



**Iowa Department of Natural Resources  
Environmental Services Division  
Air Quality Bureau**

# **Air Dispersion Modeling Guidelines**

## **For Non-PSD, Pre-Construction Permit Applications**

## Overview

Air dispersion modeling analyses are conducted to predict ground level ambient air concentrations of pollutants from facility emissions. According to 567 Iowa Administrative Code (IAC) subrule 22.3 (1) “A construction or conditional permit shall be issued when the director concludes that...the expected emissions from the proposed source or modification in conjunction with all other emissions will not prevent the attainment or maintenance of the ambient air quality standards specified in 567-Chapter 28.” Dispersion modeling is the primary tool used in air quality assessments to determine predicted attainment of the National Ambient Air Quality Standards (NAAQS). Air dispersion modeling allows the impacts from a source to be determined before a source is constructed or modified and is not restricted to the spatial and temporal limitations of an ambient monitor.

These guidelines should be used to assist in the completion of air dispersion modeling analyses. All construction permit applications are required to include Modeling Information forms MI-1 (Plot Plan Requirements), MI-2 (Emission Point Characteristics), and MD (Modeling Determination). This information is required so the permit engineers in the Construction Permit Section may determine if a dispersion modeling analysis will be required. The construction permit directions, construction permit forms and additional modeling information can be found at the DNR website: [www.iowacleanair.com](http://www.iowacleanair.com).

When a modeling analysis is required, it is acceptable to conduct a preliminary modeling analysis to determine if predicted concentrations are below the significant impact levels as defined in 567 IAC subrule 33.3(20). Construction permit projects with predicted concentrations above these levels require a facility-wide modeling analysis. Additionally, facilities that are associated with a State Implementation Plan (SIP) maintenance area or that have previous modeling analyses with predicted impacts that threaten (exceed 90%) the NAAQS may be required to conduct a facility-wide modeling analysis for the applicable pollutant regardless of the predicted impact from the project. Facilities considered to be a “major source” as defined in 567 IAC rule 22.100 may be required to submit their own facility-wide modeling analyses. As a service to non-“major source” facilities, the department will conduct the initial facility-wide modeling analysis.

These guidelines apply to construction permit applications that are not subject to the Prevention of Significant Deterioration (PSD) regulations. For PSD modeling analyses, the applicant should refer to the Iowa DNR’s PSD modeling guidelines.

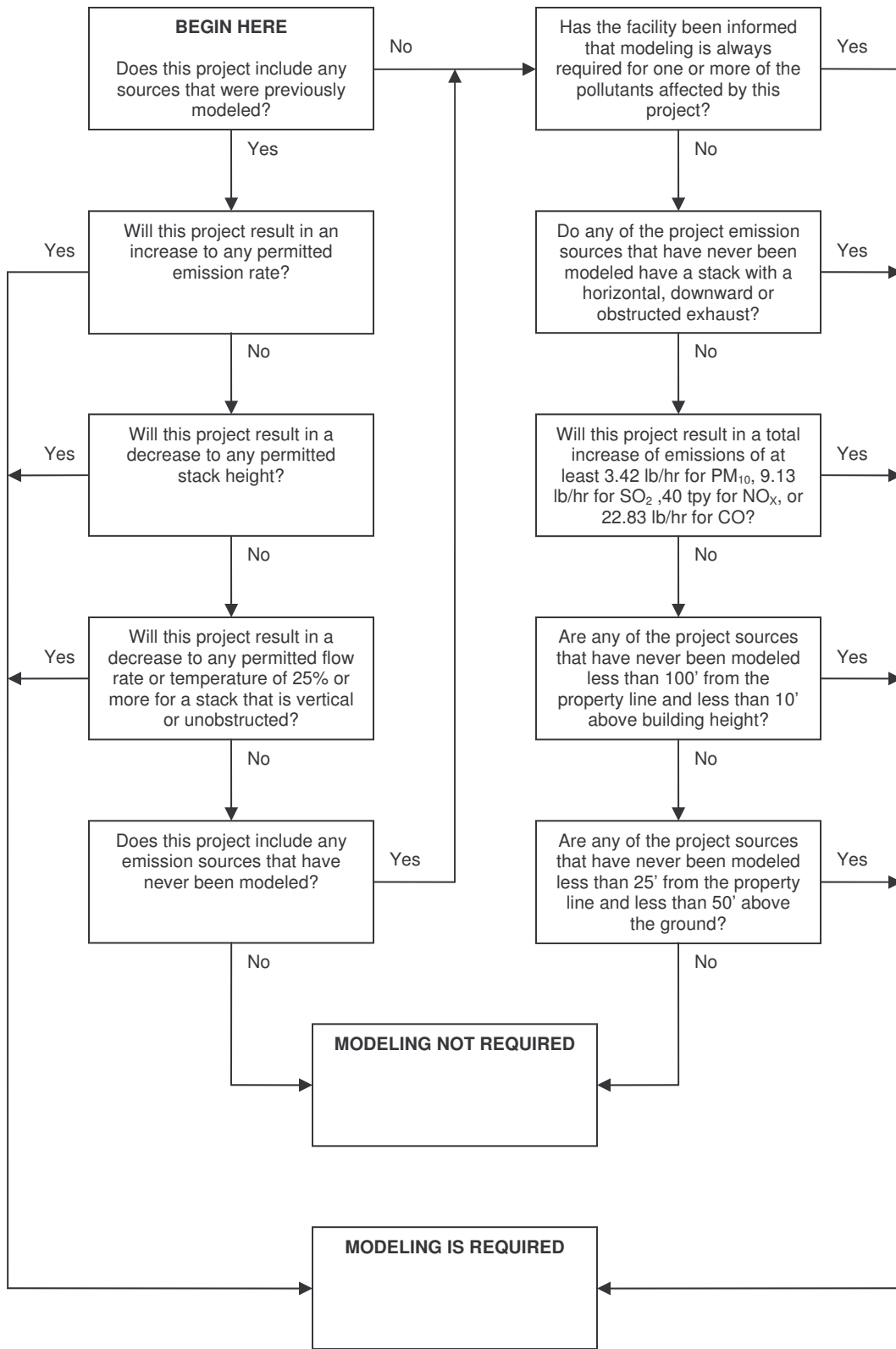
Pollutants affected by these guidelines include all criteria pollutants except volatile organic compounds (VOCs) and particulate matter with an aerodynamic diameter less than or equal to 2.5 microns (PM<sub>2.5</sub>). The department’s Modeling Group should be contacted for guidance on modeling VOCs, ozone, PM<sub>2.5</sub>, and non-criteria pollutants, if the Construction Permits Section requests such modeling.

Questions related to these guidelines and air dispersion modeling in general can be answered by calling (515) 242-5100. Ask to speak to a member of the Modeling Group.

## **Air Dispersion Modeling Applicability Procedure**

The Air Dispersion Modeling Applicability Procedure on the following page is used to determine if point source emissions associated with non-PSD construction permit projects will require an air dispersion modeling analysis. Modeling requirements for non-point source emissions will be determined on a case-by-case basis. This procedure should be used for both new construction permit projects and for modifications to previously modeled projects.

There are unique circumstances that the Air Dispersion Modeling Applicability Procedure does not address that may trigger a modeling review. Recommendations for modeling reviews that fall outside of the Air Dispersion Modeling Applicability Procedure will be reviewed by DNR management.



## Dispersion Model Selection and Options

1. Unless approval has been secured from the department to use another model, the latest version of the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) model shall be used. Regulatory default options must be used unless otherwise approved by the department.
2. The applicable averaging periods for each pollutant being evaluated must be modeled for compliance with the appropriate National Ambient Air Quality Standards (NAAQS), or significance levels as defined in 567 IAC subrule 33.3(20) and as listed below in Table 1.

Table 1. Significant Impact Levels and National Ambient Air Quality Standards

Pollutant	Averaging Period	Significant Impact Levels ( $\mu\text{g}/\text{m}^3$ )	National Ambient Air Quality Standards ( $\mu\text{g}/\text{m}^3$ )
NO <sub>x</sub>	Annual	1	100 <sup>a</sup> (NO <sub>2</sub> )
SO <sub>2</sub>	3-hr	25	1,300 <sup>b</sup>
	24-hr	5	365 <sup>b</sup>
	Annual	1	80 <sup>a</sup>
PM <sub>10</sub>	24-hr	5	150 <sup>c</sup>
	Annual	1	50 <sup>d</sup>
CO	1-hr	2,000	40,000 <sup>b</sup>
	8-hr	500	10,000 <sup>b</sup>
Pb	Calendar quarter	NA	1.5 <sup>a</sup>

<sup>a</sup> Never to be exceeded.

<sup>b</sup> Not to be exceeded more than once per year.

<sup>c</sup> Attained when the expected number of exceedances is less than or equal to 1.

<sup>d</sup> Attained when the expected annual arithmetic mean is less than or equal to the standard.

## Source Information

1. Emission units associated with the project must be modeled at their proposed allowable emission rates (lbs./hr). Varying emission rates are not permissible unless included in the permit limitations or it can be demonstrated that the variance is typical of a physical plant limitation. Facility-wide modeling of allowable emissions will only be completed on a case by case basis and is at the discretion of the Department.
2. Existing emission units located at the facility, including non-point source emissions that could be reasonably captured and vented to the atmosphere, may be modeled at their actual emission rates. Actual emission rates are to be completed according to 3), 4), and 5) below.

For guidance on modeling emission units that vent inside a building please use the Volume Source Tool located at [www.iowacleanair.com](http://www.iowacleanair.com).

3. If the project emissions result in impacts that exceed the significant impact levels, existing sources that are part of the same facility, or a support facility, must be included in the modeling analysis. The Department may require additional nearby sources to be included in the modeling analysis in areas containing a large concentration of industry. Existing sources should be modeled at actual emission rates, but if this is not possible then the sources can be modeled at potential emissions as a conservative estimate.
4. Actual emission rates used in the modeling analysis for existing emission units at the facility and nearby sources must be supported by the following acceptable methods, in order of acceptability:
  - a) Certified continuous emissions monitoring data
  - b) The most recent department approved stack test results. Contact construction permitting staff to obtain guidance on calculating an emission rate for modeling based on stack test results.
  - c) Mass balance calculations acceptable to the department
  - d) AP-42 emission factors or other engineering estimates (as accepted by the department), or other data as accepted by the department

Note: When actual emission rates are calculated the facility may use actual hours of operation in calculating the emission rate. In addition, when AP-42 emission factors or other engineering estimates are used, the calculations shall be based on a minimum of 12-months of data available and the actual hours of operation. If a minimum of 12-months of data are not available, then the allowable or permitted emission rate should be used as applicable. If this is not considered representative, then the Construction Permit Section staff should be contacted for additional guidance.

5. All calculations, spreadsheets, figures, assumptions, control efficiency rate, and justifications used to determine the actual emission rates for existing facility emission units and nearby sources must be submitted with the modeling analysis report. If this information is not submitted, the Department will use allowable (permitted emission rates or standards). If the allowables show an exceedance then the facility will be required to make appropriate changes.
6. The department may require re-modeling if there is a significant change in the method of operation or actual emissions.
7. Stacks with a horizontal or downward discharge, or an obstructing raincap on top of the stack, should be modeled with an exit velocity of 0.001 m/s.
8. An emission point with stack gas exit temperature equal to the interior temperature of the building where the emission unit is located should be modeled at 70° F per the definition of “standard conditions” in 567 IAC rule 20.2, unless the applicant can provide justification acceptable to the department that another temperature is representative of the interior

building temperature. An emission point with a temperature equal to that of the ambient air should be modeled at 0° K (which instructs the model to vary the temperature of the source with the ambient temperature).

9. Guidance for evaluating non-standard types of emission units is available on the website at [www.iowacleanair.com](http://www.iowacleanair.com). This guidance is intended to provide information on how the DNR would typically characterize non-standard sources in a dispersion model. Although this guidance does not preclude the use of other methodologies, the applicant may wish to discuss other methodologies with the DNR prior to conducting extensive modeling analyses.
10. The merging of exhaust gas streams cannot be used in the dispersion modeling analysis unless the applicable requirements of 40 CFR Part 51.100(hh)(2) are met. If merged exhaust streams were modeled, provide justification.
11. In most cases, the base elevation of a stack should match the base elevation of the building on which it is located. If not, justification should be provided to explain the inconsistency.
12. A building downwash analysis shall be conducted using the most recent version of EPA's Building Profile Input Program with Plume Rise Enhancements (BPIP-Prime). Off-property buildings that affect downwash must also be included in this analysis. All non-downwash structures should be excluded from the modeling analysis. Non-downwash structures include lattice-type structures such as switchyards, water towers, and elevated storage tanks.
13. Annual Hourly Operating Restrictions:

If annual hourly limitations are to be implemented without regard to season or month, the number of hours used should be divided by 730 hours and the result rounded to the nearest integer. Monthly averaging periods will then be modeled and the predicted concentrations from the highest months will be averaged. The number of months to include in the average is given by the integer from the previous calculation. The average predicted concentration is then multiplied by the number of hours of operation to which the emission unit will be limited and divided by 8760 hours. The result is the annual average and should be performed for each of the five years. If the number of hours to which the emission unit is to be limited is less than 365, the same procedure should be used replacing 730 hours with 24 hours and using the highest 24-hr averages rather than monthly averages.

14. Daily Hourly Operating Restrictions:

Varying emission rates may be used if the source(s) will be operated at specific times of the day. Use the EMISFACT keyword to accomplish this. If daily hourly operating restrictions are to be implemented without regard to specific times of day, the emission unit(s) should be modeled with an averaging period that corresponds to the number of hours that will be requested as the daily operating hour restriction. The impacts from this averaging period are then multiplied by the requested hours of operation and divided by 24 hours per day. The calculated impacts from the emission unit(s) with the daily operating restriction should be added to the impacts from the rest of the facility for each year of the modeling analysis. Please refer to guidance in "Suggested DNR Methodology for Modeling Facilities

Requesting Restricted Daily Operating Hours” available on the Air Quality Bureau’s web site here: [www.iowacleanair.com/prof/tech/tech.html](http://www.iowacleanair.com/prof/tech/tech.html).

15. Sources Generally Exempt from Non-PSD Modeling:

The decision to include any exempt source in the modeling analysis is ultimately up to the discretion of the permit engineer; however emission units that are listed as exempt in 567 IAC subrule 22.1(2) are generally exempt from modeling. Facilities using the small unit exemption (567 IAC subrule 22.1(2) “w”) should note that once the total combined emissions from all substantial small units using the exemption reaches the “cumulative notice threshold” as defined in 567 IAC subrule 22.1(2) “w”(8) and listed below in Table 2, the facility must apply for construction permits for all substantial small units for which the cumulative notice threshold has been reached. These substantial small units may need to be included in the modeling analysis as a part of the construction permit project.

Table 2. Cumulative Notice Threshold for the Small Unit Exemption

<b>Pollutant</b>	<b>Threshold</b> (tons per year)
Lead and lead compounds expressed as lead	0.6
SO <sub>2</sub>	40
NO <sub>x</sub>	40
VOC	40
CO	100
Particulate matter	25
PM <sub>10</sub>	15
Hazardous Air Pollutant (HAP)/Combination of HAPs	10/25

Additionally, the following are also generally exempt from non-PSD modeling:

- a) Emission units used only when the rest of the facility is NOT in operation. The department may require a separate modeling analysis of these units to verify compliance with the short-term NAAQS for PM<sub>10</sub> and SO<sub>2</sub>.
- b) Fugitive emissions from haul roads and material storage piles, unless the department has reason to believe that these units are the cause of a NAAQS violation.

## Receptor and Terrain Elevation Information

1. Receptors should be placed along the property line at 50 meter intervals. Off property receptors should be placed at 50 meter intervals within at least 0.5 kilometers of the property line. If necessary to encompass the entire impact area, include receptors at 100 meter intervals from 0.5 kilometers out to 1.5 km, 250 m intervals from 1.5 km out to 3 km, and 500 meter intervals beyond 3 km. Receptor grids must be adequately dense and should use 50 meter receptor spacing to resolve the highest applicable concentrations. The receptor grid must extend at least 500 meters from the property line.
2. Receptor grids must be adequate in extent so that concentrations are decreasing at the edges of the grid. If there is a significant terrain rise near the edge of the grid, the grid should be extended to include the area of terrain rise.
3. The most recent version of AERMAP should be used to import terrain and source elevations from Digital Elevation Model (DEM) data. This data is available on the Department's website at [www.iowacleanair.com/prof/tech/DEMData.html](http://www.iowacleanair.com/prof/tech/DEMData.html). All terrain that would intersect a line projected at a 10% slope from each and every receptor must be included in the AERMAP domain. If elevations are not used, please provide justification in the modeling report.
4. By definition, "ambient air" is the portion of the atmosphere, external to buildings to which the general public has access [567 IAC rule 20.2]. Therefore facilities where the general public has access to the property (academic institutions, government buildings, hospitals, and business parks) must be modeled with receptors placed on the property of the facility.
5. Receptors may be excluded from the modeling analysis, with the department's prior approval, for on-property easements, such as railways, provided that the facility owner or operator is willing to ensure public access to the right-of-way or easement is precluded. Permit applicants who obtain permission from the department to exclude on-property easement receptors from the modeling analysis must document in the modeling analysis report submitted to the department how public access is, or will be, precluded. Public roads or highways will continue to be modeled as ambient air.

## Meteorological Data

Five years of meteorological data must be used. The department currently maintains five year data sets for 10 National Weather Service (NWS) station locations for the period from 2000 through 2004. Applicants can obtain meteorological data suitable for use in the AERMOD model at [www.iowacleanair.com/prof/tech/AERMODMetData.html](http://www.iowacleanair.com/prof/tech/AERMODMetData.html). The website also contains a summary of the meteorological data that are appropriate for use in each Iowa County, as well as the representivity analysis that was conducted to determine the appropriate meteorological stations.

## Background Values

1. Appropriate background values must be added to modeled concentrations when a NAAQS analysis is being conducted. Current statewide default background values are listed below in Table 3.

Table 3. Regional Background Values

Pollutant	Averaging Period	Background Concentration Value ( $\mu\text{g}/\text{m}^3$ )
NO <sub>x</sub>	Annual	11
SO <sub>2</sub>	All	20
PM <sub>10</sub>	24-hr Annual	45 22
CO	All	Assume background value equals zero.
Pb	Calendar quarter	Assume background value equals zero.

2. Applicants may use local monitoring data, if available, instead of the statewide default background values, to determine more refined estimates of background values. Guidance for determining refined estimates of background values from local monitoring data can be found in 40 CFR Part 51, Appendix W, section 8.2. If refined values are used, provide a detailed explanation in the modeling report of how the background value(s) were derived, the data considered, and the resulting values used for department review and approval.

## Modeled Violations

Any source that significantly contributes (using the PSD levels of significance) to a modeled violation of the NAAQS in ambient air cannot be permitted unless an equivalent ambient impact reduction is demonstrated at the modeled non-attainment receptors. If violations of the NAAQS are modeled and the modeled impact from the source(s) does not exceed the PSD levels of significance at the receptors and for the time periods the modeled violations occur, the new permits(s) shall not be denied for modeling reasons. [567 IAC subrule 33.3(20)]

## Modeling Data Submittal Requirements

1. A summary of the air dispersion model inputs, methodology, and results relative to all applicable standards and guidelines should be submitted. Include all dispersion model, BPIP-PRIME, and AERMAP input and output files on a CD or DVD-ROM.

2. It is imperative that the air dispersion modeling checklist for non-PSD construction permit applications, as well as the Modeling Information forms MI-1 (Plot Plan Requirements) and MI-2 (Emission Point Characteristics) or equivalent are submitted with the construction permit application or the modeling analysis. The checklist is designed to help applicants avoid common dispersion modeling errors, and can help prevent revisions to the modeling analysis. Including a hard copy and an electronic copy of form MI-1 may significantly decrease the amount of time taken to conduct the modeling analysis. Plot plans created from modeling files and aerial photographs are not acceptable. Failure to submit the Modeling Information forms MI-1 and MI-2 will likely result in delay of the project.