Observation, Modelling And Management Of Urban Air Pollution (PUMA Consortium)

Objectives

- To apply a high spatial resolution meso-scale meteorological model to the West Midlands. This is the first of its kind in the UK.
- To add a coupled dispersion and atmospheric chemistry model, capable of predicting both primary and secondary air pollutant concentrations at urban background locations across the conurbation with a horizontal resolution of about 2km and a vertical resolution as low as 25m. The model will be validated against high quality measurements of primary pollutants such as carbon monoxide, sulphur dioxide and NO_X, as well as secondary pollutants including nitrogen dioxide, ozone and secondary inorganic particulate matter. It will be compared with an existing model (UAM).
- To make measurements of concentrations of a wide range of both long-lived and transient chemical species including hydrocarbons, carbonyl compounds, oxyacids of nitrogen and the free radical species OH, HO_2, RO_2 and NO_3, which play a key role in atmospheric chemistry.
- To validate the atmospheric chemical reaction mechanisms within the model in a depth not previously attempted.
- To gain insights into the chemical processes controlling the composition of the urban atmosphere at a very fundamental level.
- To produce a management model applicable for national and local government to predict the impact on air quality of specific control strategies for a wide range of criteria pollutants and on a range of timescales (minutes to years).

Location

West Midlands

Approach

This project is seeking to apply and validate a well accepted meso-scale meteorological model (the Colorado State University RAMS model) coupled with a very detailed chemical scheme within a Lagrangian particle dispersion model. This modelling approach (PUMA) promises to advance urban air quality modelling appreciably and will be subject to extensive validation at a level not previously attempted.

Start date/duration

January 1998 Four years

Lead Organisations

University of Birmingham
Atmospheric Processes Research Division, Meteorological Office
University of East Anglia
University of Leeds
University of Cambridge

Deliverables

The project will deliver an urban air quality management model. Although developed for the West Midlands, it will be generic in nature and can be applied elsewhere.

Users

Local Government Authorities
Automotive Companies, eg Rover Group, Perkins Technology Ltd
Pollution Control Companies

Further Details

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Development of a user-friendly software package for predicting the concentration of pollutant in the atmosphere from chimney emissions in urban environments

Objectives

The software package being developed in this project will assist in the design and modification of existing industrial exhaust ventilation systems in large conurbations. The package will be of immense environmental benefit to companies which monitor pollution emissions, such as the British Textile Technology Group which monitors exhaust emissions for industry and advises on how to meet HMPO health and safety guidelines. It will also allow industry to better understand the interaction of their chimney emissions with the local environment and hence, how to minimise the contamination caused. The general public will also have a cleaner environment in which to live, due to the improved understanding of pollution dispersion by industry.

Location

Leeds

Approach

The project is using a mathematical and computational fluid dynamics (CFD) approach, which will be validated against both existing and new data obtained in the field. Numerous CFD models have recently been developed to investigate the effects of pollution released from chimneys. However, most of these studies have been restricted to rural situations, in which, local topography is not important. Some have also been validated by performing experiments in large wind tunnels. Recent research work at Leeds has shown that these CFD models are inappropriate if the rotation of the earth, although small, is not taken into account. Furthermore, the research work at Leeds has involved investigating the effect of the local topography on the air flow in the region of the pollution emission.

The CFD modelling being undertaken will be appropriate to any conurbation. However, it is being concentrated on Leeds where detailed measurements of pollution emissions are either in existence or where experimental data can be obtained in the near future.

Start Date/Duration

January 1998 Two years

Lead Organisation

University of Leeds

Deliverables

This project will deliver a simple user-friendly computational fluid dynamics software package for predicting the transport of contaminants from chimneys in a conurbation environment.

Users

British Textile Technology Group
All types of industry

Further Details

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Tracers and Dispersion Of Gaseous Pollutants

Objectives

The transport and dispersion of pollutants, within and from a large urban area, are important processes due to their potential environmental impact on city inhabitants and those living in nearby communities. The release of atmospheric Tracers is a powerful technique to simulate the dispersion of pollutants and to enable direct measurement of the transport path and concentrations along the trajectory. Successful Tracers are inert, non-toxic, non-depositing, with low atmospheric background concentrations, long atmospheric lifetimes, and limited commercial use. This research project is developing the Tracer technology necessary to characterise atmospheric dispersion within the urban environment.

Location

Bristol/generic

Approach

Bristol University is exploiting the many years of experience in Tracer technology coupled with recent advances in gas chromatography/mass spectrometry techniques. There are several components to developing an effective experimental Tracer technology and this project is addressing each of these in turn:

- selection of Tracers
- analytical instrumentation for their quantitative determination in the femtolitre/litre range
- design and construction of automated sequential samplers
- Tracer release apparatus
- the preparation of accurate perfluorocarbon standards.

Start date/duration

April 1998 - three years

Lead Organisations

University of Bristol
University of Cambridge

Deliverables

This project will provide the database for testing and developing air quality models.

Users

Industry in general
Other consortia studying urban pollution problems

Further Details

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Characterisation, source-receptor modelling and fate of organics in airborne particles

Objectives

The specific objectives of this research project are:

- To further develop the method of Micro-Scale-Sealed-Vessel Pyrolysis Gas Chromatography-Mass Spectrometry (MSSV GC-MS) for identifying and quantifying compounds in airborne particulate matter in London.
- To establish spatial and temporal patterns of selected organic compounds in the London Air Quality Network.
- To determine the distribution of organic compounds in different size fractions of airborne particles.
- To determine source profiles of organic compounds in airborne particles.
- To determine the major sources of organics in particulate matter using multivariate receptor modelling techniques.
- To evaluate receptor modelling techniques with respect to dispersion models.
- To apply dispersion models to estimate the fate of organics in particulate matter.

Location

London

Approach

The research is investigating organic compounds in airborne particulate matter at kerbside and urban background sites in London and in major sources using micro-scale pyrolysis GC-MS techniques. This information is being incorporated within a receptor modelling framework to estimate the proportional source contributions to airborne particulate concentrations in London. Source apportionment by this method is being evaluated using dispersion models and a dispersion modelling approach is being used to predict the fate of organics in particulate matter.

Start Date/Duration

April 1998 Two years

Lead Organisation

King’s College, London

Deliverables

The anticipated deliverables of this project are:

- creation of a definitive methodology capable of accurately pinpointing and quantifying sources of airborne particulates
- provision of a unique dataset of organics in particulate matter that will provide a stimulus for further research aimed at improving the understanding of the mechanisms of production and the fate of organics in air
- establishment of a centre of excellence for the measurement of organic contaminants in contaminated environments
- establishment of a new working partnership with interested parties from the academic, public and private sectors concerned with air pollution research and management.

Users

British Atmospheric Data Centre
Local authorities

Further Details

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A Thermal Climatology Of The West Midlands

Objectives

A variety of statistical, measurement and modelling techniques are being used in this project to develop a thermal climatology of the West Midlands in order to redefine the existing seven climate zones that are being used by the UK Meteorological Office for the delivery of their Open Road service to Highway Engineers. The Open Road service comprises a series of road weather forecasts issued each night, in winter, for each of the seven zones.

Currently, the seven Metropolitan Councils that make up the West Midlands spend about £5 million per winter to keep the major roads clear of ice and snow - approximately 3000km are salted. The current forecasts do not take into account the Urban Heat Island Effect, ie urban centres will be significantly warmer at night than the rural surrounds, ironically, city centre roads are salted just as frequently as suburban and rural routes. The project is attempting to understand the links between road surface temperatures and air temperatures, in a complex urban environment, to bring together road weather research and boundary layer meteorology research techniques.

Location

West midlands

Approach

The project has been designed in six parts:

1. An analysis of existing historical road weather and climatological data for the West Midlands using PCA and cluster analysis.
2. Construction of a climatology of heating and cooling rates (dT/dt) between a selection of rural, suburban and urban sites.
3. The installation of a new site in Birmingham City Centre to give an estimate of heat island maxima.
4. The carrying out of a number of vehicle based traverses measuring the Sky View Factor across the conurbation.
5. The setting up of a 1km x 1km GIS for the West Midlands to include the physical climatology.
6. The running of a one dimensional energy balance model for each $1km^2$ to estimate the heat island effect for road surface temperatures.

Start Date/Duration

April 1998 Two years six months

Lead Organisation

Birkbeck College, University of London

Deliverables

This project will provide a better understanding of the climatology of a complex urban area using both measurements of air and road surface temperatures, and energy balance modelling. It will provide a link between existing knowledge of the boundary layer climate in urban areas and road weather research. It will be of direct use to local highway authorities and lead to better management of winter maintenance in the West Midlands. This in turn will lead to safer roads and more cost-effective winter maintenance. In addition, reductions in salt usage will benefit the urban ecology, reducing salt damage to trees and plants, and reducing the pollution of water draining off the roads.

Users

Local highway authorities

Further Details

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UWERN urban meteorology programme

Objectives

The key issues of this project are:

- how boundary-layer motions drive small-scale street-level circulations within the urban canopy
- how street-level circulations feed back into the larger-scale boundary-layer above by mixing heat, moisture and momentum
- how small-scale circulations within the streets mix pollutants from street-level into the boundary-layer above
- how larger-scale motions above affect the mixing.

Location

Generic

Approach

This work will bring together expertise from dynamical and observational meteorology, and theoretical and experimental fluid dynamics to make full-scale and laboratory measurements of the atmospheric boundary-layer over urban areas. The project will develop a sound understanding of the processes of mixing and transport from the street-level into the boundary-layer. It will also develop methods for parameterising these processes in urban-scale dispersion models and in numerical weather prediction models through an urban canopy model of urban areas.

Start Date/Duration

January 1999 Three years

Lead Organisations

University of Reading
University of Salford
University of Surrey

Deliverables

The project will deliver:

- a comprehensive set of measurements of the atmospheric boundary-layer above an urban area over a range of synoptic conditions and over a diurnal cycle - the first time for such measurements
- a set of controlled wind-tunnel experiments of simulated atmospheric boundary-layers over model buildings that will provide more insight than is possible from the full-scale measurements alone, particularly into the detailed spatial structure of the flow
- a method for parameterising urban areas in urban dispersion models via an urban canopy model that represents the interactive coupling of mixing and transport between street-level circulations and the boundary-layer above, and then simpler parameterisations for representing these processes in numerical weather prediction models.

Users

Meteorological Office
Cambridge Environmental Research Consultants
ICI
Zeneca

Further Details

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Evolution of the Particle Size Distribution of Vehicular Emissions in the Urban Atmosphere

Objectives

The objectives of this project are:

- to develop a Lagrangian type mathematical model of aerosol transformation/transport in an urban environment that includes condensation, evaporation, coagulation, deposition, nucleation and emission
- to assess changes in size distribution, with time, of vehicle exhaust particles emitted into urban air
- to assess by detailed modelling, the effects of water vapour and the volatility of organics on the measured size distribution.

Location

Generic

Approach

This project uses a theoretical modelling approach to study changes in particle size *after* emission from vehicles as the exhaust is dispersed into the urban atmosphere. The modelling work will make use of the input data from experimental measurements on engine emissions and atmospheric conditions in the UK together with emission inventory data and meteorological information. It uses a generic approach applicable to any city but the initial focus will be on London.

Start date/duration

January 1999 two years

Lead Organisations

University of Leeds
Middlesex University

Deliverables

To be presented at conferences and submitted to journals in the usual manner, the project will deliver:

- a Lagrangian type model of aerosol transport and transformation
- a transferable computer code to calculate aerosol size distribution under typical UK situations
- publications and reports on modelling aerosol size distributions, summarising data about their viability and relationships with meteorological conditions.

Users

British Atmospheric Data Centre
Ford Motor Co Ltd
Environmental health and medical communities

Further Details

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Sources and sinks of urban aerosols

Objectives

- measure size-segregated land-atmosphere fluxes of aerosols directly over urban areas at a time scale of 30 minutes
- quantify the role of surface activities (traffic, constructions etc) and meteorological variables in the control of fluxes
- provide a model describing the emission fluxes, transport, transformation and deposition footprint of aerosols for general application as a planning tool
- determine the fate of urban aerosols of different size and chemical composition, together with their transport distance and the influence of land use.

Location

Edinburgh

Approach

In a novel approach, this project will use existing fast response instruments on a high-level construction crane to measure the vertical fluxes of aerosols in the turbulent boundary-layer above the buildings of a major city. The measurements will provide size resolved 30-minute average fluxes of atmospheric particles in the size range 100 nm to 5 μm, and possibly beyond 5μm, from a 1 km^2 to 10 km^2 footprint. Using such methods in the turbulent boundary-layer, the project will quantify the net vertical production of aerosols by mechanical or biological activity within the city and the chemical production within the urban boundary-layer. The relationships between the measured fluxes and the major variables will be examined.

The urban measurements will be contrasted with similar flux measurements within the urban plume from the same city but at a distance of 20 km downwind. The degree to which the chemical nature of the aerosol is modified by gas-to-particle conversions will be assessed by comparing the particle size-spectra at the two sites and correlating them with precursor gas concentrations. In this way, the project will study the underlying physics of aerosol production, transport and deposition to identify the large scale processes of aerosol production in urban areas and will quantify the fate downwind.

Start Date/Duration

April 1998 Two years

Lead Organisations

NERC Centre for Ecology and Hydrology, Edinburgh
University of Manchester Institute of Science and Technology
NERC British Antarctic Survey

Deliverables

- an extensive dataset of direct measurements of vertical aerosol exchange fluxes averaged over a large urban footprint above a major city in a wide range of conditions
- an estimate of the contribution of various urban activities to the net exchange flux of the major particle modes, including resuspension and emissions from motor vehicles, heating combustion and construction activities and the effects of the key meteorological variables on fluxes and concentrations
- an estimate of the spatial distribution of the urban sources and sinks within the fetch of the measurements
- quantification of the contribution of gas-to-particle conversion to the urban aerosol budget and estimates of the processes and time-scales involved
- a model describing the urban vertical aerosol fluxes due to emission, resuspension and gas-to-particle production as well as dry deposition within and downwind of a large urban area
- a means for urban planners to quantify the effects of land use and transport strategies on aerosol production and deposition within and downwind of urban areas
- a means to quantify the fate of urban aerosols, their travel distance and composition.

Users

Edinburgh Council

Further Details

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An Instrumented Aircraft Facility to Provide Vertical Profiles of Wind, Temperature, Turbulence, Sensible Heat, Aerosol and Trace-Gas Concentrations and Fluxes t Urban Boundary Layer for PUMA Consortia Model Validation

Objectives

This project will provide facilities in the form of a low cost, highly instrumented aircraft designed for probing the turbulent and aerosol-cloud microphysical structure of the atmospheric boundary layer (ABL). Priority use will be given to the PUMA (Pollution of the Urban Midlands) consortia during the field trials planned for June 1999 and January / February 2000. The main objectives are:

- to provide high resolution 3-D wind turbulence, temperature and trace-gas variances of the urban ABL
- to provide measurements of the vertical and horizontal profile of aerosol concentration and volumetric size distribution over the Birmingham conurbation
- to provide a database of aircraft urban ABL case studies, which will be available to the PUMA and ASURE modelling communities via the appropriate NERC database committee
- to provide, where current UMIST instrumentation and facilities allow, the aircraft as a measurement platform for specific URGENT user measurement requests
- to measure the vertical entrainment and venting rates of trace-gas and aerosol between the urban ABL and the lower troposphere
- to measure the net aerosol / condensation nucleus flux downwind over an urban environment
- to construct and install a low cost aerosol collection sampling system to provide complementary aerosol chemical composition data to the PUMA measurement campaigns and to the PUMA modelling efforts.

Location

West Midlands

Approach

A flight programme of ten flight days / case studies is designated solely to the PUMA consortia. Five additional flights are being made available for either (a) instrument testing required by PUMA, which may require the removal of the base-line instruments due to space and weight limitations, or (b) specific flights to accommodate other URGENT requirements.

Start Date/Duration

Apri1999 Three years

Lead Organisations

University of Manchester Institute of Science and Technology

Deliverables

Flights within the allotted PUMA schedule are flexible and can be tailored to specific requests by PUMA modelling groups, depending on weather limitations and air-traffic control restrictions. Liaison with PUMA groups providing combined weather prediction and pollution model predictions will allow flights to be made under conditions most suitable for model validation.

Users

PUMA consortia
Other URGENT requirements

Further Details

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Airborne Particulate Pollutants: Physicochemistry and Toxicity

Objectives

- to collect and provide detailed physiochemical analysis of PM10 (defined as particulate matter which has an aerodynamic diameter of less than 10μm) from four sites (industrial, densely populated urban, open cast mining and rural) in the South Wales conurbation
- to examine the ability of the characterised samples of PM10 to produce lung inflammation, increase lung permeability or initiate epithelial damage
- to determine if the effects are transient or progressive.

Location

South Wales

Approach

This project has a multi-disciplinary approach to collect, quantify, physicochemically characterise and determine the respiratory toxicology of different samples of airborne particles. The research is especially timely because of the increasing concerns by government, medical and environmental professionals about possible adverse health effects of particulate pollution. In addition, there is growing public concern, particularly amongst asthmatics and the healthy population, who live near traffic or other particle-generating sources, that airborne pollutants may be detrimental to health.

Start date/duration

August 1998 Three years

Lead Organisation

Cardiff University

Deliverables

The studies will provide information on heterogeneity of PM10 at the four sites, link mass of particles collected to their size distribution, and from chemical analyses, help with source apportionment (traffic, industrial, mining, agriculture etc). A comparison of the results of these studies with previous findings from other environmental (eg diesel) and occupational (eg Cabosil) fine particles for which safety limits have already been set, will permit the end user organisation(s) to provide risk assessment and supply public advice.

Users

Welsh Office
Research community
Regional community

Further Details

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Development of A Lumped Gas Phase Mechanism for Use in Urban Chemical Transport Models

Objectives

This project will aim to address the requirements of urban and regional scale atmospheric models for a detailed, yet reduced, chemical mechanism which can accurately predict the formation of secondary pollutants such as ozone and NO_2. The objectives are to:

- identify the reactions from a Master Chemical Mechanism (MCM) which are relevant to the formation of important species in the urban atmosphere and those which are redundant, thus producing a skeleton scheme
- reduce the remaining reactions using methods of linear and non-linear lumping for a set of concentrations relevant to urban conditions
- prepare a repro-model based on parametrisations of the skeleton chemical scheme
- compare the reduced mechanism with the full mechanism and other existing mechanisms for a standard box model
- incorporate the mechanism into an existing boundary layer model and compare resulting concentrations of NO_2 and O_3 with measurements for an URGENT conurbation, eg through the PUMA project.

Location

Generic

Approach

The first stage of the reduction process will be to establish any reactions or species which are redundant over relevant conditions using the sensitivity and rate of production analysis options. Redundant species will be identified using overall concentration sensitivity functions and redundant reactions using a local rate sensitivity matrix combined with principal component analysis. A range of thresholds will be applied and the accuracy of the resulting reduced schemes assessed over concentration ranges relevant to the application of models used in URGENT.

In the second stage, linear lumping will be used to reduce the number of hydrocarbon species in the mechanism. Linear lumping is appropriate for these species because of the linear degradation chains they are involved with. Intermediate species however, which exhibit highly non-linear behaviour, are unlikely to be approached in this way. Quickly equilibrating species can be removed using a non-linear lumping technique essentially based on the quasi-stationary state assumption approach.

In parallel, a repro-model or a number of repro-models valid for the different concentration ranges will be generated using polynomial fits.

The final stage of the project will be to make comparisons between the reduced model and measured concentrations for more complex situations involving reactive flow simulations. This will be achieved through collaboration with other URGENT partners through PUMA.

Start date/duration

October 1998 Three years

Lead Organisation

University of Leeds

Deliverables

The project will deliver a series of reduced mechanisms with quantifiable accuracy based on the MCM for use in current urban chemical dispersion models. The larger skeleton model will be of direct use for urban trajectory modelling studies. The lumped mechanism and the repro-model will be applicable to urban and urban airshed models currently being used in the URGENT Programme.

Users

Those involved with urban chemical dispersion models and urban trajectory modelling studies

Further Details

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Urban Tree Planting as an Aid to Air Pollution Abatement: Cost-Effective Analysis of the West Midlands Case

Objectives

The objectives of this project are to calculate the benefits of large-scale urban tree planting programmes as a means of reducing human exposure to air pollutants. This will involve:

- Mapping existing vegetation cover in the conurbation.
- Discussing with planning authorities and other local government departments possible scenarios for large-scale tree planting on both public and private land in the conurbation.
- Estimating the removal rates of air pollutants by trees under present tree cover conditions and under various future planting programme scenarios. The pollutants to be considered include SO_2, NO, NO_2, PM_{10}, O_3 and volatile organic compounds (VOCs) including benzene.
- Calculating the emission rates of VOCs from trees under present and future scenarios.
- Calculating the incremental amount of ozone and aerosol likely to be formed as a result of these enhanced VOC emission rates arising from large-scale tree planting.

Location

West Midlands

Approach

The West Midlands will be used as a case study because of the data and knowledge base that will arise from the URGENT PUMA project which will provide an essential input to this project. There will also be interaction with one other URGENT project, *Thermal climatology of the West Midlands*. The models derived will, however, be applicable elsewhere.
The atmospheric transport and chemistry model that will be used will extend previous urban plume models, particularly with respect to those parts of the chemistry, emission and deposition schemes that are most sensitive to changes in tree population. A simple Lagrangian treatment of transport in the planetary boundary layer will be used. This will be coupled to a complex chemistry scheme which is compatible with state-of-the-art explicit structure-reactivity relationships and also compatible with global modelling studies.

Start date and duration

January 1999 Three years, plus 6 months extension

Lead Organisations

Lancaster University
CEH Edinburgh

Deliverables

- Quantitative information on the present and possible future tree cover in the West Midlands conurbation, together with estimates of the financial costs of a large-scale tree planting programme.
- Estimates of the possible reductions in air pollutant concentrations, and hence, reductions in human exposure to air pollutants achievable by large-scale tree planting.
- Estimates of the detrimental effects of tree planting to VOC emissions and the resultant likely increases in downwind ozone and aerosol particle concentrations under a number of possible future emission control and planting scenarios.
- Surveying, measurement and modelling methodologies that can be applied to other conurbations and to other similar problems of environmental cost-benefit analysis.
- Major publication in the peer-reviewed literature.

Progress to date

- An urban classification has been derived for the 900 km^2 of West Midland conurbation using principal component analysis and cluster analysis based on 27 attributes describing the land cover of each km^2. Thus each km^2 has been allocated one of 8 urban classes (villages and farms, open water and farms, woodlands, very light suburban, light suburban, dense suburban urban, dense urban).
- Urban morphology types have been mapped onto urban land class using the definitions in the "Trees in Towns" report (HMSO, 1994). From this mapping, a first estimate has been made of tree cover in the West Midlands area.
- First estimates of biogenic VOC and anthropogenic PM10 emission potentials from the West Midlands area have been made at 1 km^2 resolution. These estimates were made using the urban classification tree cover estimate, data from existing biogenic VOC emissions and biomass databases (Stewart *et al*., 1995), and anthropogenic pollutant concentrations and emissions inventories for the West Midlands (LRC, 1996; Veal *et al*., 1997). A first estimate has also been made of PM10 deposition and removal by trees in the West Midlands area.
- A tree survey methodology has been devised and surveying of trees in the West Midland area is underway. Twelve one-hectare plots are being surveyed in km^2 samples for each of the 8 urban classes. Each tree within the survey plots are recorded with details of height, age, condition, aspect, crown spread etc. More than 5,000 trees in 79 ha have been surveyed to date. This will provide current tree data for more accurate estimates of biogenic VOC emissions, and pollution deposition.
- Meetings have been held with each of the 7 West Midland Metropolitan Borough Councils to discuss their existing tree data and tree planting policies and to encourage councillors to consider their requirements from our project. A systematic mining of each council's existing tree data is currently underway. This will supplement and complement the field survey data.
- Workshops are planned for councils and other end-users in early 2001 to discuss future planting scenarios and to determine how we can accommodate end-user requirements.

Users

Birmingham City Council
Other local authorities

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Diode Laser Detection of Peroxy Radicals in the Atmosphere

Objectives

The aim of this feasibility study is to construct a device and assess its performance in the detection of peroxy radicals RO_2 by resonant cavity diode laser absorption. In-situ measurement of these radicals has proved a difficult task, particularly when chemically distinct species need to be characterised in order to model their individual effects on the polluted troposphere.

Approach

The first stage of the study is to construct the narrow band diode lasers. The project participants have experience of this, having made two such systems for use at 780 and 660 nm for studies of the N_2^+ ion in plasmas, and in particular, have designed extremely low noise power supplies, frequency scanning units and modulation systems that are essential for the sensitivities required. The next stage is to test the absorption on known concentrations of the different peroxy species. At the same time, the tuned cavities will be built. Designs for the cavity length control electronics already exist, as similar resonant cavities for frequency doubling diode laser radiation to form cw uv light are used by the project participants. The final stage will be to assess the operation of the cavity, for example, by introducing known low concentrations of the radicals and measuring the absorption.

Start date/duration

August 1998 Nine months

Lead Organisation

Oxford University

Deliverables

The study will demonstrate that a relatively simple, portable apparatus which can be easily controlled electronically and requires low electrical power, can be used to detect these atmospherically important radicals. If the calculated detection limits are demonstrated, this will open up the use of such instruments in urban pollution studies.

Further Details

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