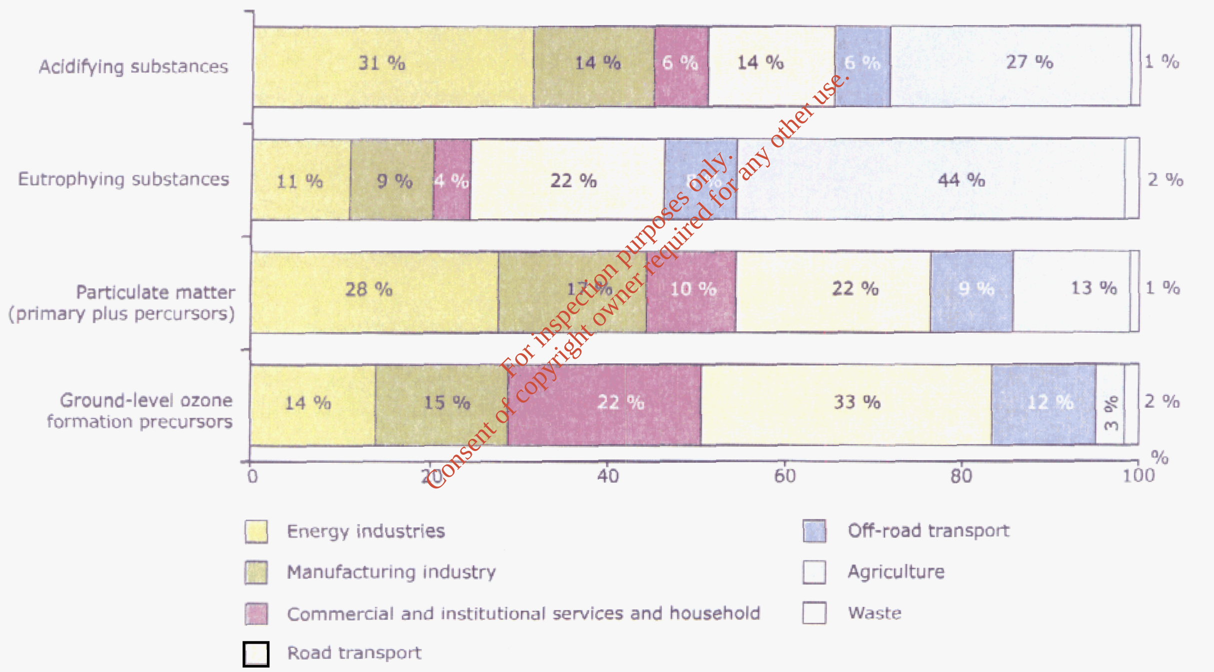
Note: The figures were constructed by combining rural and urban maps using population density. The measurement points were superimposed on interpolated concentrations. Red represents exceedances (ETC/ACC Technical Paper 2005/8).

Source: EEA (ETC/ACC).

Table 2.1 Summary of impacts by sector upon acidification, eutrophication, particulate matter and ground level ozone production

Economic sector	Issue contributed to	Pollutants of concern
Energy industries	All four issues, but largest contributions to acidifying substances and particulate matter (PM)	Mainly SO_2, but also NO_x and PM
Road transport	All four issues, largest contribution to ozone formation precursors	Mainly NO_x and PM, but also NMVOC and CO (to ozone formation)
Agriculture	Eutrophication and acidifying substances as well as to ozone formation	Mainly NH_3, but also PM
Industrial energy and processes	Smaller contributions to all four issues	Mainly SO_2 and NO_x
Residential	All four issues	Mainly SO_2, NO_x and PM
Other energy	Mainly to ozone formation	NO_x and CO

Figure 2.1 EEA-32 sector contributions to the main air pollution issues, 2004



Note: The first two bars (top-down) refer to ecosystem impacts, the third to human health impacts, and the fourth to health and vegetation impacts Energy industry: Emissions from public heat and electricity generation including fugitive emissions; Manufacturing industry: combustion and non-combustion processes; Commercial and institutional services and household: Combustion and non-combustion processes; Road transport: light and heavy duty vehicles, passenger cars and motorcycles; Off-road transport: railways, domestic shipping, certain aircraft movements, and non-road mobile machinery used in agriculture, forestry; Agriculture: manure management, fertiliser application; Waste: incineration, waste-water management.

Source: EEA (ETC/ACC).

c) Acidifying, and d) Eutrophying precursors

The acidifying potential of the emitted compounds SO_2, NO_x and NH_3 is estimated by converting each to units of acid equivalent. This is related to the electrical charge of the compound and to its molecular weight, such that the factors are: $SO_2 = 2/64$, $NO_x = 1/46$, and $NH_3 = 1/17$ acid equivalents per gram (de Leeuw, 2002).

The eutrophying potential is related to the fertilising effect of nitrogen, and hence to emissions of ammonia and nitrogen oxides. These are treated equally, i.e. that 1 unit of nitrogen as NO_x is equal to one unit of nitrogen as NH_3.

Figure 2.4 Total particulate emissions by economic sector for EEA country groupings in 2004, and contributions from each sector and pollutant to total change since 1990

Source: EEA (ETC/ACC).

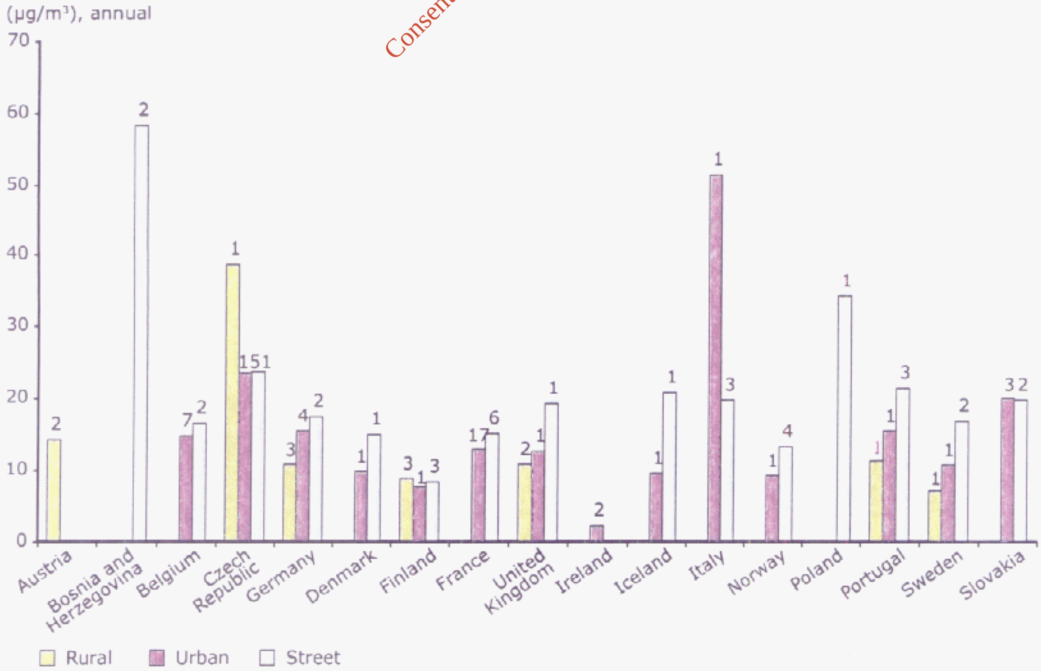
$PM_{2.5}$ air monitoring data are still fairly scarce in Europe. Hence, the effects assessment shown in Figure 3.11 is based upon modelling. Although the spatial coverage of monitoring stations is presently insufficient to assess variations across Europe, some comparison is possible between observations at monitoring stations reporting $PM_{2.5}$ and the 25 µg/m³ 'cap' value of the proposed Air Quality Framework Directive (COM(2005)447 final). According to the Air Quality Framework Directive those cap values will have to be met by 1 January 2010, agreed margins of tolerance establishing a present maximum of 30 µg/m³. Figure 3.12 summarises observations of $PM_{2.5}$ in 17 countries in Europe for 2004. As many current $PM_{2.5}$ monitor types significantly underestimate concentrations mass loss during sampling, real $PM_{2.5}$ concentrations would be higher than those shown.

The indication is that hot spot (traffic-related) locations may well exceed the cap value, although most PM observations are below the proposed limit. Concentrations generally increase from rural-to-urban-to-traffic locations, in accordance with increasing proximity to PM sources.

In recent years PM_{10} has been widely monitored; a total of 1 815 stations reporting in 2004. The relevance for health assessment is that PM_{10} measurements also capture the finer $PM_{2.5}$ particles. Indeed, health effects studies have used available PM_{10} measurements, and since the mid 1990s EU AQ limit values have been related to PM_{10}.

The ratio between $PM_{2.5}$ and PM_{10} emissions for all sectors is quite variable between countries, from 0.53 to 0.83 (Figure 3.13). Co-located monitoring of ambient air concentrations reports average ratios of 0.65, (range 0.42–0.82, std. dev. 0.09). Putaud *et al.* (2003) found an average ratio of 0.73 (range 0.57–0.85, std. dev. 0.15). Ratios closer to sources are generally lower (larger coarse fraction), whilst those farther away are higher (finer). Some sectors (e.g. industrial sources) contribute a large coarse fraction. However, PM from road transport — an important sector for population exposure — are generally finer than average and the range of the $PM_{2.5}$ / PM_{10} ratio is 0.67–0.90. Scandinavia is the exception; road transport emissions are generally coarser (0.24–0.64) here. This is due to the use of studded tyres in winter which contributes a large

Figure 3.12 Measured $PM_{2.5}$ concentrations, 2004 (µg/m³, annual average) for several countries



Note: Each bar represents average concentrations for each station type. The number of stations is on top of bars.

Source: EEA (ETC/ACC).