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SOURCE APPORTIONMENT OF PM₁₀ DURING POLLUTION EPISODES

ABSTRACT

This work describes a study of the source apportionment of particular matter with an aerodynamic diameter less than 10 μm (PM₁₀) during air pollution episodes in the United Kingdom since 1991. Episodes are defined here as occasions on which the running 24 hour concentration of PM₁₀ exceeded 50 $\mu\text{g m}^{-3}$. This pollutant is especially important as many studies in different parts of the world have suggested that the adverse health effects of PM₁₀ are significant.

Data for PM₁₀ in the UK became available in 1992 but only for a limited number of monitoring sites but now more than 50 sites are in operation. Prior to 1992 the most readily available data were for carbon monoxide, oxides of nitrogen, sulphur dioxide and ozone. The sources of these pollutants are reasonably well characterised but this is not the case for PM₁₀.

The first stage examines source apportionment during some pollution episodes which have been examined elsewhere and other episodes where there is local knowledge about the source of PM₁₀. This uses the concentrations of carbon monoxide, oxides of nitrogen, ozone and sulphur dioxide at locations where PM₁₀ is monitored as indicators for different sources of pollution. In some cases, especially construction episodes, there is little or no change in concentrations of the indicator pollutants when concentrations of PM₁₀ are high. In other cases, most notably in episodes arising from road traffic emissions and industrial sources, there are strong associations between the changes in concentrations of one or more of the indicator pollutants and of PM₁₀.

Having established that concentrations of PM₁₀ during some pollution episodes are related to those of other pollutants a quantitative approach to analysing episodes is developed. This is tested by comparing modelled and measured concentrations of PM₁₀ at a number of sites. Factors ranging from 0.2 (Suburban) to 0.5 (Roadside) have been derived for the contribution of road traffic to concentrations of PM₁₀ at different types of site. From this, calculations are made of probable concentrations of PM₁₀ in Central London in December 1991. The validity of this is tested by repeating the procedure for another episode in December 1994 for which measured PM₁₀ data are available. This approach proved particularly successful for episodes involving traffic emissions but somewhat less so for industrial sources. In episodes where secondary pollutants were involved it was poor in modelling the secondary components but was successful in identifying other contributions to concentrations of PM₁₀.

This is further developed in a feasibility study into the possibility of calculating non-episode concentrations of PM₁₀.

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