

Improvement in ambient air quality in East Germany after the German reunification: Analysis of the trends in exposure and their implications

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In recent years, ambient air pollution concentrations have been reduced Europe-wide by emission controls and fuel replacement. These measures are of particular interest for the regulating agencies as well as for the regulated entities.

One of the main objectives of our study carried out in Erfurt, Germany, was to assess the changes in ambient air quality and in the emission source structure after the German reunification, when air quality dramatically improved. For the same period we also report on selected results showing associations between decreasing air pollutant levels and short-term mortality.

We obtained data on gaseous pollutants SO₂, O₃, NO₂ and CO, mass concentrations of particulate matter (PM) < 10 μm (PM₁₀), and meteorology for the whole study period between October 1991 and March 2002. Ultrafine particle number (UFP) and PM_{2.5} mass concentrations were measured during the winter 1991/92 and from September 1995 to March 2002 at a research monitoring site.

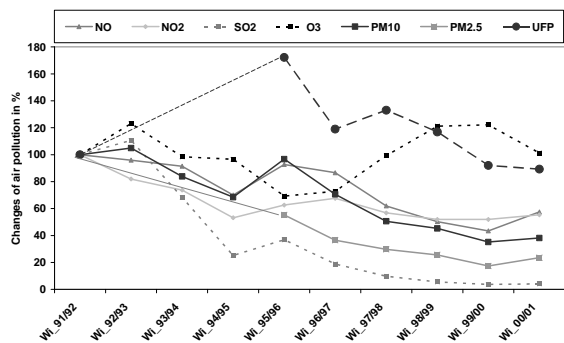


Figure 1. Changes of winter mean concentrations of air pollutants in Erfurt from winter 1991/92 to winter 2000/01 (expressed in %, the air pollutants levels in winter 1991/92 were assumed to be 100%).

As shown in Figure 1 the most rapid decrease of winter mean concentrations over the study period was observed for SO₂. The decrease of the particle mass concentration in the winter seasons was 80% and 70% for PM_{2.5} and PM₁₀, respectively. In contrast, the trend for UFP was less clear. Except of a strong increase in winter 95/96, rather stable UFP levels were observed in the following period.

An analysis of correlations and ratios between the air pollutants showed that the pollution mixture has changed during the 90ties towards a mixture

much like “Western European” urban air pollution, which is characterized by elevated concentrations of NO_x, O₃ and UFP and lower concentrations of SO₂ and TSP. Two source categories that have undergone significant changes in East Germany after the reunification include energy production (by power plants and by local heating) and the number and type of vehicles. For example, prior to the reunification many homes used individual coal furnaces for heating. This practice has nearly been eliminated after the reunification, with coal-burning ovens being replaced mostly by natural gas heating systems (Figure 2).

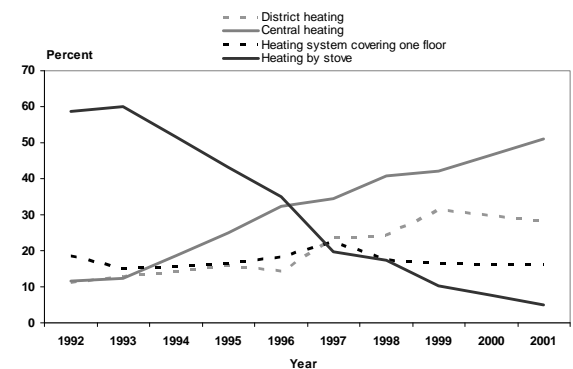


Figure 2. Changes of energy use patterns in Erfurt 1992 – 2001 (urban area).

The strongest health effects of the mortality study were observed in the transition period 1995-1997 (Breitner et al. (2009)) when changes in source characteristics took place and the benefits of ambient air quality were not yet completely achieved. Furthermore, it seems that the improved ambient air quality in East Germany after the reunification led to lower health effects at the end of the 90's than during the 90's.

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