Atmospheric Dispersion Modelling Guidelines

ENVIRONMENT PROTECTION AUTHORITY

1. Introduction

These guidelines provide the Environment Protection Authority (EPA) requirements for atmospheric dispersion modelling of emissions from existing and proposed industrial activities within the state of Tasmania. They have been produced in accordance with Section 74(4) of *Environmental Management and Pollution Control Act 1994*[1] (EMPCA). These guidelines are regularly updated, and any comments or suggestions would be welcomed.

These guidelines are deliberately generic and do not provide detailed modelling advice, such as the applicability of individual models for use in specific situations, or guidance on individual model settings that should be used. The EPA expects to be contacted to discuss issues such as these prior to commencement of modelling, and as the modelling program proceeds.

Modelling must be carried out in accordance with the relevant requirements of the *Environment Protection Policy (Air Quality) 2004*. In particular, Part 4 of the policy deals with the management of point sources (*i.e.* industrial sources) of atmospheric contaminants. Within Part 4, Section 13 deals with odour and Section 14 with atmospheric dispersion modelling. Schedules 1, 2 and 3 provide in-stack concentration limits, design criteria and odour criteria respectively.

Atmospheric dispersion modelling is a highly specialised discipline, which should not be undertaken by an unsupervised inexperienced practitioner. The modelling report should therefore contain a brief outline of the author's qualifications and experience in air pollution meteorology and atmospheric dispersion modelling.

2. Model Selection

The following atmospheric dispersion models have been accepted by the Director, Environment Protection Authority for use within Tasmania:

- **TAPM** (V4.0.4 or later)
- **CALMET/CALPUFF** (V6.334/V6.42 or later) and **CALPOST** (V6.292 or later)
- **Ausplume** (V6.0 – this model is likely to be replaced by **AERMOD** in the future)
- A hybrid approach using a combination of the above models.

Use of other models, such as AERMOD or industry-specific models requires approval by the EPA Tasmania Air Modelling Officer beforehand.

The model chosen must be appropriate for the task at hand, and this choice must be justified within the modelling report. Use of the TAPM model for near-field dispersion modelling of pollutants when the sources and receptors are at or near ground-level is not acceptable.

It has to be noted that steady-state models like AERMOD or Ausplume can only be used if the assumption that meteorological conditions are spatially uniform (or near uniform) is valid and there is no large water body present. Such conditions are not very common in Tasmania because of its complex topography.

3. Modelling Domain Extent and Resolution

The modelling domain extent must be selected to include any sensitive receptors that could be affected by emissions from the modelled premises and must be large enough to enclose the zone of maximum ground level concentrations (GLCs). Where possible, the modelling domain extent should

[1] https://www.legislation.tas.gov.au/view/html/inforce/current/act-1994-044

be large enough to reach the region where pollutant effects from the proposed premises are negligible relative to background levels. The modelling grid resolution must be fine enough to adequately capture peak GLCs.

A map must be presented covering the entire modelling domain, showing the location of the modelled emission source(s) in relation to the boundary of the premises, surrounding terrain features, other existing emission sources, major roads, built up areas and nearby sensitive receptor locations. If the map extent is greater than the modelling domain extent, then the modelling domain should be clearly marked on the map.

4. Terrain Data

The source of all digital terrain data used within the model should be acknowledged in the modelling report. Any extraction and/or development process required to convert the data into a form required by the model should be described.

Terrain contours covering the modelling domain must be clearly mapped in order to facilitate assessment of the terrain file used, and to aid interpretation of modelling results. Where there are terrain features outside the modelling domain that may influence the meteorology within the modelling domain, then these should be described, and if appropriate included in the terrain map above.

5. Meteorological Data

Unless prior agreement with the EPA has been obtained, modelling must utilise meteorological data spanning a period of at least twelve months. The source of the meteorological data must be identified, along with a description of its accuracy. The procedures used to develop the model's meteorological file must be described.

Where possible the meteorological file should be compared against long term climate data to demonstrate that it is representative of typical conditions (or otherwise). Wind roses must be presented summarising the meteorology of the modelling domain for the year.

An analysis of seasonal meteorological data needs to be presented if activities leading to seasonal increase of emissions are anticipated. The provision of other meteorological analyses, such as mixing height or atmospheric stability analyses are encouraged.

If meteorological data is obtained using prognostic meteorological models then full details of the meteorological models used (including model name and version), the model configuration, and the justification for its use have to be provided. If the TAPM model is used to generate meteorological data it is strongly recommended that values of certain parameters are changed from their defaults, i.e. the number of grid points is at least 31 by 31 and at least 30 vertical grid levels are used. The latitude and longitude coordinates of the grid centre must be accurately converted into the GDA94 (or equivalent) coordinates.

Use of meteorological data obtained from prognostic meteorological models (for example TAPM) in CALMET implies NO-OBS mode. Use of .sur and .up files generated by the prognostic models is not acceptable as CALMET treats the inputs as surface and upper air observations.

6. Emitted Pollutants

Identification must be made of all atmospheric pollutants that are likely to be emitted in significant quantities from the proposed development. The choice of pollutants selected for dispersion modelling must be justified.

In-stack concentrations and mass emission rates of all modelled pollutants must be determined for realistic peak emission scenarios. This usually corresponds to maximum measured emission rates, or emission rates calculated for maximum production or fuel usage. The origin of these in-stack concentrations and mass emission rates must be provided and justified.

It should be demonstrated that these meet the requirements of any site permits, where available, and of the *Environment Protection Policy (Air Quality) 2004*. In the absence of specific requirements for new or altered sources, it should be demonstrated that they can be considered to be at levels consistent with the application of accepted modern technology.

7. Source Characterisation

Stack architecture and release conditions must be provided for all modelled point sources of atmospheric emissions in tabular form, containing at least the following fields:

- Source identifier and/or name
- Source description (if required)
- Source easting (mE MGA)
- Source northing (mN MGA)
- Base elevation (m) at the emission point
- Height (m) of emission point above the base elevation
- Diameter (m) of emission outlet
- Exit temperature (°C *or* K) of emission
- Exit velocity (m/s) of emission
- Whether the source is wake-affected or not
- Concentration immediately prior to discharge for each significant contaminant in the emission (mg/m^3, dry gas at 0°C and 101.325 kPa)
- Mass emission rates for each significant contaminant (g/s)
- An indication of whether emission rates are constant or variable.

If the emission rates are variable, then a description of how they are expected to vary and how this variation has been accounted for within the modelling program should be provided within the main body of the report.

Where applicable other source types, such as area sources, volume sources or line sources should be incorporated into the modelling program and must be described in similar detail within the modelling report.

A conservative approach to estimating these parameters is highly recommended.

8. Background Concentrations

Where applicable the modelling must account for existing emissions into the airshed and background concentrations. Where nearby monitoring data is available, the 70^{th} percentile concentration can be used to characterise the background. Alternatively, the maximum measured value can be used as part of a screening approach or as a conservative estimate. Where there are suitable contemporaneous meteorological and ambient air quality observations, extending for a period of at least a year, then these may be directly utilised within the modelling program.

9. Model Configuration

The specific model configuration must be described in enough detail for the reviewer to duplicate the modelling if necessary.

Where applicable the modelling must take into account plume chemistry and building downwash effects. Modelling options based on Pasquill-Gifford coefficients should be avoided. Instead dispersion coefficients based on similarity theory where probability density function is a chosen option should be used. All relevant assumptions must be provided.

Pollutant averaging times and percentile levels for concentration calculations must be selected to conform to the identified design criteria and standards.

All configuration files, input files and output files must be made available to the Air Modelling Officer in digital form upon request, to facilitate detailed review and possible replication of dispersion modelling.

10. Design Criteria and Standards

Relevant design criteria and/or standards, pollutant averaging times, percentile levels and allowable exceedances must be identified for all modelled pollutants. Schedule 2 of the *Environment Protection Policy (Air Quality) 2004* provides design criteria that apply "at or beyond the boundary" of the premises involved. Odour criteria are provided in Schedule 3.

If there is no design criterion for a specific contaminant then a relevant criterion from another jurisdiction may be used, as long as its use is justified within the modelling report and the Air Modelling Officer is consulted prior to its adoption.

Clauses 11(1)(b) and 11(1)(c) of the *Environment Protection Policy (Air Quality) 2004* require that, in order to maintain a reserve capacity for airsheds, no industrial activity is permitted to emit pollution in a manner that would prejudice compliance with the Air NEPM.

11. Modelling Report

The atmospheric dispersion modelling report should preferably be a stand-alone document. Methodology and results of the assessment against the *Environment Protection Policy (Air Quality) 2004* criteria should be addressed without the need to refer to other documents.

11.1. Content

The EPA Tasmania minimum requirements regarding the information contained within a modelling report are similar to the EPA (NSW) requirements[2]. The report should include a general description of the activities at the site as well as the **relevant information previously referred to in this document**. The report should enclose the following components:

- **Site plan** which should include topography and layout of the site with the plant boundary and sensitive receptors clearly identified.
- **General description of the activities** carried out on the site addressing operations and conditions relevant to air emissions.

[2] *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, EPA (NSW), revision November 2016, pages 42-43

- **Emission inventory** which would include tables showing position of all emission sources with the type of source specified and release parameters of the emission sources (including fugitive sources) as well as identified emitted pollutants, their mass emission rates and the methodology of their calculations for each source.
- **Meteorology** including details of the software used to obtain it.
- **Dispersion modelling** should contain:
  - Detailed discussion and justification of all parameters used in the air dispersion modelling and the manner in which relevant site-specific elements may affect the pollutant(s) dispersion
  - Discussion of methodology used to account for any atmospheric pollutant formation and chemistry
  - Discussion of potential air quality impacts for all relevant pollutants based on GLC at or beyond plant boundary and all sensitive receptors
  - Tables with summaries of predicted concentrations at the sensitive receptors and figures displaying isopleths representing pollutant GLCs.
- **Conclusions and recommendations**
- **References**

11.2. Presentation

Modelling results must be presented at the appropriate percentile levels as clearly labelled pollutant isopleths against a mapped background. The use of large colour diagrams is strongly encouraged.

Isopleths highlighting the relevant design criterion or standard must be provided in cases where these criteria or standards are exceeded. Pollutant isopleths at or exceeding relevant criteria must be presented in a form that clearly contrasts with isopleths meeting the criteria.

The boundaries of the premises containing the emission sources for the proposed development must be clearly marked on the mapped background. It is often helpful to locate discrete receptor sites plant boundaries.

Tick marks must be displayed on horizontal and vertical axes displaying MGA (GDA94 or equivalent datum) eastings and northings as appropriate.

Captions for all figures displaying pollutant isopleths must provide enough information to allow their accurate interpretation if viewed in isolation from the surrounding document. Captions should therefore provide at least the following details:

- The premises and/or emission sources modelled
- The pollutant species modelled
- The modelling scenario presented
- The averaging time used
- The percentile level used
- The GLC units
- The relevant design criterion or standard that applies
- The grid maximum concentration or the maximum concentration occurring beyond the boundaries of the premises
- The dispersion model and version number used.

Where predicted pollutant isopleths are complex in form it is often useful to provide either the isopleth interval, where this varies in a consistent manner, or a list of the isopleths mapped.

Predicted GLCs should also be presented for individual sensitive receptor locations where appropriate. Elevated receptors must be included where there are concerns about above ground impacts.

In the case of multiple modelling scenarios or contaminants, it is often useful to summarise the results from the entire modelling program within a single table.

The modelling report can refer to more detailed information contained within other documents (*e.g.* stack test reports), however it should not rely on these unless they are included as appendices to the original report.

Representative model output files should be presented as appendices to the report, allowing the reviewer to check model configuration, source characteristics, tables of peak concentrations and predicted concentrations at receptor locations. All input, output and meteorological files used in the dispersion modelling should be made available in an electronic format (compatible with the modelling software used or in a text format).

It is recommended that the pages of the report are numbered and information about the version of the report, its author/s and reviewer/s is included in the report.

12. Further Guidance

It is highly recommended that EPA Tasmania Air Modelling Officer is contacted prior to the process of developing of the modelling methodology.

Further guidance can be obtained by contacting:

Air Modelling Officer

EPA Tasmania

Department of Primary Industries, Parks, Water and Environment (DPIPWE)

GPO Box 1550, Hobart, Tasmania 7000, AUSTRALIA

Ph: **(03) 6165 4617**

Email: enquiries@epa.tas.gov.au