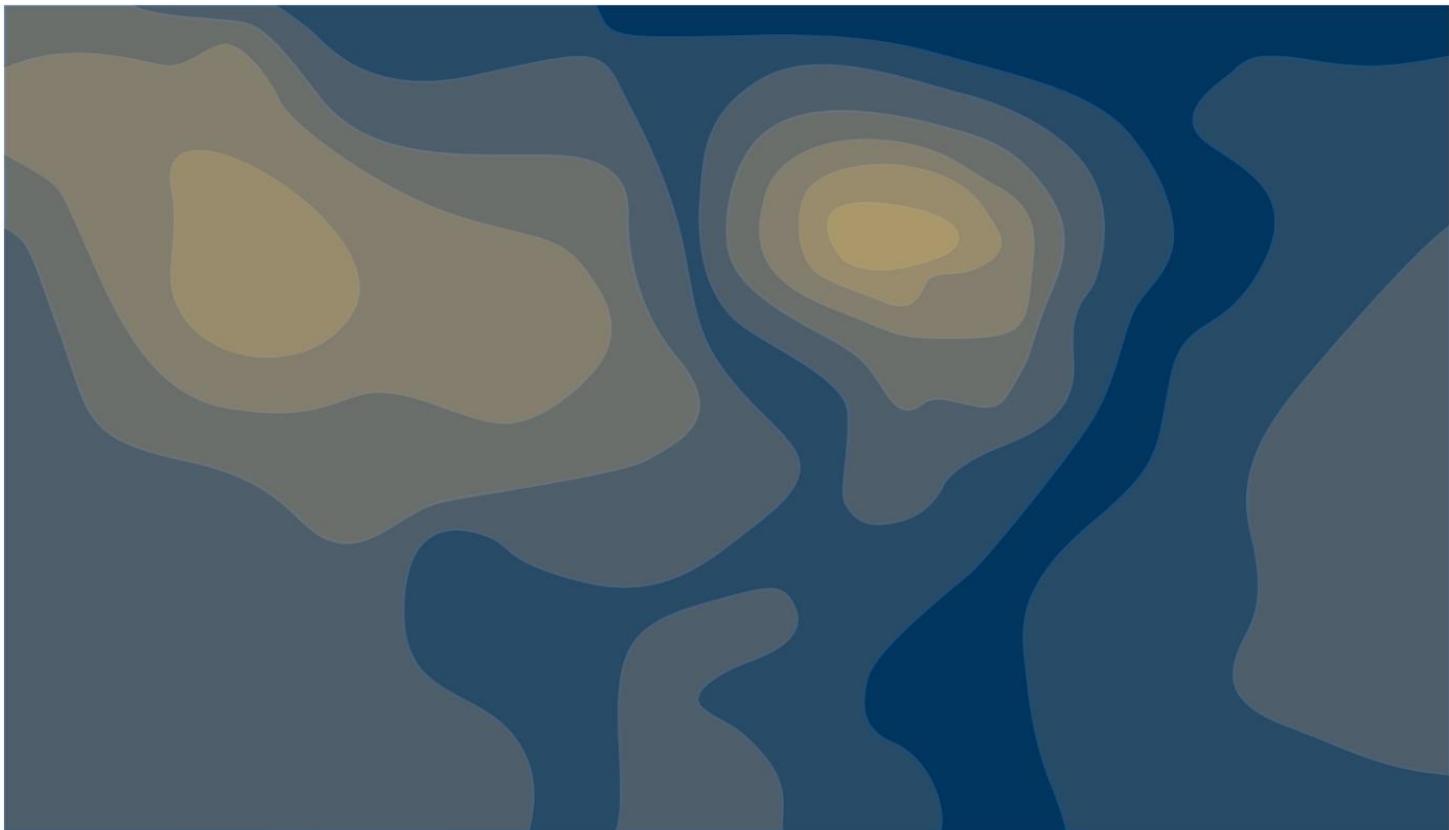


# MPCA Air Dispersion Modeling Practices



**Editor**

MPCA Risk Evaluation & Air Modeling Unit, Supervisor

**Contributors/acknowledgements**

MPCA Air Quality Permits Section – Ongoing Modeling Group

MPCA Risk Evaluation and Air Modeling Unit

**Minnesota Pollution Control Agency**

520 Lafayette Road North | Saint Paul, MN 55155-4194 |

651-296-6300 | 800-657-3864 | Or use your preferred relay service. | [Info.pca@state.mn.us](mailto:Info.pca@state.mn.us)

This report is available in alternative formats upon request, and online at [www.pca.state.mn.us](http://www.pca.state.mn.us).

**Document number:** aq2-58a

# Contents

<b>Contents</b> .....	i
<b>Figures</b> .....	ii
<b>Tables</b> .....	ii
<b>Acronyms</b> .....	iii
<b>Document summary</b> .....	1
<b>Section 1.0: Applicable air quality standards</b> .....	3
<b>Section 2.0: When to model</b> .....	5
2.1 MPCA programs supported by dispersion modeling .....	5
<b>Section 3.0: How to model</b> .....	9
3.1 Modeling basics.....	<a href="#">109</a>
3.2 Meteorology.....	<a href="#">1241</a>
3.3 Horizontal coordinate system .....	13
3.4 Terrain data .....	13
3.5 Buildings and structures.....	14
3.6 Source characterization and location.....	16
3.7 Receptor placement and ambient air .....	23
3.8 General modeling schema.....	26
3.9 Source Impact Analysis.....	29
3.10 Cumulative Impact Analysis .....	29
3.11 Running and completing the CIA.....	<a href="#">4341</a>
3.12 Evaluating the CIA modeling demonstration results.....	<a href="#">4341</a>
3.13 Pollutant considerations .....	<a href="#">4442</a>
3.14 PSD specific considerations.....	<a href="#">5048</a>
3.15 Model development details .....	<a href="#">5351</a>
<b>Section 4.0: Submittal process, forms, and online services</b> .....	<a href="#">5654</a>
4.1 Submittal process.....	<a href="#">5654</a>
4.2 Modeling protocol forms .....	<a href="#">5755</a>
4.3 Modeling results.....	<a href="#">5957</a>
4.4 EBD for criteria pollutant modeling .....	<a href="#">6058</a>
4.5 MPCA review forms.....	<a href="#">6158</a>
4.6 Additional e-Service attachments .....	<a href="#">6159</a>
<b>Section 5.0: Contacts</b> .....	<a href="#">6159</a>
<b>Appendices</b> .....	<a href="#">6260</a>

# Figures

---

Figure 1. Building layout. ....	15
Figure 2. Example of tiered building settings in AERMOD. ....	16
Figure 3. General Two stage MPCA air quality dispersion modeling practice for new or modifying sources that model the NAAQS, Increment, or the MAAQS (after Appendix W Section 9.2.3). ....	28
Figure 4. Example increment emission input file (portion). ....	32
Figure 5."Triple Helix" relationship between nearby sources, background concentration and size of the nearby source inventory. ....	33
Figure 6. Locations of hypothetical sources used in EPA's modeling for the MERP guidance. ....	<a href="#">4745</a>

# Tables

---

Table 1: NAAQS, PSD increments, and significant impact levels in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). ..	3
Table 2. MAAQS (Minn. R. 7009.0080). ....	4
Table 3. Overview of the four administrative programs that include dispersion modeling.....	6
Table 4. PSD significant emission rates (SERs). ....	7
Table 5. Point source input parameters. ....	17
Table 6. Volume source input parameters. ....	19
Table 7. Area source input parameters (area surface, area poly, area line, area circle). ....	20
Table 8. Flare source input parameters.....	21
Table 9. Open pit sources. ....	22
Table 10. Ambient air receptor locations for NAAQS and MAAQS analysis under the Title V, Federal PSD, or SIP modeling demonstrations.....	26
Table 11. Nearby source inventory characterization based on distance from source under review....	<a href="#">3736</a>
Table 12. Ranked of monitored values used for estimating representative background. ....	<a href="#">4543</a>
Table 13. Highest values from the chosen background monitor (360 readings in the most recent three-year period). ....	<a href="#">4543</a>
Table 14. Summary of MERP values for the hypothetical sources located in the Upper Midwest climate zone.....	<a href="#">4745</a>
Table 15. Conservative MERP values for $\text{O}_3$ and secondary $\text{PM}_{2.5}$ precursor emissions for hypothetical sources located in or near Minnesota. ....	<a href="#">4846</a>
Table 16. Multi-tiered approach for estimating $\text{NO}_2$ concentrations from $\text{NO}_x$ emissions. ....	<a href="#">4947</a>
Table 17. The 2021 NLCD land-use classification system. ....	<a href="#">5553</a>
Table 18. Required forms for project submittals.....	<a href="#">5755</a>

# Acronyms

---

ADJ_U*	Adjusted surface friction velocity
ARM	Ambient Ratio Method
BMPs	Best Management Practices
BPIPPRM	Building Profile Input Program for PRIME
CAA	Clean Air Act
CAD	Computer-aided drafting
CIA	Cumulative Impact Analysis
CO	Carbon Monoxide
CTM	Chemical Transport Models
EAW	Environmental Assessment Worksheet
EBD	Equivalent or Better Dispersion
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FAC	Facility Abbreviation Code
[FAC]FSnnn	User-specified identifiers
[FAC]SVnnn)	Stack/vent identifiers
FLM	Federal Land Manager
GEP	Good engineering practice
GIS	Geographic Information System
g/s	grams per second
HC	hydrocarbons
H <sub>2</sub> S	Hydrogen Sulfide
K	Kelvin
m	meters
MAAQs	Minnesota Ambient Air Quality Standards
MPCA	Minnesota Pollution Control Agency
MSBD	Minor source baseline date
MSST	Meteorological site selection tool
NAAQS	National Ambient Air Quality Standard
NED	National Elevation Dataset
NEI	National Emissions Inventory
NLCD	National Land Cover Database
NO <sub>2</sub>	Nitrogen dioxide
NO <sub>x</sub>	Nitrogen oxides
NSR	New Source Review

---

O <sub>3</sub>	Ozone
OLM	Ozone Limiting Method
Pb	Lead
P.E.	Professional Engineer
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns
PM <sub>10</sub>	Particulate matter less than 10 microns
PSD	Prevention of Significant Deterioration
PVMRM	Plume Volume Molar Ratio Method
REAM	Risk Evaluation and Air Modeling
ROI	Range of Influence
SCRAM	Support Center for Regulatory Air Models
SER	Significant Emission Rate
SIA	Source Impact Analysis
SIC	Standardized Industry Classification
SIL	Significant impact level
SIP	State Implementation Plan
SO <sub>2</sub>	Sulfur dioxide
SQRM-D	Square root mean distance method
THI	Temperature-Humidity Index
TSP	Total Suspended Particulate
µg/m <sup>3</sup>	Micrograms per cubic meter
USGS	U.S. Geological Survey
U.S.	United States
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compounds

# Document summary

This Air Quality Modeling Practices Manual (Manual) is provided by the Minnesota Pollution Control Agency (MPCA) to describe air quality dispersion modeling demonstration practices used to meet federal or state air quality program requirements. This Manual provides recommendations for developing a modeling demonstration that accounts for the most recent National Ambient Air Quality Standard (NAAQS).

This Manual does not substitute for provisions or regulations of the Clean Air Act (CAA) or any state statute or rule, nor is it a regulation itself. It does not affect the rights or procedures available to the public nor does it impose binding, enforceable requirements on any party, community, or tribe. Tribes within the state of Minnesota work directly with the U.S. Environmental Protection Agency (EPA) regarding federal rules and regulations. Therefore, it is recommended that tribal governments carefully review the Manual contents and consider which aspects are useful in informing air quality-related tribal actions and projects.

Additionally, this Manual may not apply to situations where unique or unusual circumstances exist.

Photochemical modeling and the modeling of Class I impacts are briefly addressed in this Manual but are largely outside its scope. Please contact MPCA staff for further directions if photochemical or Class I modeling is needed for your project.

The form and content of this Manual reflects changes presented by the Minnesota Legislative and Executive branches of government to enhance permitting efficiencies. ~~In order to~~ To implement these directives more efficiently, the MPCA has created an electronic modeling protocol and report forms available either through the MPCA modeling website page or through the MPCA's e-Services. The current MPCA review and approval process, along with a description of the MPCA electronic protocol form and final report form, is found in Section 4. In addition, links to the MPCA Air Dispersion Modeling website are included throughout the Manual.

The following features of this Manual are important to note:

- The content of this Manual is a compilation of modeling practices developed from a variety of state and federal air quality modeling guidance documents, with the EPA's Appendix W forming the foundation for this work.
- In the event of a conflict between this document and current EPA modeling guidance, any sources subject to federal Prevention Significant Deterioration (PSD) or State Implementation Plan (SIP) requirements should follow current EPA modeling guidance.
- Manual review and modification will be ongoing throughout the year to update existing practices as well as incorporate new practices. The MPCA welcomes your feedback on new and existing practices throughout the year and will consider including them as major changes to the Manual, which is published once a year.

The MPCA recognizes that modeling simulations are ~~variable~~variable, and that modeling must account for unique features of a project that can challenge the utility of standard modeling practices. Minor deviations from the approaches presented in this Manual can typically be approved at the staff level. In situations where major modeling practice deviations or non-standard modeling practices are involved, MPCA Environmental Analysis and Outcomes Division management will review the request to evaluate and decide whether it is appropriate to use the proposed practice on a case-by-case basis. Documentation of the non-standard approach should contain, at a minimum:

- The modeling issue encountered that cannot be resolved by standard modeling approaches.
- The relevant literature or data that supports the use of a non-standard approach.

- A detailed discussion of the suitability of the proposed non-standard approach based on relevant literature or data and its relationship to the details of the facility, meteorology, terrain, or other relevant factors as determined through consultation with the MPCA.

It is important to recognize that previous decisions on non-standard modeling approaches may not apply to current practices ~~in light of considering~~ new knowledge, modeling updates, and changes in terrain or meteorological data. Please consult the Supervisor of the MPCA Risk Evaluation and Air Modeling Unit, at [airmodeling.pca@state.mn.us](mailto:airmodeling.pca@state.mn.us) prior to protocol submittal if you encounter a situation where you anticipate a significant departure from the Manual or submittal process. Submittal of a non-standard approach protocol without consultation will significantly increase the amount of time needed for review.

Lastly, this Manual is separated into five sections:

1. Applicable ambient air quality standards
2. When to model
3. How to model
4. Submittal process, forms, and online services
5. Contacts and resources

The structure follows the form of the MPCA process for completing an air quality dispersion modeling demonstration. Once an initial air quality modeling simulation is completed, additional work may be necessary to address emission reductions, or to determine source culpability in situations where multiple sources are involved. As a special topic on source culpability and cumulative air modeling analysis, especially within the context of air quality permitting and environmental review, please refer to Appendix A. Four frequently used sections include the following:

**Section 1:** Applicable ambient air quality standards. Unlike many other states, Minnesota maintains a separate set of state ambient air quality standards that pre-date the NAAQS. The state and federal air quality standards feature prominently in air quality permitting, environmental review, and SIP modeling decisions.

**Section 2:** When to model. One of the most frequently asked questions in air regulation pertains to when an air quality dispersion modeling demonstration may be necessary for a project. This section provides a description of four programs where an air quality dispersion modeling demonstration may be necessary: PSD permitting; Non-PSD permitting; environmental review; and SIP.

**Section 3:** How to model. There are three parts to this section: Modeling basics; Setting up the model; and, Additional considerations. Part one, **Modeling basics**, is an overview of the fundamentals of air dispersion modeling. Part two, **Setting up the model**, provides instruction of the development of a modeling demonstration consistent with MPCA program-specific needs. Part three, **Additional considerations**, addresses unique regulatory modeling situations.

**Section 4:** Submittal process, forms, and online services. The Minnesota Legislature directed the MPCA and other state-level agencies responsible for environmental or natural resource permitting to streamline their administrative practices. Minn. Stat. § 116.03, subd. 2b(a) states:

It is the goal of the state that environmental and resource management permits be issued or denied within 150 days of the submission of a permit application. The commissioner of the Pollution Control Agency shall establish management systems designed to achieve the goal.

The MPCA has responded to this legislation by developing internal and external practices that clarify expectations for modeling protocols and reports as well as streamline the review and approval of air quality

dispersion modeling demonstrations. The MPCA now requests all modeling protocols be submitted electronically through the MPCA's air modeling e-Service, which is expected to further increase the efficiency of the review process. This section of the Manual presents the various online forms used to develop and approve an air quality dispersion modeling demonstration.

## Section 1.0: Applicable air quality standards

Minnesota air quality is subject to the National Ambient Air Quality Standards (NAAQS) and the Minnesota Ambient Air Quality Standards (MAAQS). The standards are administered through MPCA's state air quality permitting, assessment, and policy programs and apply to all air quality permits issued by the agency.<sup>1</sup> In support of programmatic air quality management, air quality dispersion modeling is frequently used to evaluate the standards and inform air quality permitting, environmental review, and air policy decisions. The applicable NAAQS and MAAQS, along with their modeled form, are intended for use in these evaluations (See Tables 1 and 2 below).

**Table 1: NAAQS, PSD increments, and significant impact levels in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ).**

Pollutant	*Averaging Period	Primary NAAQS ( $\mu\text{g}/\text{m}^3$ ) <sup>G</sup>	Secondary NAAQS ( $\mu\text{g}/\text{m}^3$ ) <sup>G</sup>	PSD Class II Increment ( $\mu\text{g}/\text{m}^3$ )	PSD Class I Increment ( $\mu\text{g}/\text{m}^3$ ) <sup>B</sup>	Class II <sup>2</sup> Significant Impact Level ( $\mu\text{g}/\text{m}^3$ ) <sup>H</sup>
SO <sub>2</sub> <sup>A</sup>	1-Hour	196.4 <sup>F(H4H)</sup> (75 ppb)	-	To be determined	To be determined	7.86 <sup>H1H</sup> (EPA interim value)
	3-Hour	None	1,309.3 <sup>F(H2H)</sup> (0.5 ppm)	512 <sup>F(H2H)</sup>	25	25 <sup>H1H</sup>
	24-Hour	366.6 <sup>F(H2H)</sup>	None	91 <sup>F(H2H)</sup>	5	5 <sup>F(H1H)</sup>
	Annual	78.6 <sup>F(H1H)</sup>	None	20 <sup>F(H1H)</sup>	2	1 <sup>F(H1H)</sup>
PM <sub>10</sub>	24-Hour	150 <sup>F(H6H)</sup>	150	30 <sup>F(H2H)</sup>	8	5 <sup>F(H1H)</sup>
	Annual	-	-	17 <sup>F(H1H)</sup>	4	1 <sup>F(H1H)</sup>
PM <sub>2.5</sub> <sup>D</sup>	24-Hour	35 <sup>F(H8H)</sup>	35	9 <sup>F(H2H)</sup>	1	1.2 <sup>C</sup>
	Annual	12.0 <sup>F(H1H)</sup>	15.0	4 <sup>F(H1H)</sup>	2	0.3 <sup>C</sup>
NO <sub>2</sub>	1-Hour	188.0 <sup>F(H8H)</sup> (100 ppb)	-	To be determined	To be determined	7.52 <sup>F(H1H)</sup> (EPA interim value)
	Annual	99.7 <sup>F(H1H)</sup> (53 ppb)	99.7	25 <sup>F(H1H)</sup>	2.5	1 <sup>F(H1H)</sup>
CO	1-Hour	40,071.5 <sup>F(H2H)</sup> (35 ppm)	None	None	None	2,000 <sup>F(H1H)</sup>
	8-Hour	10,304.1 <sup>F(H2H)</sup> (9 ppm)	None	None	None	500 <sup>F(H1H)</sup>
O <sub>3</sub> <sup>D</sup>	8-Hour	137.3 (0.070 ppm)	137.3	None	None	None
Pb	Rolling 3-Months	0.15 <sup>E1</sup>	0.15 <sup>E1</sup>	None	None	None

<sup>\*</sup>The National Ambient Air Quality Standards for those pollutant/averaging times is compared to the average of the modeled concentrations (e.g., 1-hour SO<sub>2</sub> is the average of the 4th highest maximum daily 1-hour concentrations) and annual PM<sub>2.5</sub> NAAQS is the average of the years in the modeled period and not simply the highest annual concentration.

<sup>1</sup>The NAAQS are applicable requirements for all air quality permits in Minnesota.

<sup>2</sup>For Class I SIL values, please contact the MPCA Air Modeling staff. Class I modeling demonstrations are not common in Minnesota.

<sup>A</sup> Minnesota is in attainment for the previous SO<sub>2</sub> standards; however, some areas of the state remain in an SO<sub>2</sub> maintenance area. In these situations, the SO<sub>2</sub> 24-Hour and Annual standards remain in effect. See SO<sub>2</sub> footnote 4 in the current [NAAQS Table](#).

<sup>B</sup> Long-range transport assessments is necessary for Class I areas. For these situations, the EPA has proposed alternative screening approaches, to support long-range transport assessments of PSD increments. 40 CFR Part 51, IV.6

<sup>C</sup> EPA has proposed the use of this value in the form of the Standard for PM<sub>2.5</sub> screening in an April 17, 2018, EPA Memorandum, *Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program*. The PM<sub>2.5</sub> 24-hour SIL is the H2H.

<sup>D</sup> The EPA issued [guidance](#) for assessing ozone and secondarily formed PM<sub>2.5</sub> impacts from single sources; the MPCA is currently developing procedures for estimating these impacts.

<sup>E</sup> At this time, AERMOD does not calculate design values for the lead NAAQS (rolling 3-month averages). A post-processing tool, LEADPOST (ZIP)(65 M), is available to calculate design values from monthly AERMOD output. This tool calculates and outputs the rolling cumulative (all sources) 3-month average concentration at each modeled receptor with source group contributions and the maximum cumulative (all sources) rolling 3-month average concentration by receptor.

<sup>F</sup> The modeled form of the applicable NAAQS reflect the high first high (H1H), high second high (H2H), high fourth high (H4H), high sixth high (H6H), and high eighth high (H8H) of their specific averaging period. Superscripts in the table above correspond to the superscripts for each modeled form of the applicable ambient air quality standard.

**Note:** PSD Class I Area 24-Hour value is generally 1 µg/m<sup>3</sup> [PM<sub>2.5</sub> is 0.27 µg/m<sup>3</sup>].

<sup>G</sup> Conversions based on EPA Docket Number EPA-HQ-OAR-2014-0464, November 29, 2016

<sup>H</sup> Please note that for the 24-hour PM<sub>2.5</sub>, 1-hour SO<sub>2</sub>, and 1-hour NO<sub>2</sub> Significant Impact Levels are compared to the average of the 1st high concentrations across the modeled period and not just the 1-high concentration.

**Table 2. MAAQS (Minn. R. 7009.0080).**

Air Pollutant	Averaging Time	Primary Standard	Secondary Standard	Form of the Standard
Hydrogen Sulfide (H <sub>2</sub> S)	30-minutes	70.0 µg/m <sup>3</sup>	-	30-minute average not to be exceeded more than two times in a year <sup>3</sup>
	30-minutes	42.0 µg/m <sup>3</sup>	-	30-minute average not to be exceeded more than two times in 5 consecutive days <sup>2</sup>
Ozone (O <sub>3</sub> )	8-hour	137 µg/m <sup>3</sup>	Same as primary	3-year average of the annual fourth high daily maximum 8-hour concentration does not exceed standard. (H4H)
Carbon Monoxide (CO)	8-hour	10 mg/m <sup>3</sup>	-	Annual second-high 8-hour concentration does not exceed standard (H2H)
	1-hour	40 mg/m <sup>3</sup>	-	Annual second-high 1-hour concentration does not exceed standard (H2H)
Sulfur Dioxide (SO <sub>2</sub> )	Annual average	79 µg/m <sup>3</sup>	-	Annual average concentration does not exceed standard (H1H)
	24-hour	367 µg/m <sup>3</sup>	-	Annual second-high 24-hour concentration does not exceed standard (H2H)
	3-hour	-	1,310 µg/m <sup>3</sup>	Annual second-high 3-hour concentration does not exceed the standard (H2H)
	1-hour	197 µg/m <sup>3</sup>	-	3-year average of the annual 99th-percentile of daily maximum 1-hour concentrations does not exceed standard (H4H)
Total Suspended Particulate (TSP)	Annual average	75 µg/m <sup>3</sup>	60 µg/m <sup>3</sup>	Annual geometric mean concentration does not exceed standard (H1H)
	24-hour	260 µg/m <sup>3</sup>	150 µg/m <sup>3</sup>	Annual second-high 24-hour concentration does not exceed standard (H2H)
Nitrogen Dioxide (NO <sub>2</sub> )	Annual average	100 µg/m <sup>3</sup>	Same as primary	Annual average concentration does not exceed standard (H1H)

<sup>3</sup> The ambient H<sub>2</sub>S air quality standard is based on a one-half hour averaging time for both the five-day and annual standards. AERMOD is limited to a one-hour time step. The MPCA maintains that the AERMOD one-hour time step is relevant to the one-half hour averaging time of the standard as the dispersion was developed and assessed using time-steps less than one-hour. If you need to model the H<sub>2</sub>S MAAQS, please contact the MPCA Risk Evaluation & Air Modeling unit to discuss the post-processing needed to evaluate the standards.

Air Pollutant	Averaging Time	Primary Standard	Secondary Standard	Form of the Standard
	1-hour	188 $\mu\text{g}/\text{m}^3$	-	3-year average of the annual 98th-percentile of daily maximum 1-hour concentrations does not exceed standard (H8H)
Lead (Pb)	Rolling 3-month average	0.15 $\mu\text{g}/\text{m}^3$	Same as primary	Maximum 3-month rolling average from 3 consecutive years does not exceed the standard (H4H)
PM <sub>10</sub>	24-hour	150 $\mu\text{g}/\text{m}^3$	Same as primary	3-year average of the annual estimated exceedance days is less than or equal to 1 (H6H)
PM <sub>2.5</sub>	24-hour	35 $\mu\text{g}/\text{m}^3$	Same as primary	3-year average of the annual 98th-percentile of 24-hour concentrations does not exceed the standard (H8H)
	Annual average	12.0 $\mu\text{g}/\text{m}^3$	15.0 $\mu\text{g}/\text{m}^3$	3-year average of the annual seasonally-weighted average does not exceed the standard (H1H)

Minnesota has state-level ambient air quality regulations developed prior to the NAAQS and are available [online](#).

The MAAQS have undergone considerable revision since the initial 1968 promulgation; however, they still apply to all facilities in Minnesota. The NAAQS are the focus of most air quality modeling demonstrations.

The MAAQS and NAAQS air pollutants overlap, with exception of Total Suspended Particulate (TSP) and Hydrogen Sulfide (H<sub>2</sub>S). Typically, these pollutants are included in non-PSD projects on a case-by-case basis or, in certain situations, may become part of an environmental review. As a regulatory practice, MPCA Air Quality Permitting may expect a modeling demonstration to include the MAAQS when a numeric MAAQS value is lower than an applicable NAAQS, or there is a difference in averaging time from the applicable NAAQS. Modeling these pollutants is typically in a non-default mode within AERMOD. Please confer with MPCA Air Quality Modeling staff if you encounter a need to model TSP or H<sub>2</sub>S.

The structure of the NAAQS and MAAQS share similar features; however, differ slightly in their application. This topic is addressed in detail Section 3.6 of the Manual. Another important difference between the NAAQS and MAAQS is the use of a NAAQS-based significant impact level (SIL)<sup>4</sup> as a *de minimis* screening value, whereas the MAAQS do not maintain any such screening values.

## Section 2.0: When to model

This section introduces the MPCA air quality management programs that most frequently rely on air quality dispersion modeling to meet their program obligations. The MPCA Risk Evaluation and Air Modeling (REAM) unit supports these needs; however, the REAM unit does not determine **when** modeling is needed for **any** of the agency air quality programs. The decision to model is unique to the programs illustrated below and reflects federal and state program obligations and resources. Once a program determines that modeling is necessary, the REAM unit supports their request through the processes and methods provided in this Manual.

### 2.1 MPCA programs supported by dispersion modeling

Air dispersion modeling frequently supports four MPCA programs. This section provides a brief overview of the expected administrative outcome and specific program contact information, the decision thresholds considered, and a general understanding of the scope of a program-specific modeling demonstration.

<sup>4</sup> A Significant Impact Level (SIL) is an EPA pollutant-specific *de minimis* ambient pollutant concentration value, applied by the MPCA as a unit of measurement in air quality dispersion modeling, air quality permitting, and air management decisions. Specific MPCA program-specific SIL applications are described throughout the Manual.

**Table 3. Overview of the four administrative programs that include dispersion modeling.**

<b>Program</b>	<b>Administrative Outcome and Contact</b>	<b>Decision Threshold Considered</b>	<b>Modeling Scope</b>
Prevention of Significant Deterioration (PSD) Air Quality Permits	Air Quality Permit Section <i>Dick Cordes, P.E.</i> 651-757-2291 <a href="mailto:richard.cordes@state.mn.us">richard.cordes@state.mn.us</a>	Compliance with applicable air quality standards	PSD modeling requirements are well established. They address compliance with applicable NAAQS and PSD increments as well as cumulative air quality issues. The impacts of a project on Class I areas may also need to be addressed.
Non-PSD Air Quality Permits	Air Quality Permit Section <i>Dick Cordes, P.E.</i> 651-757-2291 <a href="mailto:richard.cordes@state.mn.us">richard.cordes@state.mn.us</a>	Compliance with applicable air quality standards	The Non-PSD permits include federal Part 70 permits and State-Only air quality permits. Modeling may be required to assess the compliance status of a facility or to address non-PSD modifications at these facilities.
<b>Program</b>	<b>Administrative Outcome and Contact</b>	<b>Decision Threshold Considered</b>	<b>Modeling Scope</b>
Environmental Review	Environmental Impact Assessment <i>Dan Card</i> 651-757-2261 <a href="mailto:dan.card@state.mn.us">dan.card@state.mn.us</a>	Determination of potentially significant and irreversible environmental impacts at the direct, indirect and cumulative scale of impact.	Air dispersion modeling may be conducted at either the screening mode or refined mode of modeling. Impacts assessment must include direct, indirect and cumulative air analysis. Air modeling may be necessary for a project even if no air quality permit is required.
State Implementation Plan (SIP)	Air quality assessment and control plans <i>Deepa deAlwis</i> 651-757-7252 <a href="mailto:deepa.dealwis@state.mn.us">deepa.dealwis@state.mn.us</a>	Compliance with applicable air quality standards	<p>Two tiers:</p> <p>Project-specific modeling: Some projects undergoing modeling for an air quality permit may have additional SIP requirements. Modeling requirements are SIP-dependent.</p> <p>SIP development modeling: As specified by EPA and typically conducted by the MPCA. Most SIP-development modeling requires input data from selected facilities. Facilities identified as having a modeled noncompliance are notified by the MPCA and may be required to do additional modeling.</p>

## 2.1.1 PSD air quality permits

The PSD program is a federal air quality-permitting program authorized under the CAA that applies to new major stationary sources and to major modifications to major stationary sources located in areas that are either in attainment or considered unclassifiable with the NAAQS. In the event that if a source located in an area designated as non-attainment seeks a federal air permit under this program, a nonattainment New Source Review (NSR) permit is required. In either situation Under PSD, air dispersion modeling is used to evaluate potential air quality impacts (e.g., compliance with the NAAQS), along with an analysis of additional impacts analysis (e.g., impacts to ground, vegetation, visibility, etc.), as a result of caused by air emissions from a facility the planned project.

Determining whether a project is subject to PSD or NSR is based on the potential or anticipatedprojected annual emissions of PSD pollutants. This information can be found through the EPA's PSD program website page The MPCA's permit application forms and EPA's PSD program website, provide guidance to assist in this determination. For example, ~~the~~ the construction of a new facility that triggers the PSD program for a criteria pollutant would likely need to model to demonstrate compliance with the applicable NAAQS and increment. Similarly, ~~if a facility were~~ a major stationary source under the PSD program that proposes, a major modification would require modeling of each pollutant with an anticipated emission increase that exceeds its associated Significant Emission Rate (SER) provided in Table 4Table 4. Note that the PSD program identifies NO<sub>x</sub> and SO<sub>2</sub> as precursors to PM<sub>2.5</sub> and NO<sub>x</sub> and volatile organic compounds (VOCs) as precursors to ozone, and therefore ~~a~~ An emission increase greater than the SER of at least one ~~or more~~ precursor pollutants ~~would~~ requires an air quality analysis of the secondarily-formed pollutant (PM<sub>2.5</sub> and/or ozone). Section 3.13.5 discusses the demonstration tools available to evaluate the impact of precursor emissions on secondarily-formed PM<sub>2.5</sub> and ozone concentrations.

**Table 4. PSD significant emission rates (SERs).**

Pollutant	SER (tons/year)
Carbon Monoxide (CO)	100
Nitrogen Oxides (NO <sub>x</sub> )	40
Sulfur Dioxide (SO <sub>2</sub> )	40
Particulate Matter less than 10 microns (PM <sub>10</sub> )	15
Particulate Matter less than 2.5 microns	10 (Direct PM <sub>2.5</sub> ) Also 40 (NO <sub>x</sub> ) or 40 (SO <sub>2</sub> ) per 40 CFR 52.21(b)(23)(i)
Ozone (O <sub>3</sub> )	40 (VOCs) or 40 (NO <sub>x</sub> ) per 40 CFR 52.21(b)(23)(i). Direct emissions of ozone <u>of any amount</u> do not trigger PSD review.
Lead (Pb)	0.6

The PSD program manages air quality, in part, through a unique concept known as a PSD Increment (see Section 3.9.2.1). A PSD Increment reflects the amount of air pollution that is allowed to increase in a given geographic area. The rationale for this approach is a means to keep areas where air is “clean” (or below the NAAQS) from significantly deteriorating.

A PSD Increment is location-specific, meaning that each PSD increment analysis reflects the pollutant-specific ambient air quality baseline conditions of the county where the project is located. The pollutant-specific ambient air quality baseline concentration is determined at the time the first complete PSD permit application for an area (in this case, a county) is submitted to the MPCA. In Minnesota, the area of interest is the county. Federal regulations determine the pollutant-specific PSD increment value. Air quality dispersion modeling is used to examine potential air quality compliance issues with the PSD Increment. Tribal lands within the state of Minnesota work directly with the EPA for PSD increment analyses. See Section 3.10.2.1 for further details on baseline concentrations and increment modeling.

## 2.1.2 Non-PSD air quality permits

Non-PSD air quality permits include Part 70 Federal Permits, General Permits (i.e., Part 70 manufacturing nonmetallic processing etc.) State Only Permits, and Minor Source Permits (e.g., Registration series permits). The MPCA Air Quality Permitting Program determines when modeling is needed for a permit and is determined on a case-by-case basis. The MPCA Air Quality Permitting Program considers, at a minimum, the following factors when determining if NAAQS modeling may be needed:

1. Triggering PSD, nonattainment area NSR, or environmental review
2. The installation of a non-emergency internal combustion engine
3. The facility is located in a nonattainment or maintenance area for a related pollutant
4. Existing modeling that indicates a potential threat to the NAAQS
5. An increase in emissions of a related pollutant
6. Public interest (including Environmental Justice)
7. Local monitoring data indicating threats to or exceedances of an ambient air quality standard

Though these factors are broad, owners or operators may better predict when modeling may be necessary through proactive work with MPCA permitting staff in advance of potential investment in new facilities or modifications. For example, owners or operators may want to review existing modeling results for their own and nearby facilities. Air quality monitoring or modeling results approaching the numeric value of the NAAQS, PSD increments, or visibility thresholds are more likely to lead to modeling requests. Owners or operators may also work cooperatively with their local communities to improve residents' understanding of their current operations and plans. Ideally, this type of cooperation would allow resolution of local concerns.

Questions pertaining to permit-related modeling decisions should be directed to the Air Quality Permit Section at [AQPS.Modeling.MPCA@state.mn.us](mailto:AQPS.Modeling.MPCA@state.mn.us).

### 2.1.3 Environmental review

Air dispersion modeling is typically part of an air quality permit process; however, as noted above in the **When to model** section, there are other MPCA programs that may rely on air dispersion modeling. The MPCA's **Environmental Review Unit**, a non-permitting and non-regulatory program, frequently requests air quality dispersion modeling to analyze potential air quality impacts, as part of an Environmental Assessment Worksheet (EAW) or an Environmental Impact Statement (EIS). Within the Environmental Review Program, air quality modeling may include a broader cumulative effects modeling or air deposition analysis as well as an **air toxic analysis**.

Environmental review modeling decisions are determined on a case-by-case basis in consultation with the MPCA Environmental Review Project Manager and MPCA Air Quality staff. Environmental Review programs on tribal lands within the state of Minnesota are handled directly between the tribe and the EPA through the National Environmental Policy Act. If you are planning a project that is subject to environmental review, the MPCA encourages you to contact the Environmental Review Unit in advance of preparing your assessment documents. For more information on air quality assessment and environmental review, please see the MPCA [website](#). The Environmental Review Unit frequently manages EAWs for livestock operations, including the related air quality analysis. Please note that the modeling practices presented in this Manual are applied to livestock operation EAWs in a consistent manner. Alternative air quality screening approaches must function within the consistency of practice presented in this Manual.

Additionally, the air dispersion modeling information needed in an EAW may be different from an EIS and reflects the different roles of each document. An EAW is a screening document designed to reveal if there are any potentially significant and irreversible direct, indirect, or cumulative environmental effects that would require further analysis through an EIS. The air quality modeling demonstration in an EAW is often similar (if not the same) as that submitted for a PSD or NAAQS modeling demonstration, though environmental review may require additional analysis on a case-by-case basis. As such, an EAW air dispersion modeling analysis must account for any applicable ambient air quality standards or inhalation health risk values in order to determine if there are any modeled exceedances or potentially adverse environmental impacts.

An EIS may contain a more thorough environmental analysis in comparison to the content of an EAW. The EIS air quality modeling begins with the information developed from an EAW; however, the EAW provides foundational air quality impact information, considered during the public scoping process, which may expand the air quality analysis to include such topics as air pollutant deposition, refined inhalation health risk analysis, etc. There may be some overlap between the air quality modeling conducted for an EAW, EIS, and an air quality permit, depending upon the air quality assessment objectives; however, this is project specific. Air quality modeling for an EAW and EIS should not be assumed to fulfill the air quality permitting expectations.

## 2.1.4 State implementation plans

A SIP, created through Title I, Section 110 of the CAA, is a document adopted by a state and approved by the EPA. The SIP is legally binding under both state and federal law and may be enforced by authorities at either level. It is important to note that tribal lands within Minnesota are not bound by a SIP, rather, tribes work directly with EPA to demonstrate compliance with federal regulations. The SIP document includes the regulations and other administrative approaches for meeting federal air quality standards and CAA requirements.

The SIP focuses on regulation of the criteria air pollutants, which are those pollutants for which EPA has set a NAAQS to protect human health. Air toxics, or hazardous air pollutants, are regulated under other portions of the CAA and are not included in the SIP. Air quality dispersion modeling for a SIP, if required, falls into two categories: **attainment demonstrations** and **permit modeling**. Each approach is unique and presents air quality dispersion modeling as a means to evaluate compliance with the applicable NAAQS pollutant.

The development of an **attainment demonstration** is fairly straightforward. When the MPCA submits a SIP to EPA, one of the components of the SIP submittal may be air dispersion modeling that reflects the geographic area of interest. Air dispersion modeling conducted for either a revision to an existing plan or for a SIP submittal for attainment demonstration will typically follow NAAQS modeling methodologies.

That is, modeling that considers the impact of the facility, nearby sources, and background concentrations. However, additional details related to the SIP modeling may be outlined in EPA guidance documents and therefore should be considered.

Under certain circumstances, **permit modeling** and the SIP intersect. Individual facilities within a SIP maintenance area that make modifications to the facility or increase emissions may be required to submit air dispersion modeling reflecting the changes to ensure compliance with existing SIP conditions. Air dispersion modeling conducted for facilities within a SIP maintenance area should follow the air dispersion modeling process and procedures outlined in **Section 3: How to model**.

More detailed information is available on MPCA's Minnesota [SIP webpage](#).

# Section 3.0: How to model

The MPCA Risk Evaluation and Air Modeling (REAM) unit follows the applicable MPCA and EPA regulations and guidance when developing or reviewing ambient air quality model analyses for air quality permitting, environmental review, and air policy needs. This Manual describes specific practices that facilitate the efficient review and approval of a modeling protocol and report, including direction on the development of various non-emission inputs for the model. In addition, this section also describes conditions that are unique to permitting under the CAA such as SIP modeling and unique PSD requirements.

## 3.1 Modeling basics

Regulatory air quality dispersion models generate unbiased modeled ambient air quality concentrations. These modeled concentrations are generated using existing or proposed facility operational data along with mathematical formulas that represent atmospheric processes, terrain characteristics, building parameters, and pollutant-specific emission data. The development of a regulatory air quality modeling demonstration involves permitted allowable emissions instead of actual emissions, along with multiple years of meteorological data. Since permitted allowable emissions are often based on a facility's maximum emission potential, rather than actual emissions, air quality dispersion models generate possible or potential ambient air quality estimates that can be greater than measured ambient air quality concentrations. This means that a predicted ambient air quality standard violation (or related guideline value exceedance) generated through air modeling may indicate the likelihood of an actual ambient air quality issue; however, it should not be assumed that a modeled ambient air quality standard violation or guideline value exceedance corresponds to a real-world air quality pollution condition. Modeled data is used to prevent future air quality exceedances as well as air shed management. Modeled ambient air quality standard violations or guideline value exceedances can inform an MPCA decision to modify allowable emission rates, stack parameters, operating conditions, or to require SIP review for criteria pollutants. For additional discussion of model accuracy and uncertainty, please see **Section 9.0 of 40 CFR § 51, Appendix W**.

### 3.1.1 Preferred models

The MPCA follows the EPA's *Guideline on Air Quality Models* codified in 40 CFR § 51, Appendix W, to determine acceptable models and approaches for use in air quality dispersion modeling and impact analyses. As new models are accepted by the EPA, the *Guideline on Air Quality Models* is updated.

Several refined dispersion models can be used to predict ambient air concentrations from an emission source. The EPA has preferred dispersion models for evaluating pollutant dispersion within 50 km of the source (i.e., **Near-field**) and for pollutant transport greater than 50 km (i.e., **Far-field**). **Near-field** modeling is the most common air dispersion modeling and is used to evaluate a variety of PSD and NAAQS issues. **Far-field** dispersion modeling is typically related to a **Class I** analysis and may or may not include chemical transformation.

Currently, AERMOD, CTDMPlus, and OCD, are the EPA preferred refined air quality models for estimating impacts at receptors located in simple or complex terrain. AERMOD, a steady state, multiple-source, Gaussian air quality dispersion model, is the preferred MPCA air quality model, applied as a **Near-field** dispersion model for Class II and increment modeling simulations. The AERMOD modeling system can be downloaded from EPA's Support Center for Regulatory Air Models (SCRAM) [website](#). The MPCA reserves its right as a permitting authority to review and approve alternative models to AERMOD, including other EPA-preferred models, based on model performance and whether the intended use of the alternative model is appropriate for the demonstration needs. The rationale for this position rests on MPCA experience with AERMOD, along with additional support provided by peer-reviewed AERMOD performance literature, case studies, and AERMOD demonstrations provided by EPA. AERMOD has demonstrated superior predictive performance in comparison to other modeling platforms.

While no longer on the list of preferred air quality models, CALPUFF can be applied on scales of tens to hundreds of kilometers and reflects use in **Far-field** analysis as part of a **Class I** evaluation. It includes algorithms for sub-grid scale effects (such as terrain impingement), as well as longer-range effects (such as pollutant removal due to wet scavenging and dry deposition, chemical transformation, and visibility effects

of particulate matter concentrations). The *User's Guide for the CALPUFF Dispersion Model*<sup>5</sup> provides more information on the CALPUFF model. CALPUFF use in Minnesota is restricted to Class I evaluations, on a case-by-case basis, with approvals from the MPCA as well as EPA and/or the Federal land managers.

Under most circumstances, alternative model usage, whether for Class II or Class I demonstrations, will require approval by both the MPCA and EPA Region V. More detailed information regarding preferred and alternative dispersion modeling, including models available for download, is available at EPA's SCRAM [website](#).

### 3.1.2 Basic model inputs

The MPCA uses EPA's AERMOD ambient air quality dispersion model for both screening and refined Class II and increment air quality dispersion modeling demonstrations. Modeling demonstrations require specific inputs that reflect facility operations as well as sources in the nearby area. These inputs include the types of emissions, emission rates, and related pollutant release characteristics. Buildings and related structures are also included as inputs as well as discrete points where ambient air quality concentrations are predicted known as receptors. Terrain data and meteorological information are also included as part of the modeling demonstration and should reflect the spatial setting of the actual project under review.

The following is a description of typical model input variables along with a description of MPCA expectations for review and approval. Please note that the descriptions presented below correlate to the MPCA modeling protocol e-Service form and AQDM-02 spreadsheet (see **Section 4.0**).

### 3.1.3 Facility and source identifiers

Facilities should use the AQDM-02 Protocol Spreadsheet [and the Worksheet for Class II Increment Modeling \(if applicable\)](#) to provide relevant source information such as stack parameters, emission rates, and emission factors. All sections of the AQDM-02 [or Worksheet](#) must be completed before the MPCA can review and approve an air quality modeling protocol. Facilities may add additional tabs/worksheets to the workbook to provide more detailed calculations. When filling out the AQDM-02 [or Worksheet](#) please use facility and source identifiers that are consistent with the following criteria:

- The three-character Facility Abbreviation Code (FAC) used in the facility air permit or of the facility's/projects choosing.
- Standardized AERMOD source IDs and corresponding BPIP source IDs. Stack/vent identifiers ([FAC]SVnnn) should match those used in the facility air permit. See the Source Characterization section for details.
- Non-stack/vent sources (e.g., fugitive emissions from roads, storage piles, and material handling) may use other user-specified identifiers (e.g., [FAC]FSnnn). See the Source Characterization section for details.

When filling out the e-Service protocol form:

- Model IDs should match the AERMOD source IDs in the AQDM-02 [/Worksheet](#).
- Subject item IDs will be assigned automatically to existing sources.
- For new sources, please enter the AERMOD source ID in the Subject Item ID field.

<sup>5</sup> [http://www.src.com/calpuff/download/CALPUFF\\_UsersGuide.pdf](http://www.src.com/calpuff/download/CALPUFF_UsersGuide.pdf) [Retrieved May 30, 2019]

## 3.2 Meteorology

The current MPCA pre-processed meteorological data sets were developed with AERMET version 21112, as well as the EPA pre-processor AERMINUTE version 15272 with the use of EPA's surface characteristics tool, AERSURFACE version 20060. MPCA pre-processed meteorological data sets developed with the most recent versions of AERMET, AERMINUTE, and AERSURFACE for the years 2016-2020 – available [online](#). The MPCA-processed data sets include adjustments for measured daily snow cover and soil moisture as well as seasonal determinations. Previous versions of meteorological data sets are no longer available online, but can be provided upon request by contacting the Air Modeling Unit at, email: [airmodeling.pca@state.mn.us](mailto:airmodeling.pca@state.mn.us).

Because of the Appendix W release in December of 2016 where the adjusted surface friction velocity (ADJ\_U\*) approach has been approved by the EPA for use as a regulatory modeling default, MPCA has processed AERMET data using ADJ\_U\* as the default data set. For projects utilizing site-specific meteorological data collected at multiple levels, the EPA has determined that the ADJ\_U\* option *should not* be used in AERMET in combination with use of measured turbulence data. The rationale for this decision is based on the observed tendency for model under predictions resulting from the combined influences of the ADJ\_U\* and the turbulence parameters within the current model formulation.<sup>6</sup>

Please note that the MPCA can process an AERMET data set of sites using non-ADJ\_U\* upon request.

There are approximately 80 meteorological surface observing stations in the state of Minnesota, consisting of Automated Surface Observing System and Automated Weather Observing System sites. The overwhelming majority of sites are located on airport property and follow siting guidelines laid out in the Federal Meteorological Handbook. During the meteorological processing, over 100 stations from Minnesota, Iowa, Wisconsin, South Dakota, and North Dakota were examined using preliminary processing to determine usability for modeling purposes. Usability was based on the amount of missing and calm hours per year for each surface station for the years 2016 – 2020. From the original list of surface stations, 46 stations were then further processed to include site-specific daily snow cover and soil moisture conditions and corrected locational data. Currently, there are over 20 surface stations that are suitable for use in current modeling demonstrations. This information is available on our [website](#).

Selecting the appropriate meteorological data for a modeling demonstration is a critical factor in the representation of the project. The MPCA follows the EPA's guidance on the selection of meteorological data sets for air quality modeling demonstrations. Specifically, 40 CFR pt. 51, Appendix W, 8.4.1.b. states that the following should be considered when choosing representative meteorological data:

- The proximity of the meteorological monitoring site to the area under consideration
- The complexity of the terrain
- The exposure of the meteorological monitoring site
- The period of time during which data are collected

Appendix A of Appendix W, Section A.1(b)(2)(i): "Data used as input to AERMET should possess an adequate degree of representativeness to ensure that the wind, temperature and turbulence profiles derived by AERMOD are both laterally and vertically representative of the source impact area." It also states, "The values for surface roughness, Bowen ratio, and albedo should reflect the surface characteristics in the vicinity of the meteorological tower or representative grid cell when using prognostic data and should be adequately representative of the modeling domain."

To aid in meteorological site selection, the MPCA has created a free online meteorological site selection tool (MSST). This tool was created to produce an objective analysis of the representativeness measures

---

<sup>6</sup> See 86 FR 5187

discussed above. In particular, the MSST analyzes proximity, terrain, surface characteristics, urban vs. rural and snow cover to determine meteorological similarity between a selected facility and surrounding meteorological sites. The MSST is currently in the beta stage of development, so facilities are encouraged to run, evaluate and [provide feedback](#) on the usefulness of the tool. If a user disagrees with the site selected by the MSST, a different site can be selected using the justification provided by the tool. A link to the MSST as well as a technical support document describing the design of the tool and a user's guide are located in the [meteorological data](#) section of MPCA's air modeling webpage.

If the MSST is used to select a meteorological site, please enter "MSST selected site" in the "Supporting Information for Selected Station" text box in the e-Service modeling protocol. Then simply attach the CSV formatted version MSST output of the "Final Meteorological Sites" layer, under the "additional justification" attachment type in e-Services. If selecting a site other than the site selected by the MSST, provide the reasoning in the "Supporting Information for Selected Station" and "Additional Information" text boxes in the air modeling e-Service. For any questions regarding the choice of a meteorological data set(s) for your source, please contact MPCA air dispersion modeling staff to discuss. *Note: Facilities wishing to use on-site or other meteorological data should first submit a written request for MPCA review and approval of the equipment siting, data quality assurance and control plan, and meteorological data.* The MPCA reserves the right to reject on-site meteorological data that does not include siting details and related quality assurance and control information.

### 3.3 Horizontal coordinate system

Horizontal locations of receptors, sources, and buildings in AERMOD are defined on an (X, Y) coordinate system in units of meters. The terrain processor, AERMAP, used to estimate elevations of receptors and sources relies on the Universal Transverse Mercator (UTM) projection to identify these locations. Therefore, users must utilize the UTM coordinate system when creating receptor grids and defining locations of sources at a facility. The UTM coordinate system is one method of projecting horizontal coordinates of the Earth's surface on a flat plane, simplifying distance calculations between two points. The UTM system is comprised of zones numbered 1 to 60 starting from the International Dateline meridian and incrementing eastward at 6-degree longitudinal intervals. Each zone has its own set of (X, Y) coordinates. *While the state of Minnesota is located within UTM zones 14, 15, and 16, the state geospatial standard is standard practice in Minnesota to use UTM zone 15 extended (15E) across the entire state in order to maintain a single coordinate system.*<sup>7</sup>

### 3.4 Terrain data

AERMOD is applicable in simple and complex terrain environments. The model requires base elevations for each receptor and emission source, along with hill height scale values at each receptor, in order to simulate the influence of terrain features on plume dispersion. The AERMAP terrain processor may be used to estimate the base elevation and hill height scales at each receptors, along with the base elevations for each source. Note that AERMAP may also be used to estimate elevations for building structures processed in the BPIP processor.

The preferred terrain data for processing with AERMAP are the National Elevation Dataset (NED), a seamless bare earth elevation layer of The National Map (<http://nationalmap.gov>). This dataset provides seamless coverage across Minnesota and are available in 1 arc-second (~30 meters) and 1/3 arc-second (~10 meters) resolution. While 1/3 arc-second resolution is preferred for estimating receptor and source elevations, file

<sup>7</sup>*Minnesota geospatial standards: [https://www.mngeo.state.mn.us/committee/standards/standards\\_adopted-devel.html](https://www.mngeo.state.mn.us/committee/standards/standards_adopted-devel.html)*

sizes can become very large for terrain files used for a default modeling domain. Therefore, 1 arc-second resolution is acceptable and should be sufficient to resolve terrain features in Minnesota.

Terrain data have traditionally been obtained from the Multi-Resolution Land Cover Characteristics Consortium website (<https://www.mrlc.gov/>), however, since late-2018 this website no longer provides NED terrain data. An alternate source of data is the USGS National Map website (<https://viewer.nationalmap.gov/basic/>). However, the data provided by this site are only available in ArcGrid, while AERMAP requires NED terrain data in GeoTIFF format. Format conversion is required prior to running AERMAP. Published third-party instructions for converting files from ArcGrid to GeoTIFF format can be found [here](#) and [here](#). ArcMap may also be used for converting terrain files to GeoTIFF format, by importing the terrain data in ArcGrid format as a layer and then exporting the as a TIFF file. The MPCA has not yet evaluated these methods. It is encouraged to provide documentation of the terrain data acquisition and processing steps to aid the assigned modeler in the review of the protocol.

The AERMAP input and output files and terrain data used to estimate base elevations and hill height scales should be submitted with the modeling protocol. The terrain data processed at this stage is the geospatial dataset of record for the project. Elevation and hill height scale values should be preserved throughout all stages of the modeling demonstration. For example, elevations and hill height scales should be maintained for the receptors retained for a Cumulative Impact Analysis (CIA). Section 3.7 contains information on the various stages of a modeling demonstration.

Horizontal datums are projections of latitude and longitude based on a particular defined Earth shape, or spheroid. The NED data from USGS are in latitude, longitude coordinates that use the NAD83 datum. Therefore, it is preferred that receptor and source locations in UTM coordinates are derived using the NAD83 datum. However, AERMAP was designed to account for discrepancies in datums between the terrain data coordinate system and the coordinate system used to develop the receptor and source locations. Failing to account for differences in datums may result in errors in calculated elevations and hill height scales. Use the ANCHORXY keyword in the control pathway of the AERMAP input file to specify the horizontal datum used for the receptor and source locations if it differs from the datum used for the terrain data. However, the WGS84 datum is based on an ellipsoid considered to be the same as that used for the NAD83 datum. Therefore, the WGS84 datum may be considered equivalent to the NAD83 datum. See the AERMAP User's Guide for more details.

## 3.5 Buildings and structures

Airflow over and around structures significantly affects the dispersion of plumes from point sources. Modeling of point sources with stack heights that are less than good engineering practice (GEP) stack height should consider the impacts associated with building wake effects (also referred to as building downwash). GEP stack height is the height needed for a stack to avoid excessive ambient concentrations due to downwash. Downwash impacts should also be considered from stacks that are greater than GEP. As a working practice, excessive downwash is considered by EPA to be a 40% increase in concentrations in a modeled scenario modeled with and without the buildings in question. In the GEP definition, note that  $H_g$  = GEP stack height,  $H_b$  = height of nearby structure, and  $L$  = lesser dimension (height or projected width) of nearby structure. GEP stack height is calculated as the highest of the following four numbers:

- 213.25 feet (65 meters)
- For stacks in existence on January 12, 1979, and for which the owner or operator has obtained all applicable preconstruction permit approvals required under 40 CFR 51 and 52,  $H_g = 2.5H_b$ .
- For all other stacks,  $H_g = H_b + 1.5L$

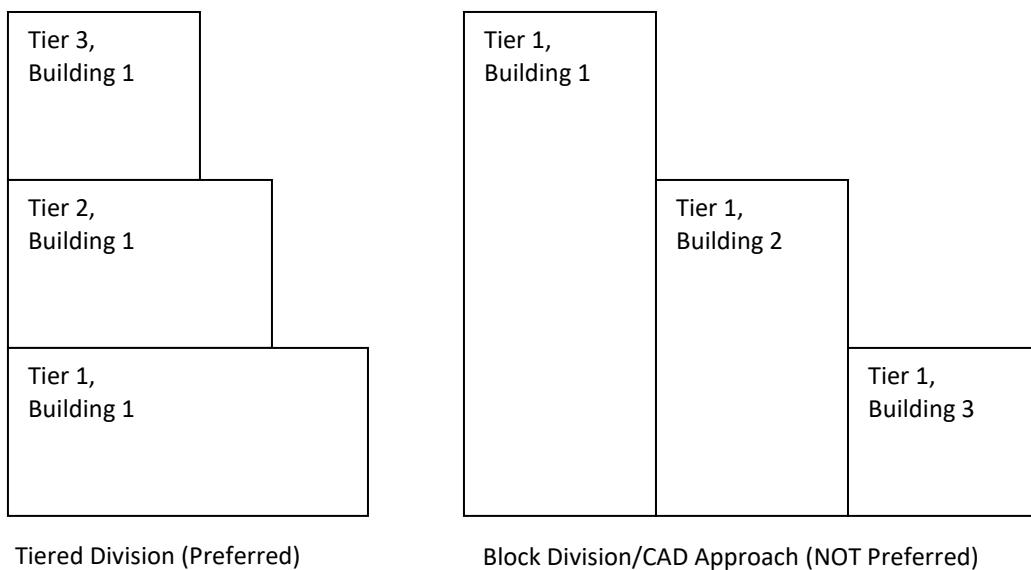
- The height demonstrated by a fluid model or field study approved by the reviewing agency, which ensures that the emissions from a stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash, wakes, or eddy effects created by the source itself, nearby structures, or nearby terrain obstacles

When calculating pollutant impacts, AERMOD has the capability to account for building downwash produced by airflow over and around structures. In order to do so, the model requires special input data known as direction-specific building dimensions for all stacks influenced by nearby structures. Methods and procedures to determine the appropriate entries to account for downwash are discussed in EPA's *User's Guide to the Building Profile Input Program* (EPA, 1995).

Due to the complexity of the GEP guidance, the EPA has developed a computer program that calculates the downwash parameters for AERMOD. The Building Parameter Input Program Prime (BPIPPRM) must be used for downwash analyses for input to AERMOD. Many AERMOD vendors include BPIPPRM within their software, which is the same as BPIP but includes an algorithm for calculating downwash values for input into the PRIME algorithm contained in AERMOD. If you are not using third-party AERMOD software, please use the most current version of BPIPPRM to determine downwash parameters. Currently, BPIPPRM can be downloaded from EPA's SCRAM [website](#).

If an AERMOD modeling demonstration requires tiered structures, the way the structures are created can have unrealistic impacts on the model outcomes. Typically, when a multi-tiered building is offered in an air quality dispersion modeling exercise, the tiers are stacked as presented in Figure 1. The “tiered division” presented below left is the MPCA preferred building submittal. A “blocked division” or computer-aided drafting (CAD) approach (right) is not preferred.

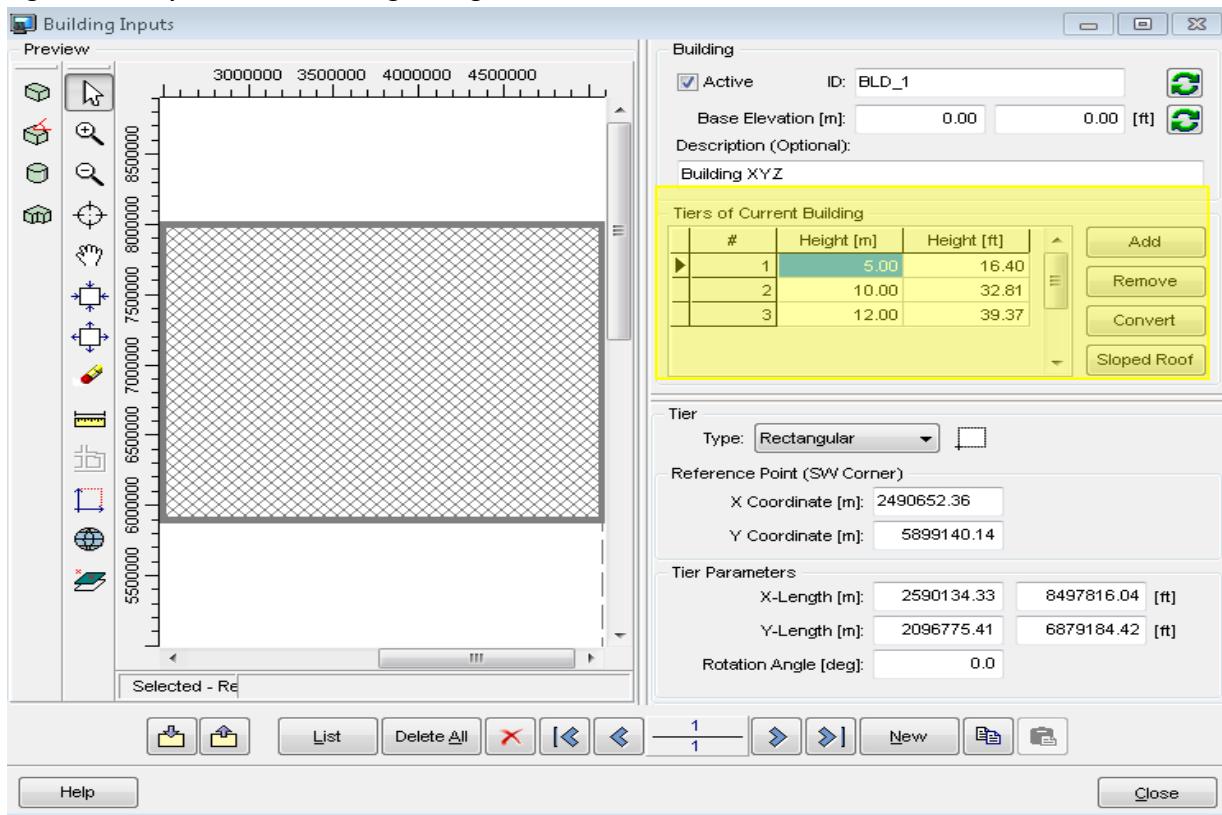
**Figure 1. Building layout.**



When creating a building input file for BPIP-PRIME using the preferred “tiered division” approach for a tiered structure, a single building name and terrain elevation will be assigned. Please note that these default assignments can be changed to reflect actual building names. Each tier, as part of the single building, will have its own height above ground and set of spatial coordinates. For visualization purposes, a three-tiered building using a third-party AERMOD interface would be defined as BLD\_1 Tier 1, Tier 2, Tier 3, etc. (see

Figure 2 below).<sup>8</sup> Using the “blocked division” approach (See Figure 1, above) will result in three separate buildings each with one tier, BLD\_1 Tier 1, BLD\_2 Tier 1, BLD\_3 Tier 1, etc.

**Figure 2. Example of tiered building settings in AERMOD.**



### 3.6 Source characterization and location

Regulatory modeling should reflect the actual characteristics and location, including elevation, of the proposed or existing emission sources. AERMOD provides several different source characterization options to simulate most emission source releases. The MPCA suggests using the most explicit source characterization to complete your modeling demonstration. Base elevation data, a critical input for all emission source characterizations, is generated using AERMAP and is applied to receptors and emission sources through AERMOD. As a general practice, base elevation data (and hill height scale) is created by AERMAP using readily available terrain data (See Section 3.4); however, site-specific elevations based on survey data may be used in lieu of published terrain data in some situations. Manual entries for a source or receptor elevation would be applied in AERMOD’s Source pathway in the AERMOD input file. If site-specific elevation data is proposed for a modeling demonstration, details of the survey information should be provided to review and validate the proposed values. Survey-based elevation data can be submitted with the modeling protocol if this option is selected.

<sup>8</sup> The MPCA recognizes that not all air quality modelers use third-party software to complete their modeling demonstrations. The third-party interface example provided above in no way explicitly or implicitly endorses or encourages third-party AERMOD applications. The example is intended as instructive information on expected building development for an air quality modeling demonstration rather than an expectation that all modeling demonstrations are supported by a third-party AERMOD support software.

The following tables offer a description of AERMOD source characterization input parameters and relevant details reviewed by MPCA. Please use the MPCA AQDM-02 [and Worksheet for Class II Increment \(if applicable\)](#) modeling protocol spreadsheet to complete this phase of your modeling demonstration.

### 3.6.1 Point sources

The point source is the most common type of source used to represent stacks, vents, and related emission sources. The point source approach is a well-defined means of representing the release of pollutants into the ambient air. Several factors should be considered in the development of a point source. At a minimum, the following parameters in [Table 5](#) are required to model a point source:

Format

**Table 5. Point source input parameters.**

Source Identification	The MPCA employs the following designation for identification of point source emissions: <b>ABC</b> <b>S</b> <b>V</b> <b>001</b> . The <b>ABC</b> designation represents the three-letter code of the company as used in the facility air permit or of the facility's/project's choosing. The <b>SV</b> letters designate this source as a Stack/Vent point source. The three-digit number after the letters ( <b>001</b> ) represents the number of the stack for the company. This number must correspond to the MPCA subject item (SI) identification (ID) number in the air permit and related data management system. Deviations from this approach, particularly with respect to stack/vent number, may cause delays in review and approval.
Release Type	AERMOD provides for the ability to model a point source with different release characteristics. These characteristics reflect an emission release from a point source that is either <b>vertical</b> , <b>horizontal</b> , or <b>capped</b> . If a vertical release is designated, no further work is needed beyond the basic characterization presented here. If a point source features a horizontal (POINTHOR) or capped (POINTCAP) release, please note this in the appropriate column of the AQDM-02 <a href="#">and Worksheet for Class II Increment (if applicable)</a> .
Stack Location	Stack/vent location is a critical to the point source characterization and should be based on the most accurate geospatial information available. This information would include three measures: the <b>X coordinate</b> (in meters); <b>Y coordinate</b> (in meters); and the <b>base elevation</b> (also in meters). Location data should follow the UTM system in Zone 15 (extended) projection in the NAD 1983 series, consistent with state of Minnesota geostatistical data standards.
Release Height	The release height represents the height of the stack above the base elevation in meters.
Emission Rate	The emission rate is pollutant specific and represents the various processes that are directed to and released from the point source stack/vent. The emission rate should be presented in units of grams per second (g/s). AERMOD is able to use the emission rate value in calculating both concentration and deposition values.
Inside Stack Diameter	This value represents the interior or inside diameter of the stack at the point of release. It should be presented in meters. The inside stack diameter is assumed to be a round stack/vent release. Facilities that have square or rectangular stack/vent releases should convert their dimensions to an equivalent circular diameter measure. This practice conserves the area of the stack opening and is relevant to estimate the exit velocity. The MPCA prefers the conversion approach, provided below: $D_e = \left( \frac{4LW}{\pi} \right)^{1/2}$ Where "L" is the length of the square or rectangular stack opening, and "W" is the width. <sup>9</sup>

<sup>9</sup> Lakes Environmental Software. Volume 8, Issue 11. Monthly Modeling Tip: Representing Rectangular Stacks. [online] Available at: <https://www.weblakes.com/Newsletter/2007/Nov2007.html> [Retrieved June 17, 2019]

Gas Exit Velocity	This input represents the exit velocity of the flue gas and is measured in units of m/s.
Gas Exit Flow Rate	This value represents the volumetric rate at which gas exits the stack, expressed in units of m <sup>3</sup> /s.
Exhaust Temperature	The AERMOD exhaust temperature parameter is in units of Kelvin (K). AERMOD provides for the ability to designate whether the stack temperature is a <b>fixed</b> value, or whether it is <b>ambient</b> or <b>above ambient</b> . The <b>fixed</b> value allows the temperature value to remain the same through the modeled simulation. This is the most common approach. Meteorology has no impact on this value. With <b>ambient</b> temperatures, meteorology is the driving factor. In these situations, a value of "0" should be provided. For temperatures <b>above ambient</b> , meteorology still plays a role; a negative value is entered (for a constant Delta T) and is added to the meteorological value to determine the exit temperature.

### 3.6.2 Volume sources

A volume source is a three-dimensional representation of an air emission source. Volume sources have a variety of applications in dispersion modeling and are typically, created as elevated and surface-based sources. As elevated sources at the facility level, they characterize emission releases from building roof vents, multiple vents, conveyor belts, roads, drop points from loaders, and material storage piles. As a surface-based representation, they characterize fugitive emissions from roads (paved or unpaved), working faces of sand or gravel operations, surface-based overburden blasting at mines and quarries, and related surfaces. **Please note:** MPCA expects paved roads to be included in the list of volume sources to be modeled, consistent with the June 15, 2021 Interim Work Practice Memorandum. Base the emission rates on calculations using the most appropriate emission factor and averaging times. The facility may apply control efficiencies based on control strategies outlined in a federally enforceable fugitive dust control plan. Please refer to the Paved Roads Interim Work Practice Memorandum at the MPCA Air Modeling [website](#) for questions, comments, or request for additional assistance.

**Table 6. Volume source input parameters.**

Source Identification	The MPCA has designated two approaches for source identification nomenclature. For volume source characterization that reflects a facility, the volume source should be identified as <b>[FAC]VL001</b> . The <b>FAC</b> designation reflects the three-letter company code consistent with the approach used in point source identification. The <b>VL</b> represents the volume source characterization. The <b>001</b> aligns to the numbering of the volume source. For <b>roads</b> or related <b>linear or surface-based emission source</b> in sequence or related arrangements, the designation is slightly different. The source identification should be <b>[FAC]VL001</b> , whereby the FAC is user-defined. The remaining portion of the source identifier functions in the same manner as the facility-based volume source identifier.																
Spatial Features	Spatial features for a volume source delineate an area of emission activity rather than a specific point of emission; however, the representation of the volume source emission on a Cartesian grid is represented as a point. The underlying assumption for this approach is the point representation of the volume source center. Spatial representation includes three measures: the <i>X coordinate</i> (in meters); <i>Y coordinate</i> (in meters); and the <i>base elevation</i> (also in meters). This is consistent with the manner in which point source locations are reported. Measures should be reported using the UTM system in Zone 15 (extended) in the NAD 1983 series, consistent with state of Minnesota geostatistical data standards.																
<b>Source Release Parameters</b>																	
Emission Rate	For modeling purposes, the pollutant-specific emission rate should be presented in units of grams per second (g/s). AERMOD is able to use the emission rate value to calculate both concentration and deposition values.																
Source Release Height Above Ground ( $H_e$ )	<p>As a general rule, the release height for a volume source is equal to one-half of the source height. When representing a building or related structure, this is a reasonable approach; however, when representing a road or other surface-based emission source, the following approach should be used:</p> $h_e = \text{Vehicle Height} * 1.7/2$ <p>Once the source release height has been determined, it should be added to the AQDM-02 <a href="#">and Worksheet for Class II Increment (if applicable)</a> in meters.</p>																
Initial Lateral Dimension of the Volume ( $\Sigma_{yo}$ ), and the Initial Vertical Dimension of the Volume ( $\Sigma_{zo}$ ).	<p>Initial lateral and vertical dimensions (initial sigmas) are based on the geometry and location of the source. They are determined by using the actual physical dimensions of the source of interest (i.e., actual height, actual width, and actual length). It is important to note that the base of a volume source must be a square. If the source cannot be characterized as square, then the source should be characterized as a series of adjacent volume sources. For blasting and detonations, EPA and MPCA “best practices” should be considered. The following procedures for estimating the initial lateral dimension (<math>\sigma_{yo}</math>) and the initial vertical dimension (<math>\sigma_{zo}</math>) for other selected sources are provided below.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Initial Lateral Dimension</th> <th style="text-align: left;">Procedure</th> </tr> </thead> <tbody> <tr> <td>Single Volume Source</td> <td><math>\sigma_{yo} = \text{side length}/4.3</math></td> </tr> <tr> <td>Line Source Represented by Adjacent Volume Sources</td> <td><math>\sigma_{yo} = \text{side length}/2.15</math></td> </tr> <tr> <td>Line Source Represented by Separated Volume Sources</td> <td><math>\sigma_{yo} = \text{center to center distance}/2.15</math></td> </tr> <thead> <tr> <th style="text-align: left;">Initial Vertical Dimension</th> <th style="text-align: left;">Procedure</th> </tr> </thead> <tbody> <tr> <td>Surface-Based Source (<math>h_e \sim 0</math>)</td> <td><math>\sigma_{zo} = \text{vertical dimension of source}/2.15</math></td> </tr> <tr> <td>Elevated Source (<math>h_e &gt; 0</math>) on or Adjacent to a Building</td> <td><math>\sigma_{zo} = \text{building height}/2.15</math></td> </tr> <tr> <td>Elevated Source (<math>h_e &gt; 0</math>) not on or Adjacent to a Building</td> <td><math>\sigma_{zo} = \text{vertical dimension of source}/4.3</math></td> </tr> </tbody> </tbody></table>	Initial Lateral Dimension	Procedure	Single Volume Source	$\sigma_{yo} = \text{side length}/4.3$	Line Source Represented by Adjacent Volume Sources	$\sigma_{yo} = \text{side length}/2.15$	Line Source Represented by Separated Volume Sources	$\sigma_{yo} = \text{center to center distance}/2.15$	Initial Vertical Dimension	Procedure	Surface-Based Source ( $h_e \sim 0$ )	$\sigma_{zo} = \text{vertical dimension of source}/2.15$	Elevated Source ( $h_e > 0$ ) on or Adjacent to a Building	$\sigma_{zo} = \text{building height}/2.15$	Elevated Source ( $h_e > 0$ ) not on or Adjacent to a Building	$\sigma_{zo} = \text{vertical dimension of source}/4.3$
Initial Lateral Dimension	Procedure																
Single Volume Source	$\sigma_{yo} = \text{side length}/4.3$																
Line Source Represented by Adjacent Volume Sources	$\sigma_{yo} = \text{side length}/2.15$																
Line Source Represented by Separated Volume Sources	$\sigma_{yo} = \text{center to center distance}/2.15$																
Initial Vertical Dimension	Procedure																
Surface-Based Source ( $h_e \sim 0$ )	$\sigma_{zo} = \text{vertical dimension of source}/2.15$																
Elevated Source ( $h_e > 0$ ) on or Adjacent to a Building	$\sigma_{zo} = \text{building height}/2.15$																
Elevated Source ( $h_e > 0$ ) not on or Adjacent to a Building	$\sigma_{zo} = \text{vertical dimension of source}/4.3$																

### 3.6.3 Area sources

Area sources characterize emissions from low level or ground level releases where there is no plume rise. Examples include storage piles, slag dumps, wastewater treatment ponds, earthen basins and lagoons. Under certain circumstances, an area source can also represent fugitive emissions. AERMOD assumes that the emitting surface area of an area source is a homogenous, uniform emitting surface with a release height above the ground at which wind speed is measured.

**Table 7. Area source input parameters (area surface, area poly, area line, area circle).**

Source Identification	The MPCA employs the following designation to identify area source emissions: <b>[FAC]AS001</b> . The <b>FAC</b> designation represents a user-defined code for the area source. The <b>AS</b> letters designate this source as an area source. The three-digit number after the letters ( <b>001</b> ) represents the number of the area source if there are multiple area sources in the modeling demonstration.
Orientation Angle from North (Degrees)	Area source orientation in AERMOD is to the north, unless otherwise specified via the <b>angle parameter</b> . If an <b>angle parameter</b> is not designated, AERMOD assumes a north-south and east-west orientation. The angle parameter that is used in AERMOD must be positive for clockwise rotation and negative for counterclockwise rotation. This is because <b>angle parameter</b> in AERMOD is applied relative to a north orientation. The <b>angle parameter</b> is defined as the north of the side that is clockwise from the vertex (X and Y coordinate location), i.e., the side with Y side length. Functionally, if the <b>angle parameter</b> is input and the value is different from 0.0 degrees, then the model will rotate the area clockwise around the vertex defined in the X coordinate and Y coordinate input fields.
Area Source Location	Three inputs are required to spatially plot an area source on a Cartesian grid: the <b>X-coordinate</b> ; the <b>Y-coordinate</b> and the <b>base elevation</b> . The <b>X coordinate</b> represents the vertex of the area source that occurs in the southwest quadrant of the source. The <b>Y coordinate</b> represents the vertex of the area source that occurs in the southwest quadrant of the source. Measures should be reported using the UTM system in Zone 15 (extended) in the NAD 1983 series, consistent with state of Minnesota geostatistical data standards. [The <b>base elevation</b> for the source is the elevation above mean sea level and should be submitted in meters].
Release Height	The <b>release height</b> represents the height above the base elevation where pollutants are entrained in the ambient air as a function of wind speed. This height is measured in meters and reflects several factors that are site and case specific.
Emission Rate	The <b>emission rate</b> for area sources is an emission rate per unit area entered in grams per second per square meter ( $g/(s \cdot m^2)$ ). The same emission rate is used for both concentration and deposition calculations.
Note on Mechanically-Generated Emissions and Area Sources	In the event that an area source is used to represent a mechanical emission (e.g., vehicles), the <b>initial vertical dimension of the plume</b> can be included as an input to the area source. This practice is consistent with and similar to the <b>initial vertical dimension</b> described in the volume source calculation illustrated above. The rationale for this approach is that the mechanically generated emissions may present turbulent mixing near the source that would present an initial depth. This approach would generally not be applicable for passive area source emissions. If this approach is employed, the value should be reported in meters.

When developing an area source, it is important to consider the **aspect ratio**, defined as the ratio of length to width. The **aspect ratio** should not exceed a 10:1 ratio. If this ratio is exceeded, the area source should be subdivided to meet the 100:1 aspect ratio limitation.

### 3.6.4 Flares

Flares are typically modeled similar to point sources and are considered a control device for a wide variety of sources. A flare source is characterized similar to a point source; however, it includes a buoyancy flux reduction relative to radiative heat loss. It also accounts for flame length in the estimation of plume height. Additionally, the heat release from the flare is utilized to calculate plume rise. AERMOD interfaces created by third party vendors typically automate the flare feature input. The following is a generic method that pertains to the “typical” flare used in an air modeling simulation. The method will be relatively accurate depending on flare parameters such as heat content, molecular weight of the fuel, and velocity of the uncombusted fuel/air mixture. Hence, this method may not be suitable for all conceivable situations. In this case, the applicant may submit a properly documented method for consideration by MPCA staff. Please

note that the EPA default approach as described in the AERSCREEN modeling guidance may also be used to represent flares. The MPCA-preferred flare characterization is described as follows:

**Table 8. Flare source input parameters.**

Source Identification	The MPCA employs the following designation for identification of flare source emissions: <b>[FAC]FL001</b> . The <b>FAC</b> designation represents the three-letter code of the company used in the facility air permit or of the facility's/projects choosing. The <b>FL</b> letters designate this source as a flare point source. The three-digit number after the letters ( <b>001</b> ) represents the number of the flare for the company. This number must correspond to the MPCA subject item (SI) identification (ID) number in the air permit and related data management system. Deviations from this approach, particularly with respect to flare number, may cause delays in review and approval.
Source Location	The location of the flare is a critical component of the source characterization and should be based on the most accurate geospatial information available. This information would include three measures: the X coordinate (in meters); Y coordinate (in meters); and the base elevation (also in meters). Measures should be reported using the UTM system in Zone 15 (extended) in the NAD 1983 series, consistent with state of Minnesota geostatistical data standards.
Effective Release Height	Specify the effective release height above the ground in meters or feet. The effective release height should be given as the stack height plus the flare height.

#### Source Release Parameters

Emission Rate	The emission rate is pollutant specific and represents the various processes that are directed to and released from the flare. For modeling purposes, the emission rate should be presented in units of grams per second (g/s). AERMOD is able to use the emission rate value in calculating both concentration and deposition values.
Gas Exit Temperature	The exhaust temperature parameter should be provided in units of Kelvin (K) wherever possible. AERMOD provides for the ability to designate whether the stack temperature is a <b>fixed</b> value, or whether it is <b>ambient</b> or <b>above ambient</b> . The <b>fixed</b> values allow for the temperature to remain the same through the modeled simulation. This is the most common approach. Meteorology has no impact on this value. With <b>ambient</b> temperatures, meteorology is the driving factor. In these situations, a value of "0" should be provided. For temperatures <b>above ambient</b> , meteorology still plays a role. The value entered is added to the meteorological value to determine the exit temperature.
Stack Inside Diameter	This value represents the diameter of the stack at the point of release. It should be presented in meters.
Gas Exit Velocity (Ms) /Gas Exit Flow Rate (acfm)	These values represents the rate at which stack gas exits the stack. Typically, the MPCA uses the gas exit flow measure ACFM for this parameter (ft <sup>3</sup> /min).

Also, many flares are subject to the regulatory requirements of the New Source Performance Standards in 40 CFR § 60.18 or those for the National Emission Standards for Hazardous Air Pollutants in 40 CFR § 63.11(b).

### 3.6.5 Open pit sources

The open pit approach is used to model fugitive particulate emissions from open pit sources (e.g., surface mines, rock quarries, frac sand operations, etc.). The algorithm simulates particulate emissions and gases that have an initial dispersion in three dimensions with little or no plume rise. A key feature of the open pit approach is the use of an "effective area" for modeling the pit emissions based on meteorology. The open pit algorithm employs a numerical integration area source algorithm that is used to model the impact of

particulate emissions from the effective area sources. In order to develop an open pit source, the following parameters are needed:<sup>10</sup>

**Table 9. Open pit sources.**

Source Identification	The MPCA employs the following designation to identify open pit source emissions: <b>[FAC]OP001</b> . The <b>FAC</b> designation represents a user-defined code for the area source. The <b>OP</b> letters designate this source as an open pit source. The three-digit number after the letters ( <b>001</b> ) represents the number of the open pit source if there are multiple open pit sources in the modeling demonstration.
Source Location	Three inputs are required to plot an area source on a Cartesian grid: the <b>X-coordinate</b> ; the <b>Y-coordinate</b> and the <b>base elevation</b> . The <b>X coordinate</b> represents the vertex of the area source that occurs in the southwest quadrant of the source. The <b>Y coordinate</b> represents the vertex of the area source that occurs in the southwest quadrant of the source. Measures should be reported using the UTM system in Zone 15 (extended) in the NAD 1983 series, consistent with state of Minnesota geostatistical data standards. The <b>base elevation</b> for the open pit source is the elevation at the <i>top of the pit opening</i> rather than the bottom of the pit. If this is a new, unconstructed pit, the base elevation should be the current terrain elevation of the proposed pit location unless validated survey data of the proposed pit area is offered for the base elevation input. This value should be submitted in meters.
Effective Pit Depth	The <b>effective depth</b> of an open pit is determined through a simple arithmetic relationship defined as: Effective Pit Depth ( $E_{pd}$ ) = Pit Volume ( $P_v$ )/(Pit Width ( $P_w$ ) x Pit Length ( $P_l$ ))
Release Height	The average release height is a value that is above the base of the pit and measured in meters. The meteorological-influenced emission character of the open pit source characterization prohibits a release height greater than the effective depth of the pit.
Open Pit Emission Rate	The open pit emission rate is similar to that used with the area source characterization. The emission rate for open pit sources is input as an emission rate per unit area. The emission rate should be entered in grams per second per square meter ( $g/(s \cdot m^2)$ ). Consistent with other source characterizations, the same emission rate is used for both concentration and deposition calculations.
Orientation Angle from North	<b>Open pit source</b> orientation is similar to the <b>area source</b> orientation in AERMOD. It is to the North, unless otherwise specified via the <b>angle parameter</b> . If an <b>angle parameter</b> is not designated, AERMOD assumes a north-south and east-west orientation. The angle parameter that is used in AERMOD must be positive for clockwise rotation and negative for counterclockwise rotation. This is because <b>angle parameter</b> in AERMOD is applied relative to a North orientation. The <b>angle parameter</b> is defined as the North of the side that is clockwise from the vertex (X and Y coordinate location), i.e. the side with Y side length. Functionally, if the <b>angle parameter</b> is input and the value is different from 0.0 degrees, then the model will rotate the area clockwise around the vertex defined in the X coordinate and Y coordinate input fields.

### 3.6.6 Wind driven fugitive sources

When modeling wind driven fugitive sources, such as outdoor drop points, wind speed may be used as a variable to estimate emissions. Hourly wind speed data, from met data used for the model, may be used to calculate variable emissions from one source. This approach allows for different hourly emission rates from each wind-related source, for each hour of the model run. Another option is to use scalars to determine emissions for different wind speed categories. If scalars are used, the highest wind speed for each wind speed category should be used to calculate emissions for all wind speeds that fall within that category. The

<sup>10</sup> **Notes:** As you construct the open pit source, it is important to pay attention to the aspect ratio of the pit, per EPA AERMOD guidance. The aspect ratio of an open pit source should be less than 10:1, consistent with an area source. Some third-party vendors have coded exceptions to this rule; however, in the event that you exceed the aspect ratio of 10:1, you may proceed with a warning message. Equivalency runs between third-party vendor software and the EPA AERMOD executable may be needed to evaluate performance. Since the pit algorithm generates an effective area for modeling emissions from the pit, and the size, shape, and location of the effective area is a function of wind direction, an open pit cannot be subdivided into a series of smaller sources. It is suggested that a rectangular shape of equal surface area be used as an approximation. The MPCA will review the use of the Open Pit source for this practice.

wind speed categories should be constructed from met data wind speed distribution quantiles. Be sure to document the wind speed categories and the wind speed chosen to determine emissions in each category in the AQDM-02 [and Worksheet for Class II Increment \(if applicable\)](#). In the most simplified and conservative approach, the highest daily average wind speed recorded during the five years of met data used for the model may be used to estimate emissions. In this simplified approach, the emissions are no longer variable. For more details on this practice, please contact the Air Quality Permitting Section at [AQPS.Modeling.MPCA@state.mn.us](mailto:AQPS.Modeling.MPCA@state.mn.us).

### **3.6.7 Tanks**

For vertical tanks, building downwash may be a concern. For this reason, it is necessary to create a circular building to represent the tank structure as either a point source or point sources to represent the release of the emissions. Small values for the exit velocity and stack diameter should be chosen as the vertical momentum and flow rate of tank emissions are generally small. Some example inputs for a tank would be an exit velocity near zero (i.e. 0.001 m/s), a stack diameter near zero (i.e. 0.001m), and an ambient exit temperature.

The placement of the point sources is dependent on the tank type. For a vertical floating roof tank, 8 point sources should be placed around the parameter of the tank. For a vertical fixed roof tank, 1 point source at the center of the tank is needed.

## **3.7 Receptor placement and ambient air**

A receptor is a specific location in the modeling domain where the model needs to provide results (i.e., concentration, deposition). Receptors are placed in areas designated as “ambient air” within the modeling domain. In Minnesota, the modeling objective (NAAQS or MAAQS) and source impact analysis, rather than the type of air quality permit (e.g., PSD versus non-PSD), affects the placement of receptors for both the project under review and the near source inventory. The MPCA, working with the EPA Region V office and Ambient Air Review Team, has refined the existing NAAQS modeling receptor placement practice based on the federal definition of ambient air ([Appendix D](#)).

Depending upon the purpose of the modeling demonstration, some or all of the following types of receptors may be appropriate.

### **3.7.1 General receptors**

General receptors are those receptors placed regularly throughout the modeling domain. The receptor network should be designed to provide a density that sufficiently captures the location and magnitude of the highest concentrations to adequately determine where potential violations of the NAAQS or PSD increments may occur. The distance between receptors should also allow graphics or mapping software to characterize concentration or deposition gradients. Receptors are typically spaced closer together near the project facility and further apart at greater distances from the source. Receptors should also be progressively more resolved near other sources of interest, such as nearby sources, areas of complex terrain, and areas with the highest concentrations. [Table 10](#) provides a general recommendation for receptor placement. While the receptor network recommended by these tables is sufficient in most cases, there may be situations where receptor density is greater in certain areas of the modeling domain than what is generally recommended. Please consult with the Air Modeling unit if you believe circumstances warrant an alternative receptor spacing.

### **3.7.2 Ambient air boundary**

The ambient air boundary delineates the division between ambient air (where the air quality standard must be evaluated) and non-ambient air (where evaluation of air quality is not required). A facility may choose to exclude all areas of the land owned (or leased to the source) and controlled by the stationary source, a portion of the land owned (or leased to the source) and controlled or may choose to model all receptors. If some or all of the facility property is excluded from ambient air, then the source must employ measures that are effective in precluding access to the land by the general public. See Appendix D for the current EPA policy on effective measures of preclusion and the MPCA Ambient Air Memorandum regarding model receptor placement. Although physical barriers (such as a fence) are the preferred approach for precluding access, other combinations of measures may be justified. Property boundaries do not dictate the ambient air boundary. The selected ambient air boundary must be supported by a General Public Preclusion Plan (Plan) that explains how the facility intends to preclude access to the un-modeled area. Note that access may only be precluded from areas that the source owns (or leased to the source) and controls, which does not include public right-of ways or easements. For questions on this or about acceptable preclusion measures, contact the air permitting unit at [AQPS.Modeling.MPCA@state.mn.us](mailto:AQPS.Modeling.MPCA@state.mn.us).

During the protocol review phase, information related to receptor placement should be included in the e-Service modeling protocol under “Receptors – Additional Comments.” In order to receive feedback on the Plan earlier in the process, the Permittee may choose to submit an existing or new General Public Preclusion Plan as an attachment to the protocol submittal. Otherwise, the Permittee must include a Plan with the modeling results. This Plan will include a map that shows the location of the ambient air boundary and what measures are being or will be used to preclude access (i.e., locations of fencing, signage, patrols, or security cameras), as well as a narrative description of the preclusion measures. The method to preclude public access described in the General Public Preclusion Plan will be reflected in permit conditions, which will be determined during the processing of the air quality permit associated with the modeling results submittal. Because the ambient air boundary location can influence the modeled results, re-modeling may be necessary if the boundary location changes. It may be beneficial for the facility to model all receptors in order to have that information available. The output from receptors inside the ambient boundary do not have to be included in the final modeling report but can be maintained for future reference in case of changes to the property boundary that affect the land that may be excluded.

### **3.7.3 Sensitive receptors**

Placement of discrete receptors in addition to the SIL-based modeling receptor grid may be necessary when a sensitive receptor (e.g., building air intakes, school, playground, hospital, and sensitive ecosystem) exists within the modeling domain. Please note that sensitive receptors located on tribal lands may not be easily identifiable through aerial maps or state databases; it may be necessary for these areas to be included in a modeling demonstration where there is tribal interest or potential impact. Please contact the MPCA modeling unit for further direction if you encounter a modeling situation that requires tribal information.

### **3.7.4 Flagpole receptors**

The default general receptor elevation is assumed to be at ground level (e.g., the elevation above sea level). In certain situations, receptors are included to represent structures where people reside such as a high-rise apartment complex. These receptors allow the user to select a specific height and are known as “flagpole receptors.”

Flagpole receptors are unique and have specific applications. Flagpole receptors, when used, are a small subset of all receptors used to evaluate ambient air. Flagpole receptors are rarely needed for most modeling demonstrations, as most of these projects are located in nonurban areas or small towns that often lack

sufficiently tall and spatially relevant structures that would justify their use. Projects that are subject to the Cumulative Levels and Effects analysis (See Minn. Stat. §116.07 subd. 4a. (a)), or environmental review, will often add flagpole receptors to their analysis and are commonly used in air quality risk assessment.

If it is determined that flagpole receptors are needed for a regulatory air quality modeling demonstration, the MPCA suggests the following practice. First, flagpole receptors should only be considered within the domain of the pollutant-specific source impact analysis (SIA) (see Section 3.7) and applied at a minimum to public open-air spaces that include open-air decks, stadium decks, rooftop terraces, playgrounds, parks or recreation areas, and parking lots.

Second, under some circumstances, flagpole receptors are used to account for breathing zone height (approximately six feet above ground elevation) for risk-related evaluations. The MPCA Risk Evaluation and Air Modeling Unit recognize that flagpole receptors are applied to buildings or elevated structures, and that receptor placement should reflect multiple levels where people either work or reside. For example, a ten-story apartment building may result in a flagpole receptor for each floor of the building.

Lastly, public interest may also inform flagpole receptor placement, especially where a project is subject to the Cumulative Levels and Effects analysis or environmental review.

### **3.7.5 Receptors on nearby source property**

All areas outside the ambient air boundary of the source under review are considered ambient air for the purposes of receptor placement. This means that nearby source property is considered ambient air to the project under review, even if portions of the nearby source property are fenced or have a suitable barrier to restrict public access (i.e., nonambient to the nearby source). Project receptors on nonambient nearby source property should not be removed from the modeling domain. The rationale for this practice is twofold and consistent with EPA's application of NAAQS and ambient air (See **Appendix D**). First, as noted above, the nearby source property, including its non-ambient portions, are considered ambient air to the project under review. A NAAQS analysis is not complete if portions of the modeling domain, determined to have a potential for a significant ambient contribution through the SIA, are then removed from areas of the analysis prior to completing the CIA (see Section 3.9). In this situation, the CIA would not reveal any modeled NAAQS exceedance on portions of the nearby source property where people are present (the nearby source). Secondly, the modeled nearby source ambient pollutant concentration **contribution** can be excluded from the receptors on its own **non-ambient** property as part of the analysis; however, *the nearby source ambient pollutant concentration contribution at receptors that are located on ambient portions of the nearby source property must remain in the analysis*. This practice provides a better understanding of the project and nearby source contribution to a modeled ambient air quality exceedance on a nearby source property. In the event a CIA results in a modeled exceedance, please refer to **Appendix A** of this Manual.

**Table 10. Ambient air receptor locations for NAAQS and MAAQS analysis under the Title V, Federal PSD, or SIP modeling demonstrations.**

<b>Federal Citation</b> <b>State Citation</b>	40 CFR § 50.1(e) Minn. R. 7009.0020 (Prohibited Emissions)	
<b>Receptor Locations</b>	<b>What to Consider:</b>	<b>Recommended Receptor Placement</b>
<b>Facility Modeling</b>	<p>1. Model <i>all</i> areas (on and off company property unless designated as <i>nonambient</i>) to evaluate NAAQS compliance. Refer to Appendix D for details on nearby source evaluation and onsite receptors</p> <p>2. <b>Special note:</b> EPA's interpretation of "nonambient" air relies on the premise that a fence or other effective measure can preclude public access. A fence of sufficient height is preferred; however, the EPA (or MPCA as a designated program) will evaluate alternative measures to preclude public access on a case-by-case basis. Permittees should be aware that fencing alternatives must be well-documented and may become a part of the facility operating permit. See Appendix D for further details.</p>	<ul style="list-style-type: none"> <li>• Nested discrete Cartesian grid centered at centroid of source under review.</li> <li>• 10 m spacing over any areas of facility property considered ambient air, if necessary.</li> <li>• 10 m spacing along the ambient boundary. For facilities with significantly large footprints, where the ambient boundary is greater than 1 km from the facility centroid, increased spacing may be considered.</li> <li>• 50 m spacing from the ambient boundary out to 1km.</li> <li>• 100 m spacing from 1km to 2 km.</li> <li>• 250 m spacing from 2km to 5 km.</li> <li>• 500 m spacing from 5km to 10 km.</li> <li>• 1,000 m spacing from 10 km to the edge of the domain.</li> <li>• Receptors are not required north of the Canadian border.</li> <li>• Please note the following: <ul style="list-style-type: none"> <li>• The areal extent of the receptor grid should be based on the source impact analysis.</li> <li>• A "Hot Spot" analysis may be necessary for areas that model concentrations near or above the applicable SIL or NAAQS.</li> <li>• Discrete FLAGPOLE receptors as appropriate (especially in dense urban environments).</li> <li>• Discrete receptors at PSD Class I locations as appropriate – ask Federal Land Managers.</li> </ul> </li> </ul>

### 3.7.5.1 Ambient air receptor locations for MAAQS modeling purposes

The State of Minnesota definition of ambient air (prohibited emissions) is largely similar to the Federal definition; however, the Federal definition of ambient air is supported by decades of EPA administrative decisions that further detail its application in air quality modeling. For this purpose, air modeling receptor placement is consistent whether one is modeling for either the MAAQS under the State of Minnesota definition of ambient air or the NAAQS and the Federal definition (See Table 10).

## 3.8 General modeling schema

The EPA has provided two levels of air dispersion modeling review to assess potential air quality impacts: the SIA (Significant Impact Analysis – see Section 3.9), and the CIA (Cumulative Impact Analysis – see Section 3.10). The **SIA** determines the following:

- If an additional air quality analysis is needed, and, if it is,

- Defines the impact area within which **CIA** (i.e., refined modeling) is conducted

Figure 3 provides an air quality dispersion modeling evaluation process schema for MPCA air quality permitting, consistent with EPA practice provided in Section 9.2.3 of Appendix W. Following this framework is an acceptable option when permit conditions require a demonstration of compliance with ambient air quality standards.

MPCA Environmental Review has developed a separate, though similar process for evaluating project air quality impacts. If air quality dispersion modeling is required for an EAW or EIS, please contact the Environmental Review Unit Supervisor, Dan Card, P.E., at 651-757-2261 or [dan.card@state.mn.us](mailto:dan.card@state.mn.us) to discuss the nature and scope of the evaluation. Modeling for a revision of a SIP may be similar to the air permitting process illustrated in Figure 3; however, consultation with the MPCA Air Quality Permitting program is suggested.

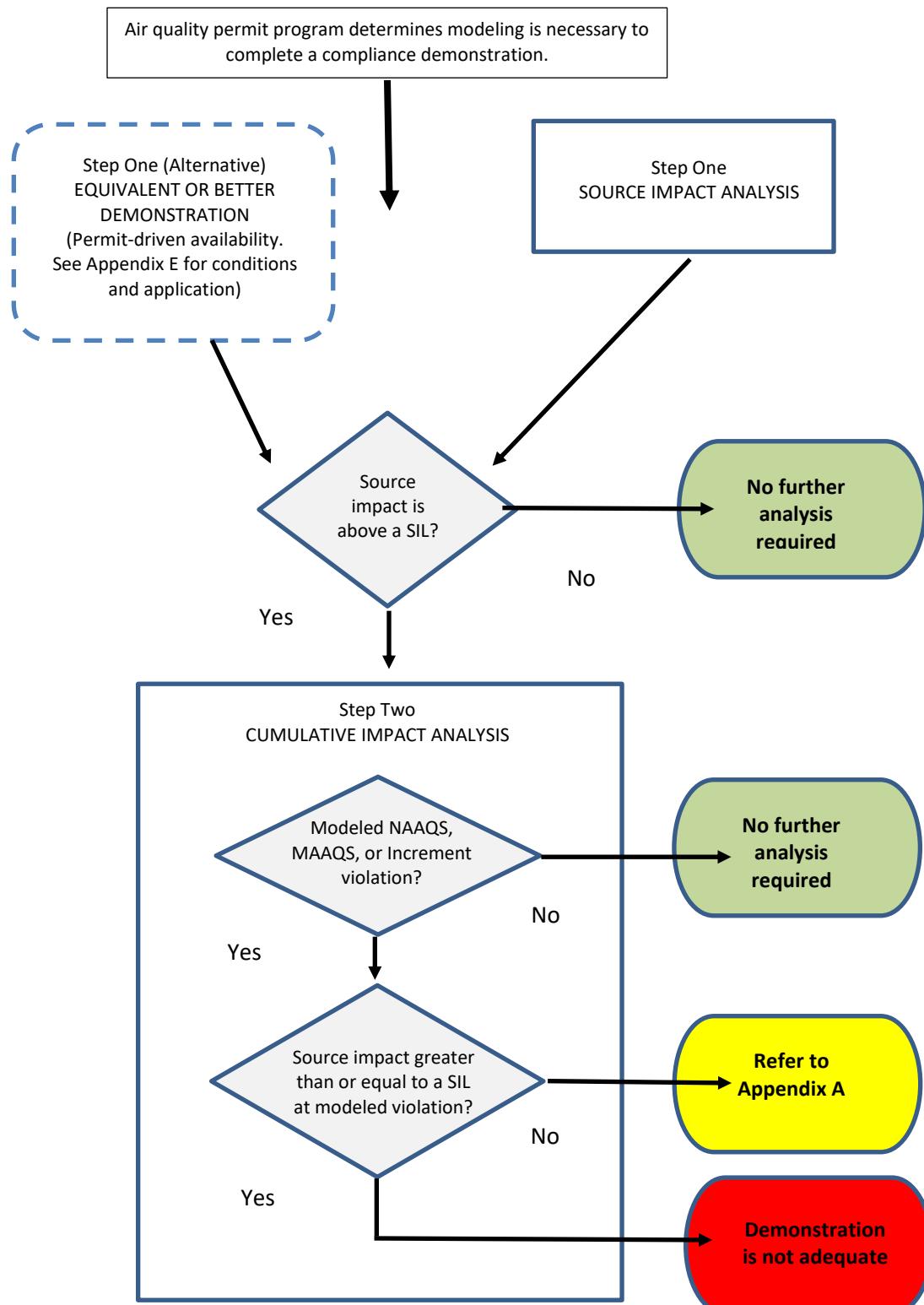
### 3.8.1 Air quality permits without compliance demonstration language

Some MPCA Part 70 and state individual permits contain conditions requiring an ambient air quality demonstration when the Permittee plans to increase emissions or change stack parameters. If the permit specifies a specific compliance demonstration, that method must be used. If the permit conditions do not specify the method of conducting this demonstration, the MPCA may allow one or more of the following methods: please contact the air permitting section at AQPS.Modeling.MPCA@state.mn.us.

- *Project SIL analysis.* ~~The MPCA reserves this methodology for the analysis of emission increases, including emissions increases associated with new stacks. The Permittee may analyze the ambient impacts from the project by modeling (only) the emission increases from the planned project. Do not include emission decreases associated with the project in the modeling analysis and do not use this methodology for stack parameter changes (except for new stacks). In this methodology, the ambient air quality impacts associated with the emission increases from new and existing stacks are determined. If the modeled impacts from the analysis, combined with the baseline and other EBD demonstration impacts are below the NAAQS/MAAQS associated with the pollutant(s) of concern, the emissions from the project are determined to meet ambient air quality standards.~~
- *EBD analysis.* ~~For facilities that have modeled previously, the MPCA may allow the use of the Equivalent or Better dispersion (EBD) method to analyze the ambient impacts from planned projects that include emission decreases and changes to stack parameters as well as emission increases. The model inputs associated with the planned or proposed configuration are positive while the inputs associated with the previously modeled configuration are negative. If the net modeled impacts from the analysis are below the SIL associated with the pollutant of concern, and the cumulative impact of the baseline modeling and any previous EBD demonstrations is below the applicable standard, the emissions from the project are determined not to adversely affect ambient air quality.~~
- *Total facility SIL analysis.* ~~The Permittee may also compare the ambient impacts from the entire "post change" facility to the associated SIL. If the overall impacts are less than the associated SIL for the pollutant(s) of concern, the emissions from the project are determined not to adversely affect ambient air quality.~~
- *Total facility refined modeling.* ~~If other modeling methods cannot assure the MPCA that the planned project does not adversely affect ambient air quality, the Permittee may need to conduct refined modeling of the facility and all nearby sources identified to significant affect air quality. (The Permittee may also conduct refined modeling without examining the cumulative ambient impacts using the above methods.) The modeled impacts are added to appropriate background concentrations. If the overall impacts are less than the appropriate ambient air quality standard, the emissions from the project are determined not to adversely affect ambient air quality.~~
- *Ambient Air Quality Monitoring.* ~~If the facility chooses not to model or cannot demonstrate compliance with ambient air quality standards through modeling, compliance level ambient~~

monitoring may be an option. There are specific requirements for compliance level monitoring, including siting and quality assurance, which can be discussed with the appropriate MPCA staff members. If your facility or proposed project are subject to an EAW or an EIS, and you are considering using this approach for impact related analysis, please contact the MPCA Environmental Review Unit to discuss this topic further.

**Figure 3. General Two stage MPCA air quality dispersion modeling practice for new or modifying sources that model the NAAQS, Increment, or the MAAQS (after Appendix W Section 9.2.3).**



## 3.9 Source Impact Analysis

The **SIA** is a modeled evaluation using the pollutant-specific SIL to address three objectives:

1. Determine if further refined modeling is needed to assess modeled air quality conditions, for some projects.
2. Define the extent of a modeling domain based on the extent of modeled concentrations above the applicable SIL value.
3. Define the extent of a source contribution analysis, as described in Appendix A, if a full impact analysis produces modeled exceedances of the NAAQS.

The SIA supports a source contribution evaluation by limiting the review specific to the receptors where concentrations are above the NAAQS and the proposed project or facility could significantly contribute to the exceedance based on the SIL analysis. In the development of the SIA, the MPCA suggests that a nested discrete Cartesian receptor grid should be used, consistent with the receptor placement described in [Table 10](#)Table 10 for the final modeling demonstration.

The SIA modeling uses AERMOD to conduct a facility-only (or proposed project) SIL evaluation. A SIA should consider an *initial* radius of 50 km from the center of the source under review; however, some sources may require a larger radius, depending on the nature of the source emissions. If this is the situation, consider that the largest radius using AERMOD is 50 km, consistent with the limitations of the model. If this is the case, an alternative dispersion model may be required.

SIA modeling with a radius less than 50km from the center of the source under review may be permissible outside of areas with complex terrain. The radius shall extend at least twice the distance from the center of the source to the most distant receptor exceeding the applicable SIL. For example, if the SIA modeling has a radius of impact of 7 km, the receptor grid must extend at least 14km from the facility. For SIA modeling with a SIL radius greater than 25km, the receptor grid shall extend 50km from the source. For all SIA modeling, the minimum acceptable radius is 10km.

The SIA is a modeling demonstration of the project-related emission sources that includes terrain, meteorology, and building downwash, but excludes nearby sources and background concentrations. The SIA applies to both PSD projects and Non-PSD projects that undergo air dispersion modeling. If the proposed project exceeds the SILs, further NAAQS and/or PSD increment modeling may be necessary to evaluate potential air quality impacts. For PSD increment-related emissions in the preliminary analysis, baseline emissions are calculated using past actuals based on the last two years of normal operations, future emissions are based on potentials. Whether PSD or Non-PSD, the next step is to determine the modeling domain extent (i.e., radius from the source in kilometers) and nearby source inventory. If the facility or project SIA results are at or below the pollutant specific SIL, further modeling analysis will likely not be needed to complete the air quality assessment.

~~Some air quality permits contain conditions that require an EBD analysis to evaluate proposed changes at a facility. The EBD evaluation relies on previous MPCA approved dispersion modeling and an applicable SIL value to measure the impact of the proposed facility action. This alternative is available for some air quality permit holders, assuming certain conditions are met. Permittees should review their air quality permit and the EBD language provided in Appendix E of this Manual, in consultation with MPCA, to determine if the EBD is applicable.~~

## 3.10 Cumulative Impact Analysis

If the SIA indicates an exceedance of an applicable SIL, further air quality modeling is needed to demonstrate compliance with the applicable NAAQS or increment. Depending on whether the proposed

project is within the PSD program determines the nature of the modeling demonstration, as PSD projects are required to determine if the proposed project will exceed PSD increment values as well as the applicable NAAQS. The MAAQS may be applicable to both PSD and non-PSD permits depending on the type and amount of pollutant emissions. Whether the project holds a PSD or non-PSD permit, the modeling demonstration should include a nearby source inventory and background concentration to account for unidentified emission sources or activities. The following discussion identifies the four steps common to CIA with details relevant to each programmatic air permit expectation.

### **3.10.1 Using the SIA results in the CIA**

Upon completion of the Stage One SIA, it is possible to refine the modeling grid by removing receptors that are at or below the numeric value of the pollutant specific SIL. Please note that the SIA SIL evaluation should consider each averaging time and related SIL value separately. A SIL exceedance of a NAAQS short-term averaging time does not necessitate the evaluation of other averaging times for the same pollutant. Please contact MPCA modeling staff with any questions.

The remaining receptors greater than the value of the pollutant specific SIL represent the modeling domain for the CIA analysis. The rest of the receptors can be removed. Once established, the CIA receptor grid, in general, should not be modified. Where necessary, flagpole receptors may be used to account for modeled concentrations on buildings. Non-ambient areas of nearby sources should be identified for purposes of evaluating the final modeling demonstration results. If the non-ambient areas of a nearby source are not known, the working assumption is that the entire nearby source property is ambient air to the source under review. Please refer to the on-site receptor discussion for nearby sources in Section 3.7.5.

### **3.10.2 Developing the project and nearby source emission inventory**

After establishing the CIA grid, potential nearby sources should be identified and evaluated to determine if they are needed in the modeling demonstration. Evaluation of the nearby source inventory is supported by MPCA modeling approaches described in Section 3.10.4. After the nearby source inventory has been determined, a nearby source emission inventory is developed that accounts for all nearby emissions that may adversely affect the compliance status of the source under review.

The determination and development of a nearby source emission inventory is more involved in the PSD program as the PSD increment analysis presents several unique analyses to determine if increment is being consumed or expanded.

#### **3.10.2.1 Emission inventory and nearby sources for PSD projects**

For PSD projects, the modeling demonstration typically includes both a NAAQS and Class II increment analysis. The PSD modeling demonstration requires the addition of nearby sources that may affect the compliance status of the source under review. The PSD Class II Increment inventory and NAAQS inventory differ with respect to compilation and operation.

The development of a Class II increment emission inventory (Increment Inventory) is a critical feature of the overall PSD Class II increment analysis. The Increment Inventory accounts for all sources in and around the impact area. The Increment Inventory also provides information on emissions increases and decreases, which have occurred from sources since the applicable baseline date. Please contact the MPCA for specific data related to the sources of interest and nearby source inventory. The MPCA can provide any of the relevant Increment Inventory data it has available; however, it is the project proposer's responsibility to develop an approvable Increment Inventory for their Class II increment demonstration.

The EPA has noted that increment consumption (and expansion) will generally be based on changes in actual emissions reflected by the normal source operation for a period of two years. In order to develop the

Increment Inventory, project proposers should prepare data that reflects the increment consumption and expansion within the impact area.

Increment consumption reflects the amount of ambient air in the applicable NAAQS that is “consumed” by pollutants from an emission source. According to the EPA:

Emission increases that consume a portion of the applicable increment are, in general, all those not accounted for in the baseline concentration and specifically include:

Actual emissions increases occurring after the **major source baseline date (MSBD)**, which are associated with physical changes or changes in the method of operation (i.e., construction) at a major stationary source; and, actual emissions increase at any stationary source, area source, or mobile source occurring after the **minor source baseline date**.

For increment expansion, the EPA considers two ways to add or expand increment:

The most common case is the reduction of actual emissions from any source after the minor source baseline date. Any such emissions reduction would increase the amount of available increment to the extent that ambient concentrations would be reduced.

The less common case of increment expansion can result from the reduction of actual emissions after the major source baseline date, but before the minor source baseline date, if the reduction results from a physical change or change in the method of operation (i.e., construction) at a major stationary source.

**Note:** *A source must have existed and been in operation on or before the baseline date to be considered for increment expansion. The source must be shut down as part of the project or have lower actual emissions to expand the increment. That is, there is no credit for contemporaneous shutdowns or for sources permitted after the baseline date that have reduced emissions, have been shut down, or will be shut down as part of the current project, since modeling is used to determine the amount of increment consumed or expanded. Therefore, a source that did not exist—or was not operating—on the baseline date would not have contributed to the air quality at that time, and there would be no need to model the source with an emission rate of zero. Omit these sources from the inventory.*

The need for a detailed inventory is the key to developing credible and valid increment values. This means that to account for changes in emissions or other source parameters, it is possible that input values will be calculated as a combination of negative numbers and positive numbers to account for a difference in baseline and current/proposed project conditions, consistent with EPA guidance:

If the change in the actual emissions rate at a particular source involves a change in stack parameters (e.g., stack height, gas exit temperature, etc.) then the stack parameters and emissions rates associated with both the baseline case and the current situation must be used as input to the dispersion model. To determine increment consumption (or expansion) for such a source, **the baseline case emissions are input to the model as negative emissions**, along with the baseline stack parameters. In the same model run, **the current case for the same source is modeled as the total current emissions associated with the current stack parameters**. [via positive emissions] This procedure effectively calculates, for each receptor and for each averaging time, **the difference between the baseline concentration and the current concentration (i.e., the amount of increment consumed by the source)**.

In general, the MPCA follows a “two entry approach” to evaluate PSD increment, consistent with EPA guidance, whereby:

- Negative emission rates for MSBD conditions
- Positive emission rates for post-MSBD conditions

An example of an input file developed for a PSD increment analysis is provided in Figure 4. Please note that negative emission values are not available for NO<sub>2</sub> due to the screening method limitations of all three NO<sub>2</sub> modeling methods. If you encounter a situation where an NO<sub>2</sub> PSD increment analysis is required for a project, please contact the MPCA modeling staff for direction on addressing this situation. The NAAQS inventory for a PSD project does not take into account negative emission values as described in the PSD increment analysis. The NAAQS inventory for a PSD project should reflect the allowable emissions for each of the nearby sources. Wherever possible, the identified nearby sources should be modeled as refined or representative stack sources. It is important to recognize that there is the possibility that the NAAQS inventory will not be consistent with the PSD increment inventory. This may result in additional work to fully account for the PSD increment and NAAQS analysis.

**Figure 4. Example increment emission input file (portion).**

** UMBR							
SO SRCPARAM	UMBR1	0.777	60.96	547.04	15.38	1.448	
SO SRCPARAM	UMBR1	-0.777	60.96	547.04	15.38	1.448	
SO SRCPARAM	UMBR2	0.554	65	449.8	9.14	2.103	
SO SRCPARAM	UMBR3	54.103	69.27	544.6	14.6	2.937	
SO SRCPARAM	UMBR4	54.103	69.27	499	13.76	2.048	
SO SRCPARAM	UMBR5	2.522	62.48	505.37	2.33	2.731	
SO SRCPARAM	UMBR6	7.129	55.78	505.4	8.05	1.969	
SO SRCPARAM	UMBR6	-7.129	55.78	505.4	8.05	1.969	
SO SRCPARAM	UMBR7	3.538	56.12	615.93	14.43	1.436	
SO SRCPARAM	UMBR7	-3.538	56.12	615.93	14.43	1.436	
SO SRCPARAM	UMBR8	0.262	21.64	811.15	3.47	0.914	
SO SRCPARAM	UMBR9	5.985	45.72	422.04	13.47	3.132	
SO SRCPARAM	UMBR10	0.605	45.72	422.04	9.14	1.113	
SO SRCPARAM	UMBR11	0.605	45.72	422.04	9.14	1.113	
SO SRCPARAM	UMBR12	0.529	45.72	422.04	9.14	0.787	
SO SRCPARAM	UMBR13	1.151	9.04	433.2	11.72	1.524	
SO SRCPARAM	UMBR14	3.087	35.05	422	13.32	3.15	
SO SRCPARAM	UMBR15	1.975	10.67	422	1.5	2.751	
SO SRCPARAM	UMBR16	0.927	10.67	422	0.9	2.438	
SO SRCPARAM	UMBR17	0.041	3.96	422	0.67	0.595	
SO SRCPARAM	UMBR18	0.082	18.59	449.82	7.8	0.254	
SO SRCPARAM	UMBR18	-0.082	18.59	449.82	7.8	0.254	
SO SRCPARAM	UMBR19	0.277	5.49	616.48	9.41	0.305	
SO SRCPARAM	UMBR20	1.245	21.85	415.4	8.65	1.717	
SO SRCPARAM	UMBR21	0.266	6.1	616.48	20.43	0.203	
SO SRCPARAM	UMBR22	7.784	7.47	810.93	41.11	0.203	
SO SRCPARAM	UMBR22	-2.784	7.47	810.93	41.11	0.203	
SO SRCPARAM	UMBR23	55.000	7.47	810.93	41.11	0.203	
SO SRCPARAM	UMBR23	-13.162	7.47	810.93	41.11	0.203	
SO SRCPARAM	UMBR24	0.28	6.1	616.48	13.7	0.254	
SO SRCPARAM	UMBR25	1.061	4.57	616.48	18.02	0.305	
SO SRCPARAM	UMBR26	0.443	6.1	616.48	15.33	0.254	
SO SRCPARAM	UMBR27	0.346	9.14	824.3	39.5	0.157	
SO SRCPARAM	UMBR28	6.137	58.52	622	7.26	2.134	
SO SRCPARAM	UMBR29	3.682	40.54	744.3	8.22	2.134	
SO SRCPARAM	UMBR30	3.207	60.5	449.8	4.6	2.07	
SO SRCPARAM	UMBR31	7.129	55.78	505.4	8.05	1.969	
SO SRCPARAM	UMBR32	3.712	58.83	505.4	2.29	3.341	
SO SRCPARAM	UMBR33	3.694	62.03	491.5	2.51	2.502	

The Umbrella Corporation (fictitious) has undergone a dramatic renovation of their facility. When the company was initially constructed, they were subject to the PSD program and operated with 33 stacks. The renovation has the facility removing five stacks and modifying emissions at one stack. The Increment emission file scenario (left) reflects these changes.

### 3.10.2.2 Emission inventory and nearby sources for non-PSD projects

The non-PSD emission inventory is like the PSD NAAQS inventory. The primary goal of a non-PSD modeling demonstration is compliance with the applicable NAAQS and MAAQS; however, the modeling also accounts for area attainment with the applicable NAAQS. This means that non-PSD modeling demonstrations are as rigorous as the PSD modeling demonstrations; however, under certain circumstances, additional emission sources may be included to account for emission sources of public interest that would not normally be included in a PSD analysis. The nearby source emission inventory should represent allowable emissions for the applicable sources. Please see section 3.10.3 for various approaches used to develop a representative background concentration for a modeling demonstration.

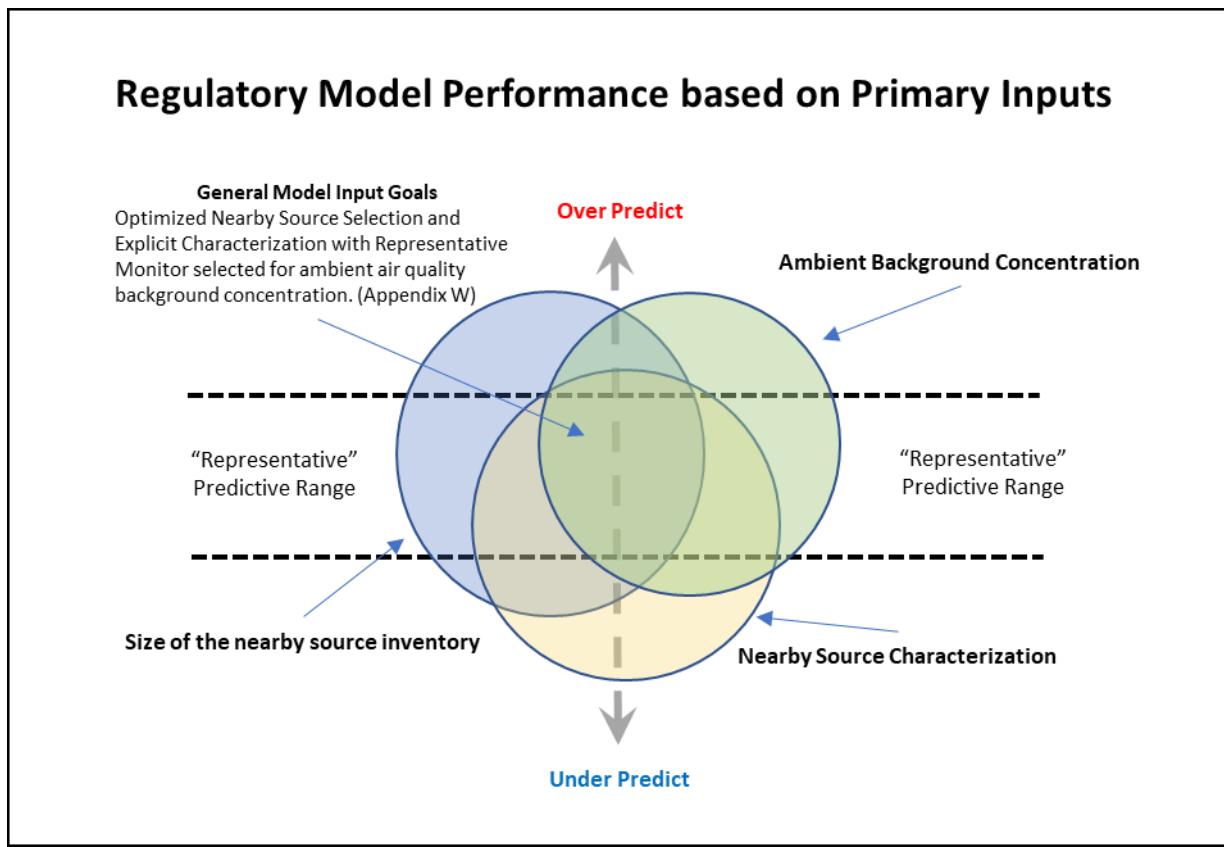
### 3.10.2.3 Nearby source selection, background concentration, and characterization

Three modeling variables that collectively represent off-site emissions are critical to the development of an appropriate pollutant-specific background concentration, and ultimately, outcome of a modeling simulation. The three variables include:

- The selection of the nearby emission sources
- Characterization of the nearby emission sources
- Pollutant-specific background concentration

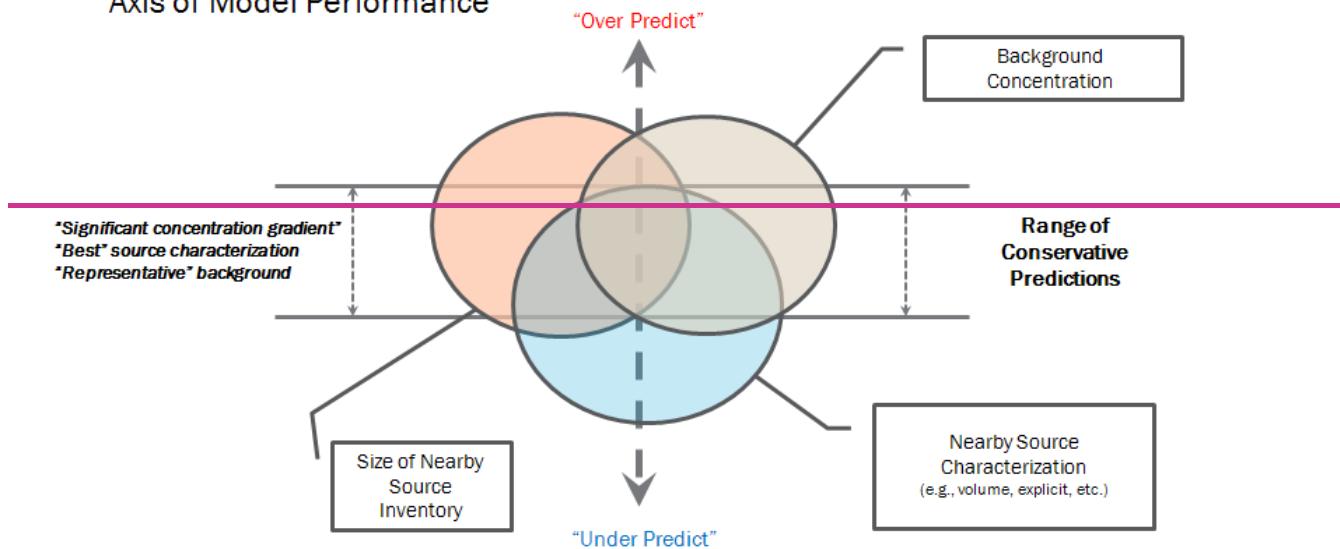
The MPCA refers to this trio of input variables as a “triple helix” of off-site source emission attributes. Collectively, these three attributes combine to create the ambient air quality concentration conditions and will vary for a given pollutant in a given area. Nearby source selection and characterization, decisions, along with the specific pollutant-specific background concentration, comprise the overall ambient air quality pollutant concentration for the modeling domain. The result has implications for explicitly identified sources as well as unidentified emission sources/activities for that geographic area. The relationship between these three attributes is illustrated in Figure 5.

**Figure 5."Triple Helix" relationship between nearby sources, background concentration and size of the nearby source inventory.**



# “TRIPLE HELIX” RELATIONSHIP

## “Axis of Model Performance”



### 3.10.2.4 Nearby source selection

Care should be taken in the selection and characterization of nearby sources, along with the ambient air quality background value selected to represent unidentified off-site emission sources or activities. To facilitate the selection of relevant nearby sources, the MPCA has developed a Geographic Information System (GIS) based approach using geospatial location information and data from the National Emission Inventory (NEI) and the state emissions inventory, that can be used to create a project-specific nearby source emission inventory. The tool is known as the GIS Nearby Source Tool and can be downloaded from our [website](#). Unlike many air quality-permitting authorities, the MPCA uses annual actual emissions to conduct the initial nearby source inventory compilation; however, the nearby source inventory is expected to be modeled using maximum allowable permitted emissions. Adjustments to the allowable emission is possible through the use of Table 8-2 in Appendix W; however, this approach must be justified and approved prior to use in a modeling demonstration.

In addition, the MPCA has provided a short [online video tutorial](#) to assist you in the use of the tool.

For select inventory years, the tool contains information for facilities in neighboring states within 50 km of a Minnesota border. The tool does not contain data for facilities in Canadian provinces at this time. Based on project location, facilities in nearby states, provinces, or tribal lands may be considered as potential candidates for a nearby source inventory. The project proposer will need to contact the state or provincial permitting authority to obtain the relevant permitting and emission information. Tribal air quality permits in Minnesota are managed through the EPA Region V office in Chicago, Illinois. The MPCA expects any facilities located outside the state of Minnesota or on tribal lands that are included in a nearby source inventory to be modeled using permitted allowable emissions.

### 3.10.2.5 Linkage between source selection and characterization

The development of a nearby source inventory is based on the likelihood that a nearby emission source will have a significant concentration gradient that affects the source under review. Per EPA's guidance in Appendix W (Section 8.3.3.b.iii.):

The number of nearby sources to be explicitly modeled in the air quality analysis is expected to be few except in unusual situations. In most cases, the few nearby sources will be located within the first 10 to 20 km from the source(s) under consideration. Owing to both the uniqueness of each modeling situation and the large number of variables involved in identifying nearby sources, no attempt is made here to comprehensively define a “significant concentration gradient.” Rather, identification of nearby sources calls for the exercise of professional judgment by the appropriate reviewing authority (paragraph 3.0(b)). This guidance is not intended to alter the exercise of that judgment or to comprehensively prescribe which sources should be included as nearby sources.

An EPA operating assumption not observed in Minnesota is that the nearby source inventory selection process is based on permitted allowable emissions. The MPCA does not rely on this assumption relying instead on the use of actual emissions for nearby source selection purposes. The rationale for this approach is based on practice of modeling active emitting facilities in the nearby source domain, rather than including an abundance of facilities based solely on their permitted allowable emissions. The EPA is aware that their operating nearby selection assumption presents a potentially larger nearby source inventory for a typical modeling demonstration and offered the language cited above to address this concern. MPCA and EPA agree that the final modeled nearby source inventory should be based on permitted allowable emissions.

The MPCA has adopted a state-specific method to develop a nearby source inventory based on practices illustrated above. To address this problem, MPCA reviewed existing EPA approved nearby emission source inventory selection methods, and, alternatively, developed related tools that reflect the core principle of the significant concentration gradient. The typical approach used in all nearby source selection approaches is a rough approximation of the significant near source concentration gradient, based on an annual emission inventory, along with the distance between the nearby source and the source under review. This information, along with some form of criteria (e.g., pollutant specific SIL) is used to determine which nearby sources should be explicitly modeled in a modeling demonstration.

The primary approach relied on by the MPCA is the square root mean distance method (SQRM-D). The MPCA has automated this approach in a MPCA GIS tool (Tool), which is available to download online; a video demonstration of the Tool is also [available](#). The Tool requires ESRI’s ArcMap software version 10.3 or higher to run and is currently using the 2011 through 2013 NEI data. Emission data updates are provided when they are made available to the MPCA. The following steps describe the Tool’s process for development of a nearby source emission inventory for a modeling demonstration.

**Step 1** – The Tool identifies all emission sources within a 50 km radius of the source under review. Nearly all modeling demonstrations will start with a 50 km search radius for nearby sources; however, some projects may require a greater radius depending on the nature and impact of pollutant emissions observed during the Preliminary Analysis.

**Step 2** – Based on the nearby source facilities identified in Step 1, the Tool will remove all sources that have less than one ton per year of the emitted criteria pollutant being evaluated (actuals). The result is the *initial nearby source emission inventory*.

**Step 3** – The Tool converts the *initial nearby source emission inventory* to the *final nearby source emission inventory* using the SQRM-D approach. Please be aware that the size of the initial nearby source emission inventory is also a key factor in determining which nearby source selection tool to use. The Tool relies on an initial emission inventory of more than five facilities; however, if the initial inventory contains five or less nearby source facilities, the MPCA suggests that an alternative approach be considered. Currently, the MPCA recommends the use of either the MNLookup Table (available [online](#)) or the state of Oregon's Range of Influence ([ROI](#)) approach.

The value of five was selected as a boundary to separate the nearby source analysis into two categories as this value represents a defendable population/sample size for the calculation of a mean. The mean distance of nearby sources from the project source becomes the “key determinant” of the significant concentration gradient analysis; the square root of the mean distance is automated in the GIS SQRM-D tool. Each nearby source determined from Step 2 is evaluated for consideration in the final nearby source inventory by comparing the annual emissions of the pollutant under consideration, divided by the distance from the project source, to the square root of the mean distance of all nearby sources from Step 2. For initial nearby source emission inventories with less than five sources, the calculation of an arithmetic mean is not appropriate and the ROI, MNLookup Table, or other MPCA approved approaches should be used. Additionally, it is not recommended to use the MNLookup Table or the Oregon ROI as a refinement to the findings generated from the GIS SQRM-D tool as these approaches rely on different underlying presumptions and methodologies for determining potential nearby sources. For example, if the GIS Tool is used to produce a list of nearby “Sources to Include” in the modeling evaluation, it would not be appropriate to use the MNLookup Table to justify excluding additional sources.

**Step 4** – At this point in the evaluation, you should have a pool of nearby source facilities to consider including in the final air quality modeling demonstration. The MPCA recognizes that it is possible to remove some of the selected near source facilities from a modeling demonstration when such factors as wind speed and direction (relative to the source under review), the relevant form of the ambient air quality standard, and, the distance between the nearby source and the source under review, are considered. Establishing the removal of potential nearby source(s) requires thorough documentation to explain why a potential nearby source was removed from the final air quality modeling demonstration inventory. Please note that if this practice is applied to a modeling demonstration and documentation is not provided that explains the removal of near source facilities, the protocol may be considered incomplete.

**Step 5** – After completion of the step described above, it is important to evaluate the final nearby source emission inventory to determine if the selected facilities are still in operation or if any major change has occurred that require adjustment in the modeling demonstration, as well as to confirm that modeled emissions are current and correct.

The modeling domain established through the selection of nearby sources should also include the radius of impact developed through the Preliminary Assessment using the appropriate SIL. MPCA urges caution in

using a 10 km distance criterion from the source under review to exclude distant nearby sources. Consistent with EPA guidance, nearby sources greater than 10km (but less than 50km) may have a significant concentration gradient on the source under review. Nearby sources with significant concentration gradients, greater than 10km, could be included in the final modeling demonstration.

### 3.10.2.6 Nearby source characterization

Nearby source emission characterization should be completed using one of two methods. When facility information and stack parameters are available nearby sources should be modeled explicitly. This includes sources that in the absence of explicit information, would typically have been characterized as a volume or area source. When there is no detailed facility information and a stack vent or vents would likely be present (e.g., registration permits), please contact the MPCA REAM unit to determine if more explicit information is available, or, alternatively, if the information can be requested from the facility. Please note that requesting nearby source information from a facility may add time to the protocol development.

Another nearby source emission and stack parameter option relies on representative estimation and characterization. Based on evaluation of source characterization methods, MPCA's current recommendation is that facilities follow the EPA screening procedure given below for representative stacks. Please contact the MPCA REAM unit to discuss the conditions and expectations of this option.

~~Nearby source emission characterization should be completed based on the distance from the source under review. This approach is based on published and actual downwash impact information on air pollutant release and transport as simulated through AERMOD. The results of this review indicate that downwash impacts on air pollutant transport are not perceptible beyond one kilometer of pollutant release from the facility. These findings have implications for the development of a nearby source inventory used in a NAAQS demonstration. For NAAQS analysis, the distance-based source characterization reflects model performance of downwash impacts on air pollutant transport and should reduce the time needed to develop a nearby source emission inventory (See Table 11). It is important to note that Table 11 does not apply to PSD increment analysis as typically, the baseline and increment analysis require more explicit data throughout the modeling domain. Please contact the MPCA Air Modeling Unit to discuss how to proceed when a PSD increment is necessary.~~

~~When facility information and stack parameters are available for relevant nearby sources, they should be modeled explicitly, meaning that the facility emission should be modeled with explicit details such as individual stack information, unpaved haul roads, stockpiles, buildings, etc. In situations where a nearby source is greater than one kilometer from the source under review, but less than ten kilometers, the nearby source characterization should include the relevant stack information, either explicit, as noted above, or "representative." Representative stack information is based on either the EPA method to calculate and select a representative stack (See Section 3.10.2.6.1 of the Manual) or, using SIC code data to select an industry-specific representative stack. The MPCA maintains source characterizations based on the Standard Industrial Classification (SIC) codes. The SIC source characterization approach is a generic representation of an emission source in a given industrial classification.~~

**Table 11.11. Nearby source inventory characterization based on distance from source under review.**

Distance from Source Under Review (Km)	Characterization Detail
<1km	Explicit characterization (specific stack vent details, haul roads, etc., including buildings)
Between 1km and 10km	Explicit or representative emission source characterization. Buildings are not required.
Greater than 10km	Representative source characterization. Buildings not required.

~~The rationale for this approach is based on the impacts of building downwash on dispersion as provided in EPA's Guideline for Determination of Good Engineering Practice Stack Height (1985) and the User's Guide To the Building Profile Input Program (2004). Between one to ten kilometers, a nearby source inventory would not typically require the addition of buildings as the downwash impacts from these nearby source structures does not impart a perceptible impact on simulated air pollutant concentrations after approximately one kilometer from their release. For nearby source facilities located greater than ten kilometers, no buildings are necessary. If explicit source data (i.e., stacks, etc.) is available for facilities at this distance, it should be used; however, if not, a representative stack as provided in Section 3.10.2.6.1, is a suitable source characterization.~~

### **3.10.2.6.1 Merged parameters for multiple stacks**

Sources that emit the same pollutant from several stacks with similar parameters that are within about 100m of each other may be analyzed by treating all of the emissions as coming from a single "representative" stack. The following process presents the EPA approach to determine a representative stack by evaluating a merged stack using the equation below:

$$M = \frac{h_s V T_s}{Q}$$

where:

- M = merged stack parameter which accounts for the relative influence of stack height, plume rise, and emission rate on concentrations
- $h_s$  = stack height (m)
- $V = (\pi/4) d_s^2 v_s$  = stack gas volumetric flow rate ( $m^3/s$ )
- $d_s$  = inside stack diameter (m)
- $v_s$  = stack gas exit velocity (m/s)
- $T_s$  = Stack temperature (K)
- Q = Emission rate (g/s)

The stack that has the lowest value of M is used as a "representative" stack. Then the sum of the emissions from all stacks is assumed to be emitted from the representative stack.

### **3.10.2.6.2 Process-based representation**

This approach should only be pursued in consultation with the MPCA and should be used only after receiving MPCA approval of the method. The stack and related parameters can be found using national database of Source Classification Code or SIC codes.

The use of volume source characterizations where explicit or representative stack information is available is discouraged and may not meet MPCA approval. The rationale for this position reflects the over or under predictive qualities of volume sources revealed in an MPCA comparison of nearby source characterization approaches.

### **3.10.2.7 Nearby source emission inventory selection**

~~The nearby sources inventory selected using the MPCA tools, can be refined in two ways. The first is a reduction in the number of initial nearby sources selected through either an evaluation of distance, wind direction, and wind speed, or a modeling approach to determine whether the potential nearby source presents a modeled ambient concentration greater than one SIL value of the applicable criteria pollutant.~~

~~The second is an adjustment of the remaining nearby source emissions using practices described by the EPA. In general, the final nearby source emission inventory is compiled using the permitted allowable emissions, as described above. The modeled nearby source emission inventory can be adjusted to account for actual~~

operating conditions (not actual emissions), consistent with Appendix W Table 8-2 (See Table 8-1 for SIP modeling). If you plan on adjusting the nearby source emission inventory for your modeling demonstration, please contact the MPCA air quality modeling unit for additional details. More details on developing the nearby source emission adjustment using Appendix W can be found in the MPCA Interim Work Practice Memorandum found in Appendix F.

In order to develop your nearby source inventory list, you will want to review previous air quality dispersion modeling files managed by the MPCA. Modeling information submitted for the purpose of a compliance demonstration is public information under the Minnesota Data Practices Act and provisions of the Clean Air Act. Public information is available to members of the public upon request to the MPCA records management department. The Risk Evaluation and Air Modeling (REAM) Unit can expedite this process, by providing modeling information to facilities and their consultants upon request. These requests can be made by emailing the REAM unit at AirModeling.PCA@state.mn.us. The existing modeling files may support spatial nearby source details under most situations; however, source parameters and emissions should be taken from the most recent air quality permit or requested from the Air Quality Permit Section (AQPS) at AirModeling.PCAAQPS.Modeling.MPCA@state.mn.us.

A word of caution is necessary. The REAM unit is providing modeling information “as is” with no content review, approval, or verification, either express or implied. This means that the information provided may or may not reflect the effective permit for a given facility. Modeling files can vary significantly in age and content and may or may not reflect the current operations or emission potentials of a nearby source. The MPCA REAM unit makes no claim on the suitability of requested data. The project proposer carries the burden to verify the accuracy of proposed modeling emission and non-emission data. data verification burden is on the requestor and may involve input and review from other The MPCA Air Quality Permitting Section Management Program will ultimately review and approve the emission inventory proposed for an air quality modeling demonstration.

The nearby source inventory selected using the MPCA tools, can be refined in two ways. The first is a reduction in the number of initial nearby sources selected through either an evaluation of distance, wind direction, and wind speed, or, a modeling approach to determine whether the potential nearby source presents a modeled ambient concentration greater than one SIL value of the applicable criteria pollutant.

The second is an adjustment of the remaining nearby source emissions using practices described by the EPA. In general, the final nearby source emission inventory is compiled using the permitted allowable emissions, as described above. This information is typically available through MPCA Air Quality Permit section that are available online. The modeled nearby source emission inventory can be adjusted to account for actual operating conditions (not actual emissions), consistent with Appendix W Table 8-2 (See Table 8-1 for SIP modeling). If you plan on adjusting the nearby source emission inventory for your modeling demonstration, please contact the MPCA air quality modeling unit for additional details. More details on developing the nearby source emission adjustment using Appendix W can be found in the MPCA Interim Work Practice Memorandum found in Appendix F.

### **3.10.3 Background concentration**

Section 8.3 of the *Guideline on Air Quality Models* (EPA, 2017) illustrates the use of background concentrations in a NAAQS analysis. Background concentrations of regulated criteria pollutants must be included in cumulative NAAQS analyses for both PSD and non-PSD applications. A different pollutant-specific concentration is needed for each applicable averaging period.

Background concentrations are developed based on air quality monitoring data collected within the vicinity of the proposed project or from similar areas determined to be reasonably representative. In some cases, monitoring data from neighboring states may be the most representative of background at the project. Data collected in another state may be used, provided it is representative of background concentrations at the project location and are of sufficient completeness and follow appropriate data validation procedures. Facilities should use either the ambient air quality design values or propose pollutant-specific background concentrations based on their own analyses following the practices illustrated in this section. In rare situations, a model-based background may be used. The proposed background concentration should be well-documented within the modeling protocol submitted to the MPCA.

If a design value is unavailable or not appropriate for the environmental setting, the use of ambient monitoring data to estimate background concentrations is the MPCA's preferred approach. Background concentrations using ambient monitoring data may be developed using a single monitor or, under certain situations, interpolation techniques using multiple monitors if the source under review is located within the array of the monitors. A significant monitoring selection factor is the monitor objective that accounts for the purpose and representative measurement scale (i.e., a few city blocks to greater than 10 kilometers). Please refer to the [MPCA Annual Air Monitoring Network Plan for Minnesota](#) (2023) (See pp. 2-3). This information should be included in the justification. Please note that air monitoring data for Minnesota can be obtained through our [website](#). Monitoring data collected outside Minnesota may be obtained from the EPA AirData [website](#). For additional ambient air quality data needs, please contact the Air Modeling Unit at [AirModeling.pca@state.mn.us](mailto:AirModeling.pca@state.mn.us).

### **3.10.3.1 Single-site monitor background concentrations**

If a project proposer intends to use a single monitor, whether it is located in Minnesota or outside of the state, please provide the following information in the "Additional Supporting Information" section on the "Background Values" screen of the e-Services protocol:

1. A description of monitoring data proposed as representative of the project area. The description should include: 1) the statistics of the data set; and, 2) the quality control/assurance measures conducted for the data (Note: This also applies to raw data provided by the MPCA). Examples of acceptable statistics include correlation or covariance-related analysis of surface roughness that describe the relationship between the two sites.
2. A discussion of the similarity between the monitor location and the project area. The discussion should compare the two areas and support the use of the monitoring data for the project site. Factors to consider:
  - A. The density and diversity of emission sources around the monitoring location. The purpose of this factor is to determine if there are similarities between the monitoring location and the source under review.
  - B. A determination of how well the monitor captures the influence of nearby sources that are not affected by the project. Factors to consider include the relationship between the prevailing winds and the nearby source location; the distance between the nearby source and the monitor; and, the monitor scale.
  - C. Differences in land use and terrain between the two locations that may influence air quality.
  - D. Similarity in monitor siting and probe height.
  - E. Purpose of the monitoring activity and the geographic scale of representation.
3. A *detailed assessment* of the relationship between the meteorology of the project area and the area where monitoring data was obtained. For example, a wind-rose analysis that depicts the similarity between the project site and monitoring site in question, wind speed analysis (focus on frequency of calm periods) and surface roughness comparison, as described above.

4. The distance between the monitor and the source under review. As a working assumption, ambient air quality monitors closer to the project will likely have concentrations most similar to those observed at or near the source under review. It is important to note that if more than one monitor is available for a modeling demonstration, preference should be given to the closest representative monitor. As discussed below, extrapolation or related averaging techniques should not be used for modeling demonstrations where the source under review is not included within the nest of multiple monitors. There is an assumption that the closer a monitor is to a source, the better it will represent ambient conditions. Be aware that this is an oversimplification. Care should be taken to consider and document the type of pollutant, spatial distribution of sources, atmospheric characteristics of the pollutant (e.g., transformation, deposition, etc.) and meteorological conditions that justify the use of the monitor.
5. The approach used to edit explicitly modeled source contributions from monitored ambient air data, consistent with the definition of “background concentration” under Appendix W. This procedure is necessary to avoid “double counting” ambient air concentrations.

### **3.10.3.2 Multi-site monitor background concentrations**

There are certain situations where a source under review is surrounded or nested within a series of ambient air quality monitors. In these situations, a background value can be developed based on interpolation techniques, whereby monitoring data is used to create a calculated ambient air quality background concentration that is representative of the monitoring data collection areas. This type of analysis is typically conducted using a GIS platform using a simple weighted averaging/inverse distance application, to a variety of geostatistical approaches (e.g., Voronoi Neighbor). The NAAQS form and averaging time can complicate this approach. Please consult with the MPCA REAM Unit to determine the best approach to take if you intend to develop a background concentration using interpolation methods.

### **3.10.3.3 Alternate approaches**

Alternative background concentration calculation methods using modeled data or seasonal/monthly approaches will be evaluated by the MPCA, considering the unique situation and factors that are offered to support its approval. Use of EPA guidance to develop seasonal or monthly pairing is considered standard practice and no longer an alternative modeling approach. A critical MPCA review factor applied to any alternative background concentration approach is the MPCA Modeling Unit’s determination that a monitor-based approach is not appropriate. It is important to note that if you are proposing an alternative background concentration approach substantial documentation may be necessary to justify the claim. Additionally, if the proposal is for a PSD project, consultation with Region V EPA is expected.

If a project proposer alleges that an alternate approach is more appropriate, substantial documentation may be necessary to justify the claim. It is important to acknowledge that if an alternative background concentration approach is proposed for a PSD project both the MPCA and the EPA are reviewing and approving agencies. All proposals for alternative background concentration methods should be included as an attachment to the modeling protocol.

## **3.10.4 Intermittent emissions**

Modeling intermittent emissions, particularly for compliance with short-term ambient air quality standards (e.g., the one-hour standards for SO<sub>2</sub> and NO<sub>2</sub>, and to a lesser degree, the 24-hour standards for PM<sub>10</sub> and PM<sub>2.5</sub>) is a frequent question. The MPCA has coordinated existing permitting practice with modeling intermittent emissions and offers the following approach to determine when to include sources with intermittent emissions as well as how to model them:

- Emergency bypass stacks used only during malfunctions (as defined in 40 CFR 60.2) may be omitted. However, units for which unpredictable intermittent emissions (such as bypass emissions)

constitute normal operation must be modeled at the maximum emission rate or according to permit conditions.

- By default, emergency generators complying with existing permit conditions that embody Best Management Practices (BMPs) need not be modeled.
  - One possible exception to this is large generators (greater than 500 hp) and/or generators located near an ambient boundary; the MPCA air quality permitting program will inform you of the need to model such units on a case-by-case basis. Because of this, the modeling protocol should identify the size and location of emergency generators that will not be included in the modeling demonstration. This may require a separate attachment in your e-Service protocol submittal.
  - Emergency generators are generators that operate primarily during emergencies and during maintenance and testing periods. Emergency generators cannot be used for peak shaving or operate to generate income for a facility to supply power to an electric grid, or otherwise supply power as part of a financial arrangement with another entity. However, an emergency generator may be operated during periods in which the Regional Transmission Organization (in this case, the Midwest Independent Transmission System Operator) has determined there are emergency conditions that could lead to a potential electrical blackout, such as unusually low frequency, equipment overload, capacity or energy deficiency, or unacceptable voltage level.
- Emergency generators without BMP permit conditions must be modeled at 8,760 hours per year.
- Non-emergency generators must be modeled at 8,760 hours per year with the following exception:
  - Generators that operate in an orderly, routine manner (and that will continue to operate in that manner) may be modeled using modeling inputs based on that routine. In most cases, the applicant must provide a site-specific history of operation (for an existing facility) or data on industry-specific practices (for new sources) to support the proposed modeling scenario.
- Emergency generators at nearby sources need not be modeled; however, generators within the nearby source inventory that are used for peak shaving or load shedding should be included in the modeling demonstration.
- Internal Combustion Engines participating in Energy Demand Response Programs by way of peak shaving or load shedding should be modeled using seasonal, monthly, and/or hourly emission scalars based on meteorological analysis of Temperature-Humidity Index (THI) data (see **Appendix C**):
  - THI values during the warm season months play an integral part in the correlation of when a facility is likely to participate in peak shaving.
  - A contract between the local electric utility and the owner or operator of the engine sets the required hours of availability for an engine participating in an Energy Demand Response Program. The permit typically limits the annual hours of operation to the hours in the contract plus the time needed to perform maintenance testing. If the engine conforms to the BMPs for its maintenance operation (except for operating when required by the local electric utility), the hours devoted to maintenance are not modeled.
  - Additional permit language related to daily and hourly operation will be required for those engines participating in peak shaving with modeled ambient levels > 90% of the NAAQS. (The permit language will address the pollutant(s) contributing that high ambient concentration.)
- Quarries and mines using blasting techniques to develop their projects or operationally, to generate stone products or raw ore material **may** be asked by either Air Quality Permitting or the Environmental Review Unit, to model these activities as part of an air quality permit, air or multi-media risk assessment, environmental review-related process, or other state or federal action where blasting activities may be of interest. The pollutants of concern from blasting typically include NO<sub>x</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub>; however, other pollutants could be considered. If requested to model these

sources, please contact the REAM unit and MPCA air quality permit section at [AQPS.Modeling.MPCA@state.mn.us](mailto:AQPS.Modeling.MPCA@state.mn.us) for additional details.

### **3.11 Running and completing the CIA**

At this step, the core CIA modeling decisions should be complete (i.e., meteorology, terrain, buildings, receptor grid, nearby source inventory, project characteristics, etc.) and described in the modeling protocol. The completed SIA modeling results, prior to removal of any receptors, can be included with the modeling protocol for MPCA review; however, it must be included with the final modeling report. In situations where the SIA is below the applicable SIL value, the results should be submitted with the protocol to support the conclusion that no further analysis is warranted.

As previously noted, pursuant to an Executive Order and state legislation, the MPCA is committed to processing permit applications within 150 days of receipt of a permit application. The MPCA has transitioned to an e-Service submittal process to support this expectation. While the information required for submittal remains similar, there are some differences in the forms required. To facilitate an efficient review of your project, please observe the following practices.

First, the MPCA expects that a single AERMOD input file for each pollutant and operational scenario will be submitted with the final modeling report. The rationale for a single input file is ease of review, and use in future modeling as either an EBD modeling demonstration for the permittee, or to represent the facility as a nearby source for a neighboring CIA. If you expect to use an alternative process to either run the modeling demonstration or process the final modeled results, please provide the details of the proposed practice in your protocol for MPCA review and approval. Additionally, if you intend to use a third-party software to generate or activate emissions in the model, or to evaluate modeled data, the MPCA will ask for additional information and may request equivalency runs to demonstrate that model integrity is conserved.

Second, the MPCA Modeling Report document (AQDM-06) is the primary administrative document of record for the modeling action. It can be submitted with attachments as needed; however, it should not be submitted as an attachment to a customized modeling report or any other document unless specifically requested by the MPCA. The AQDM-06 should provide the modeled findings and any discussions relevant to the analysis, along with documentation of any deviations from the initial protocol approval.

Lastly, the modeled results for each pollutant should be reported without rounding to two significant figures. This practice is consistent with EPA practice when comparing modeled results to the applicable NAAQS.

### **3.12 Evaluating the CIA modeling demonstration results**

An applicant for an air quality permit must demonstrate that the proposed source will not cause or contribute to air pollution in violation of any NAAQS/MAAQS. PSD applicants have an additional burden of demonstrating compliance with the applicable PSD increment value. The modeling compliance demonstration, whether for a PSD or Non-PSD source, must result in one of the following conditions:

1. The proposed new source or modification will not significantly contribute (i.e., greater than an applicable SIL value) to a modeled exceedance of the applicable NAAQS. This means that the Stage One SIA did not reveal any modeled concentrations greater than the applicable SIL value.
2. Under Stage Two CIA modeling, the proposed new source or modification, in conjunction with existing sources and applicable ambient air quality background concentration, will not cause or contribute to a modeled exceedance of any applicable NAAQS/MAAQS or PSD increment.
3. In the event that the CIA reveals a modeled exceedance, the permittee must demonstrate that the new source or project will not cause or contribute to the modeled exceedance. If the contribution of the new

source or modification is greater than an applicable SIL value, measures should be taken to secure sufficient emission reduction to offset the modeled adverse air quality impact. The MPCA response to modeled NAAQS, MAAQS, or increment exceedances is presented in **Appendix A** of this Manual.

4. The MPCA expects that modeled results for conditions 2 and 3, above, will be submitted with no exclusion of modeled nearby source contributions unless a nearby source property is clearly designated as “nonambient air” consistent with **Appendix D** of this manual. The MPCA has included a table of modeled concentrations and increment consumption categories in the AQDM-06 form, to facilitate easier presentation of the modeled results.

## 3.13 Pollutant considerations

Depending on the project characteristics and applicable air quality permit or related regulatory action, both the NAAQS and the MAAQS may be included in your modeling demonstration. Most of the NAAQS pollutants are relatively easy to model. For example, CO, PM<sub>10</sub>, and SO<sub>2</sub> are typically not subject to chemical transformation adjustments or post-processing. Default approaches for these pollutants are often part of the AERMOD software package.

Secondary formation of PM<sub>2.5</sub>, and NO<sub>2</sub>, Pb, and pollutants within the MAAQS (TSP and H<sub>2</sub>S) have specific and noteworthy approaches that can affect the success of a modeling demonstration. If you encounter a need to model secondary formation of PM<sub>2.5</sub>, NO<sub>2</sub>, Ozone, Pb, odor, or other non-criteria pollutants, please contact the MPCA REAM unit for additional information to develop your modeling demonstration.

### 3.13.1 PM<sub>10</sub> modeled design values

Compliance with the 24-hour PM<sub>10</sub> NAAQS is based on the expected number of days per calendar year with a 24-hour average concentration above the standard of 150 µg/m<sup>3</sup>, averaged over three consecutive years. The NAAQS is attained when the expected number of exceedances is less than or equal to 1.0.

The form of the 24-hour PM<sub>10</sub> NAAQS presents a challenge to modeled compliance demonstrations. The contributions from the project, any nearby sources, and background concentrations from other sources are combined for a given analysis year, as described further below to produce a concentration value. However, the form of the NAAQS does not produce a monitored background concentration that can be simply added to the project and nearby source impacts. Special consideration is needed for PM<sub>10</sub> to estimate a representative background concentration from monitored data and to estimate the overall modeled design value, as detailed below. An example of how to calculate design values for the 24-hour PM<sub>10</sub> NAAQS is included.

#### 3.13.1.1 Necessary data

This design value calculation requires the following data:

- *Air quality modeling results:* For modeling using MPCA-processed NWS meteorological data, air quality modeling should be conducted across a consecutive 5-year period for the facility and should include any identified nearby sources. The sixth highest 24-hour average modeled concentration at each receptor. For modeling using one year of site-specific meteorological data, the second highest 24-hour PM<sub>10</sub> concentration should be calculated at each receptor. The pollutant ID “PM10” in AERMOD is designed to determine the appropriate rank as the number of years modeled plus one.
- *Air quality monitoring data:* Three consecutive years of certified ambient air monitoring data from a representative monitor.

#### 3.13.1.2 Estimating representative background concentration

A representative background value for modeling against the 24-hour PM<sub>10</sub> NAAQS should be derived from the most recent three years of monitoring data. The data should be sorted in descending order based on

measured 24-hour average concentration and a ranked value should be selected based on the number of observations in the 3-year period. The appropriate rank to select is shown in Table 12.

**Table 12. Ranked of monitored values used for estimating representative background.**

Number of Observations from the Monitor	Monitor Value Used for Design Value Calculation
≤ 347	Highest Monitor Value
348 -695	Second Highest Value
696 -1042	Third Highest Value
1043 -1096	Fourth Highest Value

As an example, Table 13 shows the four highest 24-hour average concentrations from a hypothetical dataset measured by a PM10 monitor that collects data on a 1-in-3-day sampling schedule. If 360 measurements are collected over the most recent three-year period, the second highest concentration of 86.25  $\mu\text{g}/\text{m}^3$  would be selected as the representative background concentration.

**Table 13. Highest values from the chosen background monitor (360 readings in the most recent three-year period).**

Number of Background Concentration Values from the Monitor	Monitor Value Used for Design Value Calculation	Highest Values from the Chosen Background Monitor
≤347	Highest Monitor Value	112.49
348-695	Second Highest Value	86.25
696-1042	Third Highest Value	75.82
1043-1096	Fourth Highest Value	75.21

Following typical modeling practices, this background value can be included in the model input file to be applied at every receptor or added to the H6H modeled concentration after model completion.

### **3.13.4 PM<sub>2.5</sub>**

In 2006, the EPA modified the PM<sub>2.5</sub> NAAQS to a percentile based 24-hour standard averaged over a three-year period and an annual standard with a similar averaging time-period. The new PM<sub>2.5</sub> NAAQS features lower numeric values. The 24-hour standard is 35  $\mu\text{g}/\text{m}^3$  while the annual value is 12  $\mu\text{g}/\text{m}^3$ .

Modeling the new PM<sub>2.5</sub> NAAQS presents special challenges. The lower numeric values of the 24-hour and annual standards offer potential difficulties in modeling compliance for a source under review in light of the typically (and relatively) high background values in urban areas as well as the paucity of PM<sub>2.5</sub> emission data for nearby sources. An additional factor considered in a modeling analysis is the need to account for PM<sub>2.5</sub> pre-cursors (SO<sub>2</sub> and NO<sub>2</sub>) under certain conditions (e.g., PSD projects).

### **3.13.5 Secondary formation of PM<sub>2.5</sub> and O<sub>3</sub>**

Some pollutants form in the atmosphere through chemical reactions of precursor emissions. Of particular relevance for single-source criteria pollutant modeling demonstrations are ozone and secondary PM<sub>2.5</sub>. Ozone formation is driven by reactions of NO<sub>x</sub> and VOC. Ammonium nitrate and ammonium sulfate are secondarily-formed components of PM<sub>2.5</sub>, whose formation is driven by reactions of oxidized products of NO<sub>x</sub> and SO<sub>2</sub>, respectively, and directly emitted ammonia.

Gaussian dispersion models like AERMOD do not have the capability to directly estimate impacts of secondarily-formed pollutants. Models that account for the chemical reactions and physical processes that contribute to the formation, transport, and fate of these pollutants are needed. Chemical transport models (CTMs) are modeling systems that have been developed specifically to simulate these chemical and physical processes of air pollutants in the atmosphere.

Current EPA modeling guidance expects the consideration of the impacts of secondarily-formed components of PM<sub>2.5</sub> and ozone when these pollutants are evaluated in dispersion modeling demonstrations. Under current EPA guidance, this assessment is necessary when a proposed project's emissions increase will exceed the PSD significance thresholds for O<sub>3</sub> precursors and/or PM<sub>2.5</sub> and its precursors, as outlined in [Table 4](#). No preferred modeling system has been determined, and the degree of complexity of such an evaluation is case-specific. Chapter 5 of Appendix W discusses the recommended approach and models and outlines a framework based on a two-tier approach for assessing ozone and secondary PM<sub>2.5</sub>. This assessment should be incorporated into the general modeling framework that includes the SIA and CIA. For example, the impacts of secondary-formed components of PM<sub>2.5</sub> should be included with primary PM<sub>2.5</sub> impacts when evaluating whether a project's emissions increases of PM<sub>2.5</sub> exceed the applicable Significant Impact Level (SIL). If a cumulative analysis is required, secondarily-formed PM<sub>2.5</sub> from the facility's precursor emissions should be included in a PM2.5 demonstration.

The first tier involves the use of appropriate and technically credible relationships between emissions and impacts developed from existing information deemed representative of the project source's impact. EPA has provided a Tier 1 approach, described in detail below, for evaluating a source's precursor emissions in a SIL analysis to determine if further refined ambient air quality dispersion modeling is necessary.

The second tier involves case-specific application of chemical transport modeling to explicitly estimate the impact of precursor emissions. EPA has suggested use of Eulerian grid or Lagrangian models for this purpose. The appropriate tier should be selected in consultation with the MPCA and be consistent with EPA guidance. If it is determined that a Tier 2 demonstration is necessary, MPCA will work with the facility and EPA to develop modeling protocols necessary to meet the regulatory needs of the analysis. However, the MPCA acknowledges that Tier 2 demonstrations have only been necessary in rare cases and we expect a Tier 1 approach should be appropriate in nearly all situations. More detailed information may be found in the EPA's document: *Guidance on the Use of Models for Assessing the Impacts of Emissions from Single Sources on the Secondarily Formed Pollutants: Ozone and PM<sub>2.5</sub>*. This document outlines recommended procedures for estimating O<sub>3</sub> and secondarily formed PM<sub>2.5</sub> impacts from project sources.

In support of this strategy, the EPA has finalized the *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM<sub>2.5</sub> under the PSD Permitting Program* on April 30, 2019. This demonstration tool provides a framework to estimate single-source impacts of secondarily formed ozone and PM<sub>2.5</sub> under the Tier 1 approach. It is based on several CTM studies of hypothetical emission sources located across the continental U.S. A "MERP" value is an emission threshold applicable to a particular chemical and physical environment. Project increases of precursor NOx, SO<sub>2</sub>, and/or VOCs above a representative MERP emission rate determine whether the project impact may cause or significantly contribute to an exceedance of the NAAQS for O<sub>3</sub> or PM<sub>2.5</sub>.

The MERP values are calculated as follows:

$$MERP = Q_T \frac{E_H}{Q_H}$$

where Q<sub>T</sub> is a critical air quality threshold, E<sub>H</sub> is the emission rate from the hypothetical source, and Q<sub>H</sub> is the modeled impact from the hypothetical source. The critical air quality thresholds are based on the draft EPA SIL values for PM<sub>2.5</sub> and O<sub>3</sub> and represent a *de minimis* air pollutant contribution to ambient air resources.

The hypothetical source that is selected for a MERP analysis should be located in a chemical and physical environment that is representative of the environment surrounding the facility under review. Factors to consider in determining representativeness include terrain variability, land cover, meteorology, and emissions distribution of surrounding sources. Note that the hypothetical sources presented in EPA's MERP Guidance was not intended to be an exhaustive representation of all possible combinations of source types, chemical environments, and physical characteristics of a region. In the final MERP guidance, the

hypothetical sources were grouped by NOAA climate region. The lowest and most conservative values were presented for each region. As a starting point, the most conservative MERP values for Upper Midwest climate zone, shown in Table 14, should be acceptable for use without justification for most cases.

**Table 14. Summary of MERP values for the hypothetical sources located in the Upper Midwest climate zone.**

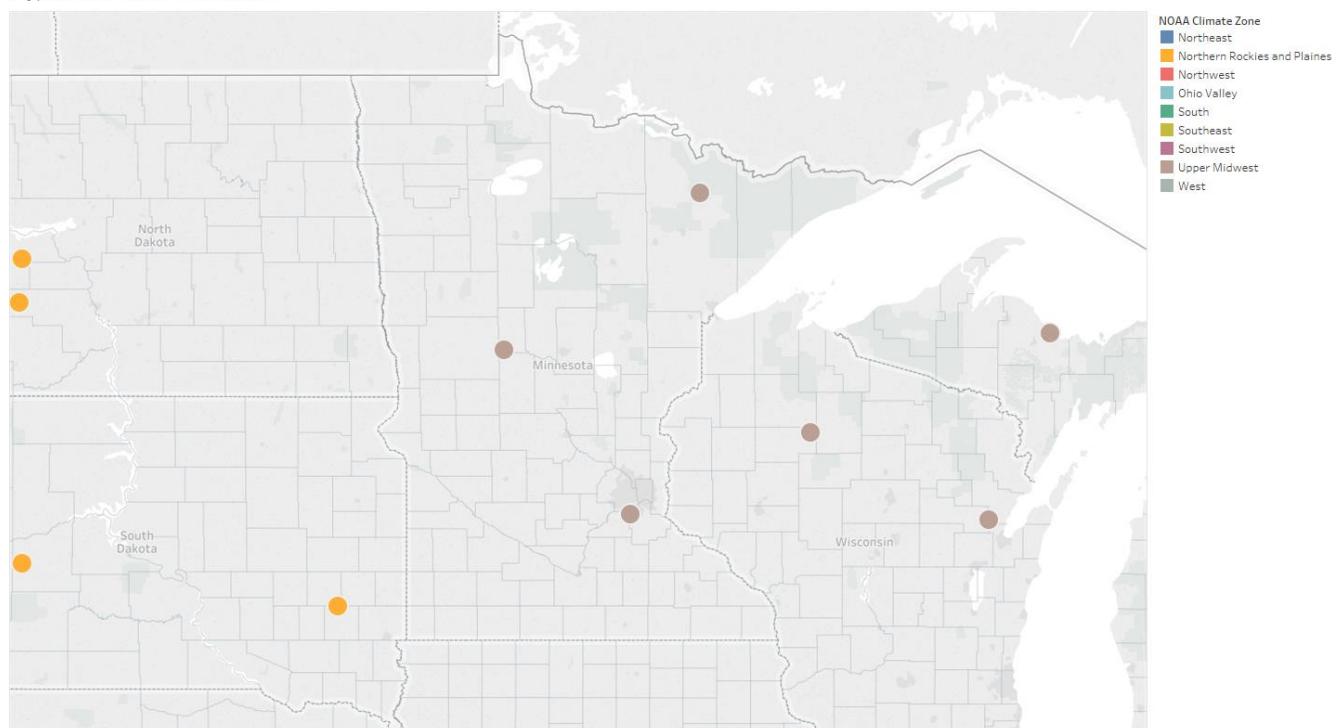
Pollutant; Precursor	Lowest	Median	Highest
Ozone – 8 hr; from NO <sub>x</sub>	125	362	4,775
Ozone – 8 hr; from VOC	1,560	2,153	30,857
PM <sub>2.5</sub> – Daily; from NO <sub>x</sub>	2,963	10,043	29,547
PM <sub>2.5</sub> – Daily; from SO <sub>2</sub>	454	2,482	6,096
PM <sub>2.5</sub> – Annual; from NO <sub>x</sub>	10,011	33,497	139,184
PM <sub>2.5</sub> – Annual; from SO <sub>2</sub>	2,522	17,997	45,113

The final MERP guidance includes three hypothetical sources located across Minnesota (Figure 6).

The most conservative MERP values for these sources, along with two in surrounding states that may be representative for demonstrations in Minnesota, are shown in Table 17.

**Figure 6. Locations of hypothetical sources used in EPA's modeling for the MERP guidance.**

Hypothetical Source Locations



**Table 15. Conservative MERP values for O<sub>3</sub> and secondary PM<sub>2.5</sub> precursor emissions for hypothetical sources located in or near Minnesota.**

County	Pollutant	MERP Values by Precursor (Tons/Year)		
		SO <sub>2</sub>	NOx	VOC
Dakota	PM <sub>2.5</sub> – Daily	1,511	11,193	-
	PM <sub>2.5</sub> – Annual	7,966	29,620	-
	Ozone – 8 hr	-	4,546	5,165
Wadena	PM <sub>2.5</sub> – Daily	643	4,552	-
	PM <sub>2.5</sub> – Annual	2,522	12,219	-
	Ozone – 8 hr	-	270	3,816
St. Louis	PM <sub>2.5</sub> – Daily	2,037	20,585	-
	PM <sub>2.5</sub> – Annual	11,746	52,766	-
	Ozone – 8 hr	-	125	6,036
Miner (SD)	PM <sub>2.5</sub> – Daily	714	6,000	-
	PM <sub>2.5</sub> – Annual	3,719	13,145	-
	Ozone – 8 hr	-	252	4,394
Rusk (WI)	PM <sub>2.5</sub> – Daily	2,169	7,234	-
	PM <sub>2.5</sub> – Annual	11,875	18,857	-
	Ozone – 8 hr	-	323	30,857

When multiple precursors are assessed, the impacts from each precursor for a particular pollutant should be evaluated relative to the applicable SIL and these relative impacts should be summed. This is accomplished by finding the ratio of emission increase to MERP value for each precursor and summing these percentages across all precursors for the pollutant and averaging period under consideration. If the total is greater than 100%, the emissions increases for the pollutant and averaging period are considered to potentially cause or significantly contribute to a NAAQS exceedance, and a CIA is required. For PM<sub>2.5</sub>, primary impacts modeled with AERMOD, relative to the SIL, should be summed with the precursor relative impacts. Example MERP evaluations may be found in EPA's guidance document.

The MERP equation also provides a Tier 1 approach for estimating secondary impacts in a CIA demonstration, if needed. The terms of the equation may be rearranged using the selected MERP value and applicable SIL value as shown:

$$Q_F = E_F \frac{Q_T}{MERP}$$

where Q<sub>F</sub> is the estimated air quality impact, E<sub>F</sub> is the facility's potential emission rate for the precursor, and Q<sub>T</sub> and MERP are the applicable SIL value and selected MERP threshold, respectively, from the SIA described above. For 8-hr ozone, the impacts for each precursor should be estimated using the equation above and summed along with a representative background concentration for comparison to the NAAQS. For daily and annual PM<sub>2.5</sub>, the impacts for each precursor should also be estimated, summed, and added to a representative background concentration. If direct PM<sub>2.5</sub> is also evaluated as part of the CIA, the H8H concentration estimated with AERMOD, that includes impacts from the facility and nearby sources, should also be added for comparison to the NAAQS.

### 3.13.6 Lead

Individual facilities modeling for the criteria pollutant Lead (Pb) will need to use the pollutant ID of OTHER in AERMOD, and select the monthly averaging period. See Section 8.1 of 40 CFR Part 51 "Guideline on Air Quality Models" for information on source emissions for a monthly averaging period. The design value for the Pb NAAQS is a rolling three-month average, as compared to the quarterly average of the old Pb NAAQS. At this time, AERMOD cannot calculate the Pb design value for comparison to the NAAQS. The EPA has developed a post-processor called LEADPOST to calculate the design value. LEADPOST takes the post file

from the AERMOD output and uses it to calculate a rolling three-month average concentration at each modeled receptor. As such, modeling for lead requires that post files be selected from the output pathway in AERMOD. MPCA modeling staff recommends generating a single AERMOD post file for the source group ALL, as opposed to generating a post file for every source.

For detailed information regarding the approach to set-up and run LEADPOST, please visit EPA's AERMOD page on their SCRAM [website](#).

### 3.13.7 Nitrogen dioxide

Typically, emission calculations and modeling are performed for  $\text{NO}_x$  emissions; however, the NAAQS and PSD increments are written for nitrogen dioxide ( $\text{NO}_2$ ) concentrations. The 2017 *Guideline on Air Quality Models* provides a multi-tiered screening approach for estimating annual  $\text{NO}_2$  concentrations from point source  $\text{NO}_x$  emissions, outlined in Table 17. The first tier contains the most conservative assumption about  $\text{NO}_x$  conversion, while the third detail produces the most refined estimate of  $\text{NO}_2$  concentrations.

**Table 16. Multi-tiered approach for estimating  $\text{NO}_2$  concentrations from  $\text{NO}_x$  emissions.**

<b>Tier 1: Full Conversion</b>	Assume total conversion of NO to $\text{NO}_2$
<b>Tier 2: Ambient Ratio Method</b>	Multiply Tier 1 results by a representative ambient $\text{NO}_2/\text{NO}_x$ ratio
<b>Tier 3: Detailed Screening</b>	Conduct detailed screening analysis using OLM, PVMRM, or other alternative screening model or technique

For Tier 1, assume total conversion of NO to  $\text{NO}_2$ . If the concentration from Tier 1 exceeds the NAAQS and/or PSD increments for  $\text{NO}_2$  proceed to Tier 2.

For Tier 2, multiply the concentrations assuming total conversion of NO to  $\text{NO}_2$  (Tier 1) by a representative ambient ratio using the Ambient Ratio Method, version 2 (ARM2). The EPA recently replaced the Ambient Ratio Method (ARM) with ARM2 as the default Tier 2 method. EPA initially approved ARM2 for use under specific cases. ARM2 provides estimates of representative equilibrium ratios of  $\text{NO}_2$  to  $\text{NO}_x$  concentrations based on measured ambient levels of  $\text{NO}_2$  and  $\text{NO}_x$  derived from national data from the EPA's Air Quality System. The ambient ratio applied varies depending on the modeled  $\text{NO}_x$  concentration following a polynomial regression. The default maximum ratio is 0.9 for the lowest modeled concentrations and the ratio decreases with increasing modeled concentrations to a default minimum value of 0.5. Project-specific alternative  $\text{NO}_2/\text{NO}_x$  ratios will be considered by the MPCA based on source-specific in-stack ratios.

The Tier 3 “detailed screening methods” approaches include two options: the Plume Volume Molar Ratio Method (PVMRM) and the Ozone Limiting Method (OLM). The PVMRM2 has been approved for regulatory use as a default and is simply now referred to as PVMRM. The PVMRM2 option features three major modifications: 1) Formulation adjustment during stable conditions to avoid over predictions (absolute dispersion coefficients); 2) Plume width impact assessment far from the centerline; and, 3) Treatment of penetrated plumes. Both PVMRM and OLM depend on  $\text{O}_3$  concentrations and in-stack  $\text{NO}_2/\text{NO}_x$  ratios. The PVMRM routine calculates the molar ratio of  $\text{O}_3$  to  $\text{NO}_x$  in an effluent plume at receptor locations using dispersion (quasi-instantaneous) rates that differ from those used by AERMOD to calculate the  $\text{NO}_x$  concentration, described as relative vs. continuous diffusion rates. The molar ratio is multiplied by the AERMOD-derived  $\text{NO}_x$  concentrations to calculate  $\text{NO}_2$  concentrations in the plume. PVMRM includes a method to simulate multiple  $\text{NO}_x$  sources by accounting for how the plumes merge and combine. PVMRM works best for relatively isolated  $\text{NO}_x$  sources while OLM works best for groups of  $\text{NO}_x$  sources (See Appendix W. Section 4.2.3.4.e.).

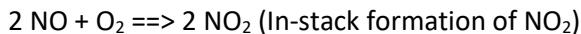
Note that ambient  $\text{NO}_2/\text{NO}_x$  ratios are calculated from ambient monitoring data. If a representative  $\text{O}_3$  monitoring site can be found (e.g., Anoka County Airport for urban areas), an alternative  $\text{NO}_2/\text{NO}_x$  ratio can be utilized.

In-stack ratio of  $\text{NO}_2/\text{NO}_x$  is also required. Unless approved by MPCA in advance, alternative ambient  $\text{NO}_2/\text{NO}_x$  ratios should not be used in lieu of the national annual default value of 0.50.

The second Tier 3 option is the use of the OLM. The theoretical support for the OLM approach reflects combustion temperatures and conversion of NO. The relatively high temperatures in the primary combustion zone typical of most conventional combustion sources primarily promote the formation of NO over  $\text{NO}_2$  by the following thermal reaction:



In lower temperature regions of the combustion zone or in the combustion exhaust, the NO that is formed can be converted to  $\text{NO}_2$  via the reaction:



An important note: In addition, other reactive species can convert NO to  $\text{NO}_2$  during and immediately following combustion as can oxidation catalysts in the exhaust—such as oxidation catalysts used to control CO and VOCs.

Thus, a portion of the  $\text{NO}_x$  exhausted is in the form of  $\text{NO}_2$ . This is referred to as the in-stack  $\text{NO}_2/\text{NO}_x$  ratio, which is in general different from the ambient ratio such as that used in the ARM.

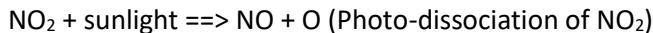
Historically, a default value of 10% of the  $\text{NO}_x$  in the exhaust was assumed to be  $\text{NO}_2$ . It is assumed that no further conversion by direct reaction with  $\text{O}_2$  occurs once the exhaust leaves the stack because of the much lower temperature once the exhaust mixes with the ambient air. Thus the remaining percentage of the  $\text{NO}_x$  emissions is assumed to be NO.

As the exhaust leaves the stack and mixes with the ambient air, the NO reacts with ambient  $\text{O}_3$  to form  $\text{NO}_2$  and molecular oxygen ( $\text{O}_2$ ):



The OLM assumes that at any given receptor location (ground level) the amount of NO that is converted to  $\text{NO}_2$  by this reaction is controlled by the ambient  $\text{O}_3$  concentration. If the  $\text{O}_3$  concentration is less than the NO concentration, the amount of  $\text{NO}_2$  formed by this reaction is limited. If the  $\text{O}_3$  concentration is greater than or equal to the NO concentration, all NO is assumed to be converted to  $\text{NO}_2$ .

In the presence of radiation from the sun, ambient  $\text{NO}_2$  can be destroyed:



As a conservative assumption, the OLM ignores this reaction. Another reaction that can form  $\text{NO}_2$  in the atmosphere is the reaction of NO with reactive hydrocarbons (HC):



The OLM also ignores this reaction. Applications of OLM option in AERMOD should routinely utilize the “OLMGROUP ALL”.

OLM and PVMRM are regulatory defaults; however, the MPCA may review specific aspects of Tier 3 screening to address project-specific ozone and in-stack ratios. Please consult with MPCA modeling staff to facilitate the review. For a Tier 3  $\text{NO}_2$  screening of a PSD permit,  $\text{NO}_2$  screening method also requires regional office consultation.

## 3.14 PSD specific considerations

The following is a brief discussion of topics relevant to the Prevention of Significant Deterioration (PSD) program, SIP program and General Modeling issues that may affect a project. In addition, the MPCA is

including a simple NAAQS/MAAQS analysis implemented through specific permit language known as an Equivalent or Better Dispersion demonstration.

### **3.14.1 PSD special topics**

As noted above, several PSD topics are treated in detail. These topics include visibility screening, particulate matter from offsite roads, and Class I increment modeling. Please consult with the MPCA Air Quality Permitting Program [at AQPS.Modeling.MPCA@state.mn.us](mailto:AQPS.Modeling.MPCA@state.mn.us) to determine if these analyses are needed for your PSD permit action.

#### **3.14.1.1 Class I air quality related values modeling**

Facilities performing PSD modeling must show they will not adversely affect any Class I areas. Projects located within 300 km of a Class I area should notify the Federal Land Managers (FLMs), including the state or tribal governing body, where applicable, of the proposed project. Some contact information is listed below. Whether a project needs to perform a visibility analysis depends on the size of the facility/project and how close it is to the Class I areas. Class I areas in Minnesota include the Boundary Waters Canoe Area Wilderness (Forest Service) and Voyagers National Park. Other nearby Class I Areas includes Rainbow Lake Wilderness (Forest Service) in Wisconsin and Isle Royale National Park in Michigan. As of this update, there are several Tribes within Minnesota pursuing Class I designation; Tribes designated as Class I areas will be included upon completion of the designation process. Please review the Class I Modeling Guidance in Appendix B for further details.

Contact list:

John Notar ([John\\_Notor@nps.gov](mailto:John_Notor@nps.gov))  
National Park Service Air Resources Division  
PO Box 25287  
Denver, CO 80225-0287  
303-969-2079

Tim Allen ([Tim\\_Allen@fws.gov](mailto:Tim_Allen@fws.gov))  
U.S. Fish and Wildlife Service  
National Wildlife Refuge System  
Branch of Air Quality  
7333 W. Jefferson Avenue, Suite 375  
Lakewood, CO 80235-2017  
303-914-3802

[Trent Wickman, PE \(trent.wickman@usda.gov\)](mailto:Trent.Wickman.PE@usda.gov)  
[Air Resource Specialist – MN, WI, MI](#)  
[U.S. Forest Service, Eastern Regional Office](#)  
[227 Isanti St](#)  
[Duluth, MN 55803](#)  
[218-341-8646](#)

Bret Anderson ([baanderson02@fs.fed.us](mailto:baanderson02@fs.fed.us))  
U.S. Forest Service  
2150 Centre Avenue, Bldg. A  
Fort Collins, CO 80526  
970-295-5981

### **3.14.1.2 PM<sub>2.5</sub> and PM<sub>10</sub> emissions from off-site roads**

PSD projects must account for the increase in emissions related to the proposed project. Although explicit modeling of project-related vehicle traffic on off-site roads is generally not required, appropriate PM<sub>2.5</sub> and PM<sub>10</sub> background concentrations should be used to account for such nearby vehicle traffic impacts on ambient PM<sub>2.5</sub> and PM<sub>10</sub> levels. Depending on the circumstances of the project, an additional impacts analysis, consistent with 40 CFR § 52.21 (n) and (o), may be required. Projects subject to environmental review may require more detailed analysis of off-site road traffic emissions.

### **3.14.1.3 PSD Class I increment modeling**

Class I areas are of special national or regional scenic, recreational, natural, or historic value for which the PSD regulations provide special protection. Under the Clean Air Act, the FLM and the Federal official with direct responsibility for management of Federal Class I parks and wilderness areas (i.e., Park Superintendent, Refuge Manager, Forest Supervisor) is charged with the affirmative responsibility to protect that area's unique attributes, expressed generically as air quality related values. The permitting authority, MPCA, is responsible for administering the PSD program and ensuring that the NAAQS and increments are protected within the state.

The meteorological data needed for a Class I modeling demonstration are substantially different from those required for Class II areas. Typically, CALPUFF Class I modeling demonstrations require gridded meteorological data. The MPCA does not provide processed gridded meteorological data; however, several public and private sector sources make this information available, in some cases, for a fee. Please review the Class I Modeling Guidance in Appendix B for further details.

The permit applicant should contact the appropriate FLM as soon as plans for a new major source or modification have begun (NSRWM, 1990). The PSD regulations specify that the reviewing authority furnish written notice of any permit application for a proposed major stationary source or major modification to the FLM and the official charged with direct responsibility for management of any lands within the area. The purpose of this document is to document and describe procedures and expectations for analyzing PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub>, SO<sub>2</sub> increments in Class I areas. For further details on Class I increment modeling, please refer to Appendix B.

### **3.14.1.4 PSD Class II increment and future growth**

The PSD program goal is to ensure that air quality in areas with clean air does not significantly deteriorate, while maintaining a margin for future industrial growth. The PSD regulations do not prevent sources from increasing emissions. Instead, they are designed to:

- Protect public health and welfare.
- Preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value.
- ~~I~~nsure that economic growth will occur in a manner consistent with the preservation of existing clean air resources.
- Assure that any decision to permit increased air pollution in any area to which this section applies is made only after careful evaluation of all the consequences of such a decision and after adequate procedural opportunities for informed public participation in the decision-making process.

The MPCA is responsible for the federal PSD program implementation in Minnesota; tribal lands within the state of Minnesota are permitted through the EPA or through the respective tribe's permitting program. Our primary goal is to protect the applicable NAAQS and overall air quality, consistent with the bullets provided above. The MPCA also recognizes the need to balance future growth and economic viability with the protection of ambient air quality. It is within the scope of future growth that the MPCA identifies three

categories where growth occurs: New facilities, modifications of existing facilities, and expansion of facilities. Each of these growth categories has the potential to consume increment and adversely impact air quality.

To ~~insure~~ ensure future growth capacity and economic viability, the MPCA observes the practice of conserving an amount of one unit of a pollutant-specific SIL value ("One-SIL") within an increment analysis for future growth. The MPCA considers this practice a state air quality management goal. If it is not possible to achieve a "One-SIL" value for future growth, then a compliant modeling demonstration with the increment value is sufficient to preserve future growth and protect the ambient air standards. A facility's permit may include requirements to remodel any future changes so the compliance with the NAAQS continues.

### **3.14.1.5 How to estimate "maximum" past actual 24-hour emissions**

Estimating past actual annual emissions is much easier (via emission inventory data) than estimating **maximum** past actual 24-hour emissions (i.e., researching old facility records). A frequent question posed to the MPCA is how to estimate maximum short-term emissions. EPA speaks to this in "NSR Advisory Memorandum 1: TSP PSD Increment Consumption in North Carolina" dated May 3, 1985. See Appendix B.8, which states:

One would expect to see such maximums occur at 5% of the total 24-hour operating time periods (which means non-operating time periods don't count in making this determination). The use of the 5% guideline is intended only to rule out the possibility that a source could deliberately operate only a few times at very high rates in order to decrease increment consumption at some future time.

NSR Advisory Memorandum 1 should be used to estimate maximum past actual short-term (3-hour and 24-hour) emissions for minor source baseline date (MSBD) conditions. If you have additional questions regarding emission estimating, please contact the MPCA air quality permit section at AQPS.Modeling.MPCA@state.mn.us

## **3.15 Model development details**

As you develop your modeling demonstration, you may need to consider the following items to either complete the analysis or further refine the demonstration when actual project conditions change. If you have specific questions, please feel free to contact the MPCA REAM unit.

### **3.15.1 Model defaults and non-defaults**

The AERMOD model supports the EPA's regulatory programs, specifically permitting of PSD and non-PSD sources. In nearly all cases, the regulatory modeling options should be the default mode of operation for any modeling demonstration. MPCA modeling staff recognizes that there are specific situations when a non-regulatory default is required. Typically, these situations involve the approach taken to address an ambient standard (e.g., NO<sub>2</sub> and the OLM); unique stack and terrain features as well as various approaches to developing a deposition modeling demonstration. Please be aware that a non-regulatory default option proposed for a modeling demonstration will likely require a review by the EPA and approval from the MPCA in the case of PSD permit modeling demonstrations prior to protocol approval. For all other permits where air quality dispersion modeling is required, the MPCA is the review and approval authority.

### **3.15.2 Urban/rural considerations**

It is necessary to classify the land use near emission sources since rates of dispersion differ between urban and rural areas. In general, urban areas cause greater rates of dispersion because of increased turbulent mixing and buoyancy-induced mixing. This mixing is due to the combination of greater surface roughness

caused by more buildings and structures. In addition, urban areas also exhibit greater amounts of heat released from concrete and similar building materials. This enhanced dispersion in urban areas occurs during the nighttime hours. The magnitude of the urban heat island effect is driven by the temperature difference between the urban and rural environments that develops at night.

EPA guidance identifies two procedures to make an urban or rural classification for dispersion modeling: the land-use procedure and the population density procedure. Both procedures require the evaluation of characteristics within a 3 km radius from a facility. The land-use procedure specifies that the land use within a 3 km radius of the source should be determined using the typing scheme developed by Auer (1978). Of the two procedures, the land-use procedure is preferred. Caution should be used when applying the population density method approach to highly industrial areas where population density values may be low, since a rural classification would be identified. These areas generally share similar land-use characteristics as highly populated urban areas and therefore should be classified as urban.

The MPCA uses land-use data utilizing the 2011 National Land Cover Database (NLCD) land-use classification system to characterize areas as urban or rural. This dataset classifies land cover at 30-meter spatial resolution using 20 categories shown in Table 18. If the total area of pixels with land use types “Developed, High Intensity,” “Developed, Medium Intensity,” “Developed, Low Intensity,” and “Developed, Open Space” is greater than or equal to 50% of the area within a 3 km circle centered over the project source, then the area should be classified as urban. Otherwise, the area should be classified as rural. Industrialized areas are typically characterized as one of the developed land-use types. The MPCA has automated this analysis through a GIS application known as the Urban vs. Rural Selection Tool, available [online](#). A [video](#) demonstration of the tool is also available online.

The urban/rural determination may be made individually for every source in the modeling demonstration, including nearby sources, and implemented using the urban source group in AERMOD. However, caution should be used when applying the land-use procedure on a source-by-source basis in complex urban settings that include large water bodies, parks, or other non-urban land-use types, which may result in a rural classification for an area within 3 km of a source. EPA guidance recommends modeling all sources in an urban complex with the urban setting to better reflect the regional nature of the urban heat island effect. Please consult with the MPCA when modeling multiple sources in a complex urban environment.

Table 17. The 2021 NLCD land-use classification system<sup>11</sup>.

NLCD Land Cover Classification Legend	
11 Open Water	
12 Perennial Ice/ Snow	
21 Developed, Open Space	
22 Developed, Low Intensity	
23 Developed, Medium Intensity	
24 Developed, High Intensity	
31 Barren Land (Rock/Sand/Clay)	
41 Deciduous Forest	
42 Evergreen Forest	
43 Mixed Forest	
51 Dwarf Scrub*	
52 Shrub/Scrub	
71 Grassland/Herbaceous	
72 Sedge/Herbaceous*	
73 Lichens*	
74 Moss*	
81 Pasture/Hay	
82 Cultivated Crops	
90 Woody Wetlands	
95 Emergent Herbaceous Wetlands	

\* Alaska only

AERMOD currently uses a population value as a surrogate to define the magnitude of the heating difference between the urban and rural environment. For relatively isolated urban areas, published census data corresponding to the Metropolitan Statistical Area (MSA) may be used to estimate a population value for that location. For the Twin Cities MSA, a population value of 2,000,000 is used. For urban corridors or large multi-county urbanized areas (including the Twin Cities) where the MSA cannot be clearly identified or does not sufficiently outline the urban area the MSA population may not be appropriate. Instead, the extent of the contiguous urban area within the 3 km radius, including the source(s) of interest, where the population density exceeds 750 people per square kilometer should be identified. This may exceed the initial 3km search area used to define a modeling domain as "urban." The total population for this area should be applied for the urban option in AERMOD, using census-tract level population data. Please note, the population value should remain consistent within the same urbanized area even~~regardless~~ if the source of interest is located in an urban downtown or near the edge of the urban environment.

### 3.15.3 Insignificant activities

The federal Part 70 program requires each state to include an insignificant activities provision in its Title V Operating Permit Program. Minn. R. 7007.1300, subp. 1 to subp. 5 and Minn. R. 7008.4100 to 7008.4110 fulfill this requirement for Minnesota. However, ***identifying an emission source or an emission unit as an "insignificant activity" under Minnesota's air quality permitting rule does not mean the emission source or emission unit is automatically omitted from a modeling demonstration.*** In fact, emission sources and emission units deemed insignificant for permitting under Minn. R. 7007.1300, subps. 3 to 4 and Minn. R. 7008.4100 to 4110 should generally be included in a modeling demonstration. Exception to the inclusion of an emission source or emission unit in a modeling demonstration is allowed for certain intermittent sources (e.g., emergency generators and fire pumps) if an air quality permit requires the Permittee to implement BMPs for the operation of these emission sources or emission units, and the permit contains the BMP requirements.

### 3.15.4 Equivalent or better dispersion

The MPCA has developed an approach to evaluate whether proposed small changes at a facility will result in EBD and thus still protect NAAQS and MAAQS.

The main goal of the EBD approach is to protect ambient standards while simultaneously avoiding full-refined modeling for minor changes at a facility. The EBD approach attempts to reuse/edit portions of the existing modeling input data to account for emission changes and/or dispersion changes at the facility in

<sup>11</sup> A note on interpreting the Developed, Open Space category (21) in Table 18. Developed, Open Space can be interpreted as urban. The Urban/Rural GIS Tool looks at all the developed areas per the 2011 NLCD land-use classification table.

order to evaluate the net change of predicted concentrations (typically within a pollutant specific SIL value). The current approach is based on well-known PSD increment concepts, which evaluate the change between previous and proposed modeling conditions.

Another goal of the EBD approach is to reduce the administrative review and response time of the MPCA modeling review for projects with minor dispersion changes. MPCA has created a single form that accounts for both the modeling protocol and modeling results/report in order to expedite our review of EBD analyses while documenting the relevant information and modeled output. This form is submitted via e-Service.

TheA forerunner to the EBD language began in the 1980s as part of a SIP proposal whereby a facility located within a SIP area would not be required to conduct a refined modeling demonstration when a minor change was being proposed if they could demonstrate that the change resulted in equivalent or better dispersion characteristics based on a pollutant-specific SIL value. As a result, facilities located within a SIP maintenance area could demonstrate through a simple analysis with readily available information that their proposed change would be equivalent or better than had been previously modeled.

The EBD is most frequently used with MPCA air quality permits and is typically not available for projects undergoing environmental review or where a SIP explicitly omits the use of this approach. In situations where a SIP is silent on the use of an EBD, prior approval must be received from EPA prior to pursuit of the analysis. Please review the language of your air quality permit with the MPCA Air Quality Permit Program to discuss the use of an EBD demonstration for any proposed changes at your facility. The details of the EBD modeling approach and case study example can be found in **Appendix E**.

## Section 4.0: Submittal process, forms, and online services

When pursuing air dispersion modeling for permitting, environmental review (EAW, EIS), and/or SIP requirements, the facility should complete and submit a complete air dispersion modeling protocol. The protocol should follow the accepted practices laid out in this document. The modeling protocol is subject to review by REAM modeling staff. Once the modeling protocol has been reviewed, the facility will be notified via the protocol approval notification form. If the notification form indicates an approval by the Agency, the facility may then conduct air dispersion modeling consistent with methodologies identified in the protocol. Modeling results should then be submitted with the permit application or applicable documents (EAW, EIS, SIP). Any deviations from the approved modeling methodology should be in consultation with the MPCA and should be documented either by resubmittal of the protocol form or in the modeling results form. If the protocol is incomplete, or if one or more components are not acceptable, the notification form will indicate the protocol is not approved. The unacceptable items should be addressed and corrected. The changes will need to be documented and submitted with the updated modeling files and information.

### 4.1 Submittal process

- Complete and submit MPCA's Air Dispersion Modeling Protocol [MPCA Online Services](#) and attach a modeling protocol spreadsheet (**AQDM-02**), [Worksheet for Class II Increment \(if applicable\)](#), and any other required attachments. The **AQDM-02** spreadsheet [and Worksheet for Class II Increment](#) cannot contain hidden cells and calculations.
- Protocol approval notification and Protocol Review Form: receipt of the Protocol Approval Notification (**AQDM-04 & AQDM-05**).
- If the protocol is not approved, document changes to protocol on the Protocol Resubmittal Form (**AQDM-1.5**). Submit this form with the updated modeling files and information. Once the protocol

has been approved and deemed acceptable, the AQDM-04 and AQDM-05 forms will be sent indicating the approval.

- Obtain and complete the MPCA Air Dispersion Modeling Results form (**AQDM-06**).
- Submit AQDM-06 with permit application and/or EAW, EIS, and/or SIP documents.

As previously noted, the MPCA has transitioned to an e-Service online delivery system. Table 19 below provides an overview of the forms required for the e-Service submittal process. If you have any questions regarding requirements for submittal, please contact the Air Modeling Unit at [AirModeling.PCA@state.mn.us](mailto:AirModeling.PCA@state.mn.us).

## 4.2 Modeling protocol forms

MPCA approved modeling protocols are required before submitting modeling reports. MPCA forms/spreadsheets for modeling protocols and modeling reports are available on our [website](#). The latest version of each form should be obtained from the website and used for each project.

The forms were developed to foster better communication regarding MPCA expectations to air permit applicants/consultants, to standardize and streamline of review of air dispersion modeling submittals, to identify/fix common mistakes and time-consuming steps, and to use less paper.

**Table 18. Required forms for project submittals.**

<b>Process</b>	<b>Protocol.</b> Submit all protocol forms and supporting files through e-Service, no hardcopies required. Files too large for e-Service (e.g. terrain files) may be submitted via CD or FTP site. <b>Modeling report.</b> For permit applicants, include the AQDM-06 and accompanying files with each required submittal of the permit application. For modeling conducted for a permit compliance requirement that doesn't require a permit amendment, submit a "pdf" copy of the AQDM-06 and accompanying files on electronic media to the Air Quality Permit Document Coordinator. <b>EBD.</b> Submit AQDM-08 via e-Service when changes address emission rates or buildings changes only. For demonstrations beyond emission rates and buildings, the hard copy version of the AQDM-08 should be used and included, along with accompanying files, with each required submittal of the permit application. If the EBD modeling supports changes that do not require a permit amendment, and a hard copy of the AQDM-08 is required, submit a "pdf" copy and accompanying files on electronic media to the Air Quality Permit Document Coordinator.
Task	Required forms

<b>Ambient Air Dispersion Modeling Protocol for Criteria Pollutants</b>		
<b>Facility Submittal</b>	Air Dispersion Modeling Protocol submittal	e-Service Modeling Protocol AQDM-02 <a href="#">Worksheet for Class II Increment (if applicable)</a> AQDM-11 (if applicable)
	Air Dispersion Modeling Protocol re-submittal (if applicable)	AQDM-1.5 AQDM-02 with changes incorporated and highlighted <a href="#">Worksheet for Class II Increment (if applicable) with changes incorporated and highlighted</a>
<b>MPCA Review</b>	Internal review process, MPCA only	MPCA protocol approval notification forms AQDM-04 and AQDM-05

<b>Ambient Air Dispersion Modeling Report for Criteria Pollutants</b>		
<b>Facility Submittal</b>	Air Dispersion Modeling Report submittal (submit with permit application and/or EAW, EIS, and/or SIP documents)	AQDM-06 General Public Preclusion Plan (if applicable)
<b>MPCA Review</b>	Internal review process, MPCA only	MPCA report approval notification form AQDM-07

Equivalent or Better Dispersion (EBD) for Criteria Pollutant Modeling		
Facility Submittal	EBD Submittal Form for Criteria Pollutant Modeling	AQDM-08 or AQDM-08 e-Service
MPCA Review	Internal review process, MPCA only	MPCA EBD review and approval notification forms AQDM-09 and AQDM-10

**e-Service modeling protocol:** The e-Service modeling protocol is a standardized online modeling protocol form that combines simple checkboxes, dropdown lists, and text to document a facility's air dispersion modeling approach. The online form provides flexibility in that it can accommodate various facility specific modeling approaches. For more information on completing the fields in e-Services and the required attachments, click [here](#). Applicants are also required to list additional/supporting files used to support modeling demonstrations.

**AQDM-1.5:** The AQDM-1.5 is a protocol resubmittal form used to capture changes from an initial e-Service protocol submittal. If changes are needed in order to approve a modeling protocol, the air modeler will request this form to be filled out specifying what changes are being made to the initial submittal. The air modeler will then enter those changes in MPCA's air modeling database. In some instances, if numerous changes are needed, a new e-Service submittal may be requested. Please note: A new e-Service submittal is not required for the AQDM-1.5 form. This form should be emailed to the assigned MPCA air modeler.

**AQDM-02:** The AQDM-02 is a spreadsheet that captures stack parameters, emission rates, and emission factors for the source under review and the nearby source inventory. All sections of the AQDM-02 must be completed (source under review and the nearby source inventory) before the MPCA will review and approve a submitted protocol. Facilities may **add additional** tabs/worksheets to the workbook to provide more detailed calculations. ***Please note the following:***

- The MPCA will not accept password protected spreadsheets or .PDF versions of a spreadsheet. Also, include all linked spreadsheets in the protocol submittal.

The AQDM-02 requests the following information:

- Specific locations for all stacks and release points, along with information pertaining to the manner in which emissions are discharged to the atmosphere (e.g., stacks with "rain caps", stacks with unobstructed vertical releases, "gooseneck" stacks, lateral discharges, vents, and fugitive releases)
- Potential or permitted allowable emissions, emission factors and references per emission release point.

Source parameter worksheets:

- Values in "emission rate" fields should be a calculated emission rate.
- Values in Area Source "emission rate" fields should be in g/m<sup>2</sup>/sec.
- List all operating scenarios to be modeled.

#### Sheet 1: Point Source Parameters

Enter stack parameters into spreadsheet tab "Stack Parameters" in the **AQDM-02** spreadsheet. A **Model Input Key** table provides descriptions along with the required units for stack parameters. Input cells are colored green. Field headings and **Model Input Key** cells are locked and cannot be altered. An Example is provided at the top of the sheet.

#### Sheet 2: Area Source Parameters

Enter area source parameters into spreadsheet tab "Area Source Parameters" in the **AQDM-02** spreadsheet. A **Model Input Key** table provides descriptions along with the required units for area source parameters.

Input cells are colored green. Field headings and **Model Input Key** cells are locked and cannot be altered. An Example is provided at the top of the sheet.

#### **Sheet 3:** Volume Source Parameters

Enter stack parameters into spreadsheet tab “Stack Parameters” in the **Modeling Parameters** spreadsheet. A **Model Input Key** table provides descriptions along with the required units for stack parameters. Input cells are colored green. Field headings and **Model Input Key** cells are locked and cannot be altered. An Example is provided at the top of the sheet.

#### **Sheet 4:** Emission Calculations

Enter fugitive source, stack vent and emission unit information and all relevant emission factors, equations, and references into the **Emission Calculations Table** found in the “Emission Calculations” tab. An Example is provided at the top of the sheet. Input cells are colored green, field headings and “EXAMPLE” cells are locked and cannot be altered. *Indicate in the **Description** field whether emissions are ‘controlled’ or ‘uncontrolled’.*

**Sheet 5 and higher:** User generated sheets. Additional sheets can be added to include information such as nearby sources, continuous emission monitor data, background calculations, etc.

**Worksheet for Class II Increment:** *This Please use this form must be used and attach it to your e-service submittal if you are conducting Class II Increment Modeling. Refer to the form instructions tab for how to use the spreadsheet. To receive supporting information that may be helpful in preparing the increment analysis send an email to AQPS.Modeling.MPCA@state.mn.us and include the following information:*

- The name and facility ID of the facility under review
- The county where the facility is located
- The pollutants that will be modeled for increment
- The names and facility IDs of any nearby sources that will be included

**Further information:** Direct any questions or comments regarding e-Service and AQDM-02 to one of the air dispersion modelers listed in the Contacts and Resources section.

## **4.3 Modeling results**

Air quality dispersion modeling demonstration results are submitted using the MPCA Air Quality Dispersion Modeling Report (AQDM-06) form. This form is used to determine modeled compliance with the applicable ambient air quality standards. A more detailed description of the form as well as content expectations is provided below.

**AQDM-06:** The content expectations of the **AQDM-06** (modeling report) document are similar to the expectations presented in the e-Service protocol form; however, there are some notable differences.

The first distinction between the protocol and the report is the type of files that are needed to accompany the project submittal. With the protocol, the only files needed for review are the input files, including BPIP, Terrain (.tif file) and appropriate meteorology, background, etc. The modeling report requires input files (if they have been modified since the initial review and approval by MPCA) as well as the output files (e.g., .plt, .pst, etc.).

Another important distinction is the documentation of changes that occurred between the MPCA review and approval of the protocol and the submittal of the final modeling report. The MPCA has streamlined the process for amendments or modifications of an MPCA approved modeling protocol. Each section of the protocol is represented in the modeling report review form that provides for an opportunity to identify and justify each modification in the approved protocol. Most changes can be addressed via

email and telephone calls with MPCA air modeling unit staff. The project proposer is required to document all the changes made to the protocol, including times and approvals provided by the MPCA, as part of the report submittal. Please note that most changes to a post-approval protocol will likely be addressed through this process. There are circumstances that would warrant a new protocol for a project instead of a simple review, approval and documentation process described above. Please consult with your MPCA air modeling unit staff assigned to the project in the event that you anticipate changes to an approved protocol to determine if the modification can be made via the modeling report or if a new modeling protocol is necessary to update the project modeling.

Modeling results are discussed in Section 4 of the modeling report and reflect the demonstration of compliance for the applicable PSD increment, NAAQS, MAAQS, or SIL's.

Section 5 of the form is provided for any discussion or comments that the project proposer would like to include as part of the modeling demonstration. This may include specific operating assumptions, rationale for changes along with dates of MPCA contacts, etc. There is no specific limit to the length of the discussion; however, if a lengthy discussion is anticipated, attachments should be used to present the full breadth of the information.

The modeling report is designed to provide for attachments, maps, graphs and related items. Please note that the AQDM-06 form is the official "Modeling Report" for the purpose of the permitting, SIP, or environmental review action. No other reporting document will be accepted without prior approval. Any other documents or reports provided in support of a modeling demonstration are subordinate to the MPCA form and must be included as attachments that align to the sections of the relevant sections of the AQDM-06 form.

For NAAQS or MAAQS modeling demonstrations, the submittal must contain a single input and output file that accounts for the cumulative modeling, irrespective of results. If a modeled violation is revealed through the cumulative analysis, please refer to Manual Appendix A. a contribution analysis can be provided, along with various source-group-related presentations to better explain whether the facility under review either causes or contributes to the modeled exceedance.

## 4.4 EBD for criteria pollutant modeling

The main goal of the EBD approach is to protect ambient standards while simultaneously avoiding full-refined modeling for minor changes at a facility. The EBD approach attempts to reuse/edit portions of the existing modeling input data to account for emission changes and/or dispersion changes at the facility in order to evaluate the net change of predicted concentrations (typically within a pollutant specific SIL value). The current approach is based on well-known PSD increment concepts, which evaluate the change between previous and proposed modeling conditions.

Another goal of the EBD approach is to reduce the administrative review and response time of the MPCA modeling review for projects with minor dispersion changes.

**AQDM-08:** MPCA has created a single form that accounts for both the modeling protocol and modeling results/report in order to expedite our review of EBD analyses while documenting the relevant information and modeled output. Note: This form does not apply to PSD or environmental review related projects.

There are two versions of this form used for submitting EBD demonstrations. The e-Services system cannot be used to submit EBD demonstrations when project changes go beyond emission rates and buildings. This includes changes to location, release height, exit temperature and velocity, diameter, and release type for existing sources. For these situations, use the standard AQDM-08 form and follow the instruction for submitting it with the applicable files. EBD demonstrations should be submitted via e-Services when changes only apply to emission rates and/or building downwash for existing sources or when new sources

are added. For these cases, complete the AQDM-08 e-Services version of the form and submit using e-Services.

## 4.5 MPCA review forms

The MPCA uses several forms for internal review that become part of the administrative record for each modeling demonstration. The specific forms that are included in the record are:

- Air Quality Dispersion Modeling Protocol Review Form (**AQDM-05**)
- Air Quality Dispersion Modeling Protocol Approval Notification Form (**AQDM-04**)
- Air Quality Dispersion Modeling Report Review Form (**AQDM-07**)
- EBD Review Form for Criteria Pollutant Modeling (**AQDM-09**)
- EBD Approval Notification Form (**AQDM-10**)

The first two review forms (AQDM-05 & AQDM-04) are used to evaluate the protocol and provide specific comments pertaining to deficiencies and uncertainty. The second form (AQDM-04) specifically is used as the document that informs a project proposer whether the protocol is approved, conditionally approved or not approved.

A similar form is used to review the modeling demonstration submitted, via the AQDM-07 form. The MPCA review process for the modeling report looks at the consistency between the approved protocol and the final modeling demonstration as well as the demonstration of compliance. Where deviations occur between the modeling protocol and report, the MPCA will review the discrepancies to determine if the deviations are justifiable unless previously approved by the MPCA. Once a modeling report is approved by the MPCA, the final approval of the modeling report, via the AQDM-07 form, is provided to the project proposer and the MPCA permitting engineer.

The process for EBD review is similar to the modeling report review. Once an EBD is approved by the MPCA, the final approval is provided to the project proposer and the MPCA permitting engineer via the AQDM-09 and AQDM-10 forms.

## 4.6 Additional e-Service attachments

An additional form captures data that was previously requested on the AQDM-01 modeling protocol form:

**AQDM-11:** The SIL Analysis and Results form captures the results of the preliminary analysis modeling from Part 2, Stage One described earlier in this document.

# Section 5.0: Contacts

---

David Brown

Phone: 651-757-2227

Email: [david.l.brown@state.mn.us](mailto:david.l.brown@state.mn.us)

- PSD modeling and Title V modeling for individual sources
- Air quality forecasting
- Meteorological data processing
- GIS tool development

Jimmy Schneider

Phone: 651-757-2393

Email: [james.d.schneider@state.mn.us](mailto:james.d.schneider@state.mn.us)

- PSD modeling and Title V modeling for individual sources

- GIS tool development
- Working practices and policy

Jim Sullivan

Phone: 651-757-2769

Email: [jim.sullivan@state.mn.us](mailto:jim.sullivan@state.mn.us)

- PSD, Title V, and environmental review modeling for individual sources
- Policy, practice, and guidance

~~Matt Taraldsen~~

~~Phone: 651-757-2588~~

~~Email: matthew.taraldsen@state.mn.us~~

- ~~Air Quality Forecasting~~
- ~~GIS tool development~~
- ~~PSD modeling and Title V modeling for individual sources~~

Nick Witcraft

Phone: 651-757-2136

Email: [nicholas.witcraft@state.mn.us](mailto:nicholas.witcraft@state.mn.us)

- PSD modeling and Title V modeling for individual sources
- Air quality forecasting
- Meteorological data processing
- GIS tool development

## Appendices

---

Appendix A – Cumulative air modeling analysis and source culpability

Appendix B – Class I guidance

Appendix C – Intermittent emissions and the temperature heat index

Appendix D – Ambient air and modeling

Appendix E – Equivalent or better dispersion example

Appendix F – Application of Table 8-2

## Appendix A

DEPARTMENT: POLLUTION CONTROL AGENCY

SF-00006-05 (4/86)  
STATE OF MINNESOTA  
Office Memorandum

DATE: October 13, 2015

TO: Don Smith, P.E.  
Manager  
Air Quality Permits Section  
Industrial Division

Bill Sierks  
Manager  
Environment & Energy Section  
Resource Management & Assistance Division

FROM: Frank Kohlasch *JK*  
Manager  
Air Assessment Section  
Environmental Analysis and Outcomes Division

PHONE: 651-757-2500

SUBJECT: Source Contribution Analysis for Modeled Exceedances in a Cumulative Modeling Analysis

The purpose of this memorandum is to describe how the Risk Evaluation and Air Modeling (REAM) unit will support the Minnesota Pollution Control Agency (MPCA) Environmental Review Program and Air Quality Permitting program using an existing Environmental Protection Agency (EPA)-approved modeling technique, referred to as a Source Contribution Analysis, to address modeled exceedances of a project under review, a nearby source, or a combination of sources that contribute to a modeled exceedance. The function of this technique is to identify which facilities in the model are significant contributors to modeled noncompliance. Of particular concern is the modeled status of the project that is subject to either environmental review or permitting. Projects subject to either of these programs with modeled noncompliance, or, alternatively are significant contributors to a modeled noncompliance, will not be able to obtain a permit or environmental review approval until the facility is able to implement controls or practices that result in significant reductions.

The Source Contribution Analysis is offered as a means to meet two regulatory objectives:

1. To provide an EPA-accepted modeling technique used to separate modeled emissions from the proposed project and other contributing sources where a modeled exceedance of an applicable ambient air quality standard is revealed; and,
2. To support program-specific decision factors for the MPCA to consider when presented with modeled exceedances and the results of a Source Contribution Analysis.

While the modeling technique described in this memorandum may have wide application; each modeled exceedance scenario should be considered on its own unique facts. The regulated community may offer alternatives to the approach presented in this memorandum for consideration by the agency.

### Primary Program and Regulatory Considerations

The MPCA REAM unit has applied the Source Contribution Analysis to a variety of projects. The following is a short summary of the applicable air quality standards and the relevant programs where the Source Contribution Analysis can be applied to facilitate Air Quality Permitting and Environmental Review.

Don Smith, P.E.

Bill Sierks

Page 2

October 13, 2015

### **National Ambient Air Quality Standards (NAAQS) and Minnesota Ambient Air Quality Standards (MAAQS)**

The air quality regulatory focus for MPCA Air Quality Permitting and Environmental Review is the National Ambient Air Quality Standards (NAAQS) and the Minnesota Ambient Air Quality Standards (MAAQS). Under the Clean Air Act sections 110(a)(1) and (2), Minnesota is required to demonstrate via its State Implementation Plan (SIP) that the state's existing rules and statutory authorities provide for the implementation, maintenance and enforcement of the NAAQS. This type of SIP submittal is known as an "infrastructure SIP" because it relies upon the existing "infrastructure" of a State's air quality management program. An infrastructure SIP must include "enforceable emission limitations and other control measures, means, or techniques, as well as schedules and timetables for compliance..." that will ensure NAAQS compliance. It must also provide for air quality modeling, as needed, to predict the effects of emissions on the NAAQS. Though not federally required, the MAAQS are included in the infrastructure SIP and are applied to facilities in a similar fashion as the NAAQS (See Minn. R. 7009.0080). Ultimately, Minnesota meets the obligations of the NAAQS and manages the MAAQS through a number of rules and statutes, specifically relying on Minn. R. 7009.0020, which prohibits emissions that cause or contribute to a violation of ambient air quality standards. The MPCA administers the NAAQS and MAAQS through a variety of programs; however, the Environmental Review and Air Quality Permitting programs most frequently encounter modeled air quality noncompliance issues.

### **Cumulative Effects and Environmental Review Modeling**

Minnesota's Environmental Policy Act (MEPA) authorizes the existence of an environmental review program, administered by the Environmental Quality Board (EQB) and implemented by various state and local units of government using EQB rules. Project proposers with actions subject to MEPA must consider the direct, indirect and cumulative potential effects of the proposed project. The MPCA Environmental Review program frequently uses air dispersion modeling to assess the cumulative potential effect of a proposed project on air quality as part of the Environmental Assessment Worksheet. Although a modeled exceedance of an ambient air quality standard (NAAQS or MAAQS) is usually considered significant for environmental review purposes, EQB rules (Minn. R. 4410.1700, subp. 7(B) specifies criteria for a responsible governmental unit to consider in their assessment of cumulative potential effects:

1. Whether the cumulative potential effect is significant. We believe this means assessing whether the totality of the modeled air emissions (project + background + other nearby sources) exceed an ambient standard or is otherwise significant;
2. Whether the contribution from the project is significant when viewed in connection with other contributions to the cumulative potential effects;
3. The degree to which the project complies with approved mitigation measures specifically designed to address the cumulative potential effect. The rule says that mitigation measures must be specific and reasonable expected to address to mitigate the environmental effects; and,
4. The efforts of the proposer to minimize the contribution from the project.

The Source Contribution Analysis approach featured in this memorandum is a reasonable and effective means to separate modeled emission sources and evaluate emission contributions from the proposed project and other nearby sources, consistent with item #2, as listed above.

## Air Quality Permit Modeling

The Prevention of Significant Deterioration program 40 CFR § 52.21(b) requires a demonstration that certain new or modified activities will not adversely affect ambient air quality. Typically, this demonstration requires ambient air modeling to show that the predicted impacts are small (i.e., *de minimis*) or that the impacts of the project's emissions, when combined with background emissions and the emissions from neighboring sources, comply with the NAAQS. Since MPCA's ability to protect ambient air quality depends on the contributions of individual sources with nearby and long-range emissions (including small stationary sources and non-point sources), a modeled demonstration must consider the cumulative contributions from all sources.

## Source Contribution Analysis

The Source Contribution Analysis was designed by EPA and presented as a means to separate facility contributions in a cumulative modeling analysis. The specific approach to complete a Source Contribution Analysis is found in the *User's Guide for the AMS/EPA Regulatory Model-AERMOD*<sup>1</sup>. This analysis is applied at each receptor in the modeling domain where modeling shows an exceedance of the applicable NAAQS or MAAQS. The results of this analysis are frequently used to determine if a project under review will require additional controls or limits to manage their emissions. Typically, MPCA uses EPA's pollutant-specific significant impact level (SIL) (usually two to four percent of the numeric value of the applicable NAAQS), where available, to evaluate the need for emission reductions. This approach meets the needs of separating the cumulative contributions of multiple modeled sources for MPCA's environmental review and air quality permitting programs.

## MPCA Evaluation to Modeled Exceedances

Using the modeled results and source separation technique identified above, the contributing or culpable sources (i.e., source under review and/or nearby sources) will be evaluated by MPCA permitting and environmental review management to determine the most appropriate program-related action based on several factors that include, but are not limited to:

- Modeled contribution to ambient concentrations
  - Modeled percent contribution to the NAAQS/MAAQS at highest receptor
  - Number of receptors with a modeled exceedance to which the facility contributes
- Quantity of facility emissions
- Permit Considerations
  - Permit status (renewal date) and permit type
  - Permit application in house
- Potential upcoming projects
- EPA guidance and input
- Source location, especially in an Environmental Justice area

---

<sup>1</sup> <http://www.epa.gov/scram001/7thconf/aermod/aermodugb.pdf> [Retrieved August 13, 2015] See specifically, EVENT processing.

Don Smith, P.E.

Bill Sierks

Page 4

October 13, 2015

Typical options for MPCA consideration will reflect the nature of the action and which source is subject to the modeled exceedance. For example:

- For the project under review seeking a permit or completing environmental review:
  - Require emission rates in a permit such that they model below the applicable SIL or screening value. Under this scenario, no further analysis would be required for the project under review.
- For modeled noncompliance of nearby sources:
  - Review modeled emissions to determine that they are correct and consistent with the most recent air quality permit. If not, additional information may be gathered and remodeling may be required;
  - In the event that the modeled emissions appear correct, document accordingly to ensure that a requirement to model or demonstrate compliance is placed in a future permit issued to the facility; or,
  - Request new modeling information from the relevant culpable nearby sources for re-modeling purposes.

This is not an exhaustive list of options and reflects reasonable possibilities based on modeled data and project information. Other options will likely emerge as each project situation and facts will vary.

### **Review of the Practice and Integration into Modeling Guidance**

This memorandum is intended to describe the practice of applying a Source Contribution Analysis where cumulative modeling identifies a modeled exceedance of either the source under review or one of the modeled nearby sources. Ultimately, this practice will be included in the MPCA Modeling Guidance if it is found to be serviceable in administering the MPCA's Environmental Review and Air Quality Permitting programs. Procedurally, this memorandum will operate as the MPCA working practice on this subject until the 2016 revision of the MPCA Modeling Guidance is completed. During this period the memorandum is in effect, the MPCA will review the performance of this approach and discuss the application of the analysis with project proposers that have used this practice on their projects. If the MPCA determines that this practice should be included in the Modeling Guidance, it will be added to the complement of modeling practices during the next guidance revision cycle and this memorandum will be archived.

FK:vs

Attachment

MPCA

# DRAFT

# Class I Cumulative

# Increment Analysis

Roberson and Cole  
1/26/2011 Update

## Table of Contents

<b>CLASS I INCREMENT MODELING.....</b>	<b>3</b>
<b>INTRODUCTION.....</b>	<b>3</b>
<b>MINNESOTA CLASS I AREAS .....</b>	<b>3</b>
<b>CLASS I SIL ANALYSIS.....</b>	<b>3</b>
1. <i>Model Selection:.....</i>	3
2. <i>Model Setup and Run: .....</i>	4
3. <i>Review Modeling Results:.....</i>	4
<b>CLASS I CUMULATIVE INCREMENT MODELING ANALYSIS .....</b>	<b>4</b>
1. <i>Model Selection: .....</i>	5
2. <i>Model Setup: Use EPA Default Settings: .....</i>	5
3. <i>Emissions Data: .....</i>	5
4. <i>Modeling Runs for Multiple Baseline Areas:.....</i>	5
5. <i>Post Processing: CALPOST and CALSUM:.....</i>	7
6. <i>Determine Class I increment impacts:.....</i>	7
7. <i>Submittals to the Reviewing Agency:.....</i>	7
<b>REFERENCES: .....</b>	<b>8</b>
<b>EMISSION INVENTORY .....</b>	<b>9</b>
<b>CLASS I CUMULATIVE INCREMENT INVENTORY DEVELOPMENT – GUIDANCE.....</b>	<b>9</b>
<b>REFERENCES: .....</b>	<b>10</b>
<b>PERMIT DETERMINATIONS.....</b>	<b>12</b>
<i>Contact Permitting Program .....</i>	28

## Class I Increment Modeling

### Introduction

Class I areas are of special national or regional scenic, recreational, natural, or historic value for which the PSD regulations provide special protection. The Federal Land Manager (FLM) of each Class I area is charged with the affirmative responsibility to protect that area's unique attributes, expressed generically as air quality related values (AQRV's). The permitting authority, MPCA, is responsible for administering the Prevention of Significant Deterioration (PSD) program and ensuring that the NAAQS and increments are protected within the state. The permit applicant should contact the appropriate FLM as soon as plans for a new major source or modification have begun (NSRWM, 1990). The PSD regulations specify that the reviewing authority furnish written notice of any permit application for a proposed major stationary source or major modification to the FLM and the official charged with direct responsibility for management of any lands within the area. The purpose of this document is to document and describe procedures and expectations for analyzing PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub>, SO<sub>2</sub> increments in Class I areas.

### Minnesota Class I Areas

Minnesota Class I areas are designated as mandatory Federal Class I areas that are managed by either the National Parks Service (NPS) or the Forest Service (FS). Class I areas within outside of Minnesota may also need to be considered, these includes areas in Wisconsin and Michigan that are managed by either the NPS or the Fish and Wildlife Service (FWS).

Class I Area	Managing Agency
1. Voyageurs National Park(VNP)	NPS
2. Boundary Waters Canoe Area (BWCA)	FS
3. Isle Royale (IR, MI)	NPS
4. Rainbow Lake (RL, WI)	FS

### Class I SIL Analysis

#### *Applicability*

Source applicability is based on a sources proximity to a Class I area, the most current recommendation is that all major sources or major modifications within 300 km of a Class I area should conduct an impact analysis of the affected Class I area(s). FLM and/or the reviewing agency may request that sources beyond 300 km also conduct an impact analysis (NSRWM, 1990).

#### **EPA Preferred Model: CALPUFF**

The current regulatory version of the CALPUFF Modeling System includes:

- CALPUFF version 5.8, level 070623
- CALMET version 5.8, level 070623
- CALPOST version 6.221, level 070622

#### ***General Steps for Modeling Facility Impacts Against Class I SILs***

1. Model Selection
2. Model Setup and Run
3. Review Results and Determine need for a Cumulative Increment Analysis

1. **Model Selection:** CALPUFF/CALMET modeling system is the EPA preferred model for far-field air dispersion modeling. Facilities should use EPA preferred model when conducting and Impact Analysis of Minnesota Class I Areas. However, when a facility is within 50K of a Class I area it

may be appropriate to use a model designed to estimate near-field impacts when conducting a SIL analysis. In this case the EPA preferred model is AERMOD. It is recommended that facilities discuss with the reviewing agencies, prior to conducting modeling, the best strategy for conducting the Class I SIL Analysis.

## 2. Model Setup and Run:

- a. CALPUFF chemistry option should be turned OFF for Increment modeling.
- b. Receptor Grid (Class I area receptor grids are provided by the NPS and can be found at <http://www.nature.nps.gov/air/Maps/Receptors/index.cfm>).
  - i. The entire Class I receptor grid should be modeled.

The intent of the PSD program is to track increment, modeling the entire grid accomplishes this. Additionally, this is consistent with the state of the practice.

**NOTE:** FLM may request that additional receptors be placed in FLM Class II areas for increment, visibility, and acid deposition modeling.

- c. Met Data: The most recent and readily available MM5 data should be used to generate met data files with grid spacing no less than 4km to ensure proper wind field development.

**NOTE:** EPA headquarters has begun processing updated data for MM5.

- d. Terrain and Land Use Data: USGS DEM 90 meter data.

- e. Emissions:
  - i. The emissions inventory associated with the facility sources should be modeled for each relevant pollutant and time period.

- f. Source characterization:
  - i. Point, volume, area, etc.

## 3. Review Modeling Results:

- a. No Modeled Exceedance of SIL at any Receptor: No further increment modeling analysis may be required – however if FLM believe AQMV will be affected they and/or the reviewing agency may request a cumulative impact analysis (NSRWM, 1990).
- b. Modeled Exceedance of SIL at any Receptor: If there is a SIL exceedance at any receptor in the affected Class I area(s) a cumulative increment modeling analysis should be performed. There are no instances for which only portions of the Class I receptor grid should be used in a modeled impact analysis or cumulative increment analysis. Precedent dictates modeling of the entire Class I Area receptor grid.

## Class I Cumulative Increment Modeling Analysis

Facilities should submit a modeling protocol and receive the reviewing agency's approval prior to conducting Class I Cumulative Increment analysis.

All major sources or major modifications within 300 kilometers of a Class I area should conduct an impact analysis of the affected Class I area(s) as described in the SIL analysis section above. Sources within 300 km of Class I areas should be included in the cumulative increment modeling analysis (EPA Memorandum, August, 2009). FLM and/or the reviewing agency may request that sources beyond 300 km also be included in the impact analysis.

## EPA Preferred Model: CALPUFF

The current regulatory version of the CALPUFF Modeling System includes:

- CALPUFF version 5.8, level 070623
- CALMET version 5.8, level 070623
- CALPOST version 6.221, level 070622

### ***General Steps for Modeling Cumulative Increment Analysis***

Since the CALPUFF model cannot model negative emissions, two model runs are required to obtain increment impacts at Class I receptors. One model run is of the increment expansion emissions and the second model run is of the increment consumption emissions (see next section: Class I Cumulative Increment Inventory Development – Guidance). The final impact analysis is the air concentration at each Class I receptor for every hour of modeled data. Post processing using CALSUM and CALPOST allows the summation of the emissions at each receptor for the specified pollutant and averaging time, the final output grid is the net concentration at each Class I receptor.

**1. Model Selection:** CALPUFF/CALMET modeling system is the EPA preferred model for far-field air dispersion modeling. Facilities should use EPA preferred model when conducting an Impact Analysis of Minnesota Class I Areas.

**2. Model Setup: Use EPA Default Settings:**

a. Modeling Domain: The modeling protocol should identify the modeling domain, including the domain coordinates, as well as verify that the domain will extend at least 50 km beyond each class I area included in the analysis.

b. Receptor Grid: Class I area receptor grids are provided by the NPS and can be found at <http://www.nature.nps.gov/air/Maps/Receptors/index.cfm>.

i. The entire Class I receptor grid should be modeled, NOT just those receptors where SILs were exceeded.

NOTE: The intent of the PSD program is to track increment, modeling the entire grid accomplishes this. Additionally, use of the entire grid is consistent with the state of the practice.

c. Met Data: The most recent and readily available MM5 data should be used to generate met data files with grid spacing no less than 4km to ensure proper wind field development.

NOTE: EPA headquarters has begun processing updated data for MM5.

d. Terrain and Land Use Data: USGS DEM 90 meter data.

**3. Emissions Data:** See next section - Emissions Inventory: Class I Cumulative Increment Inventory Development

**4. Modeling Runs for Multiple Baseline Areas:**

In Minnesota, sources that may impact the Class I areas, BWCA and VNP, extend across multiple baseline areas (counties). Since a separate inventory is needed for each baseline area (county) or section 107 area (major source baseline areas) for each class I area, pollutant and averaging time, there will be multiple increment expansion and consumption model runs corresponding to a pollutant, its averaging time, and the baseline area inventories. Since CALPUFF cannot model negative emissions, facilities must conduct one model run for the increment expansion emissions and one model run for the increment consumption emissions for each pollutant, averaging time, and baseline area inventory (See Example). CALSUM is used to scale (set negative) the expansion concentrations. CALPOST is used to set CALPUFF output for each receptor for each model run and to sum the impacts at each receptor. *Each model run shown in the Example below is for the entire Class I receptor grid.*

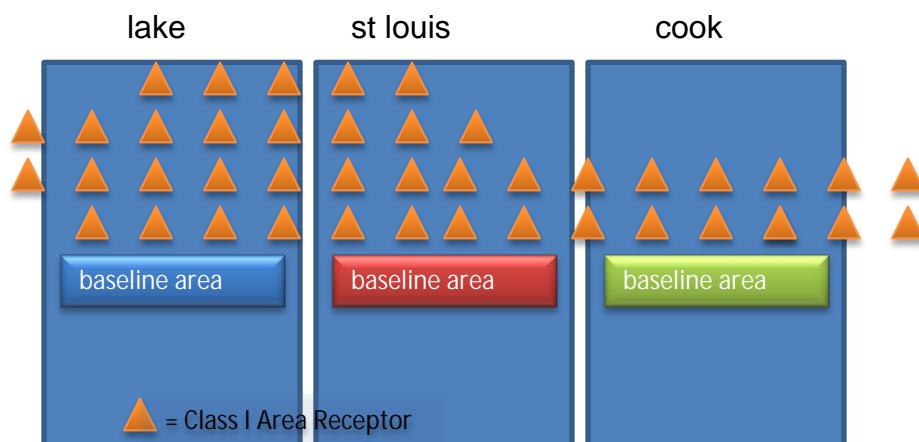
**Example:**

Class I Area: BWCA

Baseline Areas (Counties): Lake, St. Louis, Cook

Pollutant: SO<sub>2</sub>

Averaging period: Annual



**Model Runs:**

**Lake Co. SO<sub>2</sub> annual  
expansion**

**Lake Co. SO<sub>2</sub> annual  
consumption**

**St Louis Co. SO<sub>2</sub> annual  
expansion**

**St Louis Co. SO<sub>2</sub> annual  
consumption**

**Cook Co. SO<sub>2</sub> annual  
expansion**

**Cook Co. SO<sub>2</sub> annual  
consumption**

Figure 1: Schematic showing current modeling Class I Cumulative Increment for multiple counties with multiple baseline dates.

**5. Post Processing: CALPOST and CALSUM:**

CALPUFF increment expansion and consumption model runs should be post processed using CALSUM and CALPOST. CALSUM is used to scale the impacts of the increment expansion and consumption runs. The scaling factors for increment consuming and increment expanding are +1 and -1 respectively (<http://www.src.com/calpuff/FAQ-answers.htm#2.6.1>). Then CALPOST is used for summing the net increment consumption at each receptor. The facility should ensure that the files being combined are for identical time periods, have the same number of receptors and all receptors were modeled in the same order in each CALPUFF run (<http://www.src.com/calpuff/FAQ-answers.htm#2.6.1>).

NOTE: A single CALPUFF run can be used to model impacts for all pollutants and averaging times.

**6. Determine Class I increment impacts:**

Each pollutant and averaging time identified in SIL runs.

- a. Case 1: No increment violation at any Class I area receptor
  - i. Modeling is complete
- b. Case 2: Impacts equal to or exceed increment for given pollutant and averaging period.
  - i. Refer to reviewing authority's permitting program

**7. Submittals to MPCA, the Reviewing Agency:**

- a. Written report of Modeling Protocol
- b. Summary of emission inventory used and any screening conducted
- c. 1 of each of the following sample input files
  - i. CALPUFF
  - ii. CALMET
  - iii. CALPOST
  - iv. POSTUTIL(if applicable)

<http://www.cleanairinfo.com/regionalstatelocalmodelingworkshop/archive/2010/Documents/Presentations/NPS-PROTOCOL-for-CLASS-I-CLASS-II.pdf>

After Protocol Review and Approval Submit:

- d. Written report of Modeling Results
- e. Modeling Files
  - i. CALPUFF
  - ii. CALPOST
  - iii. CALSUM
  - iv. POSTUTIL (if applicable)
  - v. Met
  - vi. Terrain

**References:**

1. New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting, 1990. <http://www.epa.gov/ttn/nsr/gen/wkshpman.pdf>
2. Federal Land Manager's Air Quality Related Values Work Group (FLAG): Phase I Report – Revised 2010. Natural Resource Report NPS/NRPC/NRR—2010/232. [http://www.nature.nps.gov/air/Pubs/pdf/FLAG\\_2010.pdf](http://www.nature.nps.gov/air/Pubs/pdf/FLAG_2010.pdf)
3. EPA, OAQPS Memorandum, Clarification of EPA-FLM Recommended Settings for CALMET. August 31, 2009. <http://www.epa.gov/ttn/scram/CALMET%20CLARIFICATION.pdf>
4. EPA Regional/State/Local Dispersion Modelers Workshop. June 10-12, 2008, Denver (Englewood), CO. <http://www.cleanairinfo.com/regionalsatelocalmodelingworkshop/archive/2008/index.htm>
5. 9<sup>th</sup> Modeling Conference, October 9, 2008. <http://www.epa.gov/ttn/scram/9thmodconfpres.htm> [http://www.epa.gov/ttn/scram/9thmodconf/calpuff\\_status9mc.pdf](http://www.epa.gov/ttn/scram/9thmodconf/calpuff_status9mc.pdf)

## Emission Inventory

### Class I Cumulative Increment Inventory Development – Guidance

1. Model the proposed facility/modification emissions to determine impacts at Class I receptors.
2. Develop a cumulative increment emissions inventory for any pollutant that exceeds the applicable Class I significant impact level (SIL).
3. The cumulative inventory is based on emission changes since the applicable baseline date for the Section 107 area (county) where the receptor is located that experienced impacts above the SIL. Emission changes are expressed in pound per hour (lb/hr) for the applicable SIL averaging period, and then converted to gram/second (g/s) emission rates for modeling. The lb/hr rates are determined by determining the annual average ton-per-year (tpy) emissions for the most recent two-year period, and subtracting the annual average tpy emissions for the two-year period immediately preceding the applicable baseline date for the pollutant. The tpy emissions are converted to lb/hr emissions using annual equivalent operating hours at 100 percent capacity.
4. Separate inventories unique to each pollutant and applicable baseline date will need to be developed and modeled.

### Example

A new source is proposed to be constructed in Carlton County, Minnesota. Modeling of the proposed source's allowable emissions indicates exceedance of the SO<sub>2</sub> SIL at receptors in the Boundary Waters Canoe Area (BWCA) Class I areas in St Louis, Lake, and Cook Counties, and exceedance of the PM<sub>10</sub> SIL at receptors in the BWCA Class I areas in St Louis and Lake Counties.

The applicable baseline dates for these counties and pollutants are shown below:

County	SO <sub>2</sub> Baseline Date	PM <sub>10</sub> Baseline Date
St Louis	1986 (MiSBD)	1979 (MiSBD)
Lake	1992 (MiSBD)	1999 (MiSBD)
Cook	1975 (MaSBD)	1975 (MaSBD)

Three separate SO<sub>2</sub> increment inventories will need to be prepared (one inventory for each unique county SO<sub>2</sub> baseline date). In addition, two separate PM<sub>10</sub> increment inventories will need to be prepared (one inventory for each unique county PM<sub>10</sub> baseline date).

An SO<sub>2</sub> increment inventory would be prepared for St Louis County based on its 1986 SO<sub>2</sub> minor source baseline date (MiSBD), another SO<sub>2</sub> increment inventory prepared for Lake County based on its 1992 SO<sub>2</sub> MiSBD, and a third SO<sub>2</sub> increment inventory would be prepared for Cook County based on its 1975 SO<sub>2</sub> major source baseline date (MaSBD). The same approach would be taken for PM<sub>10</sub> inventories for St Louis and Lake Counties.

Each inventory for a county where the MiSBD has been triggered (St Louis and Lake) will in general, include sources within 300 km of the Class I area (BWCA) where the SIL was exceeded. Actual emission changes of the specific pollutant at any stationary or mobile source since the applicable MiSBD, along with actual emission changes at major sources since the MaSBD due to

a physical change (i.e. construction) or a change in the method of operation, are used to determine the increment emissions for each source in the county inventory.

The inventory for the county where the MaSBD is in effect (Cook County) is composed of emission changes since the 1975 SO<sub>2</sub> MaSBD. However, unlike for St Louis and Lake Counties, the Cook County SO<sub>2</sub> emission increment inventory is composed only of actual emission increases at major sources due to a physical change (i.e. construction) or a change in the method of operation, and, actual emission decreases at major sources due to a physical change (i.e. construction) or change in the method of operation providing those decreases are federally enforceable in a permit or State Implementation Plan. The inventory also is composed only of this set of major sources generally within 300 km of the BWCA.

**NOTE:** Contact the MPCA Permitting Unit or the project permit engineer for information regarding emission inventory submittals.

**References:**

1. October 1990 New Source Review Workshop Manual, Chapter C Air Quality Analysis
2. April 5, 1999 EPA memorandum 'Request To Clarify Prevention of Significant Deterioration (PSD) Baseline Area and Corresponding Baseline Date for Breton National Wildlife and Wilderness Area' from Bill Harnett to Robert E. Hanneschlager and Winston E. Smith (attached).
3. April 2006 Federal Land Manager 'Class I Cumulative Increment Inventory: Guidance for determining the increment-consuming/expanding sources to include in the PSD analysis.'(attached).
4. April 18, 2008 EPA memorandum 'Issues Regarding Class I Increment Analysis Inventories.' (attached).



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

breton 5, wpd

April 5, 1999

**MEMORANDUM**

OFFICE OF  
AIR QUALITY PLANNING  
AND STANDARDS

**SUBJECT:** Request to Clarify Prevention of Significant Deterioration (PSD)  
Baseline Area and Corresponding Baseline Date for Breton National Wildlife  
Refuge and Wilderness Area

**FROM:** Bill Harnett, Acting Director *William Harnett*  
Information Transfer & Program Integration Division (MD-12)

**TO:** Robert E. Hannesschlager, P.E., Acting Director  
Multimedia Planning and Permitting Division (6PD)

Winston E. Smith, Director  
Air Pesticides & Toxics Management Division (4-APTMD)

This responds to your memorandum to John Seitz, dated May 4, 1998. You requested guidance for establishing an inventory of sources to assess the air quality impacts at Breton National Wildlife Refuge and Wilderness Area (Breton)--a Class I area under the Prevention of Significant Deterioration (PSD) program. In particular, you presented three questions establishing the needed inventory and then offered two possible approaches for responding to the questions. Your staff and mine have discussed these questions, and we gave preliminary responses to participants of the Breton air quality study at the meeting in Biloxi, Mississippi on January 21, 1999. Participants of the meeting included representatives from EPA Regions IV and VI; the Minerals Management Service; Fish and Wildlife Service; the States of Alabama, Louisiana and Mississippi; and several onshore and offshore industries.

Some participants recently requested an official written response from EPA to clarify the PSD policy for carrying out the Breton air quality study. This memorandum provides EPA's position concerning the appropriate policy for determining the amount of PSD increment currently being consumed at Breton by sources in the adjoining States and by sources offshore. Our policy is most like the approach which you provided as Alternative 2 in your May 4, 1998 memorandum.

**Question 1: How do we develop a PSD emission source inventory (or conversely, a baseline source inventory) developed for Class I areas with an impact region encompassing many States?**

**Response:** In a baseline source inventory, you (the study group) should include information about any source whose emissions are determined to affect the increment in the area of concern.

Recycled/Recyclable • Printed with Vegetable Oil Based Inks on 100% Recycled Paper (40% Postconsumer)

Sources whose emissions affect the increment fall into one of two categories:

- ▶ Major stationary sources whose emissions increased or decreased as a result of construction occurring after the major source baseline date; and
- ▶ Any source (stationary source, area source, mobile source) whose emissions increased or decreased on or after the minor source baseline date.

For Breton, the major and minor source baseline dates are these:

- ▶ The major source baseline date is fixed by regulation for each applicable pollutant (January 6, 1975 for particulate matter and SO<sub>2</sub> and February 8, 1988 for NO<sub>x</sub>).
- ▶ The minor source baseline date may vary from one area to another. So do two things:
  - First identify the applicable baseline area. From the information in your earlier communications, Breton is in the Southern Louisiana-Southeast Texas Interstate Air Quality Control Region (AQCR).
  - Then determine whether such an area already has a minor source baseline date. Again, from the information in your earlier communications, the minor source baseline dates for the Louisiana portion of the AQCR are August 1977 for particulate matter and SO<sub>2</sub>, and February 1988 for NO<sub>x</sub>. As explained in our response to question 2, the minor source baseline dates associated with other nearby States are irrelevant to the increment analysis at Breton.

For a typical increment analysis, most of the sources affecting the increment normally would be located in the baseline area associated with the applicable minor source baseline date, and only a few would be located outside that baseline area. However, because of Breton's unique location, many sources whose emissions could consume its increment might be outside Breton's baseline area. You've chosen an acceptable way to identify those emissions by including sources located, at a minimum, within a radius of 100 kilometers of Breton. Adjust this approach as necessary. For example:

- ▶ Inside the 100-kilometer radius, you needn't include small sources with only trivial impacts.
- ▶ Outside the 100-kilometer radius, you should screen very large sources for the potential impacts of their emissions and for possible inclusion in the inventory.

**Question 2: Because baseline areas are limited to intrastate regions, how do emissions from sources in one State affect the increments in another State when the States have different minor source baseline dates?**

**Response:** When you calculate the amount of increment consumed in a particular baseline area, only the minor source baseline date applicable to that baseline area is relevant. Baseline areas

are limited to intrastate regions because of an EPA policy that prevents emissions from a source in one State from triggering the minor source baseline date (and establish the baseline area) in another State. *See* 45 FR at 52716, August 7, 1980. However, once the minor source baseline date and corresponding baseline area are established in any portion of a State, EPA believes that any change in air quality occurring in such area should affect the PSD increments for the area, regardless of the location of any source contributing to the change. This is consistent with Congress' intent that the maximum allowable increase in pollutant concentration (increment) in a baseline area generally be measured against the area's change in air quality which occurs following the establishment of its minor source baseline date. *See* statutory definition of "baseline concentration" at section 169(4) of title I of the Clean Air Act.

Clearly, sources located outside the affected baseline area may contribute to a change in air quality within the affected baseline area. For emissions changes from such sources to affect the increment in the same way as emissions generated inside the affected baseline area, it is necessary to relate those changes to the area's minor source baseline date. Thus, as explained in our response to question 1, the only minor source baseline date relevant to increment consumption at Breton is the minor source baseline date established for the baseline area associated with Breton.

**Question #3: Should the PSD inventory include Outer Continental Shelf (OCS) sources?**

**Response:** Yes, EPA's position is that the PSD inventory should include OCS sources, where appropriate. Congress, in declaring its purpose for the PSD provisions in section 160 of the Act, addressed the potential for increased air pollution without distinguishing between the types of air pollution sources. EPA's longstanding policy has been that baseline concentrations reflect actual air quality in an area and that any emissions not included in the baseline count against the increment.

Congress did identify certain circumstances (some permanent, others temporary) for which States could decide to exclude certain emissions from the increment-consumption process, but emissions from offshore sources was not among those exclusions. In 1990, Congress explicitly addressed the potential for air quality problems resulting from offshore sources by adding section 328 of the Clean Air Act. New section 328 sought to protect Federal and State ambient air quality standards, ensure compliance with the PSD requirements, and spread the burden of achieving these goals more equitably between onshore and OCS sources.

In 1992, EPA issued regulations at 40 CFR part 55 to implement the section 328 requirements. The EPA believes that emissions from OCS sources may affect increments whether or not an OCS source itself is subject to 40 CFR part 55. However, the only emission increases at OCS sources that count against the increments at Breton are those increases which occur after Breton's minor source baseline date. Also, emission reductions at OCS sources will expand the amount of available increment at Breton when the reductions improve the air quality at Breton after its minor source baseline date.

I hope that this information helps the Breton air quality study group to determine the air quality impacts causing Breton's PSD increment to be consumed. If more questions come up, please contact Dan deRoeck at 919/541-5593, or E-mail at deroeck.dan@epamail.epa.gov.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

APR 18 2008

OFFICE OF  
AIR QUALITY PLANNING  
AND STANDARDS

MEMORANDUM

SUBJECT: Issues Regarding Class I Increment Analysis Inventories

FROM: Dennis Atkinson, Meteorologist *Dennis Atkinson*  
Model Clearinghouse Director, C439-01

TO: Jeff Robinson, Chief  
Air Permits Section (6PD-R)

THRU: Tyler Fox, Leader *Tyler Fox*  
Air Quality Modeling Group, C439-01

INTRODUCTION

In response to your memo of April 18, 2008, the Model Clearinghouse has reviewed your proposed resolution of the issues presented, in order to properly and adequately account for cumulative impacts of emissions from all increment affecting sources in the Class I increment analysis associated with the proposed Prevention of Significant Deterioration (PSD) permit for AEP SWEPCO John W. Turk, Jr. power plant in Hempstead, AR. Recognizing the difficulty of the situation presented by the applicant's exclusion of a significant number of increment affecting sources from the original dispersion modeling analysis, we concur with your assessment of the key technical and guidance issues raised and with the general approach presented in your submittal in addressing this application.

BACKGROUND

The original Class I increment analysis submitted by AEP SWEPCO indicated numerous increment exceedances for 24-hour SO<sub>2</sub> at the Caney Creek Class I Wilderness Area, but the proposed source was less than the EPA proposed Class I significant impact level (SIL) for SO<sub>2</sub> on the high, second high (H2H) days at each violating receptor. EPA Region 6 commented in July 2007 and again in April 2008 that the applicant had inappropriately excluded increment-contributing sources. As a result of this exclusion, the modeled impacts from the original increment inventory did not provide sufficient information to conclude that the applicant did not cause or contribute to exceedances of the SO<sub>2</sub> increment in Caney Creek already identified in their previous modeling submittal, or potential exceedances that may occur on additional days due to cumulative impacts from excluded sources.

After reviewing the increment inventory data files provided by the applicant, it was apparent that the applicant had eliminated several hundred sources from Arkansas, Louisiana, Oklahoma, and Texas. Subsequent discussions with the applicant revealed that they had used an emissions over distance (Q/D) approach to eliminate increment consuming sources from their final modeled inventory (a Q/D value of less than 20 was used as a threshold to exclude sources, with Q in TPY and D in kilometers). Cursory review of the emissions total of the sources eliminated from the original modeled inventory indicated that a majority of the emissions reside in the same general area upwind of the Class I area as the source currently under permit review. Since there were a number of additional modeled impacts that were within 5%-10% of the 24-hour SO<sub>2</sub> increment level, Region 6 expressed a concern regarding the potential that the applicant could contribute significantly to additional increment exceedance periods that would not have been identified due to the elimination of those sources from the increment inventory. Based on these concerns, Region 6 requested that the applicant resubmit the Class I increment modeling including all increment affecting sources, pursuant to Section 7.2.1(a) of 40 CFR Part 51, Appendix W, hereafter referred to as the *Guideline on Air Quality Models* (or *Guideline*). In response to the request from Region 6 to include all increment-contributing sources, the applicant proposed the use of an alternative approach to identify sources to be eliminated from the additional modeled increment inventory.

#### CLARIFICATION OF RELEVANT GUIDANCE

We concur with your assessment that the key issue of concern in this case is the requirement, clearly stated in Section 7.2.1.1(a) of the *Guideline*, to include impacts from all increment-contributing sources in an analysis of impacts on PSD increments. The full text of the relevant paragraph is quoted here for reference:

“7.2.1.1 Design Concentrations for SO<sub>2</sub>, PM- 10, CO, Pb, and NO<sub>2</sub>

- a. An air quality analysis for SO<sub>2</sub>, PM-10, CO, Pb, and NO<sub>2</sub> is required to determine if the source will (1) cause a violation of the NAAQS, or (2) cause or contribute to air quality deterioration greater than the specified allowable PSD increment. For the former, background concentration (subsection 8.2) should be added to the estimated impact of the source to determine the design concentration.  
**For the latter, the design concentration includes impact from all increment consuming sources.”** [emphasis added]

This paragraph makes a clear distinction between the requirements of air quality analyses for compliance with the NAAQS as opposed to PSD increments. For NAAQS compliance modeling, a further distinction is made between estimated impacts from the source under review and background concentrations which need to be added to the source’s impact for comparison to the NAAQS. Reference is made to Section 8.2 for further guidance regarding the estimation of background concentration. Table 8.2 in Section 8.1 addresses the emission input requirements for NAAQS compliance demonstrations, and distinguishes between the proposed source, “nearby source(s)”, and “other source(s)”. A footnote to Table 8.2 indicates that impacts from the latter category can often be represented by an appropriate determination of the “background concentration” from an analysis of monitored ambient air quality data. Section 8.2.3(b) provides

the following criterion for determination of which sources to include in a NAAQS modeling analysis:

“8.2.3 Recommendations (Multi-Source Areas)

- b. Nearby Sources: All sources expected to cause a significant concentration gradient in the vicinity of the source or sources under consideration for emission limit(s) should be explicitly modeled.”

Our purpose in citing the sections of the *Guideline* related to requirements for NAAQS compliance demonstrations is to emphasize the clear distinction between the requirements for the emissions inventory needed for NAAQS compliance as opposed to PSD increment compliance. Procedures that may be applicable to determining which sources need to be explicitly modeled for NAAQS compliance cannot be applied for PSD increment compliance inventories. There is nothing comparable to the “monitored background” component typically included in a NAAQS demonstration for PSD analyses, and no technical or regulatory basis for “screening out” or otherwise excluding impacts from increment affecting sources from a cumulative (net) increment analysis.

As noted in your submittal, we also recognize the potential computational challenge of modeling a very large number of sources that may be identified as increment affecting sources, especially across a large domain that may be required for demonstrating compliance with the increments for a distance Class I area using the CALPUFF modeling system. In such situations, we believe it is appropriate and consistent with the *Guideline* to utilize a combination of screening and refined modeling techniques as a more efficient method to estimate the cumulative contribution to increment than to include all sources in the refined modeling analysis. Section 4.2.1.1(a) of the *Guideline* states that *“Where a preliminary or conservative estimate is desired, point source screening techniques are an acceptable approach to air quality analyses.”* Section 4.2.1.1(b) further stipulates that *“Agreement should be reached between the model user and the appropriate reviewing authority on the choice of the screening model for each analysis, and on the input data as well as the ultimate use of the results.”*

#### MODEL CLEARINGHOUSE RECOMMENDATION

As stated in the Introduction, we concur with your assessment of the key technical and guidance issues raised and with the general approach presented in your submittal to address this application. Although the exclusion of a significant number of sources from the original increment modeling analysis does not conform with the *Guideline* and presents a difficult situation to resolve, we agree that a reasonable and technically sound approach to provide additional assurance that the proposed source will not contribute significantly to potential PSD increment violations is feasible and can be justified for this specific case based on the information available. The most direct option to resolve the issue, which would not require any further justification by the applicant or review by the Clearinghouse, would be to perform additional refined modeling of the increment-consuming sources excluded from the original analysis to complete the impact assessment. Short of that more direct approach to resolve the issue, some mix of refined and screening-level estimates is the only alternative, provided that an

acceptable level of justification and assurance can be given that the final assessment will be protective of air quality levels.

The *Guideline* references several existing screening techniques, for both simple and complex terrain applications. However, the use of an emission/distance ratio (Q/D) as a screening technique is not addressed in the *Guideline*, and we will not address its use as a screening technique in a generic sense with this response. Our review and concurrence with your proposal merely acknowledges that use of a Q/D threshold as a tool to identify which sources to explicitly account for in the refined modeling vs. sources to be accounted for in an aggregate sense, based on the inclusion of pseudo-sources within the refined modeling, is technically reasonable given the specific circumstances of this case.

We concur with your conclusions, based on an analysis of backward trajectories to determine air mass histories on days that exceeded, that the focus for including impacts from additional sources beyond 50 km from the Class I area can be limited to the 90° sector focused on transport from the south, including the proposed facility. We see no benefit to further supplementing the inventory for sources beyond 50 km from the Class I area and outside the 90° sector. However, we also want to emphasize that such a determination could not have been made *a priori*, and can only be justified in this specific case based on the information available from the original incomplete modeling analysis.

This concurrence by the Model Clearinghouse is limited solely to this application. If you have any further questions or comments, please contact Dennis Atkinson at (919) 541-0518 or Tyler Fox at (919) 541-5562.

cc:     Roger Brode, C439-01  
          Mark Evangelista, C439-01  
          Tyler Fox, C439-01  
          Bill Harnett, C504-01  
          Michael Ling, C504-01  
          Raj Rao, C504-03  
          Richard Wayland, C304-02  
          Regional Modeling Contacts



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6

1445 ROSS AVENUE, SUITE 1200  
DALLAS, TX 75202-2733

APR 18 2008

MEMORANDUM

SUBJECT: Proposed Screening Technique for Class I Increment Analysis

FROM: Adina Wiley, Environmental Engineer (6PD-R) *Adina Wiley, Env. Eng.*

Erik Snyder, Lead Regional Modeler (6PD-L) *Erik Snyder*

Jeff Robinson, Chief *Jeff Robinson*  
Air Permits Section (6PD-R)

TO: Dennis Atkinson, Model Clearinghouse Coordinator  
Air Quality Modeling Group

This memo seeks your concurrence with Region 6's intent to accept a screening technique (with the inclusion of emissions from screened-out sources included in the modeling as a few pseudo sources) for the Class I increment analysis associated specifically with the proposed Prevention of Significant Deterioration (PSD) permit for AEP SWEPCO John W. Turk, Jr. power plant in Hempstead, AR. This screening technique will be used to augment the existing modeled Class I increment inventory submitted in January 2007.

BACKGROUND

The original Class I increment analysis submitted by AEP SWEPCO indicated numerous increment exceedances for 24-hour SO<sub>2</sub> at the Caney Creek Class I Wilderness Area, but the proposed source was less than the EPA proposed Class I significant impact level (SIL) for SO<sub>2</sub> on the high, second high (H2H) day at each violating receptor. EPA Region 6 commented in April 2007 and again in July 2007 that the applicant had inappropriately excluded increment-contributing sources and that the modeled impacts from the original increment inventory did not provide sufficient information to conclude

that the applicant did not cause or contribute to exceedances of the SO<sub>2</sub> increment in Caney Creek already identified in their previous modeling submittal, or potential exceedances on additional days due to cumulative impacts from excluded sources. Our regulatory interpretation is that removal of increment consuming sources without consideration of their potential contribution to an increment impact analysis is prohibited under Section 7.2.1.1(a) of 40 CFR Part 51, Appendix W (*Guideline on Air Quality Models ("Guideline")*)).

To develop a more comprehensive understanding of the modeled increment exceedances in Caney Creek, we conducted an air mass history analysis of the CALPUFF modeling results for days when the modeled SO<sub>2</sub> levels were within 10% and greater of the 24-hour SO<sub>2</sub> increment. Using NOAA's HYSPLIT model, backward trajectories relative to the Caney Creek Class I area were run four times a day for all days at or above 90% of the 24-hour SO<sub>2</sub> increment. Air mass history maps were generated using a computer program developed by EPA Region 7. The maps indicate the probability of an air mass passing over a particular region prior to arrival. Used in this context, the air mass history maps provide an indication of potential source regions on days when the modeled SO<sub>2</sub> increment is near or exceeds allowable levels. The air mass history maps indicate two significant areas of potential influence on the high days in Caney Creek. The area of highest probability extends predominantly south from Caney Creek towards eastern Texas and Western Louisiana. This area is in the same general area as the proposed AEP source upwind of the Class I area. Previous PSD modeling for the Western Farmers Hugo Unit 2 in Oklahoma also identified this area as an area of concern for days near or above the 24-hour SO<sub>2</sub> increment, reinforcing the necessity to adequately capture potential increment impacts from sources that lie within that region.

After reviewing the increment inventory data files provided by the applicant, it was apparent that the applicant had eliminated several hundred sources from Arkansas, Louisiana, Oklahoma, and Texas. Subsequent discussions with the applicant revealed that they had used an emissions over distance (Q/D) approach to eliminate increment consuming sources from their final modeled inventory (a Q/D value of less than 20 was used as a threshold to exclude sources, with Q in tons per year (TPY) and D in kilometers). We were aware of additional large SO<sub>2</sub> sources that should have been included in the modeled inventory. These sources are in the same upwind air mass as the proposed source. Cursory review of the emissions total of the sources eliminated from the original modeled inventory indicates that a majority of the emissions reside in the same general area upwind of the Class I area as the source currently under permit review. Since there were a number of additional modeled impacts that were within 5%-10% of the 24-hour SO<sub>2</sub> increment level, we believed that this created the potential that the applicant could contribute significantly to additional increment exceedance periods that would not have been identified due to the elimination of those sources from the increment inventory. We requested that the applicant resubmit the Class I increment modeling including all sources, pursuant to Appendix W, section 7.2.1.1(a).

In response to our request to include all increment-contributing sources, the applicant proposed the use of an alternative approach to identify sources to be eliminated

from the modeled increment inventory. We continue to believe that it is inappropriate to use screening techniques to eliminate sources from the modeled increment inventory. However, we also recognize the unique computational challenge this may create with explicitly modeling several hundred sources for the three simulation years using the CALPUFF modeling system. Therefore, while we continue to believe it inappropriate to eliminate sources from the model increment inventory, we believe that screening techniques can be used in this case to provide a preliminary and conservative estimate of the impact of more distant sources in a cumulative increment analysis without the necessity of explicit characterization of such sources in a refined modeling application.

#### EPA Region 6 Evaluation

The most correct method from both a technical and regulatory perspective should have been to include impacts from all increment affecting sources (both consuming and expanding sources), rather than using screening techniques to eliminate the impacts of some sources from an inventory. However, recognizing the potential computational challenge of modeling several hundreds sources for three simulation years with the CALPUFF modeling system, we believe it should be possible to utilize a combination of screening and refined modeling techniques to estimate the cumulative contribution to increment. Exceedances of the 24-hour SO<sub>2</sub> increment have already been identified by previous modeling; therefore, EPA Region 6 seeks to implement a method to account for the potential impacts of increment consuming sources, but to focus the inclusion of the additional increment affecting sources to areas that our analysis indicates a higher potential for cumulative impact with the current source under review.

Region 6 evaluated the following options:

1. An emissions over distance (Q/D) screening methodology developed by the United States Forest Service (USFS) and National Park Service (NPS). According to applicant, the USFS/NPS screening methodology has been used in PSD permitting actions in EPA Regions 3 and 9. In the FLM screening methodology, the source emission rate is divided by the distance to the Class I area. If the ratio is greater than 0.8 for SO<sub>2</sub>, then the source is included in the cumulative increment analysis.
2. A Chi-Over-Q technique developed by the applicant using the existing increment inventory to establish a basis for determining impact from non-modeled sources. Chi, the predicted concentration for the existing source, is divided by the emission rate Q for the existing source. This analysis is completed for all sources in the inventory; 69 sources in this instance. The  $\chi/Q$  values are then plotted as a function of distance from Caney Creek and best-fit linear and power law equations are generated. These equations can be used to estimate the emission rates that generate an impact above the proposed Class I SIL for 24-hour SO<sub>2</sub>.
3. All major and minor sources within a 50 km radius of the Class I area would be included if facility emissions were greater than 2 lb/hr. Outside of the 50 km radius, a 90° degree sector can be established to bracket the geographic area identified in our

air mass history analysis. All identified sources within the area encompassed by the 90° sector would then be added into the existing increment inventory for further analysis when the facility (all sources at one facility) exceeded a 2 lb/hr emission level. The proposed AEP facility is located near the middle of this sector, so this analysis would likely assess if the proposed source could significantly contribute to an increment violation.

#### SUMMARY OF ISSUE AND PROPOSED RESOLUTION

Region 6 recognizes that Appendix W requires all increment consuming and expanding sources be included in an increment analysis. The proposed approach is a tiered process related to distance and wind sector that will be used in addition to the existing SO<sub>2</sub> increment inventory of 44 sources. The focus will be to augment the inventory with emissions for additional sources with a greater probability of contributing to a cumulative impact with the current source under review.

Region 6 proposes that all sources within a 50 km radius of the Class I area, regardless of size, are to be explicitly modeled (including one large minor source 57 km north of the Class I area). Explicitly modeling all sources within 50 km accounts for the potential influence of recirculating wind patterns on cumulative impacts.

Outside of the 50 km radius, but within the 90-degree sector (centered south of the Class I area), a Q/D threshold of 0.8 will be used to identify the additional sources on a facility-wide basis that will be explicitly modeled (with Q expressed in TPY and D in km). The total facility SO<sub>2</sub> emission rate will be used in the Q/D analysis; facilities with a Q/D ratio greater than 0.8 will be explicitly modeled. Facilities less than or equal to 0.8 will be grouped and modeled as pseudo-point source(s) to generate a conservative screening-level estimate. The pseudo-point source location(s) will be determined after examining the locations and characteristics of the facilities below the Q/D threshold. Sources below the threshold will be grouped first based on their location from the Class I area; initial groups will be based on discrete distance bands from the Class I area. Within these distance bands, the pseudo source characteristics will be determined from the facility-wide SO<sub>2</sub> emission rates from the screened sources. A facility-wide SO<sub>2</sub> emission rate of 40 TPY or less will characterized as a low-level (height above ground) source; an emission rate of 40-250 TPY SO<sub>2</sub> will be a mid-level source; and an emission rate greater than 250 TPY will be a high-level source.

Once the additional sources are included in the increment inventory as described above, either explicitly or as pseudo-sources, the permit applicant will need to reassess increment consumption at the Caney Creek Class I Wilderness Area. For each predicted increment violation, the applicant must demonstrate that the proposed source is below the proposed 24-hour SO<sub>2</sub> Class I significant impact level for the permitting process to proceed.

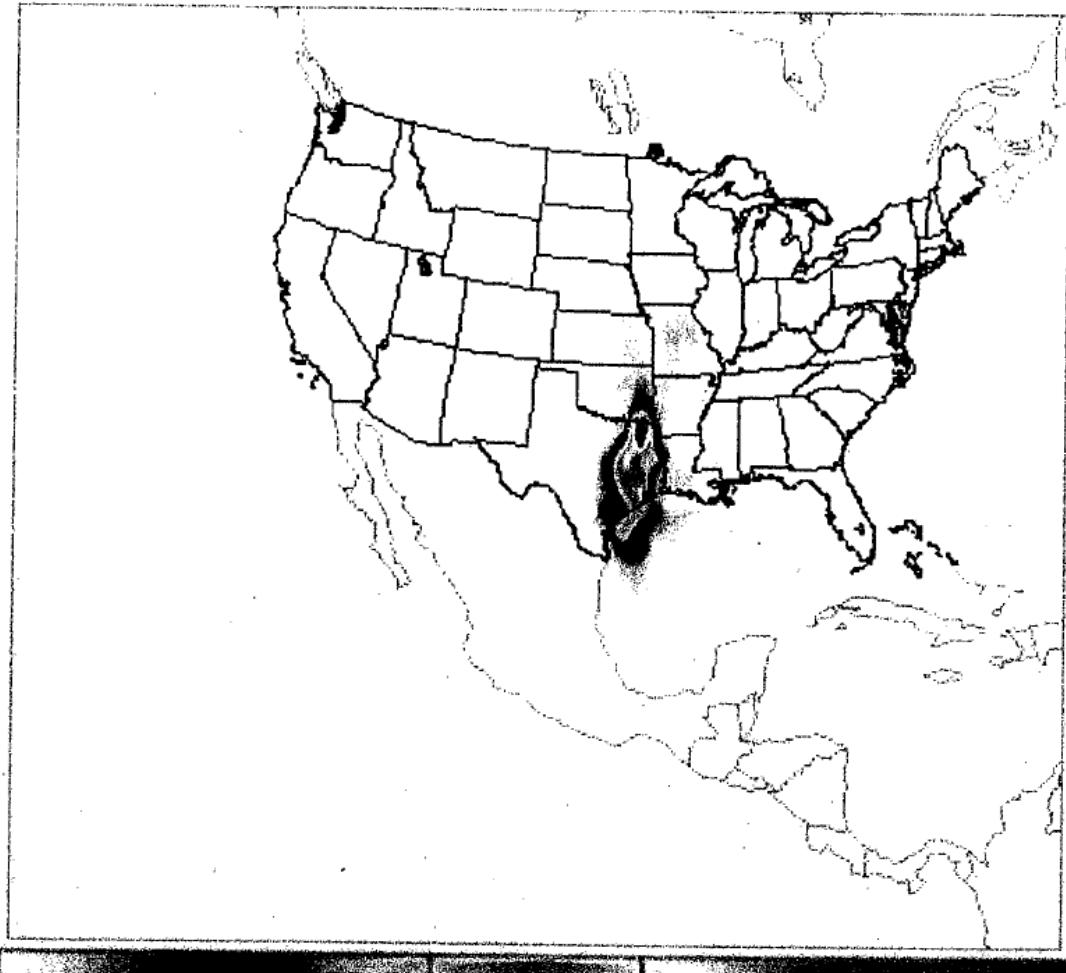
Requested Action Items:

Please review our interpretation of Section 7.2.2.1 (a) of the *Guideline* as it relates to this project. Please also clarify if our proposed procedures are technically justified and consistent with guidance.

Region 6 believes that the 90-degree sector analysis as described above is the most technically defensible compromise option in this situation as it is most consistent with Appendix W requirements to account for impacts from all sources, but will target the additional modeling effort on the area of potential contribution of the proposed source, which also coincides with the main area of concern identified by the previous Hugo, OK Class I analysis.

Please call either Erik Snyder at 214-665-7305 or Adina Wiley at 214-665-2115 if you have any questions or need further information on this issue.

cc: Tyler Fox, OAQPS AQMG



**Figure 1 - 48-hour air mass history map for Caney Creek Wilderness Area during periods when modeled SO<sub>2</sub> is greater than or equal to 90% of the 24-hour SO<sub>2</sub> increments. Due to map projection differences, the air mass history is shifted to the West compared to the actual location of the Caney Creek Wilderness.**



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

OCT 01 2008

OFFICE OF  
AIR QUALITY PLANNING  
AND STANDARDS

**MEMORANDUM**

**SUBJECT:** Clarification of Region 6 Clearinghouse Request on "Proposed Screening Technique for Class I Increment Analysis"

**FROM:** Richard A. Wayland, Director *Richard A. Wayland*  
Air Quality Assessment Division (C304-02)

**TO:** Jeff Robinson, Chief  
Air Permits Section (6PD-R)

The purpose of this memorandum is to provide clarification on language in the April 18, 2008 memo from Region 6 to our Model Clearinghouse for concurrence on their proposed screening techniques for Class I increment analysis. Based on review of the Region 6 memo by EPA's Office of General Council (OGC), it is necessary to provide these clarifications to be consistent with guidance in EPA's *Guideline on Air Quality Models* ("Guideline"), published as Appendix W to 40 CFR Part 51, and current interpretation of that guidance by OGC. We are therefore providing the language changes outlined below to the Region 6 memo to ensure this consistency with the Guideline.

The first clarification relates to the characterization by Region 6 of requirements under the Guideline contained in the first paragraph of their "Background" section, i.e.,

"Our regulatory interpretation is that removal of increment consuming sources without consideration of their potential contribution to an increment impact analysis is prohibited under Section 7.2.1.1(a) of 40 CFR Part 51, Appendix W (*Guideline on Air Quality Models* ("Guideline"))."

The review by OGC necessitates the following language change:

"Our understanding is that removal of sources in the affected areas from an emissions inventory without consideration of their potential contribution to an increment impact analysis is inappropriate under Section 7.2.1.1(a) of 40 CFR Part 51, Appendix W (*Guideline on Air Quality Models* ("Guideline")). This provision establishes the objective to include the impact of all increment consuming sources in the design concentration."

The second clarification relates to the fourth paragraph of their “Background” section, i.e.,

“In response to our request to include all increment-contributing sources, the applicant proposed the use of an alternative approach to identify sources to be eliminated from the modeled increment inventory. We continue to believe that it is inappropriate to use screening techniques to eliminate sources from the modeled increment inventory. However, we also recognize the unique computational challenge this may create with modeling several hundred sources for the three simulation years using the CALPUFF modeling system. Therefore, while we continue to believe it inappropriate to eliminate sources from the model increment inventory, we believe that screening techniques can be used to provide a preliminary and conservative estimate of the impact of more distant sources in a cumulative increment analysis without the necessity of explicit characterization of such sources in a refined modeling application.”

The review by OGC necessitates the following language change:

“In response to our request to include all increment-contributing sources, the applicant proposed the use of an alternative approach to identify sources to be eliminated from the modeled increment inventory. We generally believe that it is inappropriate to use screening techniques to eliminate sources from the modeled increment inventory. However, we also recognize the unique computational challenge this may create with modeling several hundred sources for the three simulation years using the CALPUFF modeling system. Therefore, we believe that screening techniques can be used to provide a preliminary and conservative estimate of the impact of more distant sources in a cumulative increment analysis without the necessity of explicit characterization of such sources in a refined modeling application.”

The third, and final, clarification relates to the first paragraph of their “EPA Region 6 Evaluation” section, i.e.,

“The most correct method from both a technical and regulatory perspective should have been to include impacts from all increment affecting sources (both consuming and expanding sources), rather than using screening techniques to eliminate the impacts of some sources from an inventory. However, recognizing the potential computational challenge of modeling several hundreds sources for three simulation years with the CALPUFF modeling system, we believe it should be possible to utilize a combination of screening and refined modeling techniques to estimate the cumulative contribution to increment. Exceedances of the 24-hour SO<sub>2</sub> increment have already been identified by previous modeling; therefore, EPA Region 6 seeks to implement a method to account for the potential impacts of increment consuming sources, but to focus the inclusion of the additional increment affecting sources to areas that our analysis indicates a higher potential for cumulative impact with the current source under review.”

The review by OGC necessitates the following language change:

“The preferred method from both a technical and regulatory perspective is to include emissions from all sources in the affected area (both increases and decreases) rather than using screening techniques to eliminate the emissions of some sources from an inventory. However, recognizing the potential computational challenge of modeling several hundred sources for three simulation years with the CALPUFF modeling system, we believe it is possible to utilize a combination of screening and refined modeling techniques to estimate the cumulative contribution to increment from all sources in the area. Exceedances of the 24-hour SO<sub>2</sub> increment have already been identified by previous modeling; therefore, EPA Region 6 seeks to implement a method to account for the potential impacts of all sources in the area, but to focus the explicit characterization of source emissions to areas where our analysis indicates a higher potential for cumulative impact with the current source under review.”

This memorandum will be added to the Model Clearinghouse record along with the original request memo from Region 6 and the OAQPS model clearinghouse response memo.

cc: Bill Harnett  
Tyler Fox  
Raj Rao  
Michael Ling  
Roger Brode

## **Permit Determinations**

- Please Contact MPCA Permitting Program
  - Minnesota Pollution Control Agency 651-296-6300, 800-657-3864

MPCA

# Working with Intermittent Emissions from Internal Combustion Engines by Facilities Participating in Economic Demand Response (EDR) Programs:

*Correlating Peak-Shaving and Temperature Humidity Index (THI)*

## Introduction

A growing trend in the electrical energy industry is the increasing use of demand response, otherwise known as (Emergency) or Economic Demand Response (EDR). This approach comprises a number of programs across the nation including the state of Minnesota. EDR is designed to reduce load on the complex electrical grid that powers residential consumers. A variety of methods are implemented during EDR such as energy efficient techniques and practices, load shifting from peak usage hours, and/or load shedding by use of on-site electrical generation. These programs offer financial incentives for participants from industrial, commercial, and institutional sectors where the use of existing or planned emergency generator(s) is a worthwhile option. Examples are hospitals, airports, large data centers, universities, etc. Thus, identification in this working practice proposal of these programs as not just emergency, but economic demand response generators, is critical in the application of required air permitting regulations and in turn necessary air dispersion modeling demonstrations.

### Definitions

For the most part, this discussion addresses non-emergency generators involved in economic demand response (EDR) activities. EDR activities encompass several practices referred to by a variety of terms, including peak-sharing, peak-shaving and load-shedding. A common element of EDR activities is that the owner of the non-emergency generator typically receives a financial benefit for participating in the EDR activity.

For the purpose of this discussion, *emergency generator* will generally agree with the definition of *emergency stationary R/ICE* provided in 40 CFR § 63.6675.

### Demand Response (Peak-Shaving)

#### Relevant Factors

Demand response participants typically install back-up generators primarily for use in emergency situations, mainly in the form of power failures within the electrical grid. These generators are usually diesel-powered stationary engines and have capacities of 500 kilowatt (KW) or more. They fall under the Internal Combustion Engines (ICE) category within the Environmental Protection Agency (EPA) rules and guidelines, as they generate a number of criteria pollutants including Sulfur Dioxide (SO<sub>2</sub>), Nitrogen Dioxide (NO<sub>2</sub>), Particulate Matter (PM) and Carbon Monoxide (CO) as well as several hazardous air pollutants (HAPs). The EPA developed standards and compliance methods for reciprocating engines, including generators used in demand response, under the New Source Performance Standards (NSPS) for newly-constructed units and under the National Emission Standards for Hazardous Air Pollutants (NESHAP) for both new and existing engines. The specific federal standards are: 40 CFR Part 63, Subpart ZZZZ<sup>1</sup>, 40 CFR Part 60, Subpart IIII,<sup>2</sup> and 40 CFR Part 60, Subpart JJJJ.<sup>3</sup> While the state of Minnesota also regulates emissions from ICEs,<sup>4</sup> the federal standards are more comprehensive.

Emission limitations, work practice and schedules, monitoring and record keeping are just some of the requirements found within these regulations. The rules and usage allowance of emergency generators is complex and in flux, with confusion emerging at both industry and regulatory agencies. Participation in demand response programs (in particular, whether a source receives some type of compensation in exchange for agreeing to be cut off from the grid or to supply

---

<sup>1</sup> National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

<sup>2</sup> Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

<sup>3</sup> Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

<sup>4</sup> Minn. R. 7011.2300 (Standards of Performance for Stationary Internal Combustion Engines)

power to the grid) is an important factor of whether these ICE are determined emergency or non-emergency use. In a prior version of these rules, the EPA had allowed for 100 hours per year for maintenance and testing with 50 of those hours acceptable for demand response. This changed when the USEPA published a final rule on January 30, 2013. This rule revision phased out the peak shaving allowance for ICE classified as emergency engines. As of May 2014 the peak shaving allowance was eliminated for ICE classified as emergency engines. An engine may participate in emergency demand response programs for a limited number of hours per year and still be classified an emergency engine. However, an engine that participates in a peak shaving (economic demand response) program is now treated as a non-emergency engine. Non-emergency engines are subject to more stringent requirements than emergency engines. Non-emergency engines may even require add-on controls in order to be compliant.

## Proposed Modeling Solutions

Given the new regulatory requirements, it is critical for facilities (and consultants) to apply the most accurate air dispersion modeling scenarios possible for these demand response generators. A variety of methods to characterize these scenarios have been proposed and tried on a case-by-case basis, with variations on the facility location, hours to potentially operate in a demand response agreement made with an energy utility company, generator types and sizes, grade of diesel fuel used, and/or if a newer natural gas-powered engine(s) is being used. The traditional standard solution is to model "8760" (equivalent to 24 hours per day for 365 days) to cover 24/7 operations, year-round. Another methodology that has been proposed is EMVAP<sup>5</sup> with the argument that the hours of usage are random and hard to predict. Another strategy is using EMISFACT (emission scalars) keywords in AERMOD to account for varying emissions. Operational restrictions resulting from the use of seasonal, monthly and/or hourly emission scalars can result in permit conditions.

The Minnesota Pollution Control Agency (MPCA) air dispersion modeling group is proposing a method to further hone in on the actual usage hours and operations which EMISFACT can be based upon. This new method uses a known energy utility industry practice that determines when "peak shaving" would be necessary as part of a demand response by a contracted participant. This is known as the Weighted Temperature Humidity Index (THI<sub>t</sub>).

The THI<sub>t</sub> is a formula that takes into account not only the standard Temperature Humidity Index (THI) but also the existing weather conditions of the current and previous two days. The THI<sub>t</sub> was developed for the US Weather Bureau [now known as the National Weather Service (NWS)] to calculate temperatures in relation to what it would feel like at 100% humidity (thus THI values never exceed the actual air temperature). It takes into account air temperatures and humidity conditions, dry bulb and wet bulb temperatures, respectively. Wet bulb temperature is the lowest value that would be reached if evaporation of moisture took place in the parcel. The higher the humidity, the higher the wet bulb temperature and the more difficult it is for the human body to cool down. The THI<sub>t</sub> calculation for existing weather conditions of dry bulb and wet bulb temperatures involving previous days uses a weighting means. The current day's THI receives a weight of 10, the previous day's THI a 3 and two days ago a 1. This helps the power utilities companies to anticipate electric usage. The formula for THI<sub>t</sub> is:

$$THI_t = 17.5 + 0.55 * DryBulb_t + 0.2 * WetBulb_t \text{ (Association of Edison Illuminating Companies, 2009)}$$

It is found that a value of 70 is when people generally begin to experience discomfort due to heat and humidity and grow increasingly uncomfortable when the index exceeds 80. Values in excess of 85 fall into the exceedingly uncomfortable category. Table 1 summarizes these values.

---

<sup>5</sup> USEPA Support Center for Regulatory Atmospheric Modeling, 10<sup>th</sup> Conference on Air Quality Modeling, Summary of Public Comments

**Table 1: Range of Temperature-Humidity Index Values that Negatively Affect People**

Temperature-Humidity Index	
<70	Comfortable
70-75	Becoming Uncomfortable
75-80	Uncomfortable
>80	Very Uncomfortable

*\*In the 1980s, the National Weather Service went to the Heat Index (HI) which is an apparent temperature, i.e. "feels like". It was believed to be easier to understand and comprehend by the public to communicate the gravity of the impact of excessive heat days with values in degrees and much higher than actual air temperatures. For example, an air temperature of 95 °F with high humidity, say a dew point temperature of 72 °F, would reflect a heat index of 104 °F. See Table 2 for the full range of apparent temperatures that affect people. The formula for Heat Index is:*

$$\text{Heat Index} = -42.379 + 2.04901523T + 10.14333127R - 0.22475541TR - 6.83783 \times 10^{-3}T^2 - 5.481717 \times 10^{-2}R^2 + 1.22874 \times 10^{-3}T^2R + 8.5282 \times 10^{-4}TR^2 - 1.99 \times 10^{-6}T^2R^2$$

**Table 2: Range of Heat Index Values that Negatively Affect People**

Heat Index	
80F-85F	Fatigue possible
90F-103F	Heat stroke, heat cramps, etc.
103F-124F	Heat stroke, heat cramps, etc., more likely
>125F	Heat stroke highly likely

Electricity use depends on the profile of utilization of installed electricity-consuming equipment. Based on data nationally and in the state of Minnesota, demand response peak shaving takes place during the summer months when electrical demand is greatest due to the need to power air conditioning units in residential and business operations in lieu of higher air temperatures and humidity levels experienced. It is known that most energy utility companies have peak shaving contracts with a variety of large users such as hospitals, heavy industrial and data center locations, universities and other similar scale facilities. When these peaking events take place is also well understood by way of seasonal or monthly occurrence with facility peak shaving (generators running) data as well as a strong correlation with meteorological data (observed and forecast). Additional factors include human behavioral patterns of use (i.e. work days vs weekends/holidays, etc.) and "thermal inertia" effects on buildings. The temperature humidity index plays a critical part in this correlation and ability to plan generator usage for such purpose given its use by energy utility companies in electrical load planning and subsequent requests upon demand response peak shaving participants.

## Steps/Process to Create a THI Database and Analysis

### Surface Meteorological Data Collection

The MPCA air dispersion modeling group began the process to study and analyze temperature humidity index by downloading and processing raw meteorological observation data from several NWS ASOS and FAA AWOS sites including those in the Twin Cities: Minneapolis/St. Paul (KMSP), St. Paul Holman Field (KSTP), Crystal Airport (KMIC), Flying Cloud Airport (KFCM), as well as several greater MN locations including Rochester (KRST), Mankato (KMKT),

Redwood Falls (KRFW), St. Cloud (KSTC), Duluth (KDLH), and International Falls (KINL). These sites allow for a very representative dataset for use by facilities located throughout the state that may partake in demand response peak shaving programs (See Figure 1a.). The years selected were 2006 through 2010 to encompass a five year segment comparable to what would be required in an AERMOD model run demonstration. (This has been updated to the 2009-2013 timeframe to match newly updated AERMOD processed meteorology files). \*Additional stations are being added to ensure as complete of coverage of the state as possible (see Figure 1b). This is not designed to just match the (smaller) number of AERMOD processed meteorological sites, but to allow a full state coverage for many other purposes as well.

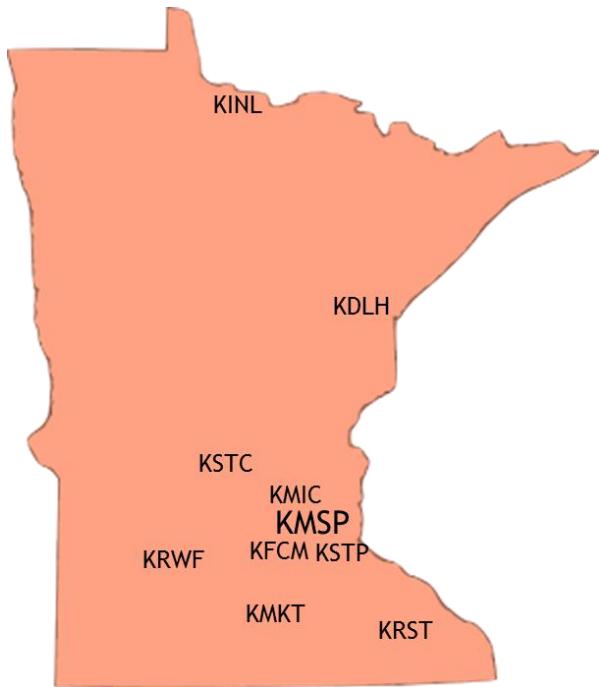


Figure 1a – Initial Set of Observation Sites

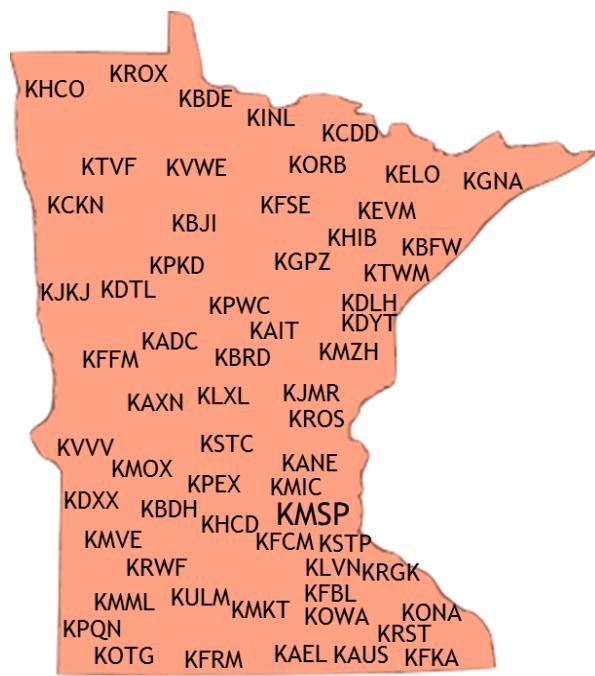


Figure 1b .Current Set of Observation Sites

## Data Analysis and Index Calculations

Calculations were done for wet bulb temperatures, vapor pressure, and relative humidity from the raw observations to allow for the Weighted Temperature Humidity Index ( $THI_t$ ) formula to be used on the resultant data. Heat Index was also computed as a frame of reference. Once calculated for the entire five year period at each hour, it was necessary to interpolate the trends and range of the data. The critical  $THI$  value, which the group considered the power utilities “bright line” value of 70, is the key in determining when demand response peak shaving actions would likely be necessary. These data are then run through simple statistical analyses to determine annual and mean graphs/usage curves to validate the best times of when peak shaving would occur, allowing for more detailed information to be entered into an air dispersion modeling demonstration.

An example is provided in Table 3 of a ‘bright line’ day of  $THI$ ’s exceeding 70, where a high likelihood of a demand response peak shaving episode would occur. Using data for July 2, 2012 from the Minneapolis/Crystal Airport (KMIC) in the northern suburbs of the Twin Cities,  $THI$  values actually reached into the mid-80s, a very uncomfortable day for people. Since it was a Monday during the workweek, the probabilities of increased electricity demand would be on the high side.

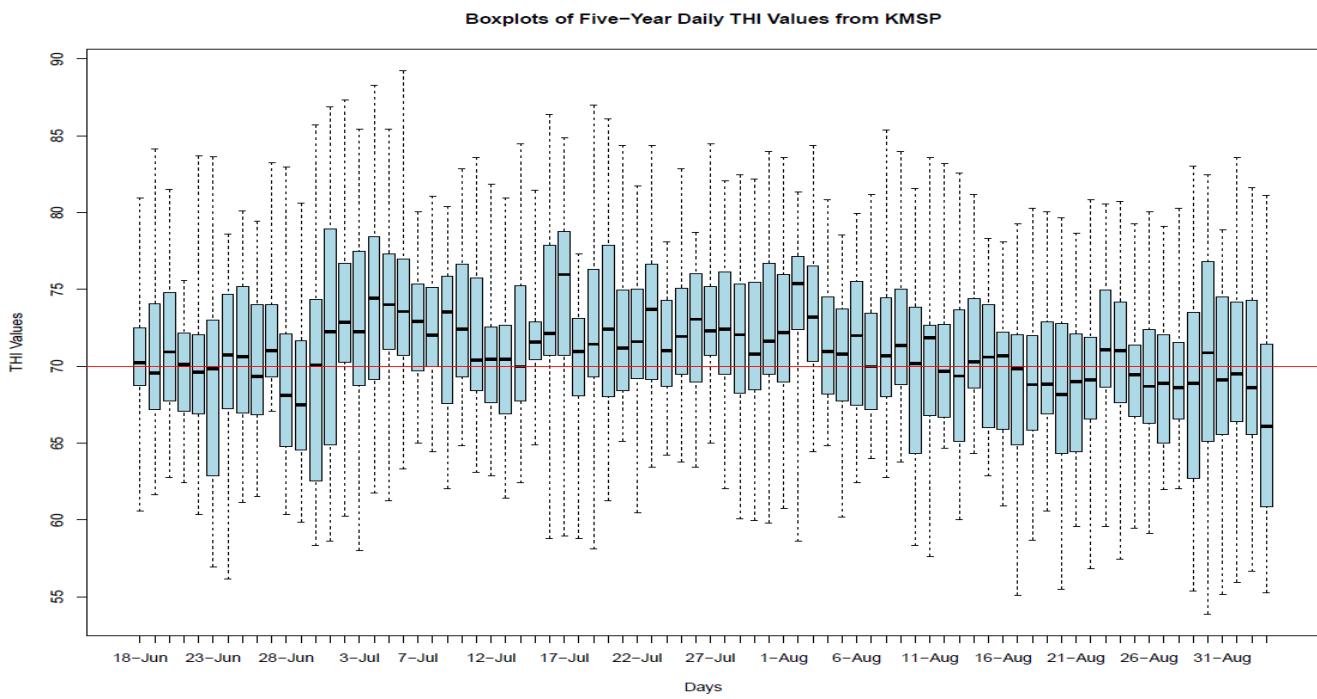
**Table 3: Surface Observations from Minneapolis/Crystal Airport and Resultant THI and HI values**

Station	Valid Time (GMT)	Temp F	Temp C	Dew Point F	Dew Point C	Vap Press (Mb)	RH	RH (raw)	WetBulb Temp C	Wetbulb Temp F	Temp-Humidity Index	Heat Index F
MIC	7/2/2012 10:53	75.02	23.90	71.96	22.20	26.71	90.22	0.9022	22.69	72.84	73	75
MIC	7/2/2012 11:53	78.08	25.60	71.96	22.20	26.71	81.5	0.815	23.17	73.71	75	78
MIC	7/2/2012 12:53	80.96	27.20	73.04	22.80	27.70	76.9	0.769	24.03	75.26	77	86
MIC	7/2/2012 13:53	84.02	28.90	73.04	22.80	27.70	69.64	0.6964	24.51	76.11	79	90
MIC	7/2/2012 14:53	87.08	30.60	73.04	22.80	27.70	63.14	0.6314	24.98	76.97	81	95
MIC	7/2/2012 15:53	89.06	31.70	71.96	22.20	26.71	57.18	0.5718	24.92	76.86	82	96
MIC	7/2/2012 16:53	93.02	33.90	69.98	21.10	24.98	47.22	0.4722	24.92	76.86	84	99
MIC	7/2/2012 17:53	93.92	34.40	71.06	21.70	25.91	47.64	0.4764	25.41	77.73	85	101
MIC	7/3/2012 18:53	96.08	35.6	69.98	21.1	24.98	42.96	0.4296	25.43	77.77	86	103
MIC	7/2/2012 19:53	96.08	35.60	71.06	21.70	25.91	44.57	0.4457	25.76	78.36	86	104
MIC	7/2/2012 20:53	98.06	36.70	71.06	21.70	25.91	41.96	0.4196	26.08	78.94	87	106
MIC	7/2/2012 21:53	98.06	36.70	71.06	21.70	25.91	41.96	0.4196	26.08	78.94	87	106
MIC	7/3/2012 22:53	96.98	36.1	66.92	19.4	22.49	37.62	0.3762	24.71	76.48	86	101
MIC	7/2/2012 23:53	95.01	35.00	68.01	20.00	23.34	41.5	0.415	24.66	76.40	85	100
MIC	7/3/2012 0:53	91.94	33.30	69.08	20.60	24.22	47.36	0.4736	24.46	76.03	83	97
MIC	7/3/2012 1:53	89.96	32.20	69.08	20.60	24.22	50.39	0.5039	24.13	75.43	82	95
MIC	7/3/2012 2:53	87.98	31.10	68.01	20.00	23.34	51.68	0.5168	23.45	74.21	81	92
MIC	7/3/2012 3:53	87.08	30.60	69.08	20.60	24.22	55.19	0.5519	23.64	74.55	80	91
MIC	7/3/2012 4:53	84.92	29.40	69.08	20.60	24.22	59.14	0.5914	23.28	73.90	79	89
MIC	7/3/2012 5:53	84.92	29.40	69.98	21.10	24.98	60.98	0.6098	23.58	74.44	79	89
MIC	7/3/2012 6:53	84.02	28.90	69.98	21.10	24.98	62.77	0.6277	23.43	74.17	79	88
MIC	7/3/2012 7:53	82.04	27.80	69.98	21.10	24.98	66.93	0.6693	23.10	73.58	77	86
MIC	7/3/2012 8:02	82.41	28.00	69.81	21.00	24.82	65.74	0.6574	23.10	73.57	78	86

## Resultant Findings of Temperature Humidity Index (and Peak Shaving Episodes)

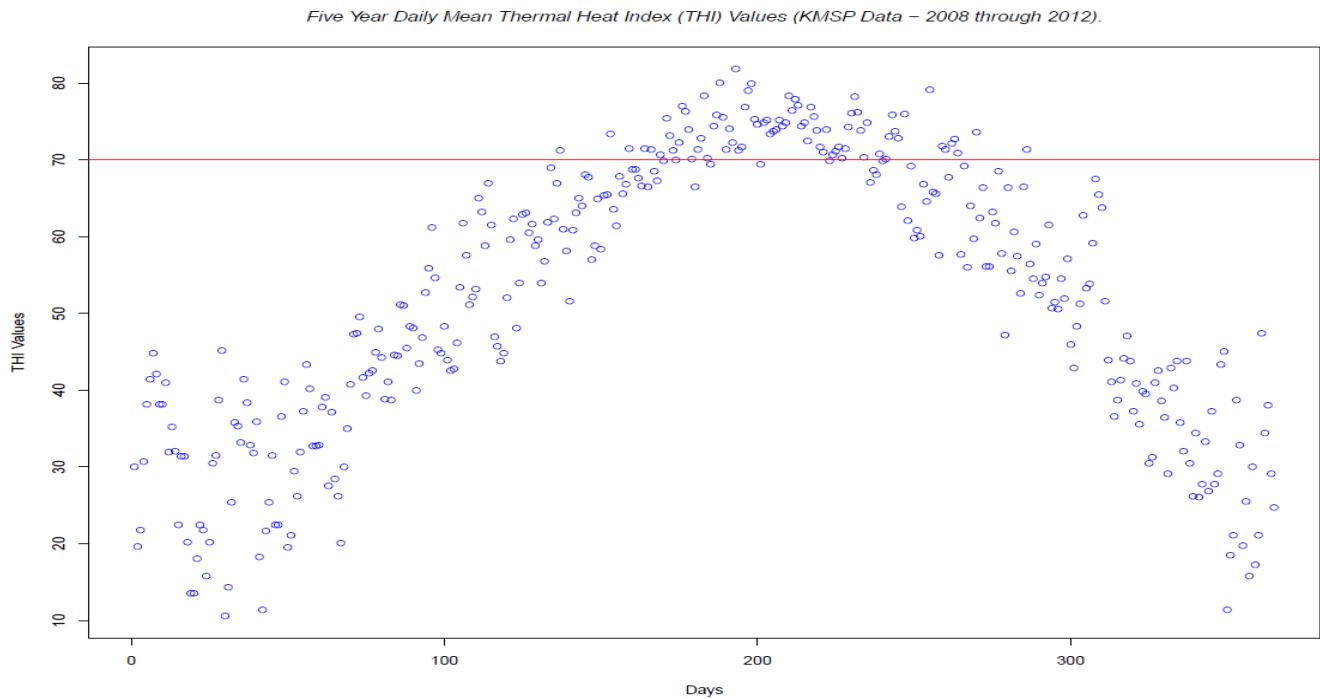
As assumed, the highest incidence of 'bright line' and higher THI values occurs during the warm season months of May, June, July, August and even into September. Despite a wide range of temperatures (and humidity levels) that can and do occur in Minnesota during the summer months, the pattern of the higher THI values is very evident. Values of 70 or higher during the 2008-2012 timeframe typically began in early to mid-June and continued through early September. The greatest values occurred during early to mid-July but with many incidences of higher values in late July and August as weather patterns ebb and flow with heat waves and cold fronts impacting the state. An interesting observation is the spike at the end of August into September. Though anecdotal, this feature is something unique to the Upper Midwest as temperatures will typically cool a few degrees compared to the peak summer season; however, dew points (i.e. humidity) tend to rise a few degrees in comparison. This is very apparent in Iowa and southern and central Minnesota as corn crops are peaking and retain a considerable amount of moisture along with prevailing southerly wind drawing moisture northward from the Gulf of Mexico. Dew points in the upper 70s to even 80 °F are commonplace during this time frame of the growing season. This can and does play an impact on human discomfort levels.

In Figure 2, a boxplot of the five year daily THI values from Minneapolis/St Paul (KMSP) shows this pattern of values during the summer months. Note the 'bright line' value of 70 as reference to high or low THI days. Also take into account the range of values of THI that can approach 90 on exceptionally hot days and as low as the lower 50s likely during a cool rainy day.



**Figure 2: Boxplots of Five-Year Daily THI Values from Minneapolis/St. Paul (2008-2012)**

Another output, (Figure 3) displays the mean THI values during the summer months with values above 70 starting around the 125<sup>th</sup> day of the year (May 5) and continuing to around the 275<sup>th</sup> (October 2) day in the calendar year. The peak days of the year fall in approximately days 150 (May 30) to 250 (September 7).



**Figure 3: Scatter Plot of Five-Year Daily Mean THI Values from Minneapolis/St. Paul (2008-2012)**

Upon studying the schedule of known demand response peak shaving (aka “load shedding”) from various facilities in the Upper Midwest it again is very evident of when this occurs during the summer months of June through early September. The maximum number of days at twelve in July and August respectively are shown in Figure 4.

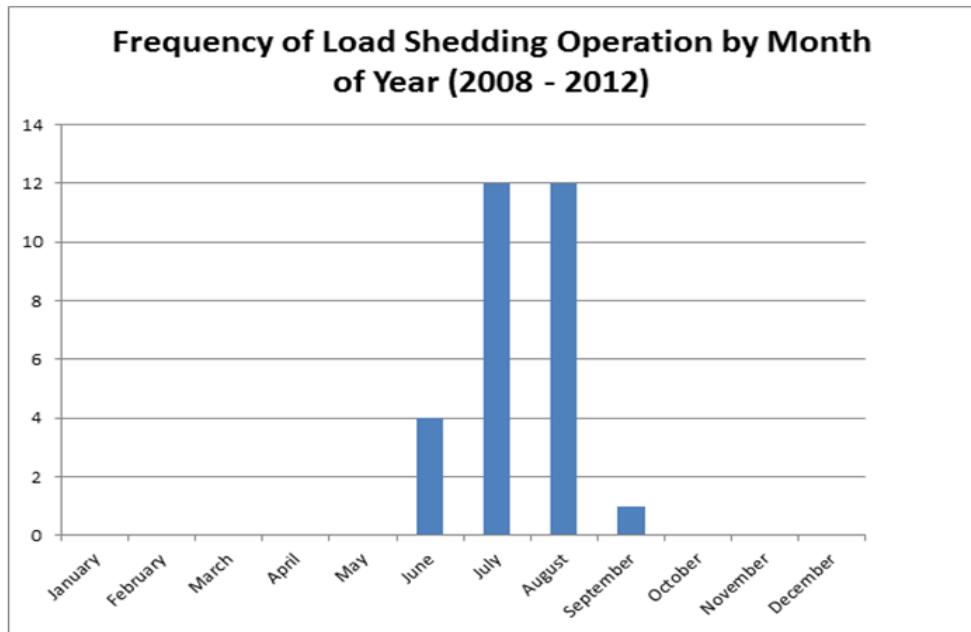
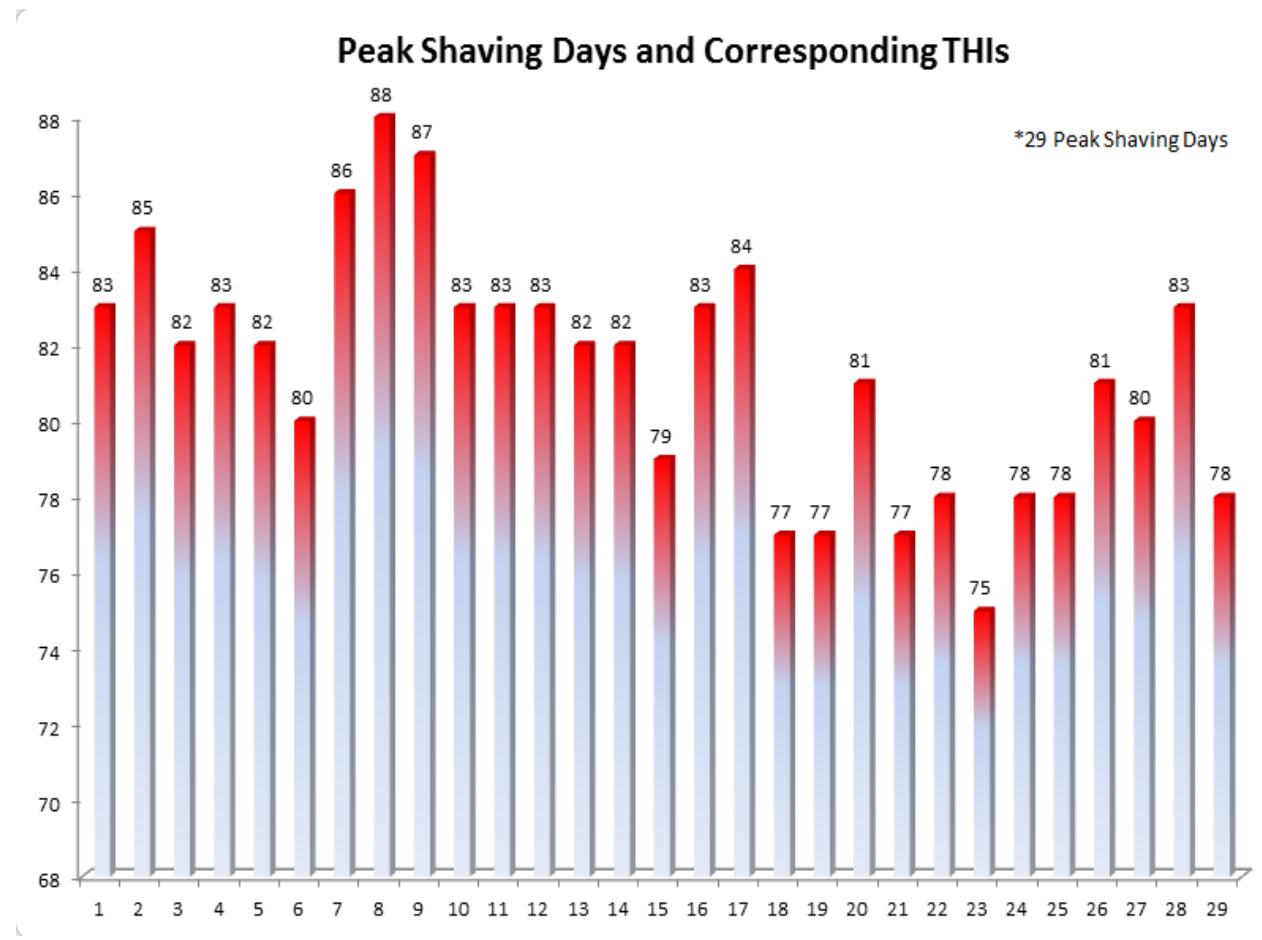


Figure 4: Average Frequency of Facility Peak Shaving Days (2008-2012)

A final representation of demand response peak shaving is a direct comparison of a facility’s peak shaving episodes over a five year span to actual temperature-humidity index values during these situations. The data clearly shows not only the times when it took place (with the THIs exceeding the ‘bright line’ value of 70), but also the extremes of the derived index that peak shaving was enacted. Figure 5 gives the raw details of peak shaving episodes with a meteorological comparison of the day’s maximum temperature recorded, the THI and Heat Index value.

Date	Day	Month	Year	Max T (F)	THI	HI (F)	Avg THI	81.3
16	Monday	July	2012	98	83	99	Lowest THI	75.0
2	Monday	July	2012	98	85	105	Highest THI	88.0
27	Wednesday	June	2012	92	82	98	Median THI	82.0
1	Thursday	September	2011	92	83	100		
2	Tuesday	August	2011	88	82	96	Avg Max T	91.1
1	Monday	August	2011	83	80	90 *AM hrs	Lowest Max T	83.0
20	Wednesday	July	2011	96	86	108	Highest Max T	102.0
19	Tuesday	July	2011	96	88	119		
18	Monday	July	2011	98	87	113	Avg HI	95.9
7	Tuesday	June	2011	102	83	100	Lowest HI	83.0
12	Thursday	August	2010	91	83	100	Highest HI	119.0
11	Wednesday	August	2010	92	83	100		
10	Tuesday	August	2010	88	82	98	Max T (F) - Maximum Temperature (degrees Fahrenheit)	
9	Monday	August	2010	94	82	96	THI - Temperature-Humidity Index (unitless)	
4	Wednesday	August	2010	88	79	90	HI - Heat Index (Apparent Temperature in degrees Fahrenheit)	
3	Tuesday	August	2010	94	83	99		
27	Tuesday	July	2010	93	84	103	Notes:	
26	Monday	July	2010	86	77	86	8/1/11 was coming off a hot weekend	
13	Thursday	August	2009	83	77	85	7/4/12 was a Wed., but a holiday - temp of 100F/THI of 88/HI of 108F	
23	Tuesday	June	2009	93	81	94	No Pk Shaving days in May despite 2 days of THIs of 80/81	
18	Monday	August	2008	89	77	87		
4	Monday	August	2008	85	78	88		
1	Friday	August	2008	86	75	83		
31	Thursday	July	2008	85	78	87		
30	Wednesday	July	2008	89	78	87		
29	Tuesday	July	2008	93	81	94		
15	Tuesday	July	2008	89	80	91		
11	Friday	July	2008	92	83	100		
25	Wednesday	June	2008	88	78	86		

Figure 5: Specific Episodes of Actual Facility Peak Shaving Days (2008-2012)



**Figure 6: Episodes of Actual Facility Peak Shaving Days & THI Measures (2008-2012)**

Figure 6 displays the peak shaving episodes in direct comparison to temperature-humidity index values registered and show a very distinct pattern of values above 75 on these days. From this dataset it can be noted that the industry 'bright line' of a THI of 70 is a planning for potential peak shaving, but no definite guarantee. As stated earlier, meteorological conditions, human behavioral patterns and thermal inertia all play an important role of when the energy utilities decide to invoke peak shaving.

Another way to display the frequency of facility peak shaving operations is by days per week as a simulated distribution during the 12 week summer season (see Figure 7). The simulated hours of operation for the load shedding case study assumed that the hours of operation likely occurred no earlier than 2:00pm and no later than 10:00pm. The days of the week where operations occur in this scenario is Monday through Thursday, for the twelve weeks of summer as delineated by the THI curve (see Figure 3). The hours of operation were generated using the random function in Excel within a normal distribution function. The simulated distribution becomes the template for hours and days of operation for the load shedding generator.

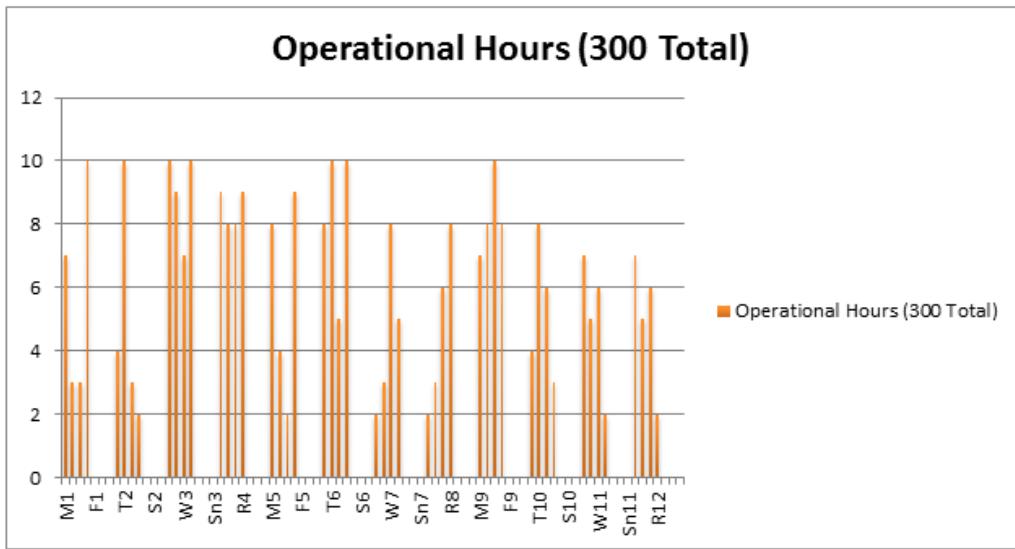


Figure 7: Theoretical Distribution of Peak Shaving (Load Shedding) during the summer months

## Implementing Known Findings of THI into an AERMOD Model Run Demonstration

### Source Data Modifications and Entries

In this method it is critical to not only know the sources and their ancillary information (stack dimensions, emission rates, temperatures, exit velocities, buildings and downwash, receptors), but also the frequency of the intermittent emissions that would be occurring. Modifying the SOURCE Pathway in the AERMOD model is key, beginning with Source Groups being assigned to the known generators (and corresponding stacks) that would be running during a demand response peak shaving event. Then within the Variable Emissions tool the information gained from the THI analysis becomes key. Using the “By Month / Hour / Day” option allows each generator to be proposed for use in peak shaving to be setup for the hours it would be operational. In this specific option, a user can input by month and the week the number of hours to run and a multiplier of the emission rate initially assigned to the generator stack. In the examples provided in Figures 8 and 9 the option choices are displayed. An important fact is that only the months of June, July and August have been entered with non-zero values, but the same could be done for May or September, if necessary.

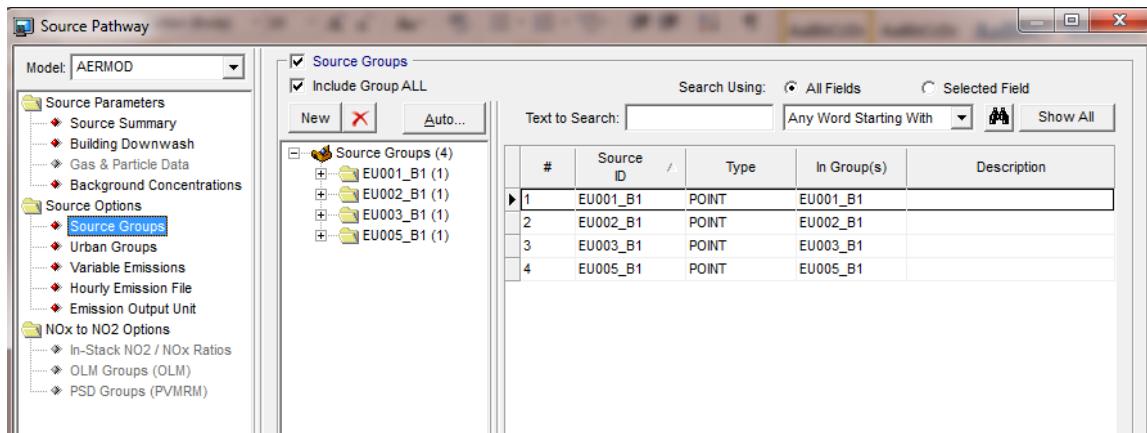


Figure 8: Source Groups for Generator Stacks Example

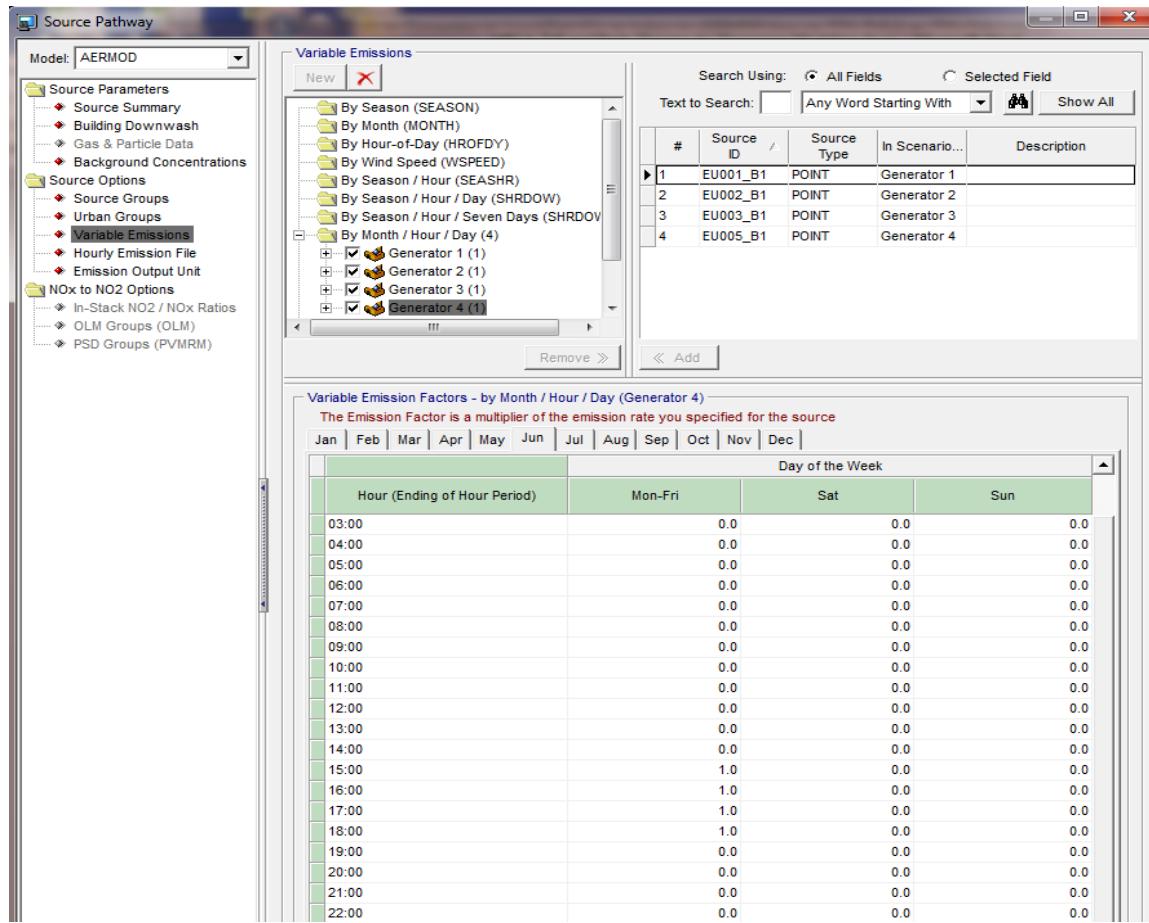


Figure 9: Variable Emissions: Entry for Hours of Day in Summer Months

## Implementation

The method proposed above can be easily implemented into an AERMOD modeling demonstration. MPCA has processed and analyzed nearly all reporting surface weather observation sites across the Twin Cities metro and statewide to allow immediate use of the data for reference of temperature humidity index (THI) days. These data will continue to be updated and/or expanded to add additional sites to ensure greater statewide and regional coverage. MPCA will continue to work with other possible time-based variable emission options and scenarios to further develop the method.

## Requirements for Permits

To ensure compliant operations along with improved, more realistic modeling results there will be certain requirements to abide by as detailed by the MPCA Air Permit division. Permit language will be required for those engines participating in peak shaving/load shedding/economic demand response (EDR) practices with modeled ambient levels  $\leq 90\%$  of the NAAQS. They will be:

Citation	Requirement
<Title I Condition: 40 CFR Section 52.21(k); Minn. R. 7007.3000> <Minn. Stat. Section 116.07, subds. 4a & 9; Minn. R. 7007.0100, subp. 7(A), 7(L), & 7(M); Minn. R. 7007.0800, subps. 1, 2 & 4; Minn. R. 7009.0010-7009.0080>	Operating Hours are limited to less than 300 hours per calendar year based on a 12-month rolling sum to be calculated by the 15th day of each month
Minn. R. 7007.0800, subp. 4	Monitoring. The Permittee shall install a non-resettable hour meter on EU001 prior to startup.
Minn. R. 7007.0800, subp. 5	Recordkeeping. For any calendar day or operation of EU 001, the Permittee shall record the hours of operation of EU 001 with the non-resettable hour meter. By the 15th day of each month, the Permittee shall calculate and record the total hours of operation for the previous calendar month and the 12-month rolling total.

Note: If modeled ambient levels  $\geq 90\%$  of the NAAQS additional special language will be required in the permit.

## References

Centofanti, Patricia. Trinity Consultants. "Demand Response Participation, Utilizing On-Site Standby Generators." Environmental Quarterly. Issue 12. Spring 2012. Web.

Demand Response Measurement and Verification, Applications for Load Research. Association of Edison Illuminating Companies, Mar. 2009. Web.

EPA, 40 CFR Parts 60 and 63. National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines; New Source Performance Standards for Stationary Internal Combustion Engines; Proposed Rule. 7 Jun. 2012.

Goldman, Charles (Lawrence Berkeley National Laboratory), Michael Reid (E Source), Levy, Roger and Silverstein, Alison (EPA). National Action Plan for Energy Efficiency, *Coordination of Energy Efficiency and Demand Response*. Jan. 2010. Web

Macgowan, John. Titan Energy. "Whats the Difference between Emergency and Non-Emergency Generators?" 26, Jul. 2012. Web

National Weather Service. Chapter 6, Surface Observations Training Guide. Sep. 2012. Web

Epstein, Yoram, Moran, Daniel. Heller Institute of Medical Research, Tel Aviv, Israel. 13 Apr. 2016. Web

## Appendix D

DEPARTMENT : POLLUTION CONTROL AGENCY

SF-00006-05(4/86)  
STATE OF MINNESOTA

# Office Memorandum

DATE : March 28, 2017

TO : Ann Foss, Manager, Mining Sector  
Sarah Kilgriff, Manager, Compliance and Enforcement Section  
Frank Kohlasch, Manager, Air Assessment Section  
Bill Sierks, Manager, Environment and Energy Section  
Donald Smith, P.E., Manager, Permitting Section

THROUGH  Ruth Roberson, Supervisor, Risk Evaluation and Air Modeling Unit

FROM : David Brown, Air Quality Dispersion Modeling  
Helen Waquiu, Air Quality Dispersion Modeling  
Jim Sullivan, Air Quality Dispersion Modeling

PHONE : 651-757-2500

SUBJECT : Clarification of MPCA Working Practice to Evaluate the Federal Definition of Ambient Air in Air Quality Dispersion Modeling

### Summary and Purpose

The purpose of this memorandum is to clarify the placement of air quality dispersion modeling receptors on facility property, consistent with the Federal definition of ambient air (40 CFR 50.1(e)) when modeling the National Ambient Air Quality Standards (NAAQS) for Minnesota air quality permits, specifically, for facilities that do not have a fence or physical barrier to preclude public access. In Minnesota, the NAAQS are applicable requirements of our air quality permits.<sup>1</sup> Receptor placement strategies have varied over the years, creating an inconsistent understanding and application of the NAAQS and federal definition of ambient air in air quality modeling demonstrations. This memorandum documents an approach that will result in a consistent evaluation of facility ambient air quality and, when necessary, help inform permittee public access control decisions. The State of Minnesota definition of ambient air is not addressed in this memorandum but is discussed in the Minnesota Pollution Control Agency (MPCA) Air Quality Dispersion Modeling Practices Manual.

### Air Quality Modeling and Ambient Air

In the 1980's the Environmental Protection Agency (EPA) guided receptor placement modeling procedures through what has become EPA's long-standing ambient air policy:<sup>2</sup>

for modeling purposes the air everywhere outside of contiguous plant property to which public access is precluded by a fence or other effective physical barrier should be considered in locating receptors. Specifically, for stationary source modeling, receptors should be placed anywhere outside inaccessible plant property. For example,

<sup>1</sup> The NAAQS and Minnesota Ambient Air Quality Standards (MAAQS) are embedded within the MPCA air quality permitting program through an integrated system of state statute, rule, and state implementation plan. Specific examples of NAAQS applicability can be found in Minn. Stat. §116.06 and §116.07, and Minn. R. 7001.0140, Minn. R. 7007.0100 7(L) and (M), Minn. R. 7009.0020.

<sup>2</sup> See EPA Memorandum from Regional Meteorologists, Regions I-X to Joseph Tikvart, Chief (MD-14) dated May 16, 1985.

receptors should be included over bodies of water, over unfenced plant property, on buildings, over roadways, and over property owned by other sources.

EPA has been consistent in the expectation of receptor placement for NAAQS modeling. Based on EPA policy interpretations of ambient air and public access control from the past three decades, the following key points are considered most relevant when considering the placement of receptors in a NAAQS modeling demonstration:

- The federal definition of ambient air is defined at 40 CFR 50.1(e) as "that portion of the atmosphere, external to buildings, to which the general public has access."
- EPA has exempted a source's area from ambient air when: (1) the source owns or controls (e.g., leasing) the land or property; and (2) precludes public access to the land or property using a fence or other effective physical barrier. The general public must be protected from areas of the facility property (owned or leased) that have modeled exceedances of the NAAQS.
- For the purpose of a NAAQS analysis, EPA expects receptor placement throughout the facility property if no approved fencing or effective physical barrier exists.

The EPA has applied the Federal definition of ambient air for the past four decades, clarifying their interpretation of public access and control over time. EPA has maintained fencing to be a chain-link fence, or any fencing of suitable height, to restrict public access and expects any proposed effective physical barriers to be as restrictive.<sup>3</sup>

### **Implications for MPCA Air Quality Dispersion Modeling**

In sum, based on the EPA policy interpretations of ambient air from the past four decades, the following key points are most carefully observed in the placement of modeling receptors for MPCA NAAQS modeling purposes:

- For the purpose of a NAAQS analysis, EPA expects receptor placement throughout the facility property if no approved fencing or effective physical barrier exists.
- A facility with a modeled NAAQS exceedance on their property should restrict the general public even if there is a remote possibility the public could use the land for any purpose or duration.
- EPA has exempted a source's area from ambient air when: (1) the source owns or controls (e.g., leasing) the land or property; and (2) precludes public access to the land or property using a fence or other effective physical barrier. The general public must be protected from areas of the facility property (owned or leased) that have modeled exceedances of the NAAQS.
- On a case-by-case basis, justification for restricting access through means other than a fence must demonstrate how the approach or combination of approaches is as effective as fencing.
- The goal of restricting access is to make clear to the general public that the area is not for public use which is almost always effectively achieved through fencing.
- Consistent with EPA's definition, the MPCA considers water bodies and forests as ambient air. Railroad tracks, grades, or bridges are considered to be ambient air based on the Federal definition.

This Memorandum should be considered as receptor placement decisions are made during the development of a NAAQS modeling protocol.

---

<sup>3</sup> Email from Randall Robinson, EPA Region 5, to Jim Sullivan, MPCA, dated March 27, 2017.

# Development of the Equivalent or Better Dispersion (EBD) Demonstration

---

## I. INTRODUCTION

The Minnesota Pollution Control Agency (MPCA) staff adapted an Environmental Protection Agency (EPA) approach to evaluate whether the projected ambient impacts of proposed small changes at a facility result in equivalent or better dispersion (EBD). If so, the MPCA can be assured that the conclusions of previous National Ambient Air Quality Standards (NAAQS) and Minnesota Ambient Air Quality Standards (MAAQS) modeling demonstrations remain and the facility continues to demonstrate modeled compliance. The EBD approach is specific to the pollutant and averaging time that prompted requirements in the current permit and assumes that the previous modeled results were at least one significant impact level (SIL) value below the applicable ambient air quality standard. This write-up describes and illustrates the EBD approach.

### A. Purpose

The main goal of the EBD approach is to protect ambient standards while simultaneously avoiding full refined modeling for minor changes at a facility. The EBD approach reuses/edits portions of the existing modeling input data to account for emission changes and/or dispersion changes at the facility in order to evaluate the net change of predicted concentrations. The EBD approach is based on well-known PSD increment concepts which evaluate the change between previous and proposed modeling conditions.

Another goal of the EBD approach is to reduce the administrative review and response time of the MPCA modeling review for projects with minor dispersion changes. MPCA staff desired a simpler way that would contain only the relevant changes to the initial regulatory modeling demonstration. In addition, a simpler form was created that accounts for both the modeling protocol and modeling results/report in order to expedite our review of EBD analyses while documenting the relevant information and modeled output.

### B. History and Evolution of Equivalent or Better Dispersion (EBD)

EPA created the initial EBD analysis concept. It became an active tool in the 1980's as part of a State Implementation Plan (SIP) proposal whereby a facility located within a SIP area would not be required to conduct a complete refined air quality dispersion modeling demonstration as required by the traditional SIP structure when a minor facility change was being proposed. This approach allowed a facility located within a SIP maintenance area to demonstrate that the potential impacts from a proposed change would result in equivalent or better dispersion than had been previously modeled.

The MPCA now uses formal permitting language allowing the use of the EBD concept when anticipating a facility change that will require ongoing assurance of compliance with ambient standards. The modeling trigger language reflects the following themes:

- A list of modeled parameters (based on allowable emissions) in the permit that become the basis for future modeling evaluations;
- Distinction between EBD demonstrations vs. full refined modeling; however, both actions are often referred to as "modeling submittals."

- Changes to a facility that include the modeled parameters and a link to update modeling through an EBD analysis;
- Actions that occur should an EBD result in a value greater than the applicable pollutant-specific SIL (when one exists). This may include permit language that directs a permittee to conduct a full refined modeling demonstration. If the EBD output is less than the relevant pollutant-specific SIL value, and the baseline modeling was at least one-SIL value below the applicable NAAQS, the facility may not need to do further air quality modeling. For ambient air quality standards that do not have a SIL, MPCA should be consulted to discuss alternatives.

For PSD and non-PSD permits with EBD language, the MPCA staff provides review and approval. The EBD is typically not available for projects undergoing environmental review or where a SIP explicitly omits the use of this approach. In situations where a SIP is silent on the use of an EBD, prior approval must be received from EPA prior to pursuit of the analysis.

## **II. Modeling Approach (“How-to-Model”)**

This section of the memorandum describes and illustrates “how-to-model” features of EBD modeling. Attachment 1 is a conceptual example of EBD input files with “before” and “after” modeling inputs. Attachment 2 is a real world example of EBD input files with “before” and “after” modeling inputs. Please note that if you are adding a source to a facility, the simplest means of evaluating potential NAAQS impact is through a SIL analysis as described in the MPCA Air Quality Dispersion Modeling Practices Manual.

### **A. Baseline Modeling**

As noted in the November 25, 2013, MPCA EBD Memorandum, there is an assumption that the previous air dispersion modeling demonstrated compliance with the applicable NAAQS. This means that the last full NAAQS (MAAQS) modeling demonstration becomes the baseline for the EBD comparison. An important condition applies to this assumption: *the modeling demonstration must present a simulation that shows compliance with the NAAQS (MAAQS) applicable at the time of the permit action.* If a previous modeling demonstration does not offer this information, then an adequate baseline for analytical comparison is not available to complete the EBD. Please contact the MPCA Air Permit Section for additional direction on this issue.

### **B. Dispersion Model**

Use the most current version of AERMOD. The primary reason for using the most current version of AERMOD is a function of consistency and accessibility. The MPCA staff designed the EBD approach as a model-version neutral method, meaning that the model version used to run the EBD does not affect the EBD output. The task of the model is to solve the Gaussian dispersion equation for the past and proposed case, at each receptor. The second task of the model is to present the output of the calculations as the difference between the two cases. All versions of AERMOD will be capable of making these calculations, meaning that input files developed from earlier versions of AERMOD should be fit for use in the most current version of AERMOD for EBD purposes. Please note that there may be situations where older modeling files pre-date AERMOD. Though not without challenge, you may try to convert the older files (e.g., ISC) to an AERMOD format.

### **C. Nearby Sources and Background Concentrations**

EBD demonstrations do not require modeling nearby sources or ambient air quality background concentrations. It is assumed that the ambient air quality background concentration and related nearby source inventory were addressed in the initial modeling demonstration that has become the baseline for EBD comparison. If no previous modeling demonstration exists, please consult with MPCA modeling staff to discuss alternatives.

#### **D. Emissions and Dispersion**

EBD demonstrations evaluate the change in allowable emissions, consistent with the scope of the permit. FYI: EBD input data resembles PSD increment input data. Both account for proposed changes at a facility by applying “before” (negative values) and “after” (positive values) scenarios. However, the “before” scenario in PSD-increment files use past actual emissions; EBD uses allowable emissions. The “after” scenario in PSD increment files use allowable emissions; EBD uses allowable emissions.

EBD demonstrations evaluate the change in dispersion; this too is consistent with the scope of the permit. FYI: Modeled parameters (detailed or summarized in the permit) are key features that affect the dispersion of pollutants from the emission sources at the facility. In order to assess the effect of proposed dispersion changes (e.g., stack parameters, building downwash, release height, sigma-yo, sigma-zo, etc.), it is important to lay out the types of emissions that should be considered and the manner in which they are characterized in the EBD evaluation. Please note that changes in buildings should also be accounted for in any EBD analysis.

#### **E. Pollutant-Specific Issues**

EBD demonstrations are pollutant and averaging-time specific. FYI: For the new NAAQS and MAAQS, this may not be much of an issue; however, for situations where the older NAAQS are applicable, new averaging times may be needed to reflect the form of the older standards (e.g., a three-hour averaging time for SO<sub>2</sub>). This situation can arise with SIP maintenance projects or specific permit provisions.

A second issue that arises is the evaluation of NO<sub>2</sub> in EBD demonstrations. Many recent full refined NO<sub>2</sub> NAAQS modeling demonstrations have used the Tier 3 approach in AERMOD to account for the NO<sub>x</sub>/NO<sub>2</sub> transformation. While this is appropriate for full refined NO<sub>2</sub> NAAQS modeling, the EBD calculations are compromised by the negative emissions of the “before” scenario. The EBD approach presents a different challenge. The current AERMOD software will not compute a Tier Two or Tier Three approach when the PSD-increment concepts are applied in a modeling demonstration; this situation also occurs for EBD. The limitation is based on the use of negative numbers in the input file. A simple remedy is to use Tier One for the EBD analysis (which is not compromised by a negative emission rate).

#### **F. Meteorology and Receptors**

EBD demonstrations generally use the same meteorological data as was used in the latest full NAAQS (MAAQS) modeling. In cases where meteorological data is pre-AERMOD or MPCA has more recent AERMET data, the newer meteorological data is required for the EBD analyses. The Adj\_U\* may be used for an EBD analysis; however, please note that the Adj\_U\* is being used in the analysis if it has not been used previously. Please consult with the MPCA modeling unit if you believe that you will require new meteorological data for your project.

Ideally, the EBD analyses should use the same receptor grid that was used in the last full modeling analysis, unless the facility proposes changes to ambient air (e.g., fencing changes; land purchase/sale), or the original terrain data used in the latest full refined NAAQS modeling is no longer supported by AERMOD. It has been noted that some facilities operate under older baseline modeling that included a polar grid arraignment. Older baseline receptor grids may require the addition of new receptors to address updates to current modeling practices. The addition of new receptors does not affect the baseline modeled dispersion. It is intended to reveal those conditions in areas that were not previous explored in the original baseline modeling. Please contact the MPCA modeling unit regarding the best terrain data for EBD work. Our current working practice is to use 1/3 minute arc NED data.

### III. Data Interpretation

The MPCA will consider a project to have equivalent or better dispersion when the modeled output at each receptor is no greater than the applicable pollutant-specific SIL value, as reported to two decimal places (i.e., hundredth decimal place).

### IV. Last Full NAAQS (MAAQS) Modeling Demonstration and the Cumulative Nature of EBD Analysis

The premise of an EBD demonstration is that the changes made subsequent to the last refined modeling demonstration result in an equivalent or better dispersion characteristic in comparison to the previous compliant modeled demonstration. In this way, the “equivalent or better” threshold is a comparison between what was modeled in the previous demonstration and the proposed changes. An additional and important assumption in this approach is the expectation that the last modeled compliance resulted in a modeled value that was at least one-SIL value below the applicable NAAQS. If this condition cannot be met, the EBD may not be applicable. If this condition is present, the EBD approach is likely suitable; however, repeated use to evaluate changes over time raise concern over baseline validity.

Based on MPCA staff review of this process, it is possible to submit multiple EBD analysis over time that reflect minor changes to a facility; however, in aggregate the changes may no longer represent facility dispersion characteristics and a new refined modeling demonstration would be needed to “true up” the baseline modeling. The rationale for this approach is specific to the sequential nature of the EBD and the impact changes have on the assumption of compliance established during the last refined modeling demonstration. Sequentially, the first EBD and contains just its changes; however, subsequent EBD analyses contribute the following:

- The second EBD analysis that contains its changes as well as changes in the first EBD analysis, followed by;
- The third EBD analysis that contains its changes as well as changes in the first and second EBD analyses, followed by;
- The fourth set of changes incorporates all the previous changes, etc...

The EBD aggregation as presented assumes no change to the model or meteorology. In short, each facility EBD history is unique to the changes made over time. The EBD accounting is focused on maintaining aggregate changes that maintain dispersion characteristics below the applicable SIL value. Significant facility changes could trigger a need for a new baseline; however, the number of model generations past the initial baseline model version, or changes in the NAAQS may also trigger the need for a new baseline analysis. Please consult with MPCA modeling staff if are likely to have anticipate multiple EBD analysis for a facility in a relatively short period of time (i.e., five years from permit issuance) or have baseline modeling that is greater than five years old. Baseline modeling that is greater than five-years old does not exclude the facility from pursuing an EBD analysis; however, it may require additional receptors or updates to the meteorological data.

#### Attachments

- Attachment #1 - Conceptual Example
- Attachment #2 - Applied Example

## Attachment #1 – Conceptual Example

---

### Introduction

Equivalent or Better Dispersion (EBD) considers different impacts due to different emissions and/or different dispersion. EBD analyses consider different emissions (if any), different operating times (if any), different stack locations (if any), different stack parameters (if any), different building downwash (if any), different ambient receptors (if any), different meteorological data (if available), etc.

The EBD analysis should use positive emission rates for the “new” case, negative emission rates for the “old” case, and the most current version of AERMOD and most current meteorological data.

Each altered emission source is modeled with “old” and “new” inputs (e.g., LOCATION, SRCPARAM, BUILDHGT, BUILDLEN, BUILDWID, XBADJ, YBADJ, EMISFACT, HOUREMIS, etc.)

### Example

Facility ABC with three altered stack/vents would have six AERMOD IDS and corresponding AERMOD conceptual inputs (e.g., AERMOD SO section; and other AERMOD sections if applicable):

- ABCSV001\_OLD with old (negative) emission rate
  - Old Inputs:
  - LOCATION
  - SRCPARAM
  - BUILDHGT, BUILDWID, BUILDLEN, XBADJ, YBADJ
  - EMISFACT (or HOUREMIS)
  - ETC.
- ABCSV002\_OLD with old (negative) emission rate
  - Old Inputs
- ABCSV003\_OLD with old (negative) emission rate
  - Old Inputs
- ABCSV001\_NEW with new (positive) emission rate
  - New Inputs
- ABCSV002\_NEW with new (positive) emission rate
  - New Inputs
- ABCSV003\_NEW with new (positive) emission rate
  - New Inputs

Use AERMOD SRCGROUP ALL and AERMOD output based on high-first-high (H1H) values, as well as applicable regulatory metrics (e.g., NAAQS).

Note: Except for “past” emissions and baseline dates, EBD inputs resemble PSD increment inputs.

## Attachment #2 – Applied Example

---

Jarden Home Brands (JHB) is located in Cloquet, Minnesota. JHB has an air permit with the EBD requirement and has proposed changes to their combined boiler stack (SV020) as summarized below.

*To comply with Permit #01700003-004 conditions requiring a PM<sub>10</sub> and PM<sub>2.5</sub> dispersion equivalency demonstration for any stack parameters changes at the Jarden Home Brands – Cloquet, MN facility, Barr Engineering conducted an AERMOD modeling analyses of a flow rate change at the Combined Boiler Stack (JHBSV020). The goal of this evaluation is to demonstrate the stack parameter change provides equivalent or better dispersion characteristics than the previously modeled parameters for JHBSV020. The specific change was an increase in flow rate from the previously modeled 36,000 actual cubic feet per minute (acf m) to 46,000 acf m. Further, the remainder of the stack parameters and emission rates for JHBSV020 were unchanged. Per information received at the July 16, 2013, MPCA modeling guidance seminar regarding equivalent dispersion demonstrations, Barr used the identical air modeling files from the issuance of the August 2012 permit as the basis for this modeling. The results from the modeling compared the permitted stack parameters to the new stack parameters for the stack.*

AERMOD SRCPARAM inputs for the JHB PM2.5 and PM10 EBD analyses are summarized below.

\*\* JHBSV020 - Boiler Combined Stack

\*\* BOILER STACK - 120' = 36.576m  
 \*\* Diameter = 38" = 0.965m  
 \*\* Temp = 250 deg F. = 394.26 K  
 \*\* JHBSV020 - 36,000 acfm -> velocity - 23.221 m/s  
 \*\* JHBSV20N - 46,000 acfm -> velocity - 29.671 m/s

SO SRCPARAM JHBSV020 -1.2096E+00 36.576 394.26 23.221 0.965  
 SO SRCPARAM JHBSV20N 1.2096E+00 36.576 394.26 29.671 0.965

EBD results indicate equivalent or better dispersion for annual PM2.5, 24-hour PM2.5, and annual PM10. EBD results do not indicate equivalent or better dispersion (two decimal places) for 24-hour PM10 (i.e., AERMOD SRCGROUP ALL had a HIGH 6<sup>th</sup> HIGH value of 0.01204 ug/m<sup>3</sup>). So, full refined 24-hour PM10 NAAQS re-modeling was conducted using a PM10 background concentration of 50 ug/m<sup>3</sup> based on 2012 data from MPCA Duluth Site 7545.

The full refined 24-hour PM10 NAAQS re-modeling results indicate continued modeled compliance at all ambient locations. Areas with predicted concentrations exceeding the 24-hour PM10 NAAQS are entirely on Sappi property and are mostly due to Sappi emission sources. Therefore, the proposed changes for the Jarden Home Brands (JHB) combined boiler stack (SV020) are acceptable.

Additional data files are on the MPCA x-drive:

X:\Agency\_Files\Outcomes\Risk\_Eval\_Air\_Mod\Air\_Modeling\Projects\01700003\_JardenHomeBrands\20131021\_EBDv1\

Figure 1 Cloquet 24-Hour PM10 H6H Predicted Concentrations (including background)

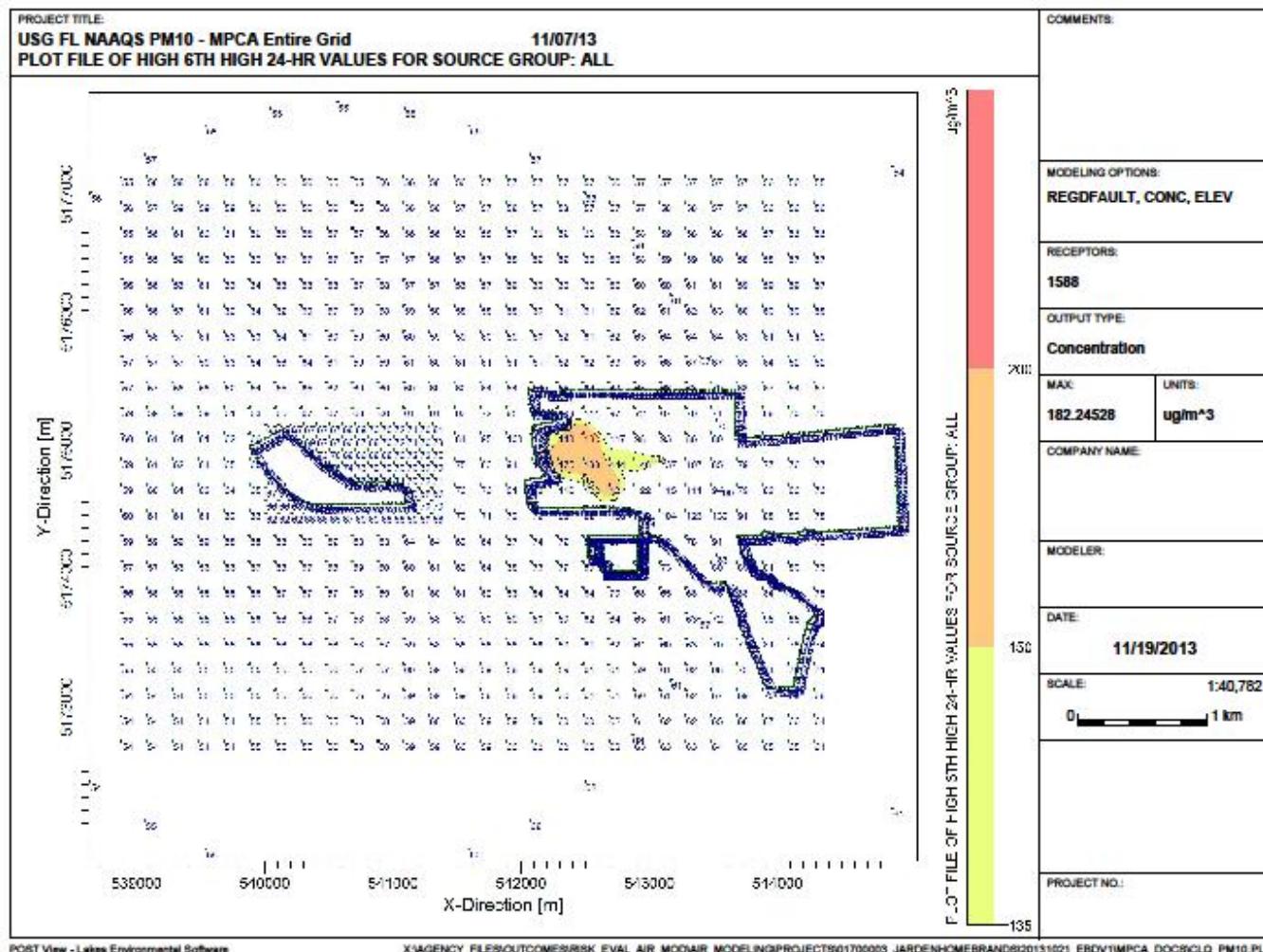


Figure 2 Eastern Cloquet 24-Hour PM10 H6H Predicted Concentrations (including background)

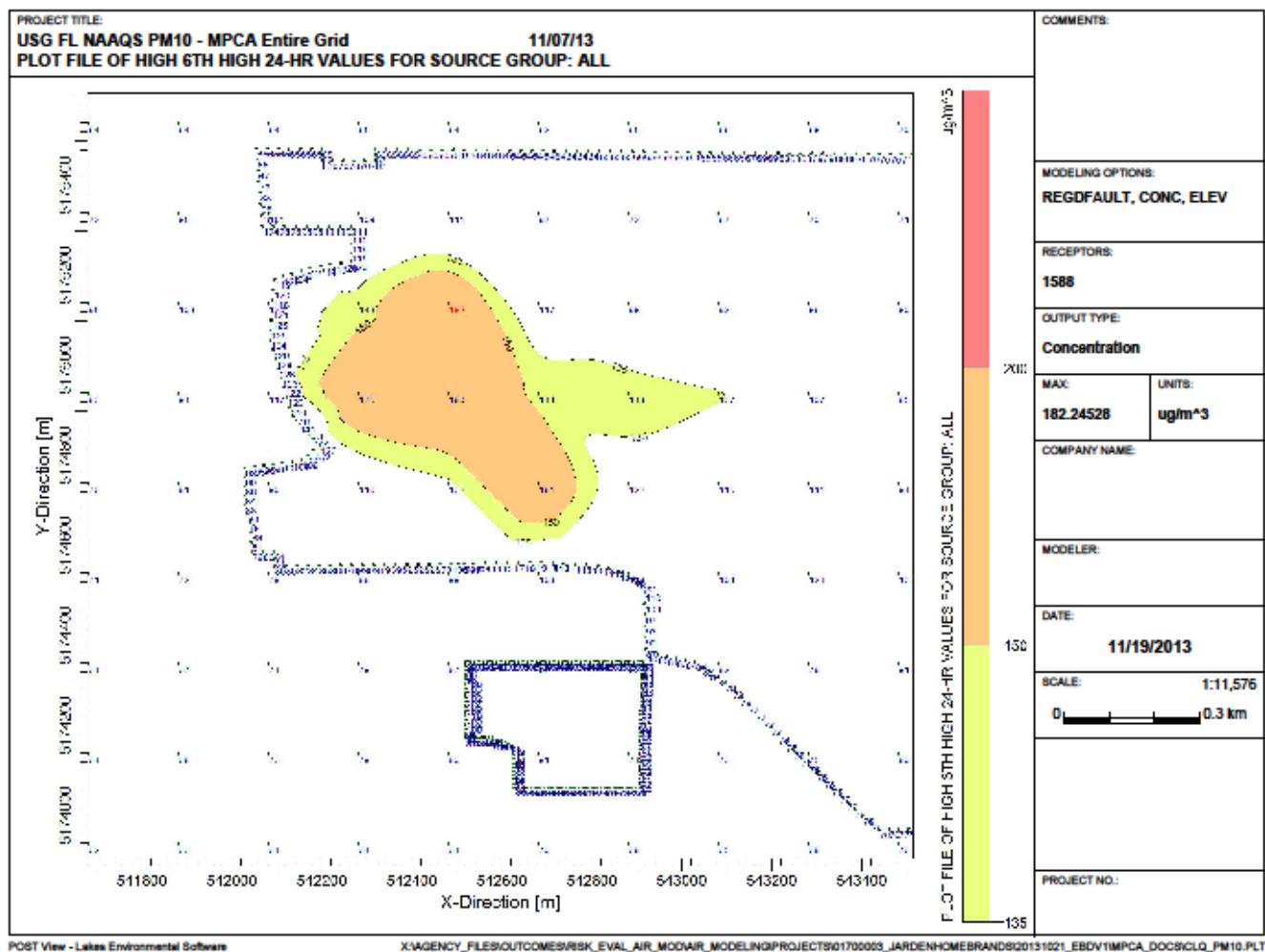
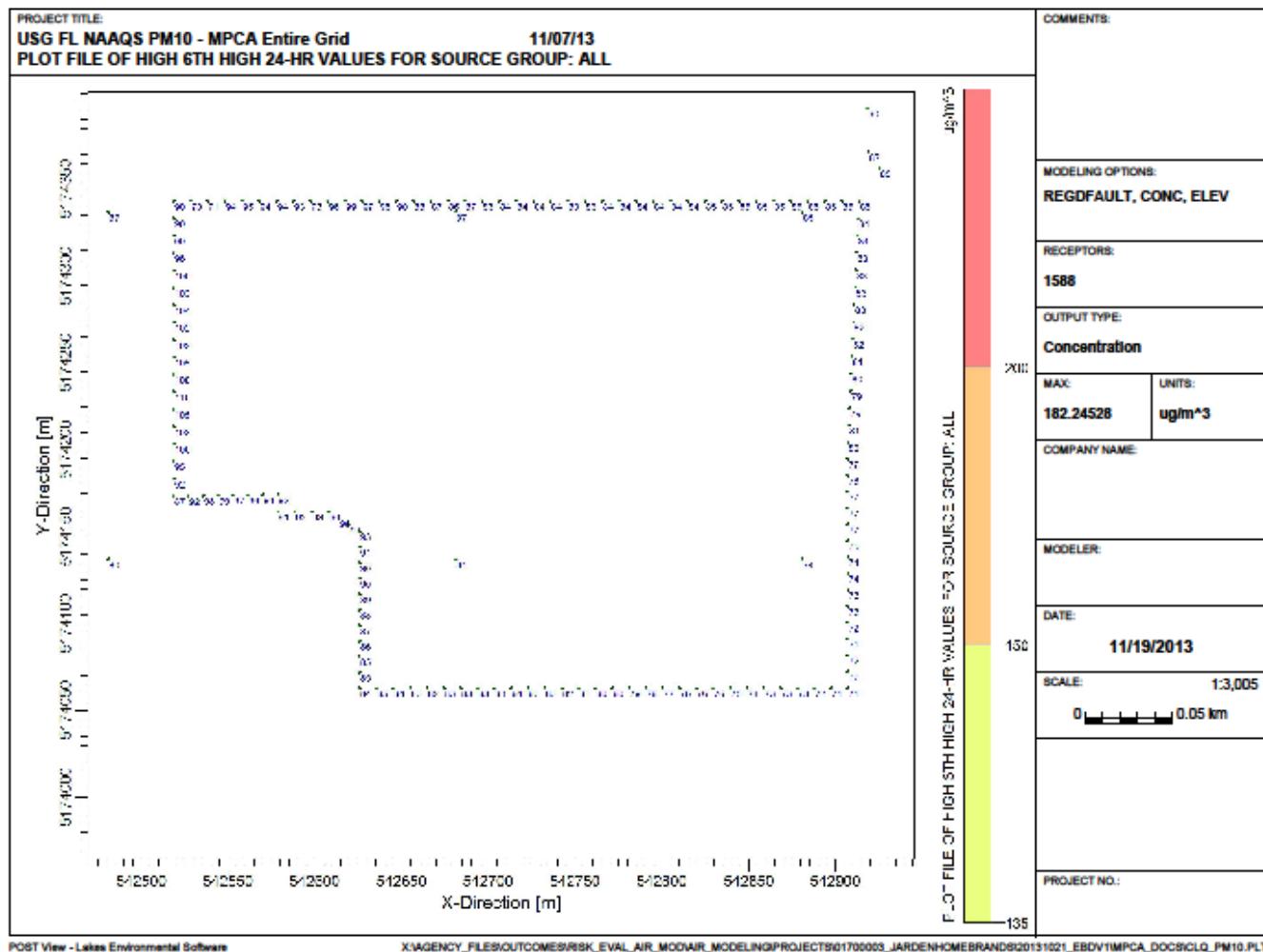


Figure 3 Jarden Home Brands (JHB) Property Line 24-Hour PM10 H6H Predicted Concentrations (including background)



## Appendix F

DEPARTMENT: POLLUTION CONTROL AGENCY

SF-00006-05 (4/86)

STATE OF MINNESOTA  
Office Memorandum

DATE: June 15, 2021

TO: Kari Palmer and Manager, Air Assessment Section, EAO  
Steve Pak Manager, Air Quality Permits Section, IND

FROM: Daniel Dix and Supervisor, Risk Evaluation and Air Modeling Unit, EAO  
Richard Cordes Supervisor, Air Quality Permits Unit 2, IND

PHONE: 651-757-2326  
651-757-2291

SUBJECT: Application of Table 8-2 (Appendix W) for Nearby Source Characterization: Working Practices

### Role of Table 8-2 in Nearby Source Characterization

In the application of air quality models, the EPA provides for the adjustment of emissions inputs for nearby sources through Table 8-2 (found in Appendix W to 40 CFR Part 51 (Table)). As noted in the preamble to the final rule (in the January 17, 2017 Federal Register), this Table “allows the model user to account for actual operations in developing the emissions inputs for dispersion modeling of nearby sources, while other sources are best represented by air quality monitoring data.”\* The “actual operations” presented in Appendix W were refined during the 2017 Federal Appendix W Guidance revision to reduce ambiguity and misunderstanding of this process and “to correctly state that the operational level for nearby sources for short-term average times is the ‘temporally representative level when actually operating, reflective of the most recent 2 years.’”† The “other sources” are assumed to be other stationary and non-stationary sources that do not have a “significant concentration gradient” on the source under review. They are best characterized as ambient air quality background conditions in the modeling demonstration.

The MPCA proposes to implement the Table, consistent with EPA’s language and reflective of existing state air quality regulations. The Table presents a process that can be used to adjust the nearby source emissions inputs; however, it is not required for nor expected of every modeling demonstration. Note that the Table allows the use of actual operations but not actual emissions.

Table 8-2 delineates methodologies for developing emissions inputs for long-term (annual and quarterly) and short-term ( $\leq 24$  hours) averaging times for the source under review as well as nearby sources. The portion of the Table that addresses nearby sources is presented below. The original EPA footnotes are included and annotated with MPCA understanding and practice.

### MPCA Implementation of Table 8-2 as Presented by EPA

Excerpt from Table 8-2. Point source model emission inputs for NAAQS compliance in PSD Demonstrations

Nearby Source(s) <sup>4,5</sup>				
	Emission limit (lb/MMBtu) <sup>1</sup>	X	Operating level (MMBtu/hr) <sup>2</sup>	X
Annual & quarterly	Maximum allowable emission limit <b>or</b> federally enforceable permit limit. <sup>5</sup>	X	Annual level when actually operating, averaged over the most recent 2 years. <sup>6</sup>	X
Short term ( $\leq 24$ hours)	Maximum allowable emission limit <b>or</b> federally enforceable permit limit. <sup>5</sup>	X	Temporally representative level <b>when actually operating</b> , reflective of the <b>most recent 2 years</b> . <sup>6,7</sup>	X

<sup>1</sup>Terminology applicable to fuel burning sources; analogous terminology (e.g., lb/throughput) may be used for other types of sources.

<sup>2</sup>If operation does not occur for all hours of the time period of consideration (e.g., 3 or 24-hours) **and** the source operation is constrained by a federally enforceable **permit condition**, an appropriate adjustment to the modeled emission rate may be made (e.g., if operation is only 8 a.m. to 4 p.m. each day, only these hours will be modeled with emissions from the source.) **Modeled emissions should not be averaged across non-operating time periods.**

**MPCA characterization / interpretation:** When demonstrating compliance with an ambient standard, Permittees may use information from the actual operations of nearby sources to adjust the model inputs. The MPCA will review proposed emissions adjustments using Table 8-2 during its review of the protocol and must approve them before their use in a regulatory modeling demonstration. However, the MPCA will not accept actual hourly emissions data to be used directly as the inputs to the model.

<sup>4</sup>Includes existing facility to which modification is proposed if the emissions from the existing facility will not be affected by the modification. Otherwise use the same parameters as for major modification.

\* 5218 Federal Register Vol. 82, No. 10, January 17, 2017. Also found in Section 8.2.2.b of 40 CFR part 51, Appendix W.

<sup>5</sup> 5202 Federal Register Vol. 82, No. 10 January 17, 2017.

<sup>5</sup>See Section 8.3.3.

**MPCA:** The MPCA will apply the definition of potential to emit from the PSD regulation to determine a maximum allowable emissions rate for units for which there is no associated permit limit.

<sup>6</sup>Unless it is determined that this period is not representative.

**MPCA:** For the MPCA to accept proposed inputs for a nearby source, the Agency must determine that the data are reasonably reflective (and potentially predictive) of how the nearby source typically operates. The MPCA will consider historical operational records (prior to the most recent two years) and planned future operation.

<sup>7</sup>Temporally representative operating level could be based on Continuous Emissions Monitoring (CEM) data **or other information** and should be determined through consultation with the appropriate reviewing authority (Paragraph 3.0(b)).

**MPCA:** The MPCA considers a number of factors to determine if proposed inputs are representative of the nearby facility's operation. Relevant "other information" may include time-of-day use, seasonal use, and similar recorded data.

<sup>8</sup>For those permitted sources not in operation or that have not established an appropriate factor, continuous operation (i.e., 8760) should be used.

**MPCA:** It is appropriate for sources lacking adequate historical data to use the unit's potential to emit. It is important for the potential to emit (PTE) to be determined for the averaging time of the standard.

## **Suggested Practices for Applying Table 8-2 in Minnesota**

The MPCA expects a submitted protocol to include a list of any nearby sources and the modeling inputs (including emissions inputs) from those sources. Because of this, the MPCA anticipates that a facility will apply the flexibility offered by Table 8-2 during the development of the Air Quality Dispersion Modeling Protocol, especially if the nearby source inventory includes facilities holding a Registration D permit. Note that using Table 8-2 may add significant additional time to the completion of protocol review.

Current practice allows for most modeling demonstrations to move forward without a Table 8-2 adjustment. However, when the cumulative modeling demonstration results in modeled noncompliance, and the source under review models pollutant concentrations greater than the applicable SIL value but below the applicable ambient air quality standard, adjusting the nearby source emissions inventory consistent with the Table may be prudent. The MPCA provides a "Table 8-2" tab in the AQDM-02 emissions spreadsheet to document all pertinent nearby source emissions work. Due to the added burden and the potential for delays from its use, the decision to apply the Table is a project-specific decision affected by a number of factors. These factors include project timelines, available resources, and the potential for modeled exceedances.

Given the nature of the Table, as well as the permit-specific information needed to complete the adjustments, consulting with the MPCA Air Quality Permitting Section is advised. Please direct questions pertaining to Table 8-2 emissions adjustments to the Air Quality Permit Section's modeling email address ([AQPS.Modeling.MPCA@state.mn.us](mailto:AQPS.Modeling.MPCA@state.mn.us)); include "Table 8-2 Modeling Inputs" in the Subject line.

### **PSD, Part 70, and other Site-specific Individual Permits**

A site-specific permit for a nearby source and the documentation that supported the development of the permit often contain the emissions rates and stack parameters needed to make adjustments using Table 8-2. When the permit does not provide an emissions rate for a specific averaging time, the value can usually be determined from emissions calculations used to develop the permit.

### **Registration Permits**

Registration permits, by themselves, lack the specificity needed to apply the Table 8-2 process directly. However, Minnesota's permitting rules require many registration permit holders to submit to the MPCA or maintain on-site the information needed to use Table 8-2. This may include stack parameters as well as the maximum fuel input rate or equipment throughput. In addition, a variety of federal and state air quality regulations that may apply to registration permit holders limit the potential emissions from various process and material handling emissions on a short-term basis.

### **Final Notes on Working Practices Documents**

This document is intended to provide the user with nearby source emissions inventory adjustment options as part of a regulatory air quality dispersion modeling demonstration. Over the next year from the date of this document, the MPCA asks users to provide feedback on the utility of this approach to enhance this practice for long-term use. Please send your feedback to the MPCA Air Quality Modeling Unit email at [AirModeling.PCA@state.mn.us](mailto:AirModeling.PCA@state.mn.us).