



Dispersion of Air Pollution & Penetration into the Local Environment

A Consortium Research Project funded by the UK EPSRC *Engineering for Health, Infrastructure and the Environment* Programme, building on the research agendas defined by the *APRIL* Network (<http://www.airpollution.org.uk>) and the EUROTRAC-2 *SATURN* project.

Why?

Over short distances in the urban environment, we do not yet have the understanding needed to answer fundamental questions about air pollution (e.g. To what levels are individuals exposed and what controls this? How do pollutants move in and over a street network? How should air quality management procedures be developed for incident management?). **DAPPLE** is a 4-year EPSRC funded project that brings together a multidisciplinary research group, from six universities (Bristol, Cambridge, Imperial, Leeds, Reading & Surrey) to address these and a number of other related questions.

The consortium is capable of undertaking field, wind tunnel and computational simulations so as to provide better understanding of the physical processes affecting street and neighbourhood scale flow of air, traffic and people, and their corresponding interactions with the dispersion of pollutants.

The street canyon intersection is of interest as it provides the basic case study to demonstrate most of the factors that will apply in a wide range of urban topologies. The novel aspects of **DAPPLE**, distinguishing it from other previous urban air pollution experiments, are:

- multidisciplinary nature of the project – main field components cover meteorology, background pollution, traffic flow, personal exposure and inert tracer releases, and these are supported by both wind tunnel (EnFlo, Surrey) and numerical modeling (Cambridge, Imperial, Reading);
- focus on an urban intersection, rather than 2-D street canyon, as very few cities are composed of long, uninterrupted, street canyons;
- investigation of the determinants of exposure at intersections, and in the surrounding microenvironments, where there is close proximity of pollution sources, the traffic, and the receptors, the people, e.g. as all parties wait for some time at the same location whilst the traffic signals change.

Who?

- University of Surrey - *Prof Alan Robins (Project Leader) & Hong Cheng*. Wind tunnel measurements. <http://vortex.mech.surrey.ac.uk/FRC/homepage.html>
- University of Leeds - *Prof Margaret Bell & James Tate*, *Institute of Transport Studies*, Traffic micro-simulation, instrumented vehicle and background pollution measurements; & *Dr Alison Tomlin & Dr Rob Smalley, ERRI*. Meteorological field measurements. <http://www.its.leeds.ac.uk>
- Imperial College - *Dr Roy Colvile, Dr Mark Nieuwenhuijsen, Prof Helen ApSimon, Surbjit Kaur, Hongbin Wang*. Exposure assessment and dispersion modelling. <http://www.env.ic.ac.uk>. *Dr Samantha Arnold, DAPPLE* field campaign manager.
- University of Reading - *Dr Stephen Belcher, Dr Janet Barlow, Dr Adrian Dobre & Dr Samantha Arnold*. Urban meteorological measurements and modelling (UWERN). http://www.met.rdg.ac.uk/~bl_met
- University of Bristol - *Dr Dudley Shallcross, Prof Peter Simmonds, Dr Graham Nickless, Damien Martin, Catheryn Price, Tony Makepeace, Brian Grealley, Alan Knights*. Tracer release field experiment. http://www.bris.ac.uk/Depts/Chemistry/Bristol_Chemistry.
- University of Cambridge - *Prof Rex Britter & Dr Marina Neophytou*. Dispersion modelling and planning of field tracer release. www-g.eng.cam.ac.uk/mng/environmental/britter.html

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Field Campaign - Where & How?

The first **DAPPLE** field campaign, 28 April – 24 May 2003, has been successfully completed. Measurements were centred at Westminster City Council (WCC – Steve Neville), London, NW1, on the intersection of Marylebone Road and Gloucester Place. The surrounding study area was approximately 250 m in radius.

The fixed location instrumentation included - 7 ultrasonic anemometers (Reading, Leeds and Imperial), 2 automatic weather stations (AWS) and 10 CO Streetboxes (Leeds). These instruments were mounted on street furniture along Marylebone Rd between WCC and Marylebone Rd AURN Supersite, courtesy of Transport for London (TfL).

Personal exposure measurements (Imperial) were made by people passing through the area via 2 different routes, 3 times a day, using 4 modes of transport, together with indoor-outdoor measurements of VOC's and ultra-fine particles, and work in collaboration with the Health and Safety Laboratory (Peter Walsh) in developing an urban exposure visualisation technique using synchronous video and exposure data to identify the main factors effecting personal exposure.

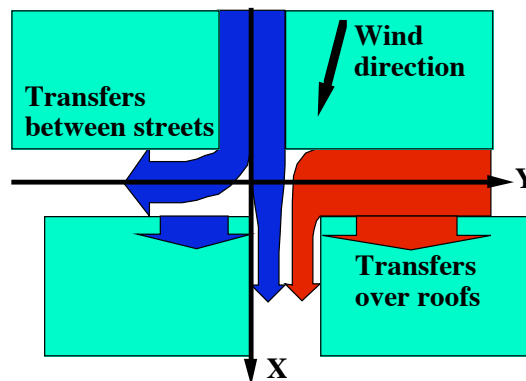
Additional **DAPPLE** measurements included SCOOT traffic data (TfL & Leeds), pollution measurements within the traffic using the ITS Leeds Instrumented Vehicle, and an inert tracer release experiment conducted from York Street (Bristol) in SW winds at 5pm on 15 May 2003.



Field site of Marylebone Road and Gloucester Place

What else – Wind tunnel & Modelling?

The fieldwork supports and is supported by wind tunnel and numerical modelling simulations that will be used to reproduce the **DAPPLE** field site at differing degrees of detail (e.g. block-shaped buildings > roof structures > architectural features). The wind tunnel experiments were conducted at the Environmental Flow Research Laboratory (EnFlo), University of Surrey, using a scale model (1:200).



Exchanges of pollutants at an intersection

Numerical simulations are being undertaken at the University of Cambridge using a suite of models of different complexity, the University of Reading using canopy models and at Imperial College London. The themes for the numerical models to address are: simulations of the **DAPPLE** field and wind tunnel experiments; urban air quality and accidental releases; and evaluation of model performance, fitness for purpose, sensitivity studies and best practice guidelines.

How to get involved?

- The success of the first campaign has meant that the consortium is now in a position to open the second **DAPPLE** experiment, 19 April – 28 May 2004, to other interested parties. To take advantage of the permissions gained to work in central London please contact Alan Robins (a.robins@surrey.ac.uk, Tel: +44 01483 689 684) to discuss possible collaborations for either the testing of equipment in an urban environment and/or full participation in the next phase of the **DAPPLE** field measurements.
- **DAPPLE** also holds regular *project advisory group* (PAG – chaired by Prof Alan Robins) and Application Sub Group (ASG – chaired by Prof Rex Britter) meetings, the aim of which are to ensure that all project participants, i.e. academics, local government employees and the wider audience, are aware of the users needs of the research output and related work in progress worldwide.
- **DAPPLE** is funded by EPSRC but welcomes opportunities for sponsorship of related work, including Ph.D. projects, smaller research projects, or consultancy. Please contact the relevant consortium members for appropriate discussions.
- We also welcome the interest and involvement of local residents in the Westminster study area. Air pollution queries and concerns can be raised via Westminster City Councils Air Pollution Hotline number 020 7641 1212.
- The most up to date **DAPPLE** information, and breaking news, is available on the website at

<http://www.dapple.org.uk>