Atmospheric Dispersion Modelling

Liaison Committee Report: ADMLC-R8

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INCLUDING

A review of the limitations and uncertainties of modelling pollutant dispersion from non-point sources

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PREFACE

In 1977 a meeting of representatives of government departments, utilities and research organisations was held to discuss methods of calculation of atmospheric dispersion for radioactive releases. Those present agreed on the need for a review of recent developments in atmospheric dispersion modelling, and a Working Group was formed. Those present at the meeting formed an informal Steering Committee that subsequently became the UK Atmospheric Dispersion Modelling Liaison Committee. That Committee operated for a number of years. Members of the Working Group worked voluntarily and produced a series of reports. A workshop on dispersion at low wind speeds was also held, but its proceedings were never published.

The Committee has been reorganised and has adopted terms of reference. The organisations represented on the Committee, and the terms of reference adopted, are given in this report. The organisations represented on the Committee pay an annual subscription. The money thus raised is used to fund reviews on topics agreed by the Committee, and to support in part its secretariat, provided by Public Health England (PHE). The new arrangements came into place for the start of the 1995/96 financial year. This report describes the most recent activities of the Committee. These included a review of the limitations and uncertainties of modelling pollutant dispersion from non-point sources. The technical specification for the contract is given in this report, and a link to the contract report can be found on the ADMLC website. Previous studies funded by the Committee are described in its earlier reports.

The Committee intends to place further contracts in future years and would like to hear from those interested in tendering for such contracts. They should contact the secretariat:

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1 ORGANISATIONS REPRESENTED ON THE COMMITTEE

The organisations on the committee at the time of publication of this report are:

AMEC Foster Wheeler

Atomic Weapons Establishment, Aldermaston

Defence Science and Technology Laboratory (Dstl)

Department for Environment Food and Rural Affairs (DEFRA)

Department of Energy and Climate Change (DECC)

Environment Agency for England (EA)

Environmental Protection Agency for Ireland (EPA)

Food Standards Agency (FSA)

Health and Safety Executive (HSE)

Health and Safety Laboratory (HSL)

Home Office

MetOffice

Public Health England (PHE)

Scottish Environment Protection Agency (SEPA)

The present Chairman is Dr Matthew Hort of the MetOffice and the Secretariat is provided by PHE.

2 TERMS OF REFERENCE

The terms of reference of the committee are:

Areas of technical interest

1. ADMLC's main aim is to review current understanding of atmospheric dispersion and related phenomena for application primarily in authorisation or licensing of discharges to atmosphere resulting from industrial, commercial or institutional sites. ADMLC is primarily concerned with dispersion from a particular regulated site or from discrete sources, and will not normally consider work in the following areas: traffic pollution, acid rain and ozone.
2. ADMLC is concerned both with releases under controlled conditions occurring at a constant rate over long periods, and with releases over shorter periods such as accidents or controlled situations where the release rate varies.
3. ADMLC is concerned with modelling dispersion at all scales, including on-site and within buildings.

Organisations and outputs

4. The Committee shall consist of representatives of Government Departments, Government Agencies and organisations with an interest in modelling dispersion of material for the situations identified above. Each organisation represented on the Committee shall pay an annual membership fee.
5. ADMLC believes that it can be most effective by limiting its membership to about 25 organisations. New organisations will only be admitted to membership of ADMLC if the majority of existing members agree to their membership.
6. ADMLC aims to review, collate, interpret and encourage research into applied dispersion modelling problems. It does not endorse particular brands or suppliers of commercial models. However, it is concerned to ensure that users for industrial applications are aware of what is available, how it can be applied to particular problems and of the uncertainties in the results.
7. The Committee will commission work on selected topics. These should be selected following discussion and provisional agreement at meetings of the Committee, followed by confirmation after the meeting. It will produce reports describing current knowledge on the topics. These may be reports from contractors chosen by the committee or may be based on the outcome of conferences or workshops organised on behalf of the committee. The money raised from membership fees will be used to fund contractors, organise workshops and report on their outcome, and any other matters which the Committee may decide.

3 WORK FUNDED DURING THE YEAR

3.1 A review of the limitations and uncertainties of modelling pollutant dispersion from non-point sources

In the main, pollutant dispersion from regulated sources mainly originates from elevated stacks, or 'point sources' and emission characteristics from these sources are generally well understood. However, an increasing number of regulated activities are fugitive, have many emission points in close proximity or are based on emission factors, and therefore, the impact of these emission characteristics on predicted concentrations are less well known. These include activities such as poultry sheds (naturally and fan ventilated), biofilters and composting windrows at bio-waste processing sites, but also include other activities such as emissions from road traffic. These sources generally share the common characteristic of being close to ground level or at ground level, which should be the focus of this project.

Modelling can be used to assess the impacts of these pollutant emissions on local receptors, commonly utilising modules in modelling packages such as line sources, area sources or volume sources. It is understood that these non-point source modules in Gaussian type models are derived from the point source concepts and similar algorithms. However, there is a lack of information on how well these modules perform when compared to measured data, how these modules compare with each other, and what uncertainties may exist when using these modules.

ADMLC is interested in seeking tenders that will review modelling methods for non-point sources, (especially for ground or near ground emission sources), the circumstances these source types best represent and the uncertainties associated with using these source types.

Stage 1

The study should begin with a literature review of published studies investigating the modelling of non-point sources. The review should focus on discussions of the sensitivities and validation of different model algorithms which represent non-point sources, including using different source types (line, volume or area) and different models. Non-point sources of particular interest are naturally and mechanically ventilated agricultural sources (intensive chicken/pig sheds), biofilters for biowaste processes, open composting windrows and traffic emissions.

Stage 2

The study should then investigate how different approaches to the modelling of non-point sources in models such as ADMS and AERMOD affect the model predictions. In particular, the implications of any assumptions made by different modelling packages in terms of limitations and uncertainties on model predictions should be examined. This should include comparing different modelling techniques for similar problems (ie does a line, area or volume source best represent a source type such as long gable-end fans, biofilters or natural ventilations pig houses, and how do they compare with a modified point source or a series of modified point sources). Model limitations may also include the use of modules such as buildings or terrain. Uncertainties of model predictions at different downwind distances, from close to the source to up to 5 – 10 km should be considered. The effects on pollutant dispersion for different meteorological conditions (short-term hourly Pasquill-Gifford A-G stability classes and long-term/annual mean) should also be considered within the different scenarios.

Stage 3

The study should also investigate the performance of the models for the non-point sources described above when compared to measured datasets collated during the literature review stage. This should lead to a discussion of model sensitivities and examine how valid the models are when compared to measurement data. The same source term data should be expressed using the different source modules available (e.g. area/volume/line) to explore the sensitivities and validity of the models. This stage should use data from a number of different source types, and should also investigate how the models perform when additional modules, such as terrain or buildings affect the model predictions. Some non-point source modules (i.e., line source) can't be run in conjunction with the building module; this should be considered in the non-point source model performance assessment.

Stage 4

The study should summarise any findings, include recommendations for how best to model non-point sources, and provide advice on any future work needed to develop this topic.

This work is published as an annex to this report (see link on website).