

# **Atmospheric Dispersion Modeling Guidance for Permits**



Nebraska Department  
of Environmental Quality

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**NEBRASKA MODELING GUIDELINES FOR PERMITS  
September 2005  
06-188**



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## PREFACE

A dispersion modeling analysis may be required with an air quality permit application under Nebraska Title 129, Chapter 17, Section 008. These guidelines have been developed to aid the source in developing an acceptable analysis and NDEQ personnel in expediting the review process.

The primary purpose of a dispersion modeling analysis is to demonstrate that all applicable National Ambient Air Quality Standards (NAAQS) and/or Prevention of Significant Deterioration (PSD) increments will be met after the proposed construction or modification. If the analysis demonstrates that the standards and/or increments will be met, the review of the permit application will not be delayed. If the analysis is incomplete, additional information will need to be submitted before the review is complete. If the modeling analysis demonstrates that the construction or modification will cause or significantly contribute to a violation of NAAQS or PSD increment, the permit cannot be issued until the potential air quality problem is resolved. Please contact NDEQ should this occur.

At this time, the Department has not developed guidance on modeling for PM<sub>2.5</sub> emissions due to the technical difficulties that exist with both PM<sub>2.5</sub> emissions estimation and modeling techniques. Many of these difficulties are discussed in the EPA Memorandum titled “*Interim Implementation of New Source Review Requirements for PM<sub>2.5</sub>*”. In accordance with this memo, the Department believes that PM<sub>10</sub> modeling requirements may be used as a surrogate for PM<sub>2.5</sub> NAAQS demonstration requirements.

Procedures outlined in the Code of Federal Regulation (CFR) Title 40, Part 51, Appendix W (Guideline On Air Quality Models) should, as a minimum, be followed when conducting an analysis. The Guideline attempts to provide guidance on appropriate modeling applications. There are some differences in procedures that are unique to the Nebraska air quality program. These differences are addressed within this document. The level of detail and complexity is also unique to each analysis. It is recommended that the source contact NDEQ modeling staff for approval of methods and levels of the analysis.

Following these guidelines will usually result in an acceptable analysis; however, each analysis is unique, and in some cases additional analysis may be required. These cases are beyond the scope of the material contained within this document. It is recommended that the source and NDEQ modeling staff discuss these details before an analysis is submitted. This can be accomplished through the development of a modeling protocol. A modeling protocol will allow NDEQ modeling staff to review and respond to questions in the protocol before the analysis is submitted. Please contact NDEQ modeling staff about any questions regarding the development of a modeling protocol. A protocol template can be found in Appendix K.

The NDEQ would like the modeling process to be as thorough as possible in a timely manner. This is for the benefit of both the NDEQ and the source as well. To accomplish this, it is important to first establish the modeling protocol. Once it has been set up, the source can commence with the modeling and submit the results along with the modeling checklist to the NDEQ for review. Failure to abide by the protocol and checklist may result in a delay of the review. Please do not hesitate to contact the NDEQ for assistance.

## Air Quality Models - Overview

### What Are Air Quality Models

- Air quality models are mathematical descriptions of pollution transport, dispersion, and related processes in the atmosphere. Models estimate the ambient pollutant concentration/deposition at many locations (receptors) based on emissions, meteorology, topography, aerodynamic turbulence induced by buildings, and other factors.

### Why are models used instead of monitoring?

- Ambient air monitors can only provide information as to current air quality at a single point. They do not predict impacts from new or modified sources. Therefore, ambient impacts from sources that do not yet exist must be determined with predictive tools such as air quality models. Models allow one to estimate air quality in the future and to explore potential control strategies.
- For existing sources, models provide a relatively inexpensive alternative to conventional monitoring studies where field equipment measures the actual concentration of a pollutant in ambient air.
- The number of receptors in a model (i.e., points where concentration values are calculated) far exceeds the number of monitors (i.e., devices measuring the concentration in ambient air) one could afford to deploy in a monitoring study. That is, models provide a cost effective way to analyze impacts over a wide spatial area where factors such as meteorology, topography, and emissions from nearby sources could be important.
- Models are not subject to the temporal limitations of most monitoring studies. For example, it is common to use 5 years of off-site or 1 year of site-specific sequential (hourly) meteorological data in a refined model for a new major source.
- A wide variety of meteorological conditions can be examined with models.

## 1.0 General Procedures

### *Modeling-When Required?*

Dispersion modeling may be required for a variety of affected environmental programs. Requirements for modeling of a new source or modification of an existing source are outlined in Nebraska Title 129, Chapter 17, Section 008. Modeling analyses are utilized to provide an indication of potential ambient impacts around the area of concern with an emphasis on NAAQS and PSD increment compliance demonstrations. Table 1.0-1 identifies thresholds for new or modified stationary emission sources that may require modeling, if the modification requires a construction permit. Several criteria listed in Table 1.0-2 may also warrant modeling for an air quality impact analysis independent of the thresholds listed in Table 1.0-1, if the modification requires a construction permit. Sources that fall under PSD regulations, 40 CFR 52.21, are required to conduct air quality analyses to demonstrate compliance with the applicable NAAQS and PSD increments. Significant emission thresholds for PSD review are listed in Table 1.0-3. Requirements for PSD analyses are described in Section 2.0 of this document.

Modeling can be divided into two levels. The first level, screen modeling, identifies impacts related to the new source or a source undergoing a modification. The second level, refined modeling, is

implemented when a screening analysis reveals a potential NAAQS violation or a significant impact on air quality. In situations where a screening model is inappropriate for an analysis, a refined model should be implemented. If modeling is required, consult the appropriate modeling staff.

**Table 1.0-1: Emission Thresholds For When Screen Modeling May Be Required**

Regulated Pollutant	Threshold <sup>a</sup> (lb/hr)
CO	23
SO <sub>2</sub>	9
NO <sub>x</sub>	9
PM <sub>10</sub>	3 <sup>b</sup>
Pb	0.1
TRS <sup>c</sup>	> 0

<sup>a</sup> Provided in pounds per hour of increased allowable emissions

<sup>b</sup> 3 pounds per hour or alternatively,  $\geq 15$  tons per year

<sup>c</sup> TRS emissions as defined in Title 129, Chapter 1

If the facility's increased allowable emissions are below the thresholds in Table 1.0-1, modeling may still be required if one or more of the criteria listed in Table 1.0-2 is true.

**Table 1.0-2: Criteria for when modeling (screen or refined) may be required**

- The Department may require modeling on a source undergoing a modification that has not previously conducted refined modeling based on facility-wide emissions,
- If source-receptor geometry may result in concentrations near or above NAAQS levels either by the modification or the entire facility,
- If terrain or elevated buildings in ambient air are within close proximity of the source,
- If the source is located within an area of concern (e.g., significant nearby background sources),
- When unique situations such as topography, meteorology, or existing adverse air quality necessitate an analysis,
- If modeling analyses are required for either RCRA, Superfund, or LUST programs,
- When short stacks or adverse dispersive conditions exist,
- If the new source or modification may produce ambient impacts as defined in Table 1.09-1 based on modeling experience.

**Table 1.0-3: PSD Significant Emissions Increase <sup>a</sup>**

Regulated Pollutant	Emission Rate (tons/yr)
CO	100
NO <sub>x</sub>	40
SO <sub>x</sub>	40
PM/PM <sub>10</sub>	25/15
Ozone (VOC)	40 (VOCs)

Regulated Pollutant	Emission Rate (tons/yr)
Pb	0.6

<sup>a</sup> taken from 40 CFR 52.21 (b) (23)

If a source is major by definition of 40 CFR 52.21 and undergoes an increase in emissions at that source as defined in Table 1.0-3, modeling would be required.

## 1.01 Levels of Analysis

There are two levels of sophistication to air quality impact analyses. The first level of analysis (screening) consists of basic modeling techniques designed to conservatively estimate short-term concentrations from the impact of stationary sources. Should this analysis show that the source would not exceed any applicable standard or maximum allowable concentration, further analysis may not be required. There are situations in which a second level (refined) analysis may be necessary. These include:

- Results of the screening analysis indicate a potential air quality problem and more accurate estimates of concentrations are required.
- Source configuration is too complex for a single-source screening model.
- Dispersion of pollutants is adversely affected by topography and/or unique meteorological conditions.
- Nearby background sources exist in the impacted area.

The second level analysis consists of more detailed analytical methods of characterizing atmospheric processes and/or chemistry. These refined analyses require additional data above and beyond that which is required in a screening analysis.

## 1.02 Submittal of a Modeling Protocol

If a refined analysis is required, a modeling protocol should be submitted prior to the modeling analysis. This procedure allows NDEQ staff the opportunity to insure that all data necessary for a proper analysis is included. Consultation with NDEQ is recommended regarding model selection, meteorological data, and neighboring sources. The applicant should allow sufficient time for NDEQ to review and respond to the protocol. The protocol should contain sufficient information about the following topics:

- Source inventory data including potential nearby background sources
- Receptor grids
- Terrain classification
- Model selection
- Model input options
- Emission source characterization
- Any other possible areas of disagreement

The data for models is unique to each source. Data should include: the maximum capacity or allowable emission rates and stack parameters for the proposed source, emission parameters of sources in the area, model options selected, meteorological data, definition of source operation which yields highest air quality impacts if not the maximum load scenario, and terrain information. Emission parameters of



proposed sources must be consistent as those outlined within the permit application. **Inconsistencies such as these will result in an incomplete submittal and may cause delays in processing the permit application.** A template protocol can be found in Appendix K.

### 1.03 Rounding Modeled Concentrations

To determine whether, or not, you meet or exceed a threshold, you take the threshold, add one additional figure to the right of the decimal point, and use standard rounding conventions to round to that number. Using the PM<sub>10</sub> PSD pre-application monitoring threshold as an example, the criterion is "less than" 10 µg/m<sup>3</sup>, so, anything equal to or less than 9.94 µg/m<sup>3</sup> would be acceptable. As stated above, round to the number "created," so if it is 9.94 the value would be rounded down to 9.9. If it were 9.95, the value would be rounded up to 10.

When the criteria is "no greater than" you would go the other direction. Using the PM<sub>10</sub> NAAQS as an example, the standard is no greater than 150 µg/m<sup>3</sup>. This states that if the results are 150 or less, the modeling is in compliance with the standard. Using the above approach, the results would have to be equal to or less than 150.04 to be in compliance -- this rounds down to 150.0, whereas 150.05 rounds up to 150.1 and would not be in compliance with the standard.

### 1.04 Screening Procedures (Level I Impact Analysis)

In general, NDEQ recommends that procedures contained within the EPA document Screening Procedures for Estimating the Air Quality Impact of Stationary Sources (Revised) (EPA publication number EPA-450/R-892-019) be followed when conducting a level I impact analysis.

Screening models are utilized to simulate absolute worst-case dispersion conditions. The advantage of such models is that they require less computer time and are more conservative than refined models. SCREEN3 is a single source, short-term model capable of estimating maximum 1-hour concentrations. These 1-hour concentrations can be corrected for applicable averaging periods using default factors in Table 1.04-1. The numbers in parentheses are the limits to which one may diverge from the general case. Please contact the Department before using a factor lower than the default factor.

<b>Table 1.04-1 Correction Factors for 1-hour Concentrations</b>			
<b>Averaging Time</b>			
<b>3-hour</b>	<b>8-hour</b>	<b>24-hour</b>	<b>Annual</b>
<b>0.9 (±0.1)</b>	<b>0.7 (±0.2)</b>	<b>0.4 (±0.2)</b>	<b>0.08 (±0.02)</b>

SCREEN3 can be utilized to simulate the effects of building downwash, effects from simple area and volume sources, and determine the initial radius of impact of a source. The major limitation of the SCREEN3 model is its single-source nature. Many proposed constructions are too complex for the use of SCREEN3, requiring the selection of another model.

The Industrial Source Complex (ISC) model and American Meteorological Society (AMS) and EPA Regulatory model (AERMOD), although considered refined models, can also be used to screen

proposed sources to determine if they create significant ambient concentrations (see Table 1.09-1) and determine the radius of impact. ISC and AERMOD overcome the single source limitation that the SCREEN3 model has.

## 1.05 Source Types

There are five basic types of sources used in models. These are:

- Point sources: These include stacks, chimneys, exhaust fans, cooling towers, and vents. These represent the most common source in dispersion models and can be modeled with most dispersion models, including SCREEN3, ISC, AERMOD, and CALPUFF.
- Area sources: These include ponds, storage piles, or open pits. These sources can be modeled in most dispersion models, including SCREEN3, ISC, AERMOD, and CALPUFF.
- Volume Sources: These are sources that have initial dispersion prior to release. These sources can be modeled in most dispersion models, including SCREEN3, ISC, AERMOD, and CALPUFF.
- Line Sources: These include roads, runways, or conveyor belts. These sources can be modeled with SCREEN3, ISC, AERMOD, and CALPUFF by representing the line source as a series of volume or area sources. The PAL model can also be used to model line sources.
- Flares: Flares can be characterized in the SCREEN3, ISC, and AERMOD model.

Source parameters for model operation are covered more extensively in Section 1.11.

## 1.06 Merging of Multiple Stacks

The SCREEN3 model is limited in application because it is a single source model. Below is a method that can be used to merge multiple sources into one stack to screen their collective impacts. This method must be used with care. If there are building downwash issues or stacks are not similar, then merging is not an appropriate method to estimate collective impacts. Please inform the NDEQ if stacks will be merged per the criteria as outlined below.

Sources emitting the same pollutant from multiple stacks within 100 meters of each other may be merged into one stack. This can be accomplished if stack height, flow rates, and stack gas exit temperatures differ by no more than 20% each. For each stack, compute a value for M (see equation 1.3.2), then use the parameters of the stack with the lowest value of M as the "merging" stack. Sum the emissions from all stacks to obtain an emission rate from the "merging" stack using the following equation 1.3.2.

### *Equation 1.3.2*

$$M = \frac{HVT}{Q}$$

where: H = stack height (m)  
 v = exit velocity (m/s)  
 D = diameter (m)  
 V = stack gas volumetric flow rate (m<sup>3</sup>/s) = (v)(D<sup>2</sup>)( $\pi$ /4)  
 T = stack gas exit temperature (K)  
 Q = individual stack pollutant emission rate (g/s)

## 1.07 Source Input Data Requirements

The following information is required for proper source characterization and screening model execution. Please note that some parameters are specifically for refined models. All input is in metric units:

### Point Source:

- Source Type - Point Source (P)
- Emission Rate - maximum (g/sec)
- Stack Height above ground (m)
- Stack Inside Diameter (m)
- Stack gas exit velocity (m/sec)
- Stack gas exit temperature (K)
- Ambient temperature (K) (Use default of 0 K if unknown)
- Building Height, Width, and Length (m)
- Receptor height above ground - flagpole receptors (Usually 0)

### Flare:

- Source type - Flare (F)
- Emission Rate - (g/s)
- Flare stack height above ground (m)
- Total heat release rate (cal/s)
- Receptor height above ground - flagpole receptors (Usually 0)

### Area Source:

- Source Type - Area (A)
- Emission Rate (g/s per square meter)- Computed by dividing g/s emissions by the total area of area source
- Source Release Height (m)
- $X_{init}$  - length of X side of area (in the east-west direction if Angle is 0 degrees) (m)
- $Y_{init}$  - length of Y side of area (in the north-south direction if Angle is 0)
- Angle - orientation angle for the rectangular area in degrees from north, measured positive in clockwise direction
- $SZ_{init}$  - initial vertical dimensions of the area source plume (m)

### Volume Source:

- Source Type - Volume (V)
- Emission Rate (g/s)
- Source Release Height (m)
- Initial Lateral Dimension of volume (m), see Table 1.11-1 for directions to compute this dimension
- Initial Vertical Dimension of volume (m), see Table 1.11-1 for directions to compute this dimension

## 1.08 Model Execution Considerations

When utilizing the SCREEN3 model - keep in mind the following:

- Source Type - P (point), F (flare), A (area), or V (volume)
- Use 0 K for ambient air temperature
- Enter zero for receptor height above ground unless elevated impacts are being considered in the analysis
- Answer NO to Complex Terrain question unless terrain within 3 miles of facility under review is higher than the shortest stack being modeled.
- Answer NO to Simple Terrain Above Stack Base question unless terrain within 3 miles of source exceeds 50% of stack height. If there is terrain that falls into this category, then this section should be used to evaluate all terrain that falls into the category.
- Use full meteorology (All stability and wind speed categories)
- Use automated receptor array. Begin with the nearest property line and extend outward to ensure that the maximum ambient concentration is calculated.
- Use discrete receptors to calculate concentrations at nearby critical receptors.

## 1.09 Determining the Radius of Impact

For each pollutant that exceeds the significance levels shown in Table 1.09-1, a radius of impact (ROI) should be determined. The ROI is the maximum distance to a source's significant impact using the SCREEN or ISC models. This may be determined with a Cartesian or polar grid. A ROI is determined for each pollutant averaging period, then the largest ROI is selected as the ROI for that pollutant. The area within the ROI must be included in the modeling analysis for all averaging periods for each pollutant. For the ROI analysis, do not consider atmospheric chemistry. Inclusion of building downwash is optional.

**Table 1.09-1 Significant Impact Levels**

Pollutant	Concentration ( $\mu\text{g}/\text{m}^3$ )	Averaging Period
PM <sub>10</sub>	5 $\mu\text{g}/\text{m}^3$	24-hour
	1 $\mu\text{g}/\text{m}^3$	Annual
Sulfur Dioxide (SO <sub>2</sub> )	25 $\mu\text{g}/\text{m}^3$	3-hour
	5 $\mu\text{g}/\text{m}^3$	24-hour
	1 $\mu\text{g}/\text{m}^3$	Annual
Nitrogen Dioxide (NO <sub>2</sub> )	1 $\mu\text{g}/\text{m}^3$	Annual
Carbon Monoxide (CO)	2000 $\mu\text{g}/\text{m}^3$	1-hour
	500 $\mu\text{g}/\text{m}^3$	8-hour

If the screening analysis shows that impacts from the proposed facility are less than the applicable significance levels, a full refined analysis may not be required. In many instances, the screening analysis will indicate that the proposed facility is exceeding the NAAQS. A refined modeling analysis (i.e., using AERMOD) would be recommended to better estimate impacts, if the SCREEN3 model identifies an exceedance of the NAAQS. Screening analyses are often inadequate due to the complexity of sources and levels of emissions. These models are useful in identifying areas of concern for a refined analysis and for receptor placement.

## 1.10 Refined Analysis (Level II Analysis)

If the level I analysis indicates a potential air quality problem or if the source under review is too complex for a single source screening model, a level II or refined analysis may be required. A refined analysis has more extensive data requirements than a screening analysis. The following sections address the data requirements necessary for completion of a refined analysis.

## 1.11 Source Types - Refined Analysis

For a more detailed description of sources, please consult either the ISC or AERMOD User's Guide.

### *Point Sources*

As described in Section 1.07, point sources represent the most common source in modeling. Point sources are used to simulate emissions from stacks, roof vents or fans, and other similar sources. The general data requirements for modeling these sources are listed in section 1.07. There are certain instances when stacks have non-vertical discharges or have "rain hats" which serve to reduce the velocity of the vertical discharge. In order to model these sources appropriately, use a vertical velocity of 0.01 m/s.

For other non-vertical discharges with an exit temperature greater than the ambient air, the stack diameter **may** be adjusted so the volumetric flow rate is the same with the vertical velocity of 0.01 m/s as it is with its actual non-vertical velocity. The equivalent diameter is calculated using the following formula:

$$d_{eq} = \sqrt{V_{act}(d_{org})^2/0.01} \quad \text{where: } \begin{array}{l} d_{org} = \text{actual diameter} \\ V_{act} = \text{actual velocity} \\ d_{eq} = \text{equivalent diameter} \end{array}$$

For cooling towers, the individual cells need to be modeled as point sources, mimicking individual stack emission points. The emissions from the cooling tower cells are divided equally between each individual cell. The stack parameters used for modeling inputs are based on the characteristics of the cooling tower fan, which is assumed to behave like a "stack". The release height is based on the height of the cooling tower cell. The stack diameter is based on the area cross-section for the cooling tower exhaust fan.

The vertical velocity can be determined by the fan rate (fan blows air at a certain flow rate). The exit diameter can be determined by the cross-sectional area of the cooling tower. The cooling tower exit temperature can be assumed to be ambient temperature (zero Kelvin in the model). The stack height would be the actual height of the cooling tower.

If downwash is an issue, refined models require building data necessary to compute building downwash parameters. The Plume Rise Modeling Enhancements (PRIME) algorithm contained within the AERMOD and CALPUFF models is used to compute building downwash. ISC-PRIME should be used if ISC is the recommended model.

### *Area Sources*

The area source model is used to simulate the effects of fugitive emissions from sources such as storage piles and slag dumps. ISC, AERMOD and Calpuff allow for the option of specifying rectangular areas and orientation angles. This allows considerable flexibility in source characterization. A 10:1 aspect ratio of length to width must be maintained when developing rectangular area sources. If this ratio is to be exceeded, the area should be subdivided accordingly to achieve the target aspect ratio.

Angular orientation of area sources may be specified within ISC, AERMOD, and Calpuff. The angle parameter is measured as the orientation from the north of the initial Yinit side length specified in the source pathway. Angular rotation is measured for the rectangular area in degrees from north, measured positive in the clockwise direction.

The area source algorithm also contains an optional vertical parameter that may be used to specify initial vertical dimensions to the area source. This parameter, similar to the volume generated source, can be useful to model emissions from mobile source activity.

### *Volume Sources*

As briefly detailed in Section 1.07, volume sources disperse emissions prior to release from sources such as building roof monitors (ridge vents) and line sources. It is important that the north-south and east-west dimension components of the volume source must be equal. When characterizing sources as volume sources, follow these steps in determining its parameters:

- Determine the number (n) of volume sources required, where n is determined by dividing the length of the source by its width. An approximate representation for long line sources can be made by placing a smaller number of line sources along it. The spacing between volume sources should not exceed twice the width of the line sources.
- Assign the emission height (H) the value representing the height above ground level of the center of the volume source.
- Find Initial Lateral Dimension (see table 1.11-1)
- Find Initial Vertical Dimension (see table 1.11-1)

**Table 1.11-1 Summary of Suggested Procedures for Estimating Initial Lateral and Initial Vertical Dimensions for Volume and Line Sources**

Type of Source	Procedure for Obtaining Initial Dimension
<b>(a) Initial Lateral Dimensions (<math>O_{y0}</math>)</b>	
Single Volume Source	$O_{y0}$ = length of side divided by 4.3
Line Source Represented by Adjacent Volume Sources	$O_{y0}$ = length of side divided by 2.15
Line Source Represented by separated Volume Sources	$O_{y0}$ = center to center distance divided by 2.15
<b>(b) Initial Vertical Dimensions (<math>O_{z0}</math>)</b>	
Surface Based Source ( $h_e - 0$ )	$O_{z0}$ = vertical dimension of source divided by 2.15
Elevated Source ( $h_e > 0$ ) on or Adjacent to a Building	$O_{z0}$ = building height divided by 2.15

Elevated Source ( $h_e > 0$ ) not on or Adjacent to Building	$O_{zo}$ = vertical dimension of building divided by 4.3
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## 1.12 Meteorological Data

Meteorological data used in a modeling analysis should be representative of the climatology at the site of the proposed construction or modification. Data that is site specific is the best data to use but is unavailable for most sources. For this reason meteorological data from a representative site is most commonly used in refined analyses. A representative site is chosen for inclusion in a Level II analysis by taking into account climatology and topography near the source. The Guideline on Air Quality Models recommends that a minimum of 1 year of site specific data or the most recent consecutive 5 years from a representative site are required for the analysis.

Meteorological data collected by the Automated Weather Data Network (AWDN) is available from the High Plains Regional Climate Center. There are over fifty AWDN monitoring stations located across Nebraska alone. A map detailing the location of each AWDN station may be viewed at <http://www.hprcc.unl.edu/awdn/location/NE.html>.

Representative meteorological data for use in refined air quality modeling analyses will be defined in a modeling protocol. The NDEQ will provide the source with the appropriate meteorological data for modeling use. The surface station closest to the source will be selected. The upper air data closest to the selected surface station will be chosen.

Table 1.12-2 lists the National Weather Service (NWS) upper air sites commonly used for modeling in Nebraska. NDEQ recommends that you obtain approval of the meteorological data to be used prior to running your model. Please contact NDEQ for information regarding meteorological data requirements. Upper air data may be viewed at <http://raob.fsl.noaa.gov>.

Table 1.12-2

Omaha ID #: 94980
North Platte ID #: 24023
Denver ID #: 23062

If site-specific data is to be collected, it is recommended that the monitoring protocol be submitted in advance to give the NDEQ sufficient time to review and accept the protocol to ensure that the monitoring proceeds smoothly. Information contained within the monitoring protocol must, at a minimum, address these items:

- (1) Meteorological variables to be monitored, collected, and submitted.
- (2) Monitoring system specifications and accuracy.
- (3) Plot map locating proposed monitoring site including all vegetation, topography, and buildings in the vicinity of the proposed location.
- (4) Quality Assurance Procedures/Missing Data Replacement procedures

NDEQ must approve the site selection and system performance specifications for the data to be utilized in a modeling analysis.

Meteorological data obtained from a site specific monitoring program should be processed using an EPA approved meteorological preprocessor. AERMET, a meteorological preprocessor, takes raw meteorological data and converts it into usable data sets for inclusion in the AERMOD dispersion model. SMERGE is the meteorological preprocessor for the CALPUFF dispersion model. SMERGE or another preprocessor approved by the Department may be used to process raw meteorological data for inclusion in CALPUFF. Please consult the Department for formatting meteorological data into a format usable for the ISC model.

The most recent five year meteorological data set will be used for modeling purposes. These data sets will be updated every five years. It is the source's responsibility to contact the NDEQ to discuss and agree on a representative meteorological dataset.

### **1.13 Emission Rates and Flow Rates**

Use of the proper emission rate is essential in air dispersion modeling. If a permitted or proposed emission rate exists for the pollutant and stack being considered, then this emission rate should be used in the modeling analysis. For new sources that do not have an emission limit, then the emission rate should be calculated from published emission factors or methods (subject to approval by NDEQ on a case-by-case basis). For all emission rates other than those permitted or proposed, all calculations should be provided with the analysis.

For sources using backup fuels, the fuel that produces the highest emission rate for each pollutant should be used when determining emission rates for modeling. Please reference Tables 9-1 and 9-2 of the Guideline on Air Quality Models for more detailed information on the calculation of emission rates for air dispersion modeling.

It is important to understand that emissions cannot be averaged over non-operating hours. For example, an emission unit that operates for 8 hours a day at maximum hourly capacity may not be averaged over the entire 24-hour period. The hourly allowable rate must be modeled. Haul road characterization is the only exception to this rule. Please refer to Appendix I to model emissions from haul roads.

It is also important to evaluate different operating loads when modeling point sources. It is recommended that 50%, 75%, and 100% operating loads be evaluated when modeling point sources. The operating load that produces the highest ambient design concentration should be used to establish construction permit limitations. The 100% operating load may not always produce the highest ambient air concentration. Operating loads less than 100% result in reduced flow rates and the potential for increased ambient air concentrations.

### **1.14 Background Concentrations**

Background sources are considered an essential element of the total air quality analysis when examining source impacts. Background air quality consists of the pollutant concentrations due to the following: natural sources, nearby sources other than the one currently under review, and unidentified sources.

Air quality data should be used to establish the background concentrations in the area of the source or sources currently under review. The existing SLAMS network for Nebraska is the preferred





source for air quality data. The first choice is to use air quality data collected in the vicinity of the source under review for the averaging period(s) being modeled. In the event that such sites do not exist, a “regional site” may be selected. A regional site consists of a monitoring site located away from the source under review, but is affected by similar sources, natural and man-made. Additionally, if the source is not isolated, a multi-source model may be necessary to establish concentrations near the source under review.

## 1.15 Nearby Sources

The modeler should take note that the construction project or modification undergoing review may not be considered in isolation from other nearby sources. Nearby sources may contribute to a predicted violation of the NAAQS. Section 9.2 in the Guideline on Air Quality Models recommends that all sources expected to cause a significant contribution to local ambient concentrations be explicitly modeled in the analysis. Table 1.09-1 provides the significant impact levels for each regulated NAAQS pollutant. The impact of nearby sources at locations where source interaction occurs should be examined. Multi-source modeling may be required. This will be examined on a case-by-case basis for state permitting sources and is mandatory for PSD sources. Nearby source information can be obtained from NDEQ as a retrieval from the AIRS data base.

## 1.16 Receptor Grids

A receptor grid in a dispersion model (i.e., AERMOD) is a set of locations where impacts are calculated. Grid resolution of the analysis should be sufficient to demonstrate that areas of maximum impact of the source under review, nearby sources, and the area where all sources in the modeling analysis combine remain below NAAQS levels. It is recommended that a Cartesian grid, of 50 meters resolution or less extending to 1 kilometer from all property boundaries, be used around the source and other locations of maximum impact. The use of polar grids except for screening will not be accepted. A coarser grid across the impact area (generally 100 meters) is most commonly employed beyond 1 kilometer from the source. Additional discrete receptors may be requested by NDEQ at locations of interest (locations of ambient monitors, etc.) and may be examined as part of the review process. It is the responsibility of the modeler to demonstrate that the receptor grid is sufficient to identify maximum ambient concentrations for each averaging period.

Ambient air is defined as the portion of the atmosphere, external to buildings, to which the general public has access. This is generally considered those places at or beyond the fenceline of a facility. The fenceline of the facility must restrict public access, or the air within the facility property may be considered ambient air. For modeling, it is recommended that receptors be spaced 50 meters apart along the fenceline.

To determine if there is a violation of the NAAQS within the area defined by the ROI analysis, the modeler should include the source under review and all nearby background sources. A fine grid (50-meter resolution or less) in the area of maximum impact should be used. The fine grid should be at least 2 kilometers by 2 kilometers with 50 meter spacing to identify the maximum concentration. Include fine grids near adjacent sources to determine if your facility significantly contributes to violations of the NAAQS near other sources. If a model predicts an exceedance of a standard, the next step is to determine if the facility being modeled significantly contributes (reference Table 1.09-1) to the violation at those receptors during the same time period the violation occurs.

## 1.17 Good Engineering Practice Stack Height

Normal atmospheric flow is often disrupted in the immediate vicinity of buildings or by terrain features. The disrupted flow near structures can serve to enhance vertical dispersion of emissions, ultimately causing an increase in the maximum ground level concentration. The technical background of aerodynamic influences is described in greater detail in the Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (EPA publication number EPA-450/4-80-023R, June 1985). When a building or other nearby structure affects the air quality impact of the proposed construction or modification that is modeled, those impacts should be explicitly modeled in the analysis. Detailed downwash screening of both the near-wake cavity and far wake regions should be performed.

Sources not undergoing permit review but included in the modeling analysis because they contribute significantly to local air quality conditions, should not automatically be excluded from downwash consideration. Some sources may be located in sufficient proximity that their immediate downwash effects directly impact air quality within the proposed construction's impact area. Any decision by an applicant to exclude the effects of downwash should be justified and approved by NDEQ. The latest version of the PRIME program should be used to determine GEP (Good Engineering Practice) stack heights and calculated projected building dimensions be submitted along with the analysis. BPIP may continue to be used in the ISC model.

## 1.18 Terrain Considerations

Simple terrain is defined as terrain with elevations below stack height. Complex terrain is defined as terrain with elevations above plume height. Intermediate terrain is defined as terrain with elevations between stack height and plume height. If there is terrain with elevation greater than the height of any stack at the facility within the area of significant impact, this terrain should be addressed with a complex terrain model or with the use of the CALPUFF dispersion model. A list of accepted complex terrain models is provided in Table 1.18-1. The preferred modeling method is the application of an integrated Gaussian/complex model.

For complex terrain, cumulative and PSD analysis, neighboring sources shall have terrain elevations included. Receptors should be identified as complex terrain or simple terrain relative to the facility being modeled, not relative to adjacent sources included in the modeling analysis.

**Table 1.18-1 Complex Terrain Models Approved for Regulatory Use**

Model Name	Land Use Classification
ISC	Rural
Complex 1	Rural
Valley	Rural
Rough Terrain Diffusion Model (RTDM)	Rural
CTSCREEN/CTDMPLUS	Rural
ShortZ/LongZ	Urban

EPA policy requires an hour-by-hour comparison of simple terrain modeling and complex terrain modeling for determination of concentrations in intermediate terrain. It is for this reason the integrated Gaussian/complex terrain model is preferred.

Complete guidance on proper terrain screening techniques is contained within Section 5.2 of the Guideline on Air Quality Models. Selection of a particular screening technique must first be approved by NDEQ. NDEQ requires that all complex terrain modeling analyses include either a United States Geological Survey (USGS) topographic map of the area under consideration or digital elevation data of the area to verify that correct receptor elevations were selected.

Pursuant to OAQPS Model Clearinghouse memorandum (dated 11/6/92), the use of complex terrain screening models for calculating ambient air quality credits will not be accepted. Estimates for air quality credits should be obtained using a simple terrain model or appropriate refined complex terrain model.

## 1.19 NO<sub>2</sub> Modeling Methodology

Supplement C to the Guideline on Air Quality Models (rule effective date 9/8/95) replaced the existing Ozone Limiting Method (OLM) with the new Ambient Ratio Method (ARM) for assessing nitrogen dioxide (NO<sub>2</sub>) impacts. Due to the lack of regional ozone monitoring data available, NDEQ recognizes this as the preferred method for assessing the ambient impacts associated with the conversion of nitrogen dioxide.

**Table 1.19-1 Tiered Nitrogen Dioxide Screening Method**

Tier 1:	Assume Total Conversion of NO to NO <sub>2</sub>	
↓		
Tier 2:	Multiply Annual NO <sub>x</sub> Estimate by Empirically Derived NO <sub>2</sub> / NO <sub>x</sub> Ratio	

Tier 1 (initial screening) screening is performed by obtaining a maximum annual average concentration and assuming a total conversion of NO to NO<sub>2</sub>. If the concentration exceeds the NAAQS and/or PSD increments for NO<sub>2</sub>, perform a tier 2 screening.

Tier 2 screening analysis is performed by multiplying the Tier 1 estimate by an empirically derived NO<sub>2</sub> / NO<sub>x</sub> value of 0.75 (national annual default). A ratio differing from 0.75 may be used if the source can show that it is based upon sound data that is representative of the area where the maximum annual impact was modeled.

The Ambient Ratio Method is currently the preferred method for assessing impacts within the wake region of a source. The source may wish to consider undertaking a monitoring program to derive localized ambient NO<sub>2</sub>/NO<sub>x</sub> ratios for regions less than 10 kilometers from a source.

All air impact analyses should use the Ambient Ratio Method for atmospheric conversion of nitrogen dioxide. Note: The Ozone Limiting Method can be considered on a case-by-case basis, provided implementation is consistent with OAQPS guidance memorandum #107 and NDEQ and EPA Region VII concur with its use.

## 1.20 Gravitational Settling and Depletion Option

The source may consider the use of gravitational settling and deposition options in cases where it is a significant factor. ISC, AERMOD and CALPUFF contain settling and dry depletion algorithms and may be used when they are a factor. Please seek NDEQ approval regarding the use of these options prior to running your model. Particle sizing, diameter, and density information along with the source of this information must be supplied to NDEQ before incorporating this information in the analysis. **Failure to provide particle sizing, diameter, and density information prior to a modeling submittal will result in an incomplete submittal and may delay the modeling review.** Please consult the Department prior to a modeling submittal regarding dry depletion modeling requirements. The wet depletion option is not recommended for regulatory modeling analyses, and should rarely be used.

## 1.21 Requirements for Determination of Completeness

The purpose of the following requirements is to expedite the permitting process. Each of the following items is part of a basic modeling analysis. There is no exemption from providing any item. Failure to address any one item will result in an incomplete ruling. NDEQ must verify that: the input is correct, the modeling was conducted properly, the meteorological data is correct, and the model output can be verified. If a complete analysis is submitted, it is simple for NDEQ to review.

A report must be submitted explaining why a permit should be issued. The document should be written with the knowledge that it is available for public review. If the supporting information for the analysis is insufficient and uncertainty exists about why certain methods were used, the analysis will be determined incomplete and a supplemental report will have to be submitted.

The following are **essential** elements of a complete refined analysis, and may be found on the modeling checklist:

- 1) Submittal of the modeling checklist, which can be found in Appendix E.
- 2) An appropriate discussion of the modeling approach for screening and refined analysis. This should include, at a minimum, which modeling options were used and why they were considered appropriate to the application. Simply selecting options and not providing information about reasoning will result in an incomplete submittal.
- 3) A discussion of the meteorological data, including identification of the source of the data and how the data was processed.
- 4) A description of the site and spacing of receptors.
- 5) A copy of the emission inventory and a listing of all sources used in the modeling, with cross-reference names/numbers to the sources in the model input.
- 6) A copy of an appropriate USGS topographic map showing the location of the proposed facility. If a portion of a topographic map is sent, please reference the quadrant from which it is taken.

- 7) A cross-reference from the model input source numbers/names to the sources listed in the permit application for the proposed facility.
- 8) A summary of the modeling results including the maximum concentration and comparison to standards.
- 9) If the modeled stack parameters are different from the stack parameters in the application, an explanation must be provided as to what special cases are being analyzed and why.
- 10) A narrative report addressing the following topics:
  - a. A narrative summary of the proposed construction, modification, or revision
  - b. The models used and the justification for using each model
  - c. All criteria pollutants, including HAPs emitted by the source
  - d. All appropriate state and federal averaging periods for each pollutant
  - e. Significant impact and radius of impact
  - f. Adjacent sources modeling and sources eliminated from the inventory
  - g. Building downwash
  - h. Simple and complex terrain
  - i. PSD requirements
  - j. Source, cumulative, and increment impact
- 12) A 3.5" floppy disk or CD containing the following:
  - a. Input data for all model runs
  - b. All BPIP input/output files
  - c. Plot files from model runs, if applicable
  - d. Meteorological data for all years of the analysis
  - e. Any non-standard or modified post-processing source codes
  - f. Output files for any model runs not submitted as hard copy
- 13) Please submit two copies for PSD minor modeling applications. For PSD major modeling applications, please submit three copies of the modeling report. The modeling report should include all items listed in this section in order to be deemed complete.

If an EPA approved model has been modified, documentation should be submitted to the Department to clarify the alteration. A test case should be submitted with the documentation, usually by modeling one receptor over a meteorological period. Any modification made to an EPA approved model should be mentioned in a modeling protocol prior to the modeling submittal. This will allow NDEQ staff to comment on and review the proposed procedures. Any modification made to a dispersion model should be consistent with guidelines provided in the Guideline to Air Quality Models.

## 2.0 PSD Modeling

Sources subject to PSD requirements should consult with the Department to determine how to proceed in the application process. For this purpose, it is required that a pre-application meeting be held to discuss all related permitting and modeling topics. Applicants may need to collect a year of site-specific meteorological and ambient data to satisfy PSD requirements (40 CFR 52.21(m)). A source considering either a meteorological or ambient monitoring program should consult with NDEQ at the

earliest opportunity so that an acceptable program can be created. These programs would include data requirements, system performance specifications, and data quality assurance procedures.

Refer to EPA's On-Site Meteorological Program Guidance for Regulatory Modeling Applications (EPA-600/3-88-043) for meteorological monitoring guidance and Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) (EPA-450/4-87-07) for ambient monitoring guidance. As stated in section 1.02, a monitoring protocol must be submitted and approved before beginning collection of data for a PSD application if these data are to be used for the analysis.

## **2.01 Analysis Requirements**

For PSD applications, a modeling protocol is required. For more information, please refer to EPA's New Source Review Workshop Manual dated October, 1990. The following items are required for PSD applications:

### ***Ambient Air Quality Analysis***

The impact area is determined by including all emissions resulting from the proposed source, including all quantifiable fugitive emissions. Please follow guidance contained in Appendix I on how to characterize fugitive PM<sub>10</sub> emissions from haul roads.

The impact area is a circular area with the radius the lesser of the distance from the source to the most distant point where a significant impact will occur or 50 kilometers from the source. Each pollutant's impact is the largest impact area for applicable averaging periods. If the maximum impact is less than EPA's significance levels (reference Table 1.09-1), then a full analysis is not required.

All sources within 100 kilometers must be considered. Methods for elimination of non-significant sources from the inventory can be proposed. A total air quality analysis must also be performed for each appropriate Class I land area using an inventory of all sources within 100 kilometers of the Class I land area. Non-significant sources can be eliminated from the inventory. Note: The inventories for the analysis near the facility and the Class I area may be different. There may be additional analyses required by the Federal Land Manager for Air Quality Related Values (AQRVs). The analysis must be conducted consistent with guidelines for refined modeling in Section 1.10 of this guideline.

### ***Additional Impact Analysis***

This analysis is required to assess the impacts of air, ground, and water pollution on soils, vegetation, and visibility. This analysis is in addition to the Class I analysis, but may use some of the same techniques that were used in the Class I analysis.

### ***Increment Analysis***

The increment analysis for the facility must use the inventory of all increment consuming sources within the radius of impact plus 50 kilometers. No sources should be eliminated from the increment inventory. When the radius of impact plus 50 kilometers extends into another state, the applicant must obtain the appropriate source inventory from the other state. The increment analysis for any Class I land areas should use the inventory of all increment consuming sources within 100 kilometers of the Class I land area. No sources should be eliminated. If there is a Class I land area in another state within 100 kilometers of the facility, then receptors must be located in the Class I land area. Increment consuming

sources near the Class I land area in the other state must be included in the analysis.

### *Emission Inventories*

The most current inventory of sources must be used. It should contain all sources currently under review by NDEQ located within the appropriate inventory area. The applicant should check with NDEQ to ensure that the inventory is up to date.

## **2.02 PSD Inventory Requirements**

The method included in Appendix D for generating the emission inventory is intended for use in PSD permitting, but is also valid for minor source permitting where multi-source analysis is required. Please note that this method is only valid for determining sources to be included in the NAAQS analysis; it does not apply to increment consuming sources. There is no criterion for removing increment consuming sources from the inventory. Removal of such sources will result in an incomplete submittal and may result in a delay of the modeling review.

In general, Nebraska does not require air toxic risk assessment analyses in support of construction permits. However, there might be situations where the general public or the source request a risk assessment be conducted. It is at the Director's discretion whether a risk assessment will be conducted. Modeling methodologies contained in Appendix G should be followed when a risk assessment is to be conducted.

Additionally, dispersion modeling may be required for sources of air contamination regulated under the Leaking Underground Storage Tank (LUST), Superfund, and RCRA programs. NDEQ, in general, follows program specific guidance for these projects when available. Sources are encouraged to contact appropriate personnel for each program for specific guidance.

## **4.0 Glossary**

### Appendix W of 40 CFR Part 51 - Guideline on Air Quality Models

EPA's Guideline recommends air quality modeling techniques that should be applied to State Implementation Plan (SIP) revisions for existing sources and to new source reviews, including prevention of significant deterioration (PSD). It is intended for use by EPA Regional Offices in judging the adequacy of modeling analyses performed by EPA, State and local agencies and by industry. The guidance is appropriate for use by other Federal agencies and by State agencies with air quality and land management responsibilities. The Guideline serves to identify, for all interested parties, those techniques and databases EPA considers acceptable. The guide is not intended to be a compendium of modeling techniques. Rather, it should serve as a basis by which air quality managers, supported by sound scientific judgment, have a common measure of acceptable technical analysis.

### Air Quality Related Value (AQRV)

Air Quality Related Value (AQRV) means a feature or property of a Class I area that may be affected by air pollution. General categories of AQRVs include visibility, odor, flora, fauna, soil, water, geologic features, and cultural resources.

### Cartesian grid

A three dimensional grid within the ISC model which estimates pollutant concentrations. The x, y, and z coordinates identify the location of each individual receptor within the grid. Receptors within each Cartesian grid are usually spaced equally from each other in the x, y plane. The x coordinate is the distance in the east-west direction. The y coordinate is the distance in the north-south direction. The z coordinate is the elevation above sea level.

### Class I Land Area

The Clean Air Act on August 7, 1977 included areas such as international parks, national wilderness areas, and national memorial parks as special areas where special care is given in protecting the natural environment. State or Indian lands reclassified as Class I are considered non-Federal Class I areas.

### Class I analysis

A Class I analysis, aided by computer models, is used to identify air pollution impacts within a Class I land area.

### Complex Terrain

Complex terrain is any terrain exceeding the height of the stack being modeled. This definition includes terrain that is commonly referred to as intermediate terrain, that is, those receptors between stack height and plume height.

### Increment Consuming Source

A source, with increased emissions after the minor source baseline date of an air quality control region, is an increment consuming source. See Appendix B for baseline dates

### Major Source

Refer to the definition for major source Nebraska Title 129, Chapter 1,

### Minor Source

As used in the Nebraska Modeling Guideline, a minor source is any stationary source that is not defined as a major source. The term is sometimes used rather loosely. The precise definition of minor source may vary based on the context in which it is used.

### Nearby Sources

A nearby source is any major source or minor source that causes a significant concentration gradient in the vicinity of a new or modified source.

### Other Background Sources

Other background sources include all sources of air pollution other than the source under review and those identified as nearby sources. Examples include area and mobile sources, natural sources, most minor sources, and distant major sources. They usually are accounted for by using an appropriate ambient background concentration as recommended in Section 9.2.2 of Appendix W of 40 CFR Part 51 or by application of a model using inventory recommendations in Table 9-2 of Appendix W.

### Polar grid

A polar receptor grid within the ISC model is used to estimate impacts of air pollution a set distance from a point of origin. Receptors within a polar grid are defined by the angle from north



and the radial distance from the origin.

Representative Site

A representative site used for a background concentration is a location where the air pollution impact from a criteria pollutant is similar to the impact nearby the modified source requiring modeling.

Significant Impact

For a given pollutant, a significant impact exists if the impact in ambient air exceeds a modeling significance level. A list of criteria pollutant significance levels is contained in Table 1.3.5-1.

Simple Terrain

Simple terrain is an area where terrain features are all lower in elevation than the top of the stack of the source.

UTM

The Universal Transverse Mercator (UTM) system is a widely used plane coordinate system. Plane coordinate systems use distances from a specified reference point as the basis for all locations. The UTM system is based on a transverse Mercator projection. In this system, the projection is secant to the Earth's surface to balance scale variations. Further, the UTM system divides the Earth's surface into zones that are 6 degrees of longitude wide. Each zone is numbered, and the quadrilaterals 8 degrees of latitude high within a zone are lettered.

This scheme of lettering and numbering provides a simple mechanism for locating areas on a coarse grid. Precise locations on the earth are described in terms of north-south (northing) and east-west (easting) distances, measured in meters from the origin of the appropriate UTM zone (Star and Estes, 1990). Most of Nebraska is in zone 14, while the extreme eastern portion is in zone 15.

**5.0 Acronyms**

- AERMOD      AMS/EPA Regulatory Model
- AQCR        Air Quality Control Region
- AQRV        Air Quality Related Values
- ARM         Ambient Ratio Method
- CFR         Code of Federal Regulations
- CO          Carbon monoxide
- EPA         Environmental Protection Agency
- GEP         Good Engineering Practice

<u>ISC</u>	Industrial source complex model
<u>LUST</u>	Leaking Underground Storage Tanks
<u>NAAQS</u>	National ambient air quality standards
<u>NDEQ</u>	Nebraska Department of Environmental Quality
<u>NESHAPS</u>	National Emission Standards for Hazardous Air Pollutants
<u>NO<sub>x</sub></u>	Nitrogen oxides
<u>NSPS</u>	New Source Performance Standards
<u>OAQPS</u>	Office of Air Quality Planning and Standards
<u>OLM</u>	Ozone Limiting Method
<u>PAL</u>	Point, Area, Line Source model
<u>Pb</u>	Lead
<u>PM<sub>10</sub></u>	Particulate matter, less than 10 micrometers in diameter
<u>PSD</u>	Prevention of Significant Deterioration
<u>RCRA</u>	Resource Conservation and Recovery Act
<u>ROI</u>	Radius of impact
<u>SCRAM</u>	Support Center for Regulatory Air Models
<u>SIP</u>	State Implementation Plan
<u>SLAMS</u>	State/Local Air Monitoring System
<u>SO<sub>x</sub></u>	Sulfur oxides
<u>TSP</u>	Total suspended particulate
<u>USGS</u>	United States Geological Society
<u>UTM</u>	Universal Transverse Mercator coordinate system
<u>VOC</u>	Volatile Organic Compounds

## Appendix A - State and National Ambient Air Quality Standards

### State and Federal Ambient Air Quality Standards (Nebraska Title 129, Chapter 4)

Pollutant	Ambient air quality standards ( $\mu\text{g}/\text{m}^3$ )	
	Primary Standard	Secondary Standard
Particulate Matter:		
PM <sub>10</sub> , annual <sup>a</sup>	50	50
PM <sub>10</sub> , 24-hour <sup>b</sup>	150	150
Sulfur Dioxide:		
SO <sub>2</sub> , annual <sup>c</sup>	80	-
SO <sub>2</sub> , 24-hour <sup>d</sup>	365	-
SO <sub>2</sub> , 3-hour <sup>d</sup>	-	1300
Nitrogen Dioxide:		
NO <sub>2</sub> , annual <sup>c</sup>	100	100
Ozone:		
O <sub>3</sub> , 1-hour <sup>e</sup>	235	235
Carbon Monoxide:		
CO, 8-hour <sup>d</sup>	10,000	-
CO, 1-hour <sup>d</sup>	40,000	-
Lead:		
Pb, calendar quarter <sup>c</sup>	1.5	1.5

- a Standard is attained when the expected annual arithmetic mean is less than or equal to  $50 \mu\text{g}/\text{m}^3$ .
- b Standard is attained when the high, sixth high average over a five year meteorological record is less than or equal to  $150 \mu\text{g}/\text{m}^3$ .
- c Never to be exceeded.
- d Not to be exceeded more than once per year.
- e Standard is attained when the expected number of exceedances is less than or equal to 1.

Examples of demonstrating compliance with several national ambient air quality standards (NAAQS):

PM<sub>10</sub> annual standard: Receptor A was found to have the highest annual concentrations over the five year period.

receptor A in 1987=  $34 \mu\text{g}/\text{m}^3$ , receptor A in 1988=  $54 \mu\text{g}/\text{m}^3$ , receptor A in 1989=  $36 \mu\text{g}/\text{m}^3$   
 receptor A in 1990=  $29 \mu\text{g}/\text{m}^3$ , receptor A in 1991=  $45 \mu\text{g}/\text{m}^3$

known background concentration =  $12 \mu\text{g}/\text{m}^3$ ,  $54 + 12 = 66 \mu\text{g}/\text{m}^3$ ,  
 standard=  $50 \mu\text{g}/\text{m}^3$

Modeling indicates a violation of the PM<sub>10</sub> annual NAAQS.

PM<sub>10</sub> 24-hour standard: Receptor B was found to have the highest 24-hour concentrations over the five-year period. The concentrations below are listed according to the highest concentrations over the five years.

receptor B in 1987= 200 ug/m<sup>3</sup>, receptor B in 1990= 180 ug/m<sup>3</sup>, receptor B in 1988= 168 ug/m<sup>3</sup>,  
receptor B in 1991= 165 ug/m<sup>3</sup>, receptor B in 1989= 161 ug/m<sup>3</sup>, receptor B in 1987= 143 ug/m<sup>3</sup>

High, sixth-high = 143 ug/m<sup>3</sup>, known background concentration= 30 ug/m<sup>3</sup>  
143 + 30 = 173 ug/m<sup>3</sup>, standard= 150 ug/m<sup>3</sup>

Modeling indicates a violation of the PM<sub>10</sub> 24-hour NAAQS.

SO<sub>2</sub> annual standard: Receptor C was found to have the highest annual concentration over the five year period.

receptor C in 1990= 24 ug/m<sup>3</sup>, known background concentration= 5 ug/m<sup>3</sup>,  
24 + 5 = 29 ug/m<sup>3</sup>, standard= 80 ug/m<sup>3</sup>

Modeling indicates that the SO<sub>2</sub> annual standard is attained.

## Appendix B - PSD Increment Consumption and Baseline Dates

Under 40 CFR 52.21(k), a proposed major source or modification must demonstrate that it would not cause or contribute to a violation of (1) any national ambient air quality standards in any air quality control region, or (2) any applicable maximum allowable increase over the baseline concentration in any area. In the preparation of an ambient air quality impact analysis pursuant to 52.21(k)(2), it is necessary to determine which sources contribute to consumption of increment and which are considered part of the baseline inventory. Source(s) belonging to the increment inventory are determined under the following regulations:

Pursuant to 40 CFR 52.21 (b)(14)(i)(a) the major source baseline date for particulate matter is January 6, 1975. Actual emissions increases and decreases at any major stationary source in a Nebraska air quality control region after this date will affect the maximum allowable increase (increment).

CFR 52.21(b)(14)(ii) defines the minor source baseline date as the earliest date after the trigger date established under 52.21(b)(14)(ii)(a) on which a major stationary source or major modification subject to provisions of 40 CFR 52.21. For particulate matter, the trigger date is August 7, 1977. Therefore, the first major source or major modification subject to provisions of PSD after August 7, 1977 in a Nebraska air quality control region would trigger the minor source baseline date for that control region. After that date, actual increases and decreases at all sources will affect the maximum allowable increase.

Pollutant	Averaging Period	PSD Increments ( $\mu\text{g}/\text{m}^3$ )		
		Class I	Class II	Class III
Particulate Matter < 10 $\mu\text{m}$ (PM <sub>10</sub> )	24-hour	8	30	60
	Annual	4	17	34
Sulfur Dioxide (SO <sub>2</sub> )	3-hour	25	512	700
	24-hour	5	91	182
	Annual	2	20	40
Nitrogen Dioxide (NO <sub>2</sub> )	Annual	2.5	25	50

**Table B-2. PSD Baseline Dates in Nebraska (as of August, 1998)**

Pollutant	Major Source Baseline Date	Minor Source Baseline Date	Baseline Area
Nitrogen Dioxide (NO <sub>2</sub> )	February 8, 1988	April 29, 1992	Entire State
Sulfur Dioxide (SO <sub>2</sub> )	January 6, 1975	November 18, 1977	Entire State
Particulate Matter	January 6, 1975	Not Triggered	AQCR 085 - Omaha and Douglas County
Particulate Matter	January 6, 1975	April 29, 1992	AQCR 085 - Bellevue
Particulate Matter	January 6, 1975	April 27, 1979	AQCR 085 - Sarpy County
Particulate Matter	January 6, 1975	Not Triggered	AQCR 086
Particulate Matter	January 6, 1975	April 2, 1981	AQCR 145
Particulate Matter	January 6, 1975	July 10, 1980	AQCR 146 - Cass County
Particulate Matter	January 6, 1975	Not Triggered	AQCR 146 - Dawson County
Particulate Matter	January 6, 1975	November 18, 1977	AQCR 146 - Remainder of State

40 CFR 81.300 outlines the relationships of areas as delineated under Section 107 (d) of the Act to the PSD program. 40 CFR 81.300 states the following:

“(b) Designated areas which are listed below as attainment (“Better than national standards”) or unclassifiable (“Cannot be classified”) for total suspended particulate (TSP), sulfur dioxide (SO<sub>2</sub>), and nitrogen dioxide (NO<sub>2</sub>), represent baseline areas or portions of baseline areas which are used in determining compliance with maximum allowable increases (increments) in concentrations of the respective pollutants for the prevention of significant deterioration of air quality (PSD). With respect to areas identified as “Rest of State” it should be assumed that such reference comprises a single area designation for PSD baseline area purposes.”

Therefore, areas as delineated under 40 CFR 81.328 for PM represent the effective AQCRs for the Nebraska PSD program. Counties are subsections of the AQCR.

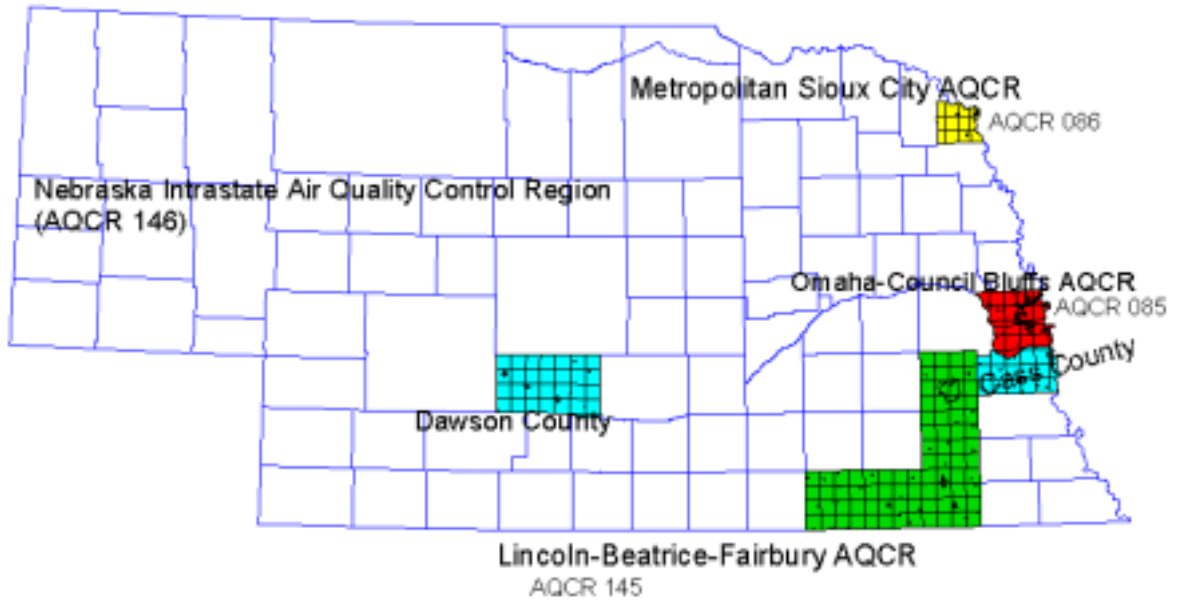


Figure B - I: Nebraska PM Baseline Areas as of 8/1/98. Entire State Serves As Baseline Area for NO<sub>2</sub> and SO<sub>2</sub>.

## Appendix C – NO<sub>2</sub>, Ozone Limiting Method Screening Technique

In 1996, OAQPS Model Clearinghouse Memorandum #107 was issued discussing the appropriate application of the Ozone Limiting Method (OLM). OLM, as originally presented by Cole and Summerhays, only considered a single source in the example provided in their December 1979 JAPCA article. USEPA, with Clearinghouse Memorandum #107, clarified its guidance concerning the implementation of the OLM. OLM, as intended, requires “that the individual NO<sub>x</sub> plumes from each stack should be subjected to the oxidizing potential of the hourly background ozone concentration. Subsequent hourly estimates of NO<sub>2</sub> at each receptor due to emissions from each source can then be combined to produce a total hourly NO<sub>2</sub> concentration due to emissions from all NO<sub>x</sub> sources at the facility.”

The following is a three-tiered screening approach can be used to obtain estimates of annual average NO<sub>2</sub> from point sources.

<b>Tier 1</b>	Assume total conversion of NO to NO <sub>2</sub> .
	↓
<b>Tier 2</b>	Apply OLM to annual NO <sub>x</sub> estimate obtained in Tier 1 using representative annual O <sub>3</sub> concentration
	↓
<b>Tier 3</b>	Apply OLM separately for each hour of the year or multi-year period.**

\*\*The annual average NO<sub>2</sub> concentration obtained in Tier 3 should use the following equation:

$$\text{TOTAL NO}_2 = \sum_{i=1}^N \text{OLM} [\text{O}_3, \text{NO}_i]$$

Where, i = contribution of NO<sub>x</sub> from each individual source at a receptor; and  
O<sub>3</sub> = background ozone, same everywhere

The important point to remember when using the OLM in the determination of whether a source is ozone or NO limited, is that this is accomplished individually for each source. Each source is assumed to be confronted by the same (inexhaustible supply of) background ozone. Each source's emissions are converted on an individual basis.



## Appendix D - PSD NAAQS Inventory Screening Technique

### Screening Threshold Method for PSD Modeling

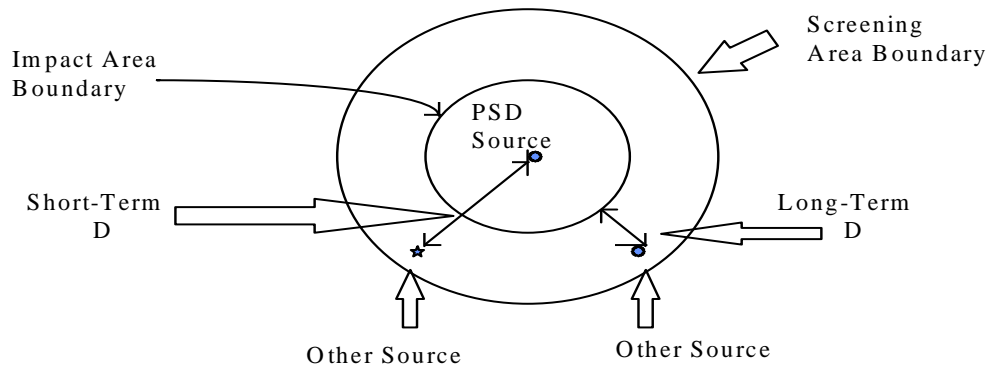
This method is best suited for situations where a PSD source has several sources outside its impact area, but within its screening area. The object is to find an effective means to minimize the number of such sources in a model, yet to include all sources which are likely to have a significant impact inside the impact area.

As a first-level screening technique, it is suggested to include those sources within the screening when:

$$Q = 20D$$

where Q is the maximum emission rate, in tons/year, of the source in the screening area; and D is a distance, in kilometers, from either:

- a. the source in the screening area to the nearest edge of the impact area, for long-term analyses
- or
- b. the source in the screening area to the PSD source defining the impact area, for short-term analyses.



This method does not preclude the use of alternate screening techniques or of more sophisticated screening techniques given the approval of the review agency. Also, this method does not prevent the review agency from specifying additional sources of interest in the modeling analysis.

The justification for this “Screening Threshold Method” rests upon the following assumptions:

- Effective stack height = 10 meters
- Stability class D (neutral)
- 2.5 meter/second wind speed
- mixing height = 300 meters
- $Q = 20D$  = Critical emission rate for a given pollutant
- One hour concentrations derived from figure 3-5D in Turner's WADE or from PTDIS
- 3-hour and 24-hour concentrations estimated using "Vol. 10R". Annual impacts are 1/7 of 25 hour impacts.

The results, for various distances, are shown in the table below:

D (km)	Q (T/yr)	1-hr Conc (ug/m3)	3-hour Conc. (ug/m3)	24-hr Conc. (ug/m3)	Annual Conc. (ug/m3)
0.5	10	47	42	19	2.7
1.0	20	32	29	13	1.9
1.5	30	27	24	10	1.4
2.0	40	23	21	9	1.3
3	60	18	16	7	1.0
4	80	17	15	7	1.0
5	100	14	13	6	1
6	120	13	12	5	1
10	200	10	9	4	1
20	400	7	6	3	1
30	600	6	6	3	1
40	800	6	6	3	1
50	1000	7	6	3	1

The "Screening Threshold" method is conservative. Most sources either have effective stack heights greater than 10 meters, or they have several short stacks spread out over an industrial complex. Thus, actual modeled concentrations will most likely be lower than the "Screening Threshold" would indicate in the table above. One implication of the table is that all major sources within 5 kilometers of the subject PSD source or within 5 kilometers of the PSD source's impact area should be scrutinized before being exempted from the final emissions inventory.

## Appendix E - Air Quality Modeling Checklist

(Revised February 2006)

### Air Quality Modeling Checklist

Air Quality modeling and this checklist should be submitted with your construction permit application. Please check all boxes, which you have completed. If any boxes are left unchecked, please give a brief explanation as to why.

#### 1) General Information

- A)  Submittal Date:
  
- B)  Facility Name:
  
- C)  NDEQ Facility ID Number:
  
- D)  Facility County Location:
  
- E) Modeling requirement:     Minor Source (State)     Major Source (PSD)
  
- F)  A modeling protocol has been established and reviewed by NDEQ.

#### 2) Pre-Application Monitoring

This section applies only to projects that will undergo PSD review.

- A) Do predicted air quality concentrations exceed the applicable pre-application monitoring exemption thresholds shown in the table below?

Pollutant	Averaging Period	Exemption Threshold (µg/m <sup>3</sup> )
CO	8-hour	575
NO <sub>2</sub>	Annual	14
PM <sub>10</sub>	24-hour	10
SO <sub>2</sub>	24-hour	13
Pb	Calendar quarter	0.1
Mercury	24-hour	0.25
Beryllium	24-hour	0.0001
Fluorides	24-hour	0.25
Vinyl chloride	24-hour	15
Total reduced sulfur	1-hour	10
Hydrogen sulfide	1-hour	0.2
Reduced sulfur compounds	1-hour	10

- No. Pre-application monitoring is not required
- Yes. Representative air quality monitoring data must be provided to the NDEQ prior to submittal of the permit application, or pre-application monitoring will be required for each pollutant that exceeds the thresholds in the table above.

#### 3) Dispersion Model Selection and Options

A) Which model and version was used?

- AERMOD, version:
- ISCST3 with PRIME, version:
- ISCST3 without PRIME, version:
- Calpuff, version:
- Other \_\_\_\_\_, version:

Note: The most recent version of a model shall be used unless an older version has been approved by the NDEQ.

B) Regulatory Default Option selected?

- Yes
- No. Justification for the selection of each non-regulatory default option must be included. Non-regulatory default options selected without prior approval of the NDEQ may result in rejection of the modeling analysis if the justification provided is not sufficient.

C) Pollutants Modeled (mark all that apply)

- NO<sub>x</sub>
- Lead
- PM<sub>10</sub>
- CO
- SO<sub>2</sub>
- Other:

#### 4) Source Information

A)  A discussion on the proposed operating scenarios and the methodology used to model them has been included.

B)  Tables summarizing the locations, hourly emission rates, and release points for all point, area, volume, and open-pit sources have been included in the modeling analysis report. Building information has been included as well.

C)  All assumptions, calculations, and figures necessary to justify the emission rate, stack height, sides, heights of release, initial dispersion coefficients, and volume have been provided.

D)  For NAAQS modeling, the facility and nearby sources shall use potential emission rates. Reference Tables 8.1 & 8.2 in CFR 40 Part 51 Appendix W.

E)  For PSD Increment modeling, the “project” shall use potential emission rates, the rest of the facility and the nearby sources shall use actual emission rates if available.

F)  All modeling input and output files have been submitted on a CD. This includes met data, BPIP files (if applicable), and any other files used or created during the modeling process.

G) Operational Capacity Limits

- 100% capacity.
- Less than 100% capacity. This load should be modeled. In any case, the load causing the highest predicted concentration in addition to the design load should be included in the refined modeling.

H) Varying emission rates used?

- Yes. This is not permissible unless the operating restrictions are placed in the permit. Haul road emissions may be allowed to vary. Contact the NDEQ regarding haul road modeling.
- No



- I) Emission rate scaling factors used in the modeling analysis?
- No
  - Yes. A discussion on how emission scalars were developed must be included. Those scalars which should be identified in any enforceable permit provision (such as restricting hours of operation) should also be included.
- J) Have several stack been merged into one stack for modeling purposes?
- No
  - Yes. The merging of existing gas streams is not permissible, and credit for merging cannot be used in the dispersion modeling unless a creditable net emissions reduction is realized by such merging, or another exemption provided under Title 129, Chapter 16 allows for such merging to be credited.
- K) Was building downwash evaluated?
- No. Justification for not evaluating building downwash must be included.
  - Yes. The PRIME algorithm should be used to evaluate building downwash effects.
- L) Has a plot plan of the facility with the proposed project been included with the modeling submittal or application?
- Yes
  - No. Information on building parameters and locations must be provided in the modeling submittal or permit application.
- M) How were haul roads modeled?
- Release height equal to half the height of the truck's wheel and an initial vertical dimension based upon the height of the truck divided by 2.15
  - Other. Provide an explanation as to how the haul roads were modeled.
  - Haul roads were not modeled. BMP will be utilized.
- N) Identify the methodology used to calculate the pound-per-hour haul road emission rate for demonstrating compliance with the 24-hr PM<sub>10</sub> NAAQS or PSD increment level. Answer only if haul roads were modeled.
- Multiplied annual haul road emissions (tons per year) by 2 and divided the result by 8,760 hours. This rate was modeled for each hour of the meteorological period.
  - Divided annual haul road emission (lb/hr) by 8,760 hours. This rate was modeled for each hour of the meteorological period.
  - 80% of the annual haul road emissions (tons per year) were assumed to occur during daylight hours (7 am to 7 pm). The remaining 20% of emissions were assumed to occur overnight (7 pm to 7 am).
  - Other methodology:
- 5) Receptor Information
- Receptors at the facility fenceline are placed at 50 meter intervals.
  - Receptors beyond the facility fenceline are placed at 50 meter intervals within 200 meters of the facility.
  - Receptors beyond 200 meters placed at 100 meter intervals out to a distance of 2 kilometers of the facility.
  - Receptors beyond 2 kilometers placed at 250 meter intervals out to a distance of 5 kilometers

of the facility.

Receptors beyond 5 kilometers placed at 500 meter intervals out to a distance of 7 kilometers of the facility.

Receptors beyond 7 kilometers placed at 1000 meter intervals out to a distance of 10 kilometers of the facility.

6) Terrain Features

A) Was elevated terrain considered in the modeling analysis?

No

Yes. Please indicate how receptor elevations were determined.

i) Which digital elevation model (DEM) was used?

90 meters; 1 degree

30 meters; 7.5 minute

Other:

B) Which terrain setting was used?

Complex

Simple

C) Which land use setting was used?

Urban

Rural

7) Meteorological Data

The source has acquired the necessary five individual year files and, if modeling PM<sub>10</sub>, the combined 5-yr file.

8) Impact on Air Quality

A) Did modeling analysis include background concentrations as listed below?

Pollutant	Averaging Period	Background Concentration Value ( $\mu\text{g}/\text{m}^3$ )
NO <sub>x</sub>	Annual	15
	3-hour	120
	24-hour	48
SO <sub>2</sub>	Annual	12
	24-hour	60
PM <sub>10</sub>	Annual	25
	1-hour	7570
CO	8-hour	2330
	Pb	Calendar quarter

Yes

No. Please discuss how background concentrations were determined. It is recommended that the source receive NDEQ approval to use background concentrations other than those listed in the table above prior to commencing a modeling analysis.

B)  The facility has obtained background source information from NDEQ and has included them in the modeling.

9) Please make sure all information requested in this checklist is included with your submittal. An



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incomplete submittal may result in a delay in processing your application.

## Appendix F- Characterizing Limited Hours of Operation within Dispersion Models

Situations arise, especially in the electric and gas industry, when an emission unit is limited by the number of hours of operation per year. When characterizing an emission unit that is limited and is being evaluated against an annual national ambient air quality standard, several steps are required to adequately demonstrate attainment. Please consult the NDEQ for proper modeling procedures when using emission scalars.

(1) In situations where an emission unit is limited under 365 hours per year, the highest impacts at the controlling receptor for those limited hours of operation are to be summed and then divided by 8760 hours. The result provides an annual impact.

$$X_{\text{annual}} = (X_{1\text{-hour}} + X_{2\text{-hour}} + \dots + X_{n\text{-hour}}) / 8760$$

n = number of limited hours of operation  
X = impacts

(2) In situations where an emission unit is limited below 8760 hours per year but above 364 hours per year, the number of limited hours of operation should be divided by 730 hours to derive a monthly emission scalar. The value should then be rounded up to the nearest integer. The integer identifies the number of months in the dispersion model the emission unit is to emit air pollution. The months that produce the highest impacts should then be modeled to produce annual impacts.

$$M = n / 730$$

n = number of limited hours of operation  
M = monthly emission scalar

For example, emission unit is limited to 1000 hours of operation per year.  
 $M = 1000 \text{ hours} / 730 \text{ hours} = 1.37$   
 $M = 1.37 \Rightarrow 2$

The two months that produce the highest total impacts, including affected source plus nearby background sources, should be included in the dispersion model and to place the other ten monthly emission scalars equal to zero. The resulting concentration will be a conservative annual impact.

(3) When the adjusted monthly emission scalar is divisible by three, a quarterly emission scalar may be considered.

For example, an emission unit is limited to 4000 hours of operation per year.  
 $M = 4000 \text{ hours} / 730 \text{ hours} = 5.48$   
 $M = 6$

quarterly emission scalar =  $M / 3$   
 $Q = 6 / 3 = 2$

The two quarters that produce the highest impacts should be included in the dispersion model, placing the other two quarters equal to zero.





## Appendix G - Cancer Risk Assessments for Hazardous Air Pollutants

If a cancer risk assessment is required in support of a construction permit, EPA guidance should be followed to adequately estimate potential cancer risk levels. Please refer to EPA's [Guidelines for Carcinogen Risk Assessment \(EPA/630/P-03/001F\)](#). This document may be found on-line at <http://www.epa.gov/cancerguidelines>

## Appendix H - Total Reduced Sulfur Modeling Guidelines

### *H.0 Overview of Dispersion Modeling Analyses for TRS Compounds*

Pursuant to Nebraska Title 129, Chapter 17, Section 008, atmospheric dispersion modeling may be required as part of a construction permit application. These guidelines have been developed to aid the modeler in developing an acceptable analysis and to aid NDEQ personnel in expediting the review process.

Following these guidelines will usually result in an acceptable analysis; however, each analysis is unique, and in some cases additional analysis may be required. It is recommended that the modeler and NDEQ staff discuss related details before an analysis is submitted. This can be accomplished through the submission of a modeling protocol. A modeling protocol will allow staff to review and respond to questions in the protocol before the analysis is submitted.

The purpose of a dispersion modeling analysis is to demonstrate that the Nebraska Total Reduced Sulfur Ambient Air Quality Standards (TRS AAQS) will be met after the proposed construction or modification. If the analysis is incomplete, sufficient information will need to be submitted before the review is complete. If the modeling analysis demonstrates that the construction or modification will cause or significantly contribute to a violation of TRS AAQS, the permit cannot be issued. Please contact NDEQ should this occur.

Procedures outlined in Appendix W to 40 CFR Part 51, EPA document Guideline On Air Quality Models (EPA publication number EPA-450/2-78-027R (revised) as modified by Supplement C) should, as a minimum, be followed when conducting an analysis. The Guideline provides fairly complete guidance on appropriate modeling applications. There are some differences in procedures that are unique to the Nebraska air quality program. These differences are addressed within this document. The level of detail and complexity is also unique to each analysis. It is recommended that the modeler contact NDEQ modeling staff to discuss the methods and levels of the analysis.

### *H.1 Levels of Analyses*

A dispersion modeling analysis involves two phases: (1) the preliminary or screening level analysis and (2) a full impact analysis or refined analysis. In the phase 1 analysis, only the proposed new source or proposed modification is modeled. The results of the phase 1 analysis are used to determine whether the applicant must perform a full impact analysis. A full impact analysis may not be required of applicants when the proposed source or modification does not increase ambient concentrations by more than the significant impact levels as defined in Section 1.2 of this document.

A full impact analysis is required when the modeled estimates of the proposed source exceed the defined significant impact levels for each of any of the averaging periods of the Nebraska TRS AAQS. This impact analysis is greater in scope than the phase 1 analysis because it considers emissions from the following: (1) the proposed source, and (2) existing sources including those at the existing facility, and nearby and regional background sources.

Figure 1 describes the steps for the applicant to follow for conducting a dispersion modeling analysis to demonstrate compliance with the Nebraska TRS AAQS, and is examined in greater detail in the sections that follow.

### ***H.2 Determining the Impact Area***

The proposed source or modification's impact area is the geographic extent to which the required air quality analysis for the TRS AAQS is carried out. The impact area includes all locations at which the proposed source or modification will equal or exceed the significant impact level. The highest modeled concentration for each averaging time for the TRS AAQS is used to determine the significance of impact.

The impact area is a circular area with a radius extending from the source to (1) the most distant point where modeling estimates a significant impact will occur, or (2) a radius of 50 km from the source, whichever of 1 and 2 are less. The modeling analysis is conducted within the circle that circumscribes the significant impacts. Due to minimized travel times associated with the instantaneous AAQS, the impact radius should be determined for only the 30-minute averaging period. The determination of impact area must include all quantifiable fugitive emissions associated with the source. If the maximum ambient impact of the proposed source or modification is below the significant impact level for all locations, the full impact analysis may not be required.

**Table 1 -- Significance Levels For TRS Air Quality Impacts**

Time Period	Concentration
Instantaneous (1 minute)	0.25 ppm
30 minute	0.005 ppm

### ***H.3 Modeling Emissions Inventory***

If the phase 1 analysis predicts significant impacts at any locality, a full impact analysis is required. It is the responsibility of the applicant to establish the necessary inventories of all sources and their emissions required to carry out the TRS AAQS analysis. The Department may provide a list of existing sources upon request once the radius of impact is established. The applicant is responsible for identifying and providing data for those additional sources that could affect air quality within the impact area. The Department will review the proposed modeling inventory for completeness and approve it for use in the analysis.

The Department requires that all nearby sources be modeled explicitly as part of the TRS AAQS analysis. Nearby sources are considered those sources expected to cause a significant concentration gradient in the impact area of the proposed source or modification. Several screening methods exist for the elimination of nearby sources from the modeling inventory. It is recommended that the applicant contact the Department before eliminating any sources from the modeling inventory.

### ***H.4 Computation of Emission Rates***

Use of the proper emission rate is essential in air dispersion modeling. If a permitted or proposed emission rate exists for the pollutant and stack being considered, then this emission rate should be used in the modeling analysis. For new sources that do not have an emission limit, then the emission rate should be calculated from published emission factors or obtained from test methods (subject to approval by the

Department on a case-by-case basis). For all emission rates other than those permitted or proposed, all calculations should be provided with the analysis.

The short-term AAQS requires that modeled emission rates reflect the design capacity of the equipment or process and continuous of operation of the source(s) unless such operation is constrained by

a federally enforceable permit condition limiting such operation. Please reference Table 9-2 of the Guideline on Air Quality Models for more detailed information on the calculation of emission rates for air dispersion modeling for short-term standards.

### ***H.5 Model Selection***

In general, two levels of models exist: screening and refined dispersion modeling. Screening models are used to eliminate more extensive modeling for the preliminary analysis or the full impact analysis, as in the phase 1 analysis. Refined dispersion models provide more accurate estimates of source impacts, and are utilized if estimates provided by screening models indicate a threat to any applicable standard (phase 2).

### ***H.6 Instantaneous (1 minute) Time Period***

The evaluation of sources for the instantaneous TRS AAQS cannot be accomplished utilizing the current regulatory air dispersion models (ISC, AERMOD, CALPUFF) due to the short time period under evaluation. These models can only provide a 1-hour estimate of concentrations; and the use of mathematical methods to convert the 1-hour estimate to a 1-minute value will likely result in an underestimation of concentrations. Several models or variations of existing screening models may be suitable for application when evaluating sources against this standard. Accidental release models such as DEGADIS, SLAB, or AFTOX provide for the evaluation of point source applications for the time period of interest.

These models require user supplied meteorological conditions; therefore, proper documentation must be provided to the Department to assure that worst-case meteorological conditions have been evaluated for the geographic area of interest. Another model, INPUFF, can be used to provide short time period estimates from single point sources over a wider receptor field. Each of these models may be utilized for analysis of the instantaneous standard. The applicant is encouraged to contact the Department prior to initiation of an impact analysis.

If the source(s) under evaluation is subject to the effects of aerodynamic downwash, the models mentioned above will not be considered suitable for use in these scenarios. For these situations, it is recommended that the TSCREEN model be utilized. TSCREEN uses the SCREEN3 model component to provide the user with the ability to explicitly treat building downwash situations.

Each of the models recommended in this section are single source models, causing the limitation of use of such in multiple source situations. For situations where sources are more than several hundred meters distant from one another, it would not be necessary to consider the cumulative nature of impacts due to time-of-travel restrictions of the modeled time period. However, in a multiple source situation with sources located at the same industrial complex, it will be necessary to consider the cumulative nature of these impacts. One method is to model each source independently and sum the contributions of each to provide an estimate of total impacts. Another method, outlined in Section 2.2 of the Screening Procedures for Estimating the Air Quality Impact of Stationary Sources - Revised (EPA-450/R-92-019) allows for the merging of stacks into a single "representative stack."

Sources emitting the same pollutant from multiple stacks within 100 meters of each other may be merged into one stack if stack height, flow rates, and stack gas exit temperatures differ by no more than 20% each. For each stack, compute a value for M (see equation), then use the parameters of the stack with the lowest value of M as the "merging" stack. Sum the emissions from all stacks to obtain an emission rate from the "merging" stack using the following equation:

$$M = \frac{HVT}{Q}$$

**where:** H=stack height (m)  
 V=stack gas volume flow rate (m<sup>3</sup>/s)  
 T=stack gas exit temperature (K)  
 Q=pollutant emission rate (g/s)

Sources with stack parameters that vary by greater than 20% may not be merged by use of this formula and must be modeled independently and their contributions summed to determine the cumulative impacts.

### ***H.7 30-Minute Time Period***

For most modeling analyses, the applicant should refer to the Guideline on Air Quality Models for a list of recommended models. ISC, AERMOD and CALPUFF provide the user with the ability to simulate a wide variety of emission sources and provides 1-hour concentration estimates. ISC and AERMOD are not capable of treating calm or near calm conditions; therefore, these models cannot make concentration estimates during these meteorological conditions. CALPUFF can evaluate concentrations during calm or near clam conditions.

CALPUFF, may be required by the Department for use in evaluations with the 30 minute time period. CALPUFF is non-steady state puff model utilizing three dimensional meteorological modeling (CALMET) for resolution of meteorological conditions for which ISC and AERMOD may not be capable of. CALPUFF has a hierarchy of modeling options, having both a simple screening mode capable of replicating ISC concentrations and a three dimensional meteorological analysis mode.

1-hour estimates from each model can be converted to 30-minute values according to the equation outlined Section 1.04 of this document.

### ***H.8 Evaluation of Impacts***

Evaluation of impacts from sources for demonstration of compliance with both TRS AAQS shall be made at receptors placed in ambient air. Instantaneous concentrations or 1-minute estimates yielded from models outlined in Section 1.4.1 of this document will be used for evaluation with the instantaneous standard.

1-hour concentration estimates provided by models outlined in Section 1.5.2 of this document will be converted to 30 minute averages by use of the '1/5th Power Law'. The equation for this conversion is as follows:

$$C_1 / C_s = (t_s / t_1)^{1/5}$$

where: C<sub>1</sub> = concentration estimate for sampling time t<sub>1</sub>  
 C<sub>s</sub> = concentration estimate for shorter sampling time t<sub>s</sub>

Most current Gaussian dispersion models rely on meteorological and sampling data that are time averaged. These models also assume steady-state conditions over that time period. Due to this, it makes this class of models most applicable for averaging times of several minutes to 1 hour. For evaluation of time periods less than this time period, this time averaged formula could underestimate a peak

instantaneous concentration. Therefore, use of this equation for evaluation of concentrations with the instantaneous standard is not recommended.

Concentration estimates made by the modeling systems outlined in Section 1.5.2 of this document are output in units of  $\mu\text{g}/\text{m}^3$ . Therefore, it is necessary to convert these units into the units which the TRS AAQS is expressed -- parts per million (ppm). This may be accomplished by the use of the following equation:

$$\text{ppm} = \frac{(\mu\text{g}/\text{m}^3)(24.5)}{(\text{MW})(1000)}$$

where:  $\mu\text{g}/\text{m}^3$  = modeled concentration, expressed in micrograms per cubic meter

MW= molecular weight of the compounds, expressed in terms of hydrogen sulfide ( $\text{MW}_{\text{H}_2\text{S}} = 34.08$ )

An example of this conversion: A source models a 30-minute impact of  $110 \mu\text{g}/\text{m}^3$ . The conversion of the concentration would look like this:

$$\text{ppm} = \frac{(110)(24.5)}{(34.08)(1000)} = 0.079 \text{ ppm } 30\text{-minute average}$$

### ***H.9 Requirements for Determination of Completeness***

The purpose of the following requirements is to expedite the modeling review. Each of the following items is part of any basic modeling analysis. Failure to address any one item will result in an incomplete modeling analysis. NDEQ will verify that input is correct, modeling was conducted properly, that meteorological data is correct, and that model output can be verified. The document should be written with the knowledge that it is available for public review. If the supporting information for the analysis is insufficient and uncertainty exists about why certain methods were used, the analysis will be determined incomplete and supplemental information will have to be submitted to the Department.

The following elements are required in order for the Department to perform the needed review:

1. 3.5" floppy or CD disk(s) containing the following:
  - a) Input data for all model runs;
  - b) All BPIP input/output files;
  - c) Plot files from model runs, if applicable.
  - d) Meteorological data for all years of the analysis.
  - e) Any non-standard or modified post-processing source codes;
  - f) Output files for any model runs not submitted as hard copy.
2. An appropriate discussion of the modeling approach for screening and refined analysis. This should include at a minimum which models and options were used and why they were considered appropriate to the application.
3. A discussion of the meteorological data, including identification of the source of the data and how the data was processed.
4. A description of the site and spacing of receptors.



5. A copy of the emission inventory and a listing of all sources used in the modeling, with cross-reference names/numbers to the sources in the model input.
6. A copy of an appropriate USGS topographic map showing the location of the proposed facility. If a portion of a topographic map is sent, please reference the quadrant from which it is taken.
7. A cross-reference from the model input source numbers/names to the sources listed in the permit application for the proposed facility.
8. A summary of the modeling results including the maximum concentration and comparison to standards.
9. Hard copy of output files for years of maximum ambient concentrations.
10. If the modeled stack parameters are different from the stack parameters in the application, an explanation must be provided as to what special cases are being analyzed and why.
11. The following topics must be addressed within the report:
  - a) a narrative summary of the proposed construction, modification, or revision;
  - b) the models used and the justification for using each model;
  - c) all TRS compounds emitted by the source, and the computation of emission rates;
  - d) all appropriate state averaging periods for TRS addressed in the analysis;
  - e) significant impact and radius of impact.
  - f) adjacent sources modeling and sources eliminated from the inventory;
  - g) building downwash;
  - h) simple and complex terrain;
  - i) source and cumulative impacts.

## Appendix I – Characterizing Haul Road Emissions

### 24-hour PM<sub>10</sub> modeling for NAAQS and increment analyses

The Department generally does not require haul road PM<sub>10</sub> emissions to be modeled in comparison with the PM<sub>10</sub> 24-hour NAAQS and increment. If the Department does require haul roads to be modeled for the 24-hour averaging period, then the haul road PM<sub>10</sub> emissions shall be computed according to procedures provided below.

For grain receiving trucks that travel on paved roads at ethanol production facilities a “12-hour average rate” shall be used in the 24-hour modeling analysis. For all other facilities an annual average rate may be used in the model. The annual average rate is the annual emission rate divided by 8,760 hours. The “12-hour average rate” is a compromise between the pit-receiving rate at an ethanol plant and an annualized grain-receiving rate. The pit-receiving rate is the receiving pit capacity, typically rated in bushels per hour. The annualized grain-receiving rate is calculated as the expected annual grain truck requirement divided by 8,760 hours. The NDEQ recognizes that the pit-receiving rate is too restrictive and that a more common sense approach is needed to characterize emissions from this activity. The NDEQ is concerned that the annualized grain-receiving rate may greatly under predict potential 24-hour air concentrations. Therefore, the “12-hour average rate” is a compromise between the two extremes.

To derive the “12-hour average rate” divide the annual grain truck requirement by 4,380 hours. The “12-hour average” rate is then modeled for each hour of the meteorological record to estimate 24-hour concentrations. This methodology assumes that an ethanol plant can receive its daily grain requirement in a 12-hour period. This methodology should not be interpreted as modeling twice the amount of grain trucks per year. In essence, this modeling guidance requires that an emission unit be modeled at a rate reflective of the averaging period of concern. Grain trucks can be received greater than the annualized rate at most ethanol facilities in a day. Therefore, the NDEQ recommends this methodology to adequately protect the 24-hour PM<sub>10</sub> NAAQS. The annualized grain-receiving rate or the “12-hour average rate” may be used to demonstrate compliance with the annual PM<sub>10</sub> NAAQS. Alternatives to this methodology may be submitted to the NDEQ for review.

The ISC-predicted haul road 24-hour concentration is to be multiplied by a factor of 0.6 to account for the tendency of a plume to exhibit enhanced meander near the ground over an hour. For AERMOD and CALPUFF analyses, please consult the Department for appropriate procedures.

### Annual PM<sub>10</sub> modeling for NAAQS and increment analyses

Haul road emissions shall be modeled for the annual averaging period unless the source is implementing or proposing to implement a Department-approved Best Management Practice (BMP) plan. All nearby background source haul road emissions that do not have BMPs are to be explicitly modeled for the annual averaging period.





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## Appendix J – Modeling Procedures for Portable Asphalt Plants

### *J.1 Permit-By-Rule (PBR) Asphalt Plants*

Portable asphalt plants that elect to be permitted under Nebraska's Permit-By-Rule (PBR) air quality regulations will be required to compute air emissions using a Department's "Asphalt" computer program or "Asphalt" automated spreadsheet, and to provide the program output files to the Department. The Department will then evaluate predicted  $PM_{10}$  concentrations resulting from the proposed asphalt plant project in comparison with the  $PM_{10}$  24-hour national ambient air quality standards (NAAQS). The Department may perform modeling to evaluate compliance with the sulfur dioxide NAAQS, if the portable asphalt plant is expected to burn high sulfur diesel fuel, residual oil, and/or waste oil. Predicted concentrations resulting from a proposed portable asphalt plant, electing to be permitted under the PBR, will be evaluated at the nearest public access point and beyond.

### *J.2 Non-PBR Asphalt Plants*

Portable asphalt plants that do not elect to be permitted under Nebraska's PBR shall compute emissions using the Asphalt program or spreadsheet and to provide the program output files to the Department. The Department will then evaluate predicted  $PM_{10}$  concentrations resulting from the proposed asphalt plant project in comparison with the  $PM_{10}$  24-hour national ambient air quality standards (NAAQS). The Department may perform modeling to evaluate compliance with the sulfur dioxide NAAQS, if the portable asphalt plant is expected to burn high sulfur diesel fuel, residual oil, and/or waste oil. Predicted concentrations resulting from a proposed portable asphalt plant, electing not to be permitted under the PBR, will be evaluated at the plant's property line.

### *J.3 Asphalt Computer Program & Spreadsheet Maintenance*

The Department developed a computer "Asphalt" program and an automated Excel spreadsheet to estimate potential air emissions resulting from a typical portable asphalt plant. The programs compute pound-per-hour emissions using AP-42 emission factors. By using one of the Asphalt programs, air emissions calculations are standardized and allow the Department to expedite the review of the proposed portable asphalt plant project. The Department will maintain and update the Asphalt computer program and spreadsheet as necessary. Please consult the Department if you have any questions concerning the modeling methodologies for portable asphalt plants.

## Appendix K – Modeling Protocol

### Air Dispersion Modeling Protocol

Proposed Plant – City, NE

Facility Name

The following modeling protocol has been prepared and is being submitted to the NDEQ for review and approval in accordance with Section 1.2-1 of the NDEQ's Draft Atmospheric Modeling Guidance for Permits dated November 2002.

The protocol summarizes the information that will be used to conduct the dispersion modeling in support of the proposed plant located in Saunders County, NE.

#### Air Dispersion Model

- [REDACTED]

#### Labeling

- Emission points will be properly identified within the model with a specific ID number and a brief description.

#### Pollutants/Averaging Periods

- [REDACTED]

#### Sources Types

- Point sources will be adjusted in accordance with the Nebraska Modeling Guidelines for Permits dated November 2002 as needed if stack/vents is discharging horizontally or has a rain cap.
- Fugitive sources will be initially modeled using pseudo point source parameters of 0.01 meters for diameter and 0.01 meters/sec for exit velocity. The exit temperature will be ambient, with a representative average release height and location.
- The haul roads will be modeled for the annual averaging period only.

#### Downwash

- All facility buildings and structures will be evaluated for downwash.

#### Terrain and Land Use

- [REDACTED] terrain
- [REDACTED] setting



## Receptor Grid

- 50 meter spacing on the fence
  - 50 meter spacing from the fence out to a distance of 200 meters
  - 100 meter spacing from 200 meters out to a distance of 2 km
  - 250 meter spacing from 2 km out to a distance of 5 km
  - 500 meter spacing from 5 km out to a distance of 7 km
  - 1000 meter spacing from 7 km out to a distance of 10 km
- 
- Concentrations should clearly be decreasing to below significance levels near the edge of the receptor grid, if not, additional receptors should be added. Fine grids (50-meter) should be placed over the area of maximum concentration to ensure that the true maximum concentration is identified.

## Meteorological Data

- Met data from [REDACTED], NE for the years [REDACTED] is the appropriate data and will be provided by the NDEQ.
- The individual year met files will be used to evaluate all predicted impacts but the concatenated 5-year file will be used to evaluate predicted impacts of PM<sub>10</sub> 24-hour concentrations.

### *Background Concentrations*

- PM<sub>10</sub>
  - Annual – 25 micrograms per cubic meter
  - 24-hr – 60 micrograms per cubic meter
- NO<sub>x</sub>
  - Annual – 15 micrograms per cubic meter
- CO
  - 8-hr – 2,330 micrograms per cubic meter
  - 1-hr – 7,570 micrograms per cubic meter
- SO<sub>2</sub>
  - Annual – 12 micrograms per cubic meter
  - 24-hr – 48 micrograms per cubic meter
  - 3-hr – 120 micrograms per cubic meter

## Nearby sources

- (Please contact the NDEQ regarding background sources)

## References

- USEPA, 1985, Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations). EPA-450/4-80-023R, June 1985. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- USEPA, 1988. "Air Quality Analysis for Prevention of Significant Deterioration (PSD)", July 5, 1988 Memorandum from Gerald A. Emison, Director Office of Air Quality Planning and Standards, to Thomas J. Maslany, Director Air Management APCD. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- USEPA, 1990. New Source Review Workshop Manual. Draft. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- USEPA, 1992a. Workbook for Plume Visual Impact Screening and Analysis (Revised). EPA-454/R-92-023. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- USEPA, 1992b. Screening Procedures for Estimating the Air Quality Impact of Stationary Sources (Revised). EPA-454/R-92-019. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- USEPA, 1993a. Procedures to Estimate NO<sub>x</sub> Emission Increases from Mobile and Area Sources for PSD NO<sub>2</sub> Increment Applications. EPA-452/R93-004. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- USEPA, 1993b. Tiered Modeling Approach for Risks due to Sources of Hazardous Air Pollutants. EPA-450/4-92-001. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- USEPA, 1993, Guidance on the Application of Refined Dispersion Models for Hazardous/Toxic Releases. EPA-454/R-93-002, May 1993. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- USEPA, 1997a. "Interim Implementation of New Source Review Requirements for PM<sub>2.5</sub>", October 21, 1997, Memorandum from John S. Seitz, Director Office of Air Quality Planning and Standards. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- USEPA, EPA - Technology Transfer Network (TTN) Bulletin Board System (BBS) (919/541-5742). U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.
- NDEQ, Title 129 - Nebraska Air Quality Regulations. Nebraska Department of Environmental Quality, Lincoln, NE 68509.