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Air pollution in Europe 1990–2004

OH Sub No. 35

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Large areas of Europe saw clear declines in acid deposition from 1990 to 2004. The downward trend is due to reductions in sulphur emissions, mainly from large point sources (heat and power generation). However, in 2004 still approximately 15 % of the EU-25 ecosystem area sensitive to acidification received deposition of acidifying compounds above critical loads.

As sulphur emissions fell, nitrogen became the predominant acidifying agent. In many areas of Europe eutrophication due to atmospheric N deposition is now a more serious problem than acidification (Figure 3).

Figure 3 highlights nutrient nitrogen pressures on the most sensitive ecosystems. More generally, in 2004, approximately 47 % of the EU-25 ecosystem area sensitive to an oversupply of nitrogen received excess nitrogen deposition leading to eutrophication in sensitive ecosystems, such as forests or waters. Ammonia emissions from animal husbandry increasingly determine the magnitude and spatial pattern of nutrient nitrogen critical loads exceedances.

Rural background, sub-urban, urban and hot spot concentrations

- Hemispheric transport of air pollutants may contribute to air pollution problems in the northern hemisphere and thus may mask the effects of air pollutant emissions reductions in Europe.

Long-range transport and pollutant dispersion together with meteorological (and topographical) conditions have a significant influence on local air pollution. Regional background contributions to urban background $PM_{2.5}$ and PM_{10} levels are typically in the range from 60–90 % ([2]). High rural background PM and also O_3 concentrations result from (fairly slow) reactions between the precursor gases emitted, making it difficult to control concentrations of those pollutants through local abatement alone. However, urban NO_2 and benzene concentrations are not dominated by regional pollutant levels. Concentrations increase typically as one moves from rural to urban to hot spot areas.

The relationship between ozone levels at rural, urban and hot spot locations is more complicated than for PM_{10} and NO_2. This is due to the chemical reactions involved in the build-up of ozone. On the one hand, long residence times and strong solar radiation in large urban areas especially in southern Europe may lead to substantial photochemical production of ozone in and downwind of such areas. Here, maximum urban background and suburban ozone concentrations sometimes exceed those in the nearby rural areas, while concentrations at hot spots, i.e. near roads, always remain lower (due to the reaction of NO with ozone). In general, O_3 levels at traffic hot spots are lower compared to urban background sites, where ozone concentrations are in turn lower than at rural locations.

In order to reach long term objectives with an air quality for ozone that does not give significant negative effects on human health and the environment, substantial emission reductions of both NO_X and VOCs would be needed at local, regional and hemispheric level. For PM, no safe level has been identified. Moreover, further substantial emission reductions of primary particulate matter and PM precursors such as NH_3, NO_X, and SO_2 are needed to bring down the present levels and so reduce damage to human health.

Emission control regulations in Europe

By setting interim environmental objectives, the European Union has committed itself to reducing the air pollution of four key pollutants — SO_2, NO_X, NMVOC and NH_3 by year 2010 below levels that have serious effects on human health and sensitive elements of the environment (National Emission Ceiling Directive, 2001/81/EC). Compared with the 1990 situation the area where critical loads of acidity are exceeded shall be reduced by at least 50 % by 2010 in each 50 x 50 km grid cell used for mapping. Ground-level ozone concentrations above the critical limit for human health shall be reduced by two thirds and the values above the critical level for crops and semi-natural vegetation by one third (in all grid cells; 2010 compared to 1990).

Furthermore, several emissions abatement measures have been introduced for the main emitting sectors since the 1990s (Table 1).

Another important strand to European air pollution reduction policy was the adoption of the Air Quality Framework Directive (1996) which, via daughter directives on air quality, sets limit or target values for the concentrations of designated contaminants in air. SO_2 and PM_{10} limit values for health protection had to be achieved in 2005. NO_2 and lead limit values will have to be reached by 2010.

([2]) Convention on Long-range Transboundary Air Pollution: Draft EMEP Particulate Matter Assessment Report, June 2007.