Issues in Environmental Science and Technology 8
EDITORS: R.E.HESTER AND R.M.HARRISON

Air Quality Management

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Preface

Concern over air quality has never been higher in the public mind in both developed and less developed countries. This concern is reflected in ever tightening legislation, and the vigorous activity of regulatory authorities. The easily won gains in air quality have already been made throughout the developed world by the implementation of inexpensive but effective control measures. Air quality management is therefore addressing an ever steepening part of the cost/benefit curve, whereby each incremental improvement in air quality becomes increasingly expensive as the atmosphere becomes cleaner. Thus, methods to quantify the improvements required, to predict the source controls most appropriately applied, and to provide cost/benefit analyses of the reductions are becoming increasingly sophisticated. This volume deals with the scientific aspects of such air quality management procedures.

The first article, by D. R. Middleton, sets the scene by describing from a UK perspective the developments currently in hand to provide a scientific basis for air quality management. Subsequent articles deal with specific components of the air quality management process. Effective control of primary air pollution depends critically upon good knowledge of the sources of emissions and their geographic locations. This is encompassed by emissions inventories, and the article by D. Hutchinson deals with the now rather sophisticated subject of compilation of source emissions inventory data; it is illustrated by reference to the recently compiled emissions inventory for the UK West Midlands. A second crucial aspect of air quality management is the monitoring of air pollution. This provides information on the temporal trends in air quality and gives a direct measure of the compliance or otherwise of air pollutant concentrations with ambient air quality standards designed to protect human health, ecosystem function or the integrity of inert materials. The design and operation of air monitoring networks is described in the third article by J. Bower. Both source emissions data and monitoring information are central to the activity described in the fourth article by A. Skouloudis, who gives a comprehensive overview of the scientific considerations in the European Auto-Oil study, which was sponsored by the European Commission in order to determine the most cost-effective means of meeting air quality targets. It was therefore central to the setting of vehicle emission and fuel quality standards for implementation in the years 2000 and 2005.

Secondary air pollutants are those formed within the atmosphere and these present considerable difficulties in evaluating the effectiveness of controls of precursor emissions upon concentrations of the secondary pollutant. Often the relationship between emission of the precursor and concentration of the pollutant are strongly non-linear. The fifth article by P. Hopke on source–receptor modelling of air pollution addresses the very difficult technical issue of how, starting from ambient air quality data, it is possible to identify the source areas contributing to secondary pollutants to the atmosphere. The sixth article by M. Hornung and colleagues deals with the use of geochemical or biological

tolerances (critical loads) to determine the maximum allowable inputs of acidic pollutants to the terrestrial environment. This approach is now heavily embodied in air pollution control policy development within Europe. The final article by A. C. Lloyd gives a fascinating perspective of the successes and problems of air pollution control in California, the US state which has for many years led the way in promoting vigorous air pollution control measures, but still has massive problems to overcome.

We are very fortunate in having attracted articles from leading workers in this field representing the best of scientific endeavour from both Europe and North America. We are most grateful to them for providing readers with a comprehensive perspective of the current state of the art of air quality management.

Roy M. Harrison
Ronald E. Hester

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Roy M. Harrison, BSc, PhD, DSc (Birmingham), FRSC, CChem, FRMetS, FRSH

Roy M. Harrison is Queen Elizabeth II Birmingham Centenary Professor of Environmental Health in the University of Birmingham. He was previously Lecturer in Environmental Sciences at the University of Lancaster and Reader and Director of the Institute of Aerosol Science at the University of Essex. His more than 250 publications are mainly in the field of environmental chemistry, although his current work includes studies of human health impacts of atmospheric pollutants as well as research into the chemistry of pollution phenomena. He is a former member and past Chairman of the Environment Group of The Royal Society of Chemistry for whom he has edited 'Pollution: Causes, Effects and Control' (RSC, 1983; Third Edition, 1996) and 'Understanding our Environment: An Introduction to Environmental Chemistry and Pollution' (RSC, Second Edition, 1992). He has a close interest in scientific and policy aspects of air pollution, currently being Chairman of the Department of Environment Quality of Urban Air Review Group as well as a member of the DoE Expert Panel on Air Quality Standards and Photochemical Oxidants Review Group and the Department of Health Committee on the Medical Effects of Air Pollutants.

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Improving Air Quality in the United Kingdom

DOUGLAS R. MIDDLETON*

1 Introduction

The concentration of pollutants in urban areas from sources near the ground has become of increasing concern in the UK, particularly since the London pollution episode of December 1991. During this episode from 11 to 15 December 1991, NO_2 was unusually high, with values from 350 to 400 ppb recorded at several sites and reaching 423 ppb at Bridge Place.[1,2] These values were well above the standard[3] which recommended a maximum hourly average concentration for NO_2 of 150 ppb. A study[4] by South East Institute of Public Health mapped contours of air pollution measurements in the form of annual average concentrations of nitrogen dioxide (NO_2). During 1995, these contours in much of London were above the NO_2 Standard that appears in the UK National Air Quality Strategy.[1] This Standard is 21 ppb for an annual mean. Since in London some 76% of the emissions of oxides of nitrogen are associated with road transport,[5] measures for improving air quality will have to address transport planning. Looking forward, the report[2] shows a projection of NO_2 contours in London for the year 2000. It suggests that by that date in central London, NO_2 will still be likely to exceed 40 $\mu g\,m^{-3}$ (*i.e.* 21 ppb).

The Environment Act 1995 has increased the powers for local authorities to manage air quality and to consult with a wide range of bodies. The decisions to be taken in managing air quality will cross traditional boundaries. It will be necessary, for example, for Environmental Health Officers and environmental scientists in local government to liaise quite closely with traffic planners and

*Any views expressed are those of the author.

[1] DoE, *The United Kingdom National Air Quality Strategy*, Department of the Environment CM 3587, HMSO, London, 1997.

[2] QUARG, *Urban Air Quality in the United Kingdom*, first report of the Quality of Urban Air Review Group, Department of the Environment, London, 1993.

[3] EPAQS, *Expert Panel on Air Quality Standards (Nitrogen Dioxide, Ozone, Carbon Monoxide, Sulphur Dioxide, Benzene, 1,3-Butadiene)*, Department of the Environment, HMSO, London, 1996.

[4] SEIPH, *Air Quality in London 1995*, third report of the London Air Quality Network, South East Institute of Public Health, Tunbridge Wells, Kent, 1996.

[5] M. Chell and D. Hutchinson, *London Energy Study*, London Research Centre, London, 1993.