

**Atmospheric Dispersion Modelling
Liaison Committee Report: ADMLC-R14**

September 2021

INCLUDING

**A Review of Approaches to Dispersion Modelling of
Odour Emissions and Intercomparison of Models
and Odour Nuisance Assessment Criteria**

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 include a review of approaches to dispersion modelling of odour emissions and intercomparison of models and odour nuisance assessment criteria. 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:

Atomic Weapons Establishment, Aldermaston (AWE)

Defence Science and Technology Laboratory (Dstl)

EDF Energy

Environment Agency for England (EA)

Environmental Protection Agency for Ireland (EPA)

Food Standards Agency (FSA)

Health and Safety Executive (HSE)

UK Meteorological Office (MetOffice)

National Resources Wales (NRW)

Office for Nuclear Regulation (ONR)

Public Health England (PHE)

RISK-AWARE

Scottish Environment Protection Agency (SEPA)

The present Chairman is Dr Simon Gant of the Health and Safety Executive 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

3.1 **A review of approaches to dispersion modelling of odour emissions and intercomparison of models and odour nuisance assessment criteria**

Dispersion modelling of odorous emissions is a commonly used technique in the assessment of the potential for an activity to cause nuisance odours. The current standard approach used in the UK/Ireland and in other countries applies the 98th percentile of hourly averages over a period of a year to assess the potential for odour nuisance. The experience of regulatory bodies with regard to the reliability of this assessment approach is mixed, and there are a number of known sources of uncertainty in this approach. In general, the assessment of odour nuisance using dispersion modelling is relatively complex for a variety of reasons including:

- Difficulty in adequately characterising the source terms for a given activity.
- Sources of odour are often non-point sources with low efflux velocities close to ground level, which increases the potential error in the model outputs, as described in the 2016 ADMLC Report ADMLC/2016/06.
- Human response to odours is complex and difficult to adequately describe through discrete numerical assessment criteria. Further research is required in relation to the dose-response relationship on which nuisance criteria are currently defined.

Whilst these areas (above) merit further research, the scope of this proposed project relates more specifically to the technical approach to modelling and assessing odour emissions and their impacts, including the utility of alternative short-term modelling techniques rather than the standard hourly average based approach, and a comparison of the nuisance criteria applied in different jurisdictions. The proposed tasks are broken down as follows:

Task 1:

Complete a brief review of applicable odour nuisance criteria and assessment methods from different jurisdictions (including Austria, Germany, France, Netherlands, Australia and New Zealand). This should include review of the types of dispersion model used in odour impact assessment, the assessment criteria applied to assess the likelihood of nuisance (e.g. the use of the 'odour hour' concept in Germany, or the Western Australia 3-minute average criteria) and results from any available studies on the efficacy of these approaches (including summary details of any validation studies completed). The findings of this review should be considered in refining the scope of Task 2 below. At the end of Task 1 a brief interim report should be submitted to ADMLC with the high level findings

and a revised proposal for the activities to be completed during Task 2. This report should also include details of the proposed datasets to be used, as detailed under Task 2 below. ADMLC will provide comment on this report as necessary.

Task 2:

Carry out a model intercomparison on the application of traditional odour modelling approaches and the application of more recent techniques, including specifically the use of fluctuation models (such as the fluctuations module within the ADMS model), and other approaches as may be identified during Task 1.

The assessment should be based on the use of identical source terms and other relevant input data, but should consider a number of different release scenarios (e.g. point source, area source, jet source). The scenarios do not all need to be based on existing datasets, but this would be preferred (and where possible consideration should be given to datasets based on or including monitoring/complaint data). The proposed datasets should be selected and summary details submitted to the ADMLC for review and comment prior to commencement of further analysis (as part of the interim report under Task 1).

The chosen input data should be representative of the expected characteristics of typical odour emission sources (velocity, temperature, odour concentrations, etc.) and should include datasets representative of relatively steady-state (e.g. WWTP or intensive agriculture site) and non-steady state odorous emissions (e.g. municipal waste transfer station).

In particular the assessment should include:

- Evaluation of the model outputs and validation of the models based on the selected datasets/scenarios;
- Comparison of odour nuisance assessment findings based on comparison of traditional hourly-average (98th percentile values compared to the standard 1.5, 3 and 6 OU/m³ thresholds) assessment criteria and data from shorter term (minutes) fluctuation models. This should include application and comparison of nuisance criteria/assessment techniques from other jurisdictions as determined from Task 1 above. Analysis of peak to mean ratios and factors which influence this ratio (including distance and proximity to buildings which cause turbulence/downwash) should also be considered as part of the assessment;
- Discussion and evaluation of modelling uncertainties. Validation studies should be referenced where available and/or model comparisons should indicate confidence ranges;
- Identify the factors, for each modelling technique, which have the biggest influence on the ability of the model to accurately represent odours and their impacts (e.g. source terms, fluctuation parameters, averaging times, effect of distance from source, continuous or intermittent emissions, etc);

- For modelling of non-steady state emissions with meteorological fluctuations, determination/assessment of the relative contribution of these two factors to variations in odour levels at remote receptors should be completed for some relevant scenarios (e.g. odour from waste transfer/waste processing activities).

Task 3:

A draft report should be prepared on the findings of Task 1 and Task 2. This should include recommendations on the utility of fluctuation models or other modelling techniques to support odour nuisance assessment. Recommendation for additional work to further develop alternative approaches to modelling odours should also be presented. This task should also allow time and expenses for the project team to present the findings of the study to the ADMLC at an appropriate ADMLC meeting.