

**Atmospheric Dispersion Modelling
Liaison Committee Report: ADMLC-R10**

January 2017

INCLUDING

**High Level Review of the Sensitivity of Dispersion
Model Predictions to Individual Source Term
Parameters**

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 high level review of the sensitivity of dispersion model predictions to individual source term parameters. 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:

ADMLC Secretariat
Public Health England
Chilton
Didcot
Oxon
OX11 0RQ

E-mail: admlc@phe.gov.uk

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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)

Department for Environment Food and Rural Affairs (DEFRA)

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 High Level Review of the Sensitivity of Dispersion Model Predictions to Individual Source Term Parameters

In general terms Dispersion Modelling seeks to describe how pollutants are dispersed in the atmosphere by wind advection and diffusion. A required starting point for forward looking Dispersion Modelling is a description of the source term, which is generated as a result of a particular type of operation or event:

- Operation may consist of an intended or abnormal contaminant release from a process via a vent/chimney stack or drain point
- Event could range from the catastrophic failure of a vessel or pipe-line, to releases associated with process mal operation or mechanical defect (holes).

Depending on the type/sophistication of the Dispersion Model the source term needs to be described to a greater or lesser extent; number of parameters along with parameter precision. At its simplest a source term may consist of a pure chemical substance released in gaseous form at temperature T with virtually no momentum at a constant continuous release rate. More complex source terms could consist of describing a multi-component release from the failure of a pressure vessel bursting as a result of an accelerating decomposition or the unpacking of a ruptured pipeline conveying Liquefied Natural Gas.

ADMLC is interested in establishing the sensitivity of dispersion model predictions to particular individual source term parameters for a broad range of scenarios, with the aim of clearly identifying which source term parameters are the most important. It may well be the case that for some dispersion models little more than substance molecular mass, release mass & duration sufficiently describes the source term and anything else is largely irrelevant.

Specifically ADMLC is interested in source terms used for short range (few hundred metres to several kilometres) dispersion modelling of hazardous substances for instantaneous, transient and continuous releases.

Initially the review should consider the issues of source term sensitivity in a generic way, with possible categorisation by modelling type/approach.

A key aspect of the review will then be to clearly identify individual source term models, which may in some cases be imbedded within particular dispersion models. To identify any underlying, possibly simplifying, assumptions that have a direct impact on the number of source term parameters and required precision. An important aspect not to overlook is to determine whether meteorological conditions (wind speed, stability) feature in the source term description.

The review should then focus on individual Dispersion Model source term requirements/sensitivities for modelling releases from:

- Evaporating Pools (Low Momentum)
- Pressurised Catastrophic Failures (Flashing)
- Jet Releases (High Momentum and Directional)
- Spray Releases
- Fire Plumes (Warehouse)
- Fire Plume (Outside Burning Pool)

Release durations associated with Instantaneous, Transient (short duration say 3 - 10 minutes) and Continuous releases are of particular interest.

A typical list of models may include ADMS, ALOHA, DRIFT, HOTSPOT, PHAST, QUIC VLSTRACK, etc

The output of the review should consist of a short summary report with findings communicated in a suitable tabular format. Ideally the summary section of the report should attempt to draw out any general findings or trends concerning the sensitivity (or just as importantly the insensitivity) of dispersion model predictions to individual source term parameter variances.