Guidance for Modelling Dispersion of Air Pollutants in the NT

ntepa Northern Territory Environment Protection Authority

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Acronyms	Full form
AAQ NEPM	National Environment Protection (Ambient Air Quality) Measure
AERMOD	Regulatory steady-state Gaussian air dispersion model by AMS/US EPA
AERMET	Meteorological pre-processor for AERMOD
AMS	American Meteorological Society
APAC	Air Pollution Assessment Criteria
AQIA	Air quality impact assessment
AUSPLUME	Non-regulatory steady-state Gaussian plume dispersion model
DLPE	Department of Lands, Planning and Environment
CALMET	Diagnostic three-dimensional meteorological model
CALPOST	Post-processing software for CALPUFF model
CALPUFF	Non-steady-state Lagrangian Gaussian air dispersion puff model
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EP Act	Environment Protection Act 2019
EPL	Environment Protection Licence
GDA2020	Geocentric Datum of Australia 2020
GLC	Ground level concentration
IAC	Impact Assessment Criteria
MAXMOD	Screening model for predicting GLC under worst-case meteorological conditions
MGA	Map Grid of Australia (coordinate grid system based on UTM projection and GDA2020)
mE MGA	Metres East (MGA coordinate grid)

Acronyms	Full form
mN MGA	Metres North (MGA coordinate grid)
NEPC	National Environment Protection Council
NO-OBS	No observational data
NPI	National Pollutant Inventory
NR Maps	Natural Resource Maps of NT prepared by DEPWS
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
SCREEN3	Single source screening Gaussian plume dispersion model
TAPM	The Air Pollution Model (CSIRO prognostic meteorological and non-Gaussian air pollution model)
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator projection
WMPC Act	Waste Management and Pollution Control Act 1998

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1. Introduction

1.1. Overview

The Northern Territory Environment Protection Authority (NT EPA) has developed environmental factors and objectives[1] to improve certainty and increase transparency within the environmental impact assessment process. Environmental factors are broad divisions of the environment that a proposed action could impact. The environmental factors are categorised under five themes of Land, Water, Sea, Air and People.

An environmental objective for each factor reflects the expected outcomes for these parts of the environment. These objectives provide an indicator against which to assess achievement of the objects of the *Environment Protection Act 2019*[2] (EP Act): the NT EPA uses the objective in making its judgement about whether the environmental impact of a proposed action may be significant and ultimately whether a proposed action is likely to be acceptable. The environmental objective for the NT EPA's environmental factor of Air Quality is "Protect air quality and minimise emissions and their impact so that environmental values are maintained."

Everyone has a duty to protect the air quality of the Northern Territory during planning, design, construction, operation, remediation or closure of any activities and developments. All reasonably practicable measures must be undertaken, through air quality management, to avoid and mitigate impacts on air quality beyond the boundary of the premises on which the activity is occurring.

Air quality management relies on air dispersion modelling analyses to identify source contributions to air quality problems and assist in the design of effective strategies to reduce harmful air pollutants impacting on the environment.

1.2. Purpose of guidance

The purpose of this guidance is to support the NT EPA advice on protection of environmental air quality in the NT. This guidance provides technical instructions for modelling atmospheric dispersion of emissions from existing and proposed industrial activities within the Northern Territory. The intention is to assist proponents achieve the following objectives:

- Prepare air quality impact assessments to inform an environmental impact assessment process under the EP Act for activities that have the potential to have a significant impact on air quality.
- Demonstrate effective risk mitigation for activities proposed or operating under environment protection approvals or licences under the *Waste Management and Pollution Control Act 1998*[3] (WMPC Act).
- Use air dispersion models that are appropriate for the task, taking into consideration conditions typical to the NT environment.
- Ensure that air dispersion modelling is conducted to a level expected by the NT EPA (note that strategic assessments may involve more elaborate modelling than required in this guidance).

[1] https://ntepa.nt.gov.au/__data/assets/pdf_file/0020/804602/guide-ntepa-environmental-factors-objectives.pdf
[2] https://legislation.nt.gov.au/en/Legislation/ENVIRONMENT-PROTECTION-ACT-2019
[3] https://legislation.nt.gov.au/Legislation/WASTE-MANAGEMENT-AND-POLLUTION-CONTROL-ACT-1998

- Ensure that contents of air dispersion modelling reports provided to the NT EPA are comprehensive and consistent, such as including all air pollutants emitted, including background concentrations, and selecting appropriate assessment criteria.
- Ensure that the air quality impact assessment is conducted by a suitably qualified person.

1.3. Source and limitations of the guidance

This guidance is generic. It does not provide detailed modelling advice, which the proponent should seek from suitably qualified and experienced professionals, who in turn may need to consult with the Department of Lands, Planning and Environment (DLPE) before selecting a model and its settings to be used in specific situations. Consultation with DLPE may also be necessary as the modelling program proceeds.

This guidance is consistent with other nationally accepted modelling guidelines, including:

- NSW Approved Methods for Modelling: *Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales*. (NSW EPA, 2022a)
- VIC EPA Guideline: *Guideline for Assessing and Minimising Air Pollution, EPA Victoria Publication 1961 February 2022*. (EPA Victoria, 2022)
- TAS EPA Guideline: *Atmospheric Dispersion Modelling Guidelines, EPA Tasmania, October 2020*. (EPA Tasmania, 2020).

The NSW Approved Methods for Modelling (NSW EPA, 2022a) provides guidance on the required level/detail of assessment. It covers topics on emissions inventory data; meteorological data; background concentrations, terrain, and sensitive receptors; and dispersion modelling methods. Other topics covered include impact assessment criteria; chemical transformation; interpretation of dispersion modelling results, including cumulative impacts; and reporting.

2. Model selection

A refined dispersion modelling technique that employs site-specific input data as required for a Level 2 assessment described in the NSW Approved Methods for Modelling should be used for air dispersion modelling in the NT.

For situations when the likely emissions of pollutants to air is very low, it may be appropriate to use a less refined screening-level modelling technique as required for a Level 1 impact assessment.

2.1. Approved models for Level 2 impact assessments

The following atmospheric dispersion models are acceptable for use within the NT for a Level 2 air quality impact assessment (AQIA):

- **TAPM (**V4.04 or later)
- **CALMET/CALPUFF** (V6.334/V6.42 or later) and **CALPOST** (V6.292 or later)
- a hybrid approach using a combination of the above models.

The model chosen must be appropriate for the task, and this choice must be justified within the modelling report. The report must document model limitations, since these are inherent in all models.

Modellers should not use non-regulatory models for AQIA. The AUSPLUME dispersion model is no longer supported as a regulatory model and must not be used.

Scientific justification must support the use of other models, such as AERMOD or industry-specific models for deviation from the preferred methods specified in this guidance.

Steady-state models like AERMOD can only be used if the assumption that meteorological conditions are spatially uniform (or near uniform) is valid and there are no large water bodies including rivers, lakes and lagoons present. Such conditions are not common in Darwin due to proximity to the sea, for example.

The AERMET meteorological pre-processor for AERMOD may not be suitable for standard use in Australia (EPA Victoria 2013).

The NSW Environment Protection Authority has guidance for CALMET/CALPUFF users to determine site-specific optimum model options and settings for a range of conditions and model scenarios (NSW EPA, 2011).

The New Zealand Ministry for the Environment has prepared a guide to atmospheric dispersion modelling which provides good-practice protocols for carrying out the modelling. The document covers: when dispersion modelling is appropriate; how to model efficiently with the most appropriate input data; the advantages and disadvantages of different modelling techniques; how to obtain necessary data including emissions and meteorological data; how to get good information out of a model; and how to display and communicate the results clearly and effectively (NIWA, 2004).

Other useful guidance documents for atmospheric dispersion modelling are listed below:

- Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (Ireland Environment Protection Agency, 2019)
- Air Quality Modeling Guidelines (Texas Commission on Environmental Quality, 2019)
- Air Quality Dispersion Modeling - Preferred and Recommended Models (US EPA, 2023)
- British Columbia Air Quality Dispersion Modelling Guideline (British Columbia Ministry of Environment and Climate Change Strategy, 2022)
- Guidance Environmental permitting: air dispersion modelling reports. (UK Environment Agency, 2021)
- Air Quality Modelling Guidance Notes (WA Department of Environment, 2006).

The next subsections provide summary descriptions of some regulatory air dispersion models.

2.1.1. CALPUFF

CALPUFF is a Lagrangian puff model that uses a non-stationary three-dimensional meteorological field. It is a multi-layer, multi-species, non-steady-state Gaussian puff dispersion model that can simulate the effects of time- and space-varying meteorological conditions on pollutant transport. This enables the model to account for a variety of effects such as spatial variability of meteorological conditions, causality effects, dry deposition and dispersion over a variety of spatially varying land surfaces, plume fumigation, low wind-speed dispersion, pollutant transformation and wet removal. CALPUFF has various algorithms for parameterising dispersion processes, including the use of turbulence-based dispersion coefficients derived from similarity theory or observations (Earth Tech, 2000).

The US EPA has accepted CALPUFF as a guideline model for regulatory applications involving the long-range transport of pollutants (>50 km). It can also be used on a case-by-case basis in situations involving complex flow and non-steady-state cases up to 50 kilometres from the source.

The CALPUFF modelling system includes CALPUFF (the model); CALMET, which is a diagnostic meteorological model that produces three-dimensional wind fields based on parameterised treatments of terrain effects such as slope flows and terrain blocking effects. Meteorological observations are used to determine the wind field in areas of the domain within which the observations are representative; and CALPOST, the post-processor for calculating time-averaged concentrations, deposition fluxes, and visibility impacts.

2.1.2. TAPM

CSIRO developed The Air Pollution Model (TAPM) to simulate three-dimensional meteorology and pollution dispersion in areas where meteorological data are sparse or non-existent. The modelling system contains a number of dispersion modules. These include a particle/puff dispersion model for dispersion from point, line, area and volume sources, and a three-dimensional grid-point model for urban air pollution studies. The dispersion model allows for plume rise and building wake effects, wet and dry deposition, and photochemistry for urban airshed applications. When using TAPM, V.04 or later should be used for air dispersion modelling in the NT.

Air pollution predictions for environmental impact assessments usually use Gaussian plume/puff models driven by observationally based meteorological inputs. TAPM is different to these approaches in that it solves approximations to the fundamental fluid dynamics and scalar transport equations to predict meteorology and pollutant concentration for a range of pollutants important for air pollution applications (Hurley, P., 2005).

2.1.3. AERMOD

AERMOD is a steady-state Gaussian plume model, which assumes horizontal homogeneous meteorology over the whole domain. It is a US EPA regulatory model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain, with the modelling system comprising three components: AERMOD (dispersion model); AERMET (meteorological pre -processor); and AERMAP (terrain pre-processor) (US EPA, 2022).

Scientific justification must support the use of AERMOD in the NT.

2.2. Level 1 impact assessments

For low-level emissions to air, dispersion modelling screening tools such as SCREEN3 or MAXMOD can be used for screening-level assessments (Level 1). These are for situations where full scale air quality monitoring is not warranted or able to be used. Examples of when a Level 1 assessment might be used include temporary use of a thermal oxidiser in a hydrocarbon remediation project at a service station in a residential area and hydrocarbon emissions guidelines must not be exceeded; emissions from an air stripper used in a hydrocarbon groundwater remediation project; single vent stack used during maintenance turnarounds; estimating impacts of hydrocarbon emissions from service stations; and estimating impact of hydrocarbon emissions from storage tanks from vents or rim seals.

If a screening-level dispersion modelling technique is selected, its use must be justified, and assessment must be conducted with worst-case scenario meteorology and concentration input data.

3. Modelling domain extent and resolution

The modelling domain extent that is selected must include any current and proposed 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 be large enough to reach the region where pollutant concentrations from the proposed premises are negligible relative to background levels. The modelling grid resolution must be fine enough to capture peak GLCs adequately.

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 locations of nearby sensitive receptor that could be impacted by the emissions. If the map extent is greater than the modelling domain extent, then the modelling domain should be clearly marked on the map.

Appropriate grid cell size and averaging periods should be used for determining compliance with impact assessment criteria when doing airshed modelling. A 1-km grid should be used for large air sheds with residential areas and averaging periods should be 1-hour averages; monthly averages and annual averages - all calculated from rolling half hour averages. When using screening tools with A-F stability classes, the maximum concentration (3-minute averages) at any location in the domain should be used to determine compliance against assessment criteria.

4. Terrain data

The modelling report should acknowledge the source of all digital terrain data used within the model and describe any extraction and/or development process required to convert the data into a form required by the model.

To facilitate assessment of the terrain file used and aid interpretation of modelling results, the report must clearly map out all terrain contours covering the modelling domain. The report must include a description of any terrain features outside the modelling domain that may influence the meteorology within the modelling domain and, if appropriate, include the features in the terrain map.

5. Meteorological data

Modelling must utilise meteorological data spanning a period of at least twelve months. The AQIA report must provide the source of the meteorological data, along with a description of its accuracy. It must also describe procedures used to develop the model's meteorological file.

Where possible, the report should include a comparison of the meteorological file against long-term climate data to demonstrate that it is representative of typical conditions (or otherwise). Wind roses summarising the meteorology of the modelling domain for the modelled period must be included in the report.

The report must include an analysis of seasonal meteorological data if anticipated activities could lead to a seasonal increase of emissions. 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 must be provided.

It is good practice to change the values of certain parameters from their defaults after generating meteorological data using TAPM, e.g., the number of grid points modelled should be at least 31 by 31 with at least 30 vertical grid levels. Also, accurately convert the latitude and longitude coordinates of the grid centre to the GDA2020 (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. Source characterisation

The proponent must develop an emissions inventory that characterises all sources of air pollutants at the premises with potential to have impacts on the environment (including human health and vegetation). Identify the source type, location and potential air pollutants emitted as described below. The choice of pollutants selected for dispersion modelling must be justified, with consideration given to the amounts emitted, toxicity, odour and the formation of secondary air pollutants such as photochemical smog and aerosols.

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. Provide the origin of these in-stack concentrations and mass emission rates with justification.

6.1. Point sources

Point sources emit pollutants into the air from a small opening such as a stack or vent.

Provide stack architecture and release conditions 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
- peak to mean ratios used for any odour assessment.

6.2. Other source types

Where applicable, incorporate other source types, such as area sources, volume sources or line sources into the modelling program and provide a description in similar detail within the modelling report. Include the locations, sizes and emission rates of these source types in the emissions inventory table. A conservative approach to estimating these parameters is highly recommended.

6.3. Variable or intermittent emissions

If the emission rates are variable, then describe the expected variation and explain within the main body of the report how the modelling program accounted for the variation.

Intermittent emissions (plant start-ups or plant upsets) may cause more pollution than normal emissions. Although these activities are not normally considered in standard assessments, they should be investigated to determine worst-case emission scenarios. The modelling must assess both continuous and intermittent emissions and determine if the latter are insignificant in magnitude and/or very improbable over the lifetime of the plant and may be screened out. Screening of emissions cases must be based on the joint consideration of probability of occurrence and magnitude of emission. The upper bounds of likely operational variability of emission sources should be selected for modelling large sources. However, for smaller sources, the 99.9th percentile can be used if data on distribution of emission rates is available.

7. Background concentrations

The modelling must account for existing emissions into the airshed and background concentrations, where applicable. Emissions from the proponent's facility must be combined with existing background levels before comparison with the relevant impact assessment criteria.

The maximum measured value can be used as part of a screening approach or as a conservative estimate of the background concentration. 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.

Historical air quality monitoring data (including meteorological data) dating back to 2011, measured at the NT EPA air quality monitoring stations is available on the NT EPA air quality website: http://ntepa.webhop.net/NTEPA/.

When background concentration data for any pollutants being modelled is not available, emissions from major sources (including potential sources which are at a stage of approval) within the airshed that emit any of those pollutants that could influence air quality must be included in the modelling.

Modelling analysis may be limited to emissions from the proponent's facility only; if the proponent shows (to the satisfaction of the NT EPA) that the background concentrations of the modelled pollutants and other local sources of these pollutants are insignificant. Information on major local sources can be obtained from Environment Protection Licences (EPLs) and from the National Pollutant Inventory (NPI).

The modelling report must provide results of incremental impacts (facility emissions only) and cumulative impacts (facility plus background emissions) of emissions.

8. Model configuration

Describe specific model configuration in enough detail to enable other modellers to duplicate the modelling if necessary.

Where applicable, the modelling must consider plume chemistry and building downwash effects.

Coastal fumigation should be included in the modelling when tall stack sources are within approximately 500 m of the coast. Dispersion models that cannot be used to conduct coastal fumigation when required, should not be used for the assessments.

Use dispersion coefficients based on similarity theory where probability density function is a chosen option for modelling in preference to options based on Pasquill-Gifford coefficients. Provide all relevant assumptions.

Select pollutant averaging times and percentile levels for concentration calculations to conform to the identified design criteria and standards.

Make available all configuration files, input files and output files to the NT EPA in digital form upon request, to facilitate detailed review and possible replication of dispersion modelling.

9. Impact assessment criteria and standards

Identify relevant impact assessment criteria (GLC design criteria) and/or standards, pollutant averaging times and applicable percentile levels of dispersion model predictions for all modelled pollutants.

Impact assessment criteria (IACs) in the *NSW Approved Methods for Modelling* (NSW EPA, 2022a) or air pollution assessment criteria (APACs) in *Vic EPA Guideline* (EPA Victoria, 2022), are risk-based concentrations that help identify emissions likely to pose unacceptable risk to human health and the environment. They are different from Work Health and Safety standards which are administered by NT WorkSafe.

Some IACs in Tables 13 and 14 (Chapter 7) in the *NSW Approved Methods for Modelling* are outdated in comparison with current global standards. These criteria should be substituted with corresponding values from Table 3 of the *Vic EPA Guideline* since these values have been adopted from sources which are based on more updated understanding of health impacts from exposure of pollutants.

If standards are not available, proponents can use the hierarchy detailed in the *Vic EPA Guideline* as a basis to develop appropriate standards for the relevant compounds.

Application of the criteria should be consistent with procedures outlined in the corresponding guidance documents. For example, Chapter 7 of the *NSW Approved Methods for Modelling* provides impact assessment criteria (IACs) that apply "at or beyond the boundary" of the premises involved or "at receptor sites", depending on the level of assessment and pollutant type. Chapter 7 also provides IACs for odorous compounds. In the *Vic EPA Guideline*, APACs with averaging times less than 24 hours apply at any location at or beyond the boundary of the facility. APACs with averaging times of 24 hours or greater apply at discrete sensitive locations.

If impact assessment criteria are exceeded, the dispersion modelling must be revised to include various pollution control strategies until compliance is achieved. Also, sensitivity analysis involving variation of parameters such as source release parameters and efficiency of pollution control equipment can be conducted to select the most cost-effective and environmentally effective control strategy.

It is recommended that to maintain a reserve capacity for airsheds, no industrial activity is permitted to emit pollutants in a manner that would prejudice compliance with standards in the *National Environment Protection (Ambient Air Quality) Measure* (AAQ NEPM)[4] as amended.

Air emissions and any control measures proposed must meet the emissions limits for the relevant premises set out in the *NSW Protection of the Environment Operations (Clean Air) Regulation*[5] (as adopted in the NT).

Odour emissions may also require dispersion modelling to demonstrate compliance with impact assessment criteria or a need to install an odour control unit.

10. Modelling report

The air dispersion modelling report submitted by the proponent should demonstrate that concentrations and emission rates meet the requirements of any site licences and approvals, where available. In the absence of specific requirements for new or altered sources, it should be demonstrated that they can be at levels consistent with the application of accepted modern technology and in accordance with the management hierarchies prescribed under the EP Act and WMPC Act, including consideration of best available techniques (BAT)[6].

NT EPA may not accept reports that do not meet the all the requirements set out in this section, including presentations requirements.

10.1. Content of report

The atmospheric dispersion modelling report must be a stand-alone document.

The minimum requirements regarding the information contained within a modelling report should be as described in the *NSW Approved Methods for Modelling* (NSW EPA, 2022a). 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. Methodology and results of the assessment against the NSW Approved Methods for

[4] https://www.legislation.gov.au/Details/F2021C00475
[5] https://legislation.nsw.gov.au/view/html/inforce/current/sl-2022-0811
[6] BAT means the available techniques that are the best for preventing or minimising emissions and impacts on the environment. 'Techniques' include both the technology used and the way the installation is designed, built, maintained, operated, and decommissioned.

Modelling (NSW EPA, 2022a) (or latest version) criteria should be addressed without the need to refer to other documents. The report should enclose the following components:

- **Executive summary** should include the purpose of the proposal, type of dispersion model used, limitations and summary of the results detailing any exceedances.
- **Site plan** should include topography and layout of the site (showing the locations of all modelled sources) with the plant boundary and sensitive receptors clearly identified.
- **General description of the activities** carried out on the site should address operations and conditions relevant to air emissions.
- **Emissions inventory** which should include tables showing the positions 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.
- **Meteorolog**y section should include a description of the techniques used to prepare the meteorological data file. A Level 2 assessment should include a discussion of the prevailing dispersion meteorology at the proposed site. Include wind rose diagrams, an analysis of wind speed, wind direction, stability class, ambient temperature, mixing height, and joint frequency distributions of wind speed and wind direction as a function of stability class. Demonstrate that the site-representative data adequately describes the expected meteorological patterns at the site under investigation.
- **Background** air quality data used in the assessment should be explained and provided in tables.
- **Dispersion modelling** section should contain:
  - detailed discussion and justification of all parameters used in the air dispersion modelling and the way relevant site-specific elements may affect the pollutant(s) dispersion
  - model calibration outputs showing good fit against background data
  - 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 and cumulative concentrations at the sensitive receptors, against corresponding IACs - highlighting all exceedances
  - figures displaying isopleths representing pollutant GLCs as described in the next section
  - all input and output files, including meteorological files should be presented when requested.
- **Conclusions and recommendations** should be included.
- **References** should be provided for all documents cited.
- **Author's biography** - Atmospheric dispersion modelling is a highly specialised discipline. The modelling report should demonstrate that the modelling has been undertaken by an appropriately

qualified and experienced professional/s and include an outline of the author's qualifications and experience in air pollution meteorology and atmospheric dispersion modelling.

10.2. Presentation

Present modelling results at the appropriate percentile levels as clearly labelled pollutant isopleths against a mapped background from satellite or aerial photography. The use of large colour diagrams is strongly encouraged.

Provide isopleths highlighting the relevant design criterion or standard. Present pollutant isopleths at or exceeding relevant criteria in a form that clearly contrasts with isopleths meeting the criteria.

Present separate isopleths for the predicted emissions from the proposed development and from cumulative emissions. Also, from different scenarios modelled e.g., with and without mitigations.

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.

Display tick marks on horizontal and vertical axes displaying MGA (GDA2020 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:

- premises and/or emission sources modelled
- pollutant species modelled
- modelling scenario presented
- averaging time used
- percentile level used
- GLC units
- relevant impact assessment criteria or standard that applies
- grid maximum concentration or the maximum concentration occurring beyond the boundaries of the premises
- 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.

Present predicted GLCs 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.

Present representative output files as appendices to the report, allowing the reviewer to check model configuration, source characteristics, tables of peak concentrations and predicted concentrations at receptor locations. Make available all input, output and meteorological files used in the dispersion modelling in an electronic format (compatible with the modelling software used or in a text format). Also, submit digital spatial data with formats compatible with Google Earth or NR Maps.

Number all pages of the report and include information about the version of the report, its author/s and reviewer/s in the report.

11. Sampling – source emissions

A sampling program to validate the dispersion model is likely to be required as a condition of an environmental approval, in which case, the proponent must sample emission sources such as point source stationary emissions in accordance with the latest version of *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (NSW EPA, 2022b). The results of sampling must be used to update and validate any pollutant dispersion model, using the same model used for the AQIA and to confirm compliance with the impact assessment criteria contained in the latest version of the *NSW Approved Methods for Modelling* (NSW EPA, 2022a).

12. Monitoring - ambient air quality

Approval or licence conditions may require ambient air quality monitoring. This must be done in accordance with the ambient air monitoring requirements contained in the latest version of the NSW *Ambient Air Monitoring Guidance Note* (NSW EPA, 2022c) and the *Approved Methods for Sampling and Analysis of Air Pollutants in NSW: Comparison Table* (NSW EPA, 2022d). Pollutants concentrations must comply with AAQ NEPM standards of the National Environment Protection Council (NEPC). The Victoria EPA publication *440.1: A guide to the sampling and analysis of air emissions and air quality* provides additional guidance on ambient air quality monitoring (EPA Victoria, 2002).

13. Mitigation measures

The final design, installation and operation of the plant should not preclude the ability to retrofit additional air pollution emissions controls to the satisfaction of the NT EPA.

NT EPA expects the use of BAT for controlling air emissions. Proponents should refer to relevant documents such as the European Union BAT reference documents (BREFs)[7] for further guidance.

[7] https://eippcb.jrc.ec.europa.eu/reference/

14. References

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15. Further guidance

It is highly recommended that the Environmental Regulation branch at DLPE is contacted prior to developing the modelling methodology.

For further guidance or to provide a comment on this guidance, contact:

Environmental Regulation Branch
Department of Lands, Planning and Environment (DLPE)
Floor 1, Arnhemica House, 16 Parap Road, Parap
PO Box 3675, Darwin, NT 0801

Phone: (08) 8924 4218
Email: environmentalregulation@nt.gov.au