



South Carolina

Modeling Guidelines for Air Quality Permits

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Table of Contents

1.0 INTRODUCTION 1

1.1 BACKGROUND 1

1.2 WHEN IS A COMPLIANCE DEMONSTRATION REQUIRED? 1

1.3 HOW IS COMPLIANCE DEMONSTRATED? 2

1.4 SCOPE OF THIS DOCUMENT 2

1.5 BUREAU ASSISTANCE 4

2.0 EXEMPTIONS AND DEFERRALS - FROM SUBMITTING AN AIR QUALITY ANALYSIS - STANDARDS NO. 2 AND 8 5

2.1 UPDATED AIR QUALITY ANALYSIS NOT REQUIRED, STANDARDS NO. 2 & 8 5

2.2 EXEMPTIONS AND DEFERRALS - STANDARD NO. 2 6

2.3 EXEMPTIONS AND DEFERRALS - STANDARD NO. 8 10

3.0 GENERAL MODELING CONSIDERATIONS 17

3.1 EMISSION RATE NOTES 17

3.2 SOURCE OVERVIEW 18

3.3 MERGED STACK PARAMETER 19

3.4 NON-VERTICAL AND RAIN-CAPPED STACKS 20

3.5 URBAN / RURAL CLASSIFICATION 21

3.6 BACKGROUND DATA 22

3.7 COLLOCATED FACILITIES 22

4.0 SCREEN MODELING 24

4.1 WHEN TO USE SCREEN MODELING 24

4.2 PREFERRED MODEL 24

4.3 SCOPE 25

4.4 SCREEN3 MODEL OVERVIEW 25

4.5 GOOD ENGINEERING PRACTICE (GEP) STACK HEIGHT ANALYSIS 26

4.6 NON-VERTICAL AND RAINCAPPED STACKS 28

4.7 SCREEN3 INPUT NOTES 29

4.8 SCREEN3 MODELING FOR NITROGEN DIOXIDE (NO₂) 32

5.0 REFINED MODELING	33
5.1 WHEN TO USE REFINED MODELING	33
5.2 PREFERRED MODEL.....	33
5.3 SCOPE	34
5.4 MODEL USAGE.....	34
5.5 INFORMATION TO SUBMIT TO THE BUREAU	35
5.6 URBAN / RURAL CLASSIFICATION.....	35
5.7 SOURCE NOTES	35
5.8 RECEPTORS	41
5.9 METEOROLOGICAL DATA	42
5.10 TERRAIN DATA	43
5.11 DOWNWASH	43
5.12 AERMOD OUTPUT AND METEOROLOGICAL DATA FILE OPTIONS TO USE FOR COMPARISON TO AMBIENT STANDARDS.....	44
5.13 MODELING NO ₂ – MULTI-TIERED APPROACH	44
6.0 REPORTING REQUIREMENTS	46
6.1 SUMMARY.....	46
6.2 FACILITY DESCRIPTION	46
6.3 EMISSION POINT DATA.....	47
6.4 ANALYSIS DETAILS.....	48
6.5 MODEL RESULTS.....	48
6.6 MODELING FILES	49
7.0 PSD (PREVENTION OF SIGNIFICANT DETERIORATION) MODELING	50
7.1 INTRODUCTION	50
7.2 PSD PRE-APPLICATION MEETING AND MODELING PROTOCOL	52
7.3 CLASS II / CLASS I AREA ANALYSES	54
7.4 CLASS II AREA ANALYSIS	54
7.5 CLASS I AREA ANALYSIS	65
7.6 AIR QUALITY MODELING REPORT	68
APPENDIX A - Model Output and Meteorological Data File Options, SC Standards No. 2 and 8 (and PSD CLASS II NAAQS).....	69

<u>APPENDIX B</u> - Air Toxics Data (SC Standard No. 8).....	71
<u>APPENDIX C</u> - Standard No. 8 (Air Toxic) Deferral Analysis Example.....	81
<u>APPENDIX D</u> - Additional PSD Information	85
<u>APPENDIX E</u> - References	89

1.0 INTRODUCTION

1.1 BACKGROUND

South Carolina (SC) Regulation 61-62.1 requires facilities to obtain an air quality permit from the Bureau of Air Quality (Bureau) prior to the construction or operation of certain stationary sources of air pollution in South Carolina (see SC Regulation 61-62.1, Section II (SCDHEC, n.d.(a))for an explanation of air quality permit requirements and permit exemptions).

The permit application should include a compliance demonstration showing the emissions from the facility will not interfere with the attainment or maintenance of any ambient air quality standard. Specifically, the demonstration should address compliance with SC Regulation 61-62.5, Standards No. 2, 3.1, and 8, as applicable. In addition, for a proposed major source (i.e., Prevention of Significant Deterioration (PSD)) permit, a source impact analysis is required that demonstrates allowable emission increases will not cause or contribute to an exceedance of SC Regulation 61-62.5, Standard No. 7 PSD increments (additional Federal requirements may apply to PSD projects, as outlined in Section 7 of these Guidelines).

Note that a compliance demonstration for the Standard No. 7 PSD increments is not required at the time of permit issuance for non-PSD projects (SCDHEC, 2017b).

1.2 WHEN IS A COMPLIANCE DEMONSTRATION REQUIRED?

A new or revised compliance demonstration is required, for the applicable standards of SC Regulation 61-62.5, for the following:

- New and existing facilities/sources for which a compliance demonstration has never been submitted
- Existing sources that increase emissions and/or make modifications in the parameters used in a previous compliance demonstration that can cause a higher offsite pollutant concentration.

In general, a compliance demonstration would be required for most construction permit applications (including all PSD construction permit applications) and for certain Title V and Conditional Major permit applications.

A compliance demonstration is normally waived for a facility that seeks, and meets the eligibility criteria for, a General permit (for example, General Construction permit for Concrete Plants). However, the Bureau reserves the right to request a compliance demonstration if there are citizen or regulatory concerns.

Sources subject to Standard No. 3.1, Hospital/Medical/Infectious Waste Incinerators, may be required to show compliance with allowable ambient concentrations shown in Section III of that Standard.

1.3 HOW IS COMPLIANCE DEMONSTRATED?

Compliance with the applicable air quality standards can be demonstrated using one or more of the following methods:

- Exemption/deferral
- Air quality analysis based on air dispersion modeling
- Air quality analysis based on other information

Exemption/deferral refers to facilities/sources/pollutants which qualify to be exempt from any further air quality analysis (i.e., using air dispersion modeling or other information), or for which an air quality analysis can be delayed to a later time. An air quality analysis based on air dispersion modeling refers to a compliance demonstration based on the execution and results of an approved screening or refined air dispersion model.

Air quality analysis based on other information is addressed in a separate guidance document (SCDHEC, 2017a) maintained at the Bureau's Air Dispersion Modeling webpage.

1.4 SCOPE OF THIS DOCUMENT

The main purpose of this guideline document is to assist applicants in the development of compliance demonstrations based on:

- Exemption/deferral analyses, and
- Air quality analyses based on dispersion modeling

It is assumed that the user of this document has basic knowledge of dispersion modeling principles and techniques. As such, the Guidelines are not intended to be a comprehensive resource on dispersion modeling in general. Rather, the material presented is focused mainly on the following:

- Bureau expectations/requirements specific to analyses for facilities in South Carolina
- Topics that have required frequent clarification by the Bureau in the recent past
- New or updated material as deemed appropriate by the Bureau

Adherence to these Guidelines should help ensure that an exemption/deferral and/or air dispersion modeling analysis submitted by an applicant is acceptable to the Bureau and should help facilitate the approval process. However, because of the number of variables involved and the spectrum of unique situations that exist, the Bureau may require additional information or that different procedures be adopted in certain situations. Also note that, as guidance, these procedures do not supersede any statutory or regulatory requirements.

Note that air dispersion modeling guidance will be confined to topics directly related to SCREEN3 and AERMOD, which are the preferred models for screening and refined modeling analyses, respectively, in South Carolina.

Updates

- These Guidelines will be updated as needed, and thus may change at any time. Any section that has been updated since the original release date, shown on the title page of this document, will contain the date of latest revision in the section header.
- Note that EPA or other guidance and regulations can change at any time and any such changes may supersede all or part of this guidance.
- The webpage links shown in this document (embedded or contained in the reference list in Appendix E) may change from time to time. In case there is a delay in updating a link and an incorrect/unexpected site is encountered, please note that most of the cited EPA and SCDHEC material should be accessible via the following general websites: www.epa.gov/scram and www.scdhec.gov/environment.

1.5 BUREAU ASSISTANCE

The Bureau may provide assistance in conducting a compliance demonstration, by request, for the following:

- Small businesses, as defined in the Federal Clean Air Act. A small business is a facility that meets all of the following:
 - Has 100 employees or less
 - Is a stationary, non-major source of emissions
 - Is a small business concern as defined in the Small Business Act (Small Business Administration, 2013) (which generally means one which is independently owned and operated (rather than a subsidiary of a larger business) and is not dominant in its field of operation)
- Small facilities owned by federal, state, and local governments (note: facilities that are too large or complex, such as major state-owned institutions of higher learning, will generally not qualify for assistance); and
- Facilities claiming that compliance demonstration requirements will cause economic hardship to them, verified through the submission of documentation such as balance sheets, income statements, etc.

All facilities receiving assistance are responsible for providing to the Bureau in a timely manner all facility/site information necessary to conduct the analysis.

Note that, since the time required by the Bureau to develop the compliance demonstration is not included in the permitting time frames, the time spent developing these analyses will not be counted toward the time clock for permit issuance.

The offer of Bureau assistance does not preclude a facility from conducting its own compliance demonstration, if desired.

2.0 EXEMPTIONS AND DEFERRALS - FROM SUBMITTING AN AIR QUALITY ANALYSIS – STANDARDS NO. 2 AND 8

Some facilities, sources or emission points may be exempt, or their emissions deferred from the requirement to submit an air quality analysis for the purpose of demonstrating compliance with the ambient air quality standards established in SC Regulation 61-62.5, Standards No. 2 and 8.

Please note the following:

- This exemption/deferral guidance does not apply to pollutants triggering Prevention of Significant Deterioration (PSD) permit actions.
- An exemption from the requirement to submit an air quality analysis is not necessarily an exemption from permitting requirements. Please contact the Bureau for guidance on whether a source exempt from the requirement to submit an air quality analysis is also exempt from permitting requirements.
- Exemptions and deferrals may be rescinded and an air quality analysis required if there are citizen or regulatory concerns or the facility is located in or near a non-attainment area.

General circumstances for which an updated air quality analysis is not required for Standards No. 2 and 8 are listed in Section 2.1. Details of exemptions and deferrals for Standard No. 2 are presented in Section 2.2, and for Standard No. 8 in Section 2.3.

2.1 UPDATED AIR QUALITY ANALYSIS NOT REQUIRED, STANDARDS NO. 2 & 8

An updated compliance demonstration is not required for the following:

- Replacement or Modification of Existing Sources
 - Replacement of sources with new sources (like-for-like, reconstruction, etc.) that have equivalent or lower emissions than the original source.
 - Modifications or changes to a source (i.e., fuel type, raw material changes, etc.) that generate equivalent or lower emissions and provide the same or improved dispersion as compared to the original modeled source.

Note: For either case above, the current compliance demonstration for the facility on file at the Bureau must be up to date and include the original source.

- Relocation of a source – so long as the dispersion parameters are not worsened, and the new location is not closer to the facility property boundary than the original location.
- Removal of a Source
- Software Changes/Updates – including updates to air dispersion modeling software and meteorological data sets used in AERMOD modeling.
- Emission Factor Changes
A new compliance demonstration is not required when emission factors (including, but not limited to, AP-42 factors) are updated, unless there is an actual increase in emissions (as shown by a stack test, for example). Any compliance demonstration performed after the emission factor change, however, must include current emission factors.

2.2 EXEMPTIONS AND DEFERRALS - STANDARD NO. 2

2.2.1 Exempt Facilities

1) Cotton Gins and Country Grain Elevators

Cotton gins and country grain elevators (facilities which directly receive grain from farms during harvest seasons and include drying and cleaning operations in addition to handling and storing grain) are exempt from the requirement to submit an air quality analysis contingent upon the facility in question not being a part of a larger facility. These facility types are exempted due to the sporadic or seasonal operation of their sources and the fact these sources typically emit large particulate that should quickly settle near the facility. Facilities with a negative compliance or complaint history may be required to submit an air quality analysis.

2) Concrete Batch Plants and Pug Mills

Concrete batch plants and pug mills that are not part of a larger facility may be granted an exemption on a case-by-case basis. The decision on whether to grant an exemption will be based on the proximity and density of residences and other population centers. Existing facilities' compliance and complaint history will also be taken in to consideration before granting this exemption.

2.2.2 Exempt Sources

Certain sources are exempt from permitting based on size, emission levels and operating characteristics.

Except in the case of compliance demonstrations for Prevention of Significant Deterioration (PSD) permits, the Bureau exempts the following sources from the requirement to submit an air quality analysis for Standard No. 2:

- Equipment as listed in the "Bureau of Air Quality Permit Exemption List" (SCDHEC, 2016a).
- Roads (paved or unpaved) and storage piles that are maintained using a fugitive dust control plan to minimize fugitive dust emissions.

2.2.3 Exempt Emission Rates

Emissions less than the exemption emission rates set by the Bureau are exempt from air quality analysis requirements. Exemption emission rates per pollutant are shown in Table 2.1 below.

Table 2.1			
EXEMPTION EMISSION RATES – STANDARD NO. 2 ⁽¹⁾			
Pollutant		Threshold ⁽²⁾	
PM ₁₀	Particulate Matter ≤ 10 microns	1.14 lb/hr or 5 TPY ⁽³⁾	Per Source/Emission Point ⁽⁵⁾
PM _{2.5}	Particulate Matter ≤ 2.5 microns		
SO ₂	Sulfur Dioxide		
NO _x	Nitrogen Oxides		
CO	Carbon Monoxide	10.0 lb/hr or 5 TPY ⁽⁴⁾	
Pb	Lead	0.114 lb/hr ⁽⁶⁾ or 0.5 TPY	Facility-wide
1) This guidance does not apply to pollutants triggering PSD permit actions.			
2) Emissions (controlled or uncontrolled) less than the threshold are exempt from air quality analysis requirements and are not required to be included in a facility-wide compliance demonstration.			
3) An emission rate ≥ 1.14 lb/hr but < 5 TPY would also qualify for exemption.			
4) An emission rate ≥ 10.0 lb/hr but < 5 TPY would also qualify for exemption.			
5) If an emission point vents emissions from more than one source, and at least one of the sources does not qualify for exemption, then all sources/emissions venting from that emission point will be ineligible for exemption and should be addressed in an air quality analysis, regardless of the potential exemption status of the individual sources.			
6) Facilities with a short-term controlled or uncontrolled potential emission rate greater than or equal to this amount may qualify for exemption if emissions are limited to < 250 pounds in any 3-month period.			

2.2.4 Deferral Emission Rates

The Bureau allows small emission increases per source or emission point to be deferred from air quality analysis requirements at the time of a construction permit or operating permit modification application.

Please note the following:

- The deferral of an air quality analysis does not exempt a facility from enforcement action, including possible penalties, should a subsequent air quality analysis indicate that a standard has been exceeded.
- For a deferral to be granted for a pollutant/source/emission point, the emission increase must be less than the deferral emission rate, shown in Table 2.2 below, for the pollutant in question (note that lead (Pb) emissions are not eligible for deferral).
- A deferral may not be allowed if the existing facility-wide compliance demonstration (modeled concentration plus background concentration) for the pollutant in question is greater than 90% of the standard.
- A demonstration showing compliance for deferred increases will be required five years after the date of the deferral, at operating permit renewal, or at the time of the next permit application for which a compliance demonstration is necessary for the pollutant in question, whichever comes first. If this compliance demonstration indicates noncompliance with the standards, the facility will be required to bring the facility back into compliance before a permit will be issued.

Deferral emission rates per pollutant are shown in Table 2.2 below.

Table 2.2			
DEFERRAL EMISSION RATES – STANDARD NO. 2 ⁽¹⁾			
Pollutant		Threshold ⁽²⁾	
PM ₁₀	Particulate Matter ≤ 10 microns	1.14 lb/hr or 5 TPY ⁽³⁾	Per Source/Emission Point ⁽⁵⁾
PM _{2.5}	Particulate Matter ≤ 2.5 microns		
SO ₂	Sulfur Dioxide		
NO _x	Nitrogen Oxides		
CO	Carbon Monoxide	10.0 lb/hr or 5 TPY ⁽⁴⁾	
1) This guidance does not apply to pollutants triggering PSD permit actions.			
2) Emission <u>increases</u> (controlled or uncontrolled) less than the threshold, for an existing facility, may be deferred.			
3) An emission rate ≥ 1.14 lb/hr but < 5 TPY would also qualify for deferral.			
4) An emission rate ≥ 10.0 lb/hr but < 5 TPY would also qualify for deferral.			
5) If an emission point vents emissions from more than one source, and at least one of the sources does not qualify for deferral, then all sources/emissions venting from that emission point will be ineligible for deferral and should be addressed in an air quality analysis, regardless of the potential deferral status of the individual sources.			

2.3 EXEMPTIONS AND DEFERRALS - STANDARD NO. 8

2.3.1 Exempt Sources

There are several bases on which sources may be exempt from the requirement to demonstrate compliance with Standard No. 8. The two most commonly used are:

- 1) Fuel-burning sources that burn only virgin fuel or specification used oil as defined in SC Regulation 61-62.1; and
- 2) Sources subject to, and in compliance with, one or more Federal MACT (Maximum Achievable Control Technology) or area source standards.

See SC Reg. 61-62.5, Standard No. 8 (SCDHEC, n.d.(a)) for further discussion of basis #2 above and additional bases for exemption.

Additional bases for exemption not mentioned in Standard No. 8 include the following:

- The Bureau's leak detection and repair (LDAR) program. Participation in this preventative maintenance program will exempt the facility from the requirement to show compliance with Standard No. 8 for leakage emissions from equipment such as pipes, flanges, pumps and valves. See the Bureau's LDAR guideline document (SCDHEC, 1994) for more information.
- Lagoons – Emissions from lagoons do not have to be considered in determining compliance for Standard No. 8 at this time.

Note: Sources that are not subject to permitting are not necessarily exempt from demonstrating compliance with Standard No. 8 (see SC Reg. 61-62.5, Standard No. 8, Section I.B).

2.3.2 Exempt Emission Rates

1) De Minimis emission rate

<p>A pollutant (air toxic) is exempt from any further air quality analysis if:</p>
<p>Facility-wide emission rate \leq de minimis emission rate*</p> <p>(both rates in lb/day)</p>
<p>*See Table B.1 (Appendix B) for the de minimis emission rate of all pollutants regulated by Standard No. 8.</p>

The total facility-wide emission rate (lb/day) of a pollutant should be computed as follows:

- Continuous Source – For a source that is capable of operating continuously, use the maximum hourly rate in lb/hr multiplied by 24 hours/day to obtain a maximum lb/day emission rate.

- Intermittent or batch sources – For a source that is part of an intermittent or batch type process, use the total pounds of the pollutant that can be emitted in a day (i.e., based on the maximum number of batches or intermittent processes capable per day).

Note: Emissions which represent less than 24-hour operation or those that represent less than the maximum daily emissions for a process will require a permit restriction limiting the hours of operation or other process limits in order to qualify as de minimis. To prevent permit restrictions, the maximum emissions that assume a 24 hours/day operation should be used.

Summary information relating to the de minimis analysis should be submitted to the Bureau for review.

2) Trace Emissions

Trace emissions (per source or emission point) are exempt from the requirement to be included in a Standard No. 8 compliance demonstration.

Many chemical mixtures used in the manufacturing process may contain trace amounts of hazardous chemicals which are not required to be listed on a Safety Data Sheet (SDS). The trace chemicals themselves as well as levels present may also vary from shipment to shipment for many of the chemical mixtures used in the process. This makes it very difficult to determine trace air emissions. In some cases an SDS may list these trace chemicals as being present at levels of <1% of the mixture. The "<" implies the exact concentration in the mixture is unknown and possibly could be present at a concentration of zero to 0.9%.

Unless the Bureau determines otherwise, if a toxicity category I (i.e., low toxicity) air pollutant is listed on the SDS at <1% (or tested to be <1%), then the toxic pollutant can be considered as a true trace emission and need not be reported as an air emission. Otherwise, the following guidance should be used to determine what emissions should be included in emission estimates for an air emission point:

- a) If the toxic chemical is classified as an OSHA carcinogen* and is less than 0.1% of the air emissions by weight (excluding the weight of dilution components such as air, water vapor, oxygen, nitrogen, and

carbon dioxide), then it can be considered a true trace emission and need not be included in the Standard 8 compliance demonstration.

- b) If the toxic chemical is not classified as an OSHA carcinogen* and is less than 1% of the air emissions by weight (excluding the weight of dilution components such as air, water vapor, oxygen, nitrogen, and carbon dioxide), then it can be considered a true trace emission and need not be included in the Standard 8 compliance demonstration.
- c) If reasonable process knowledge should indicate the presence of intermediate reaction products, then the guidance in items a and b above should be used to determine if the emission can be considered a true trace emission and need not be included in the Standard 8 compliance demonstration.

[* The list of OSHA carcinogens can be found in Table II of (EPA, 2013) (they are noted by a 0.1% entry in the de minimis concentration column of this table).]

2.3.3 Exempt Pollutant

Sodium hydroxide (NaOH) emissions are exempt from Standard No. 8 in the following circumstances:

- NaOH emissions resulting from use in a scrubber for air pollution control purposes.
- NaOH emissions from storage tanks (due to the extremely low vapor pressure of NaOH).

2.3.4 Deferred Emissions

The Bureau allows certain facility-wide emission increases per pollutant to be deferred from air quality analysis requirements at the time of a construction permit or operating permit modification application.

Facilities that have citizen or regulatory complaints based on air toxics may be required to submit modeling showing compliance even though the facility may meet the criteria for using the deferral approach. The Bureau will handle this issue on a case-by-case basis.

Note: The deferral of an air quality analysis does not exempt a facility from enforcement action, including possible penalties, should a subsequent air quality analysis indicate that a standard has been exceeded.

A deferral approach may be considered if both of the following conditions are met. If they aren't met, a revised compliance demonstration will be required for the pollutant in question.

- 1) There is a previous modeling demonstration that showed compliance for the pollutant in question. Data from this baseline analysis is used in the deferral determination.
- 2) The proposed increased emissions emit from sources with dispersion parameters and locations similar to those in the baseline modeling demonstration. Thus, both conditions below must be true:
 - a) The merged stack parameter (M) value (see Section 3.3 of these Guidelines) for the stack or stacks with the new emissions should be greater than or equal to 50% of the current worst-case M value for the stack, or stacks currently emitting the pollutant in question.
 - b) The stack or stacks with the new emissions cannot be more than 25% closer to the nearest property boundary than the current stack or stacks.

A demonstration showing compliance for deferred increases will be required five years after the date of the deferral, at operating permit renewal, or at the time of the next permit application for which a compliance demonstration is necessary for the pollutant in question, whichever comes first. If this compliance demonstration indicates noncompliance with the standards, the facility will be required to bring itself back into compliance before a permit will be issued.

Deferral Procedure, per pollutant (Standard No. 8):

- Information Required:
 - Stack parameter data for sources with proposed new emissions and previously modeled sources.
 - Facility-wide emission rate from the most recent modeling demonstration. This emission rate is considered the baseline emission rate.

- Modeled concentrations from the most recent modeling demonstration.
- Proposed emission rate from sources in the construction permit application.
- Emission rates for increases that were previously deferred (if applicable).
- Analysis:
 - 1) Divide the baseline modeled concentration by the maximum allowable ambient concentration (MAAC, see Table B.1 in Appendix B), then multiply the result by 100 to obtain the percent standard consumed in the modeling demonstration.
 - 2) Round up the value found in Step 1 to the nearest higher percent standard value shown in Table 2.3, Column A.
 - 3) Using the value found in Step 2, determine the corresponding increase multiplier of the baseline emission rate in Table 2.3, Column B.
 - 4) Multiply the increase multiplier by the baseline emission rate. This value is the cumulative maximum emission rate increase that may be deferred from modeling.
 - 5) Add the proposed emission rate to any previously deferred emission rates that have not been modeled. If the total is less than the cumulative maximum emission rate increase allowed, found in Step 4, modeling may be deferred until a new baseline demonstration is completed or until the time of the next operating permit renewal. Otherwise, an air quality analysis must be conducted by the facility to show compliance for this pollutant.

The information relating to the deferral analysis must be submitted to the Bureau for review.

Table 2.3			
DEFERRAL INCREASE LEVELS (STANDARD NO. 8)			
A	B	A (cont'd)	B (cont'd)
Percent Standard Consumed in Previous Modeling	Increase Multiplier of Baseline Emission Rate	Percent Standard Consumed in Previous Modeling	Increase Multiplier of Baseline Emission Rate
5	6.33	55	0.27
10	3.00	60	0.22
15	1.89	65	0.18
20	1.33	70	0.14
25	1.00	75	0.11
30	0.78	80	0.08
35	0.62	85	0.06
40	0.50	90	0.04
45	0.41	95	0.02
50	0.33	100	0.00

A deferral analysis example is shown in Appendix C.

3.0 GENERAL MODELING CONSIDERATIONS

The topics covered in this section pertain to both screen and refined modeling analyses, i.e., SCREEN3 and AERMOD analyses, since this Guideline document focuses on those models. Topics pertinent to only SCREEN3 or only AERMOD are addressed in Sections 4 and 5 (“Screen Modeling” and “Refined Modeling”) as appropriate.

3.1 EMISSION RATE NOTES

- Permitted Emission Rate
If a permitted emission rate exists for the emission point and pollutant being considered, then it should be used in the modeling analysis. If the permitted emission rate is not reflective of the actual emission rate, then the actual rate can be used if the Bureau is requested to change the emission rate for that emission point in the permit.
- Averaged Emission Rate
Emission rates that are averaged due to non-continuous or limited hours of operation must take into account the averaging periods of the standard(s) for the pollutant(s) in question. For example, an air toxic pollutant emission rate should be averaged over a 24 hour period since all air toxic standards are based on 24 hour average concentrations. Emission rates that are averaged may require additional record keeping requirements in the permit.
- Worst-case emission rate (sources with backup fuel)
The fuel that produces the highest emission rate for each pollutant should be used when determining emission rates for modeling. For example, if a boiler burns primarily natural gas and uses No. 2 fuel oil as backup, the No. 2 fuel oil would be used to determine the boiler emission rate for SO₂.
- Emission Rate Increase
If the emission rate pertinent to modeling increases due to physical or process modifications, the existing compliance demonstration must be revised if the emission rate increase for the facility or source is greater than the rate allowed as a deferral (deferrals are addressed in Sections 2.2.4 and 2.3.4), or if the revised emission rate is one that causes the facility to not be in compliance with an ambient standard. If the change is one that identifies

regulated pollutants that were not previously identified for this process, a revised compliance demonstration must be submitted.

3.2 SOURCE OVERVIEW

A brief overview of model source types is shown in Table 3.1. Source examples and/or defining characteristics are shown for each type and whether the source type can be modeled using SCREEN3 or AERMOD. Some additional source information is presented in Sections 4 and 5.

Table 3.1			
SOURCE TYPE OVERVIEW			
Source Type	Examples / Info	Can Model with:	
		SCREEN3	AERMOD
POINT	Well-defined stack, chimney, vent, exhaust fan, etc.	Yes	Yes
AREA	<ul style="list-style-type: none"> • Low-level or ground-level release with no plume rise, such as pond, storage pile or open tank. • Rectangular shape (footprint; length to width ratio up to 10:1) 	Yes	Yes
AREAPOLY	Same as AREA except shape (footprint) can be represented as an irregular polygon.	No	Yes
AREACIRC	Same as AREA except shape (footprint) is represented as a circle.	No	Yes
VOLUME	<ul style="list-style-type: none"> • Source has initial dispersion prior to release (to the atmosphere) such as building roof monitor, collection of vents, conveyor belt (transfer point), and building (doors and windows). • The shape (footprint) must be a square (irregular footprints may be split up into two or more separate volume sources). • Often used to model fugitive emissions. 	Yes	Yes
LINE	<ul style="list-style-type: none"> • Linear sources such as rows of vents or roads. • Can also be represented as a series of separate volume or area sources. 	Yes (as a line of separate sources)	Yes
BOUYANT LINE	Parallel, low-level buoyant sources (“pot rooms”) associated with aluminum reduction plants. May also apply to other linear industrial sources, where plume rise and downwash effects are important.	No	Yes

Table 3.1			
SOURCE TYPE OVERVIEW			
Source Type	Examples / Info	Can Model with:	
		SCREEN3	AERMOD
OPEN PIT	<ul style="list-style-type: none"> • Below-ground source that is enclosed on all sides, like a coal mine or rock quarry. • Rectangular shape (footprint) with maximum length to width ratio of 10:1. 	No	Yes
FLARE	Modeled using FLARE source type in SCREEN3; modeled using POINT source type in AERMOD.	Yes	Yes

3.3 MERGED STACK PARAMETER

The merged stack parameter, M, has two main uses:

- 1) To consolidate modeling of a pollutant that is emitted from multiple similar stacks, by assuming all of the emissions discharge from a single, representative (worst-case) stack.
- 2) To compare dispersion characteristics between stacks (i.e., the stack with lowest M value would be “worst-case”).

The following guidelines should be considered when merging stacks (note: if using M to only compare dispersion characteristics between stacks, only item 1 applies):

- 1) They must be point sources.
- 2) They should be located within 100 meters of each other.
- 3) The stack heights, volumetric flow rates and exit temperatures (Kelvin) should not vary by more than 20 %.
- 4) Dissimilar stacks, i.e., those not meeting the criteria in items 2 or 3 above, should be merged with caution as an overly conservative model concentration may result.

The method for merging stacks is shown below (if M is being used to only compare dispersion characteristics between stacks, only steps 1 and 2 are needed):

- 1) Compute the dimensionless parameter M for each stack:

$$M = (H_s \cdot V_f \cdot T_s) / Q$$

where

M = merged stack parameter

H_s = stack height above ground (m or ft)*

V_f = volumetric flow rate ($\pi d^2/4$)v

where

d = stack exit (inside) diameter (m or ft)*

v = vertical stack gas exit velocity (m/s or ft/s)*

T_s = stack exit temperature (Kelvin), and

Q = pollutant emission rate (g/s or lb/hr)*

[* Either metric or English units may be used, but they must be consistent for like parameters between stacks.]

- 2) Determine the stack with the lowest M value. This is the most conservative, or worst-case stack.
- 3) For modeling, sum the emissions (Q_{sum}) from the stacks that are being merged. Use Q_{sum} along with the stack parameters of the worst-case stack and the shortest distance to property line (among the stacks being merged) in the modeling analysis.

3.4 NON-VERTICAL AND RAIN-CAPPED STACKS

3.4.1 Horizontal and Rain-capped Stacks

The procedure for modeling horizontal and rain-capped stacks is different when using SCREEN3 versus AERMOD. See Sections 4.6 and 5.7.1 for instructions on modeling with SCREEN3 and AERMOD, respectively.

Note: A discharge from a stack with a “flapper” rain cap, i.e., that opens fully during discharge and does not impede vertical flow, should be modeled the same as a vertical stack in both SCREEN3 and AERMOD.

3.4.2 Discharge Between Vertical and Horizontal

Use the vertical component of the actual velocity for stacks that discharge at an angle between vertical and horizontal. The equation to compute the vertical component is shown below.

$$V_{\text{vert}} = V_{\text{act}} \cos(\alpha)$$

where

V_{vert} = vertical component of actual velocity

V_{act} = actual exit velocity as reported

α = angle of the stack from vertical (degrees)

3.5 URBAN / RURAL CLASSIFICATION

The procedure to determine whether to use urban or rural dispersion coefficients can be found in EPA's *Appendix W* (EPA, 2017a). This document lists methods based on land use and population density that can be used to determine the proper classification. Of the two, the land use method is considered more definitive.

- Land Use Procedure – If more than 50% of the area within a 3 km radius of the source is classified as heavy industrial, light-moderate industrial, commercial or compact residential (Auer, 1978) (land use types I1, I2, C1, R2 or R3, respectively), the urban mode should be used. Otherwise, use the rural mode.

The Bureau maintains an online “Landuse Tool” at <https://gis.dhec.sc.gov/landcover/> (SCDHEC, 2018) that may be used to make the urban/rural assessment, based on the Land Use Procedure.

- Population Density Procedure – If the population density within a 3-kilometer radius of the facility is greater than 750 people per square kilometer, then the urban mode should be selected. Otherwise the rural mode should be used.

Guidance on selecting population data for this method is presented in EPA's *AERMOD Implementation Guide* (EPA, n.d.(a)).

Most areas in SC will classify as rural using these procedures. An area that meets the urban criteria will typically be located near the core of one of the larger metropolitan areas (for example, near downtown Columbia).

3.6 BACKGROUND DATA

Background values must be added to modeled concentrations before compliance can be determined for the following:

- SC Standard No. 2
- For PSD projects, Class II NAAQS and Soil / Vegetation analyses (refer to Sections 7.4.3.2 and 7.4.5.2)

The Bureau maintains a set of current background data that can be downloaded at the Bureau's [Air Dispersion Modeling Data webpage](#) (SCDHEC, n.d.(b)).

Please note the following regarding the use of background data:

- The default background values to be used should be the most recent data from the most representative or conservative monitoring site.
- Considerations for representativeness or conservativeness of the background data used should include:
 - Proximity of the background data site to the facility.
 - Comparison of the following at the facility vs. the monitoring site:
 - Land use (including urban/suburban/rural as well as comparative proximity of industrial and/or population centers)
 - Terrain (including the presence or absence of significant land features)
 - Weather regimes, etc., as appropriate
- If refinement is necessary (when using AERMOD), seasonal or other temporally paired background values may be used (with proper justification – see EPA March 1, 2011 clarification memo (EPA, 2011)).
- To fill data gaps, a combination of data from different monitoring locations may also be considered, if properly justified.

3.7 COLLOCATED FACILITIES

Facilities that are determined to be collocated for permitting purposes (SCDHEC, 2016c) should be modeled together as one facility.

- In an AERMOD analysis, all emissions, emission points, and buildings are combined together with the receptor grid placed around the collocated facilities

at the property boundaries and beyond, with no receptors placed on either facility's property.

- If using SCREEN3, the analysis would be performed as usual, with each emission point modeled separately using the distance to the closest property boundary (of either facility) for the closest receptor and adding the worst-case results for each pollutant to obtain the total predicted concentration to be compared to the applicable ambient air standards.

In addition, for non-PSD projects, facilities that are contiguous or adjacent to one another, but which are not necessarily determined to be collocated for permitting purposes, may voluntarily choose to submit collocated modeling as described above as long as all facilities are in agreement that a combined collocated analysis will be used to demonstrate compliance with the applicable ambient air standards.

4.0 SCREEN MODELING

4.1 WHEN TO USE SCREEN MODELING

Screen modeling is generally less complex and requires less expertise and effort compared to refined modeling, and generally produces more conservative results. Screen modeling is best suited for facilities with a low number of sources, emitted pollutants and buildings, as well as flat terrain. Facilities with larger numbers of sources, pollutants, buildings and variable or complex terrain are generally better suited for refined modeling.

Additional factors that may preclude the use of screen modeling in favor of refined modeling include, but are not limited to:

- Facilities with variable or nonstandard operating hours
- Pollutants/averaging periods for which the form of the standard is complex (for example, the SO₂ 1-hr standard, which is defined as the 99th percentile of the peak daily 1-hour concentrations averaged over 3 years)
- The need for refined treatment of NO_x to NO₂ conversion to obtain a lower modeled concentration of NO₂ (for example, using Tier 2/ARM2 or Tier 3 OLM or PVMRM in AERMOD, as discussed in Section 5.13)
- The need to incorporate temporally varying background values into a Standard No. 2 analysis

Note that there is no requirement to submit both screening and refined modeling (in situations, for example, where SCREEN3 modeling provides results above a standard so refined modeling has to be performed). Also, in situations where more than one pollutant requires modeling and compliance for a standard can only be shown using refined modeling for at least one pollutant, it is usually best to submit only refined modeling for all of the pollutants.

4.2 PREFERRED MODEL

EPA's SCREEN3 model is the preferred screening model for use in South Carolina. SCREEN3 provides reliable, conservative results when properly executed, and is relatively simple to use. AERSCREEN, EPA's replacement for SCREEN3, may also be used. However, the amount of input information and level of expertise required to run AERSCREEN are similar to those needed to run AERMOD, and are much greater than those needed for SCREEN3. For those reasons, the Bureau accepts the use of

SCREEN3 for screening modeling except in the case of modeling done for Prevention of Significant Deterioration (PSD) permits. The use of AERSCREEN is required for screening modeling performed for PSD permits. Information about AERSCREEN is available from EPA's SCRAM/Screening Models website (EPA, n.d.(b)). Consult this information and BAQ modeling personnel prior to submitting AERSCREEN modeling.

4.3 SCOPE

The intent of this (Screen Modeling) section of the Guidelines is to highlight certain information pertinent to SCREEN3 analyses for facilities in South Carolina. It is not intended to be a comprehensive source about SCREEN3 modeling in general. The topics covered here are ones that have required frequent clarification from the Bureau in the past or address specific expectations for SCREEN3 modeling analyses in South Carolina. Additional information about SCREEN3, including the SCREEN3 User's Guide, is available at EPA's SCRAM/Screening Models website (EPA, n.d.(c)).

4.4 SCREEN3 MODEL OVERVIEW

SCREEN3 can be used for point, volume, area and flare sources. The model has been designed for single source calculations. These calculations include estimating maximum ground-level concentrations and the distance to the maximum, incorporating building downwash calculations into the results, estimation of concentrations in the cavity recirculation zone, estimating concentrations due to inversion break-up and shoreline fumigation, and determining plume rise for flare releases. The model can be used for multiple sources by adding the maximum impacts for multiple runs or using the methods in Section 3.3 to merge nearby point sources into a single representative (worst-case) point source.

The model calculates 1-hour concentrations (24-hr concentrations for complex terrain) that can be converted to other averaging periods using the factors contained in Table 4.1 below (vendor software may make these conversions automatically).

Table 4.1			
FACTORS FOR CONVERTING SCREEN3 1-HOUR AVERAGE MODEL RESULTS TO OTHER AVERAGING PERIODS			
Averaging Period	Simple Terrain	Complex Terrain	
		Simple ⁽¹⁾	Complex
1 hour	1.0	2.5	4.0
3 hours	0.9	2.5	4.0
8 hours	0.7	1.75	2.8
12 hours	0.6	1.5	1.5
24 hours	0.4	1.0	1.0
3 months	0.3	0.75	0.75
Annual	0.05	0.125	0.125

1) Simple terrain impact in the complex terrain portion of the SCREEN3 model.

4.5 GOOD ENGINEERING PRACTICE (GEP) STACK HEIGHT ANALYSIS

The main purpose of a Good Engineering Practice (GEP) stack height analysis, as it relates to SCREEN3 modeling, is to determine whether a stack exhaust plume is subject to a downwash effect from a nearby structure, and if so, what building dimensions to use in the SCREEN3 model run for that stack. A secondary purpose regards helping to determine whether to use the actual or calculated GEP stack height in modeling for a stack taller than 65 meters.

Note that, as an alternative to the GEP stack height equation, a fluid modeling study can be used to determine the GEP stack height (see SC Regulation 61-62.7 (SCDHEC, n.d.(a)) for further information).

4.5.1 Definition of GEP Stack Height

GEP stack height is the minimum stack height needed to theoretically prevent the stack exhaust plume from being entrained in downwash and brought back to ground-level in the wake of nearby obstructions.

GEP stack height is calculated using the following equation (heights are measured from ground-level elevation at the base of the stack):

$$H_{\text{gep}} = H + 1.5 L$$

where

H_{gep} = GEP stack height

H = height above stack base of adjacent structure or nearby structure

L = lesser dimension (height or projected width) of nearby structure.

4.5.2 Impact on SCREEN3 modeling

- If GEP stack height > actual stack height:
 - Plume entrainment in downwash must be taken into account by including building dimensions in the SCREEN3 model run.
- If GEP stack height ≤ actual stack height:
 - The stack is considered GEP, and plume entrainment within the wake of nearby obstructions is unlikely and does not need to be considered (i.e., no building dimensions need to be included in the SCREEN3 model run).

4.5.3 Analysis Steps

For each stack, the analysis should include the following steps:

- 1) Identify all buildings that are within 5L of the stack, including those that are offsite. These buildings must be evaluated to determine if downwash needs to be addressed for the stack in question.
- 2) Calculate the GEP stack height using the GEP stack height equation (Section 4.5.1) for each building identified in Step 1.
- 3) The highest calculated GEP stack height from Step 2 is the GEP stack height for the current stack.
- 4) If the GEP stack height is less than or equal to the actual stack height, downwash does not need to be considered for this stack and the analysis may stop here. Otherwise, continue to Step 5.
- 5) If the GEP stack height is greater than the actual stack height, run the SCREEN3 model using the dimensions of each of the buildings that are within 5L of the stack, and for which the calculated GEP stack height was greater

than the actual stack height. The highest model result from these runs should be used for this stack.

Note that terrain features that are located within 5L of a stack (L is the terrain feature height above stack base) can cause wake effects and may be considered on a case-by-case basis.

Additional information on GEP stack height analysis can be found in (EPA, 1985).

4.5.4 Stack Height to use in modeling

As mentioned above, a secondary reason to use GEP stack height analysis is to help determine what stack height should be used in the modeling analysis.

In general, the actual stack height should be used in modeling unless all of the following are true:

- The actual stack height exceeds 65 meters.
- The actual stack height exceeds the calculated GEP stack height.
- The stack (excluding flares) was constructed, reconstructed or under major modification after December 31, 1970.

If all these conditions are true, the GEP calculated stack height or a stack height of 65 meters (whichever is greater) may be used.

4.6 NON-VERTICAL AND RAINCAPPED STACKS

4.6.1 Modeled Velocity

The exit velocity in the upward vertical direction is the velocity required in modeling. To properly model point source discharges that are non-vertical or have solid rain caps (i.e., that force a horizontal or downward discharge), a reduced velocity should be used in the model as follows:

- 1) For horizontal and downward discharges, and for stacks with solid rain caps, use 0.001 m/s.
- 2) For stacks that discharge at an angle between vertical and horizontal, use the vertical component of the actual velocity (see Section 3.4.2).

4.6.2 Stack Diameter Adjustment

[Note: This adjustment applies to only SCREEN3 analyses.]

The stack diameter may be adjusted (increased) for a non-vertical or rain-capped discharge if the exit temperature is greater than ambient. Using the adjusted diameter in the model will ensure that the volumetric flow rate is the same with the reduced vertical velocity (0.001 m/s or V_{vert} as computed using the equation in Section 3.4.2) as it is with the actual velocity combined with the actual diameter. The adjustment is optional, but will produce a lower modeled concentration compared to using the actual diameter.

The adjusted diameter is calculated using the formula:

$$d_{\text{adj}} = \sqrt{V_{\text{act}} (d_{\text{act}})^2 / (V_{\text{mod}})}$$

where

- d_{adj} = adjusted diameter to be used in the model (meters)
- V_{act} = actual (total) stack velocity as measured/reported (m/s)
- d_{act} = actual stack diameter (meters)
- V_{mod} = modeled stack velocity (0.001 or V_{vert} , m/s)

4.7 SCREEN3 INPUT NOTES

This section addresses only topics that have required frequent clarification from the Bureau in the past or address specific Bureau expectations for modeling analyses in South Carolina. Please see EPA's *SCREEN3 User's Guide* (EPA, 1995) for more information.

1) Point Source:

- Non-vertical and rain-capped stacks – see Section 4.6.

2) Area Source:

- Emission rate -- emissions should be divided by the total area of the source, i.e., grams/sec/m² (vendor interface software may accept total emission rate from which the per-unit rate is automatically computed).
- Distance to plant boundary is measured from the center of an area source.

3) Volume Source:

- Initial horizontal dimension (σ_{y0}) = length of side divided by 4.3
- Initial vertical dimension (σ_{z0}):
 - Surface based source:
 - σ_{z0} = vertical dimension of source divided by 2.15
 - Elevated source on or adjacent to a building:
 - σ_{z0} = building height divided by 2.15
 - Elevated source not on or adjacent to a building:
 - σ_{z0} = vertical dimension of source divided by 4.3
- Distance to plant boundary is measured from the edge of a volume source.

4) Ambient Temperature = 293 K

5) Urban / Rural Option

- Use Rural for most locations in SC (see Section 3.5 for more information)

6) Building Downwash

- Should be used if GEP stack height > actual stack height (see Section 4.5).

7) Terrain Options

The area in the vicinity of the facility should be reviewed for the presence of elevated terrain that needs to be included in the model.

- Flat (0 m terrain elevations modeled)
 - All terrain within 2 km of the facility is equal to or below 50% of the stack height.
 - Fugitive emissions modeled as volume or area sources should be modeled as flat terrain regardless of the elevation of the surrounding terrain.
- Simple Elevated*
 - Terrain elevation within 2 km of the facility is higher than 50% of the stack height, but does not exceed stack height.
- Complex*
 - Terrain elevation within 2 km of the facility is higher than the shortest stack for the pollutant being considered.
 - Also consider terrain features out to 20 km for stack heights of 50 meters or greater.

[* Note: For Simple and Complex terrain, all stacks should be modeled using flat terrain, then again using Simple Elevated and/or Complex terrain, as applicable, to ensure the maximum modeled concentration is identified for each stack.]

8) Meteorology

- In general, use "Full" (all stabilities & wind speeds). Exceptions to this may occur on a case-by-case basis (for example, for daylight operations only).

9) Receptors

- Use the automated receptor array that extends from the nearest property line to 2 km, to ensure that the maximum ambient concentration is calculated.
- Discrete distances should be used to account for:
 - Property within the plant boundary that is not owned by the plant (such as public roads, railroad tracks (other than spurs), etc.)
 - Points of critical terrain elevation
[Note: For Simple Elevated and Complex terrain, it is usually sufficient in areas where terrain gradually rises to place receptors at the terrain distance and height for the closest location that exceeds 50% of stack height, the closest location that exceeds the stack height, and the location of the maximum terrain height within 2 km, as applicable. Terrain with more abrupt changes in elevation and facilities with taller stacks (height greater than 50 feet) may need to include more intermediate elevations.]
- Terrain Elevations
 - Use for Simple Elevated and Complex terrain
 - Elevations should be the difference between the terrain feature and the stack base elevation

10) Shoreline Fumigation

- This is not required unless the source is within 3 km of the ocean.

4.8 SCREEN3 MODELING FOR NITROGEN DIOXIDE (NO₂)

When determining compliance with the NO₂ standards, NO_x (rather than NO₂) emissions are normally input in the model and it is conservatively assumed that 100% of the NO_x emissions are converted to NO₂ after leaving the emission point.

As an option, it is acceptable to use the following conservative conversion estimates for calculating concentrations to compare to the NO₂ standards:

- 80% for the 1-hr averaging period
- 75% for the annual averaging period

[The normal simple terrain SCREEN3 output concentrations would be multiplied by 0.80 for the 1-hr standard and 0.75 x 0.05 for the annual standard (0.05 converts the output to an annual averaging period).]

5.0 REFINED MODELING

5.1 WHEN TO USE REFINED MODELING

Refined modeling generally requires more input data, expertise and effort compared to screen modeling, and typically provides more realistic (less conservative) results.

A number of factors can cause refined modeling to be used for a compliance demonstration instead of screen modeling, including, but not limited to the following:

- Screen modeling for a facility has failed to demonstrate compliance.
- Screen modeling cannot accommodate a particular source type (for example, Open Pit source).
- A facility is too large/complex for screen modeling to be practical (for example, numerous emission points, pollutants, or buildings, nonstandard operating hours, etc.).
- Need for refined treatment of NO_x to NO₂ conversion to show compliance with the NO₂ standards.
- Need to incorporate temporally varying background values for a Standard No. 2 analysis.

Note that there is no requirement to submit both screening and refined modeling (in situations, for example, where SCREEN3 modeling provides results above a standard so refined modeling has to be performed). Also, in situations where more than one pollutant requires modeling and compliance for a standard can only be shown using refined modeling for at least one pollutant, it is usually best to submit only refined modeling for all of the pollutants.

5.2 PREFERRED MODEL

AERMOD is the current EPA-preferred regulatory guideline model for refined permit modeling. It should be used for all refined permit modeling projects in South Carolina. Other models on the EPA preferred/recommended list, such as CALPUFF and BLP (Buoyant Line and Point source) should not be used unless prior approval has been obtained from the Bureau. [Note: CALPUFF may be used for certain long range assessments in PSD modeling, as addressed in Section 7 of these Guidelines.]

5.3 SCOPE

The intent of this (Refined Modeling) section of the Guidelines is to highlight certain information pertinent to non-PSD AERMOD modeling for facilities in SC. It is not intended to be a comprehensive source of information about AERMOD, its usage, or refined modeling in general.

The topics covered here are ones that:

- Address specific Bureau expectations for modeling analyses in SC
- Have required frequent clarification from the Bureau in the past
- Are new or updated material included at the discretion of the Bureau.

EPA's *AERMOD User's Guide and Addendum*, and other information about AERMOD and related programs (AERMET, AERMAP, AERSURFACE, AERMINUTE, BPIP Prime and LEADPOST) are available via the EPA SCRAM Preferred/Recommended Models website (EPA, n.d.(a)). The *AERMOD Implementation Guide*, available at the same website, provides information on the recommended use of AERMOD for a range of issues and types of applications.

5.4 MODEL USAGE

All permit compliance demonstrations based on refined modeling submitted to the Bureau should employ:

- The latest version of AERMOD, available at the time modeling is conducted. The most recent program updates can be obtained from the EPA SCRAM website. [Note: Graphical user interface software containing the AERMOD program, available from third-party vendors, can be used as long as these programs employ the latest version of the AERMOD program.]
- Regulatory default options. [Note: On a case-by-case basis, the Bureau may approve the use of non-default and/or beta AERMOD options, with proper justification. The use of any non-default/beta option must be approved in advance by the Bureau and may require additional conditions and/or emission limits be placed in the permit.]

5.5 INFORMATION TO SUBMIT TO THE BUREAU

In general, a summary of all model inputs, methodology and results relative to the applicable standards and guidance should be included in the permit application (general reporting requirements are addressed in Section 6 in these Guidelines). This includes digital modeling files, e.g. AERMOD and BPIP-Prime input and output files, which should be submitted in digital format (disk, email, ftp or USB flash drive). Note that it is not necessary to submit any AERMET (meteorological) or National Elevation Dataset (NED) files that were used (unless files other than those supplied on the SCDHEC web site were used, which would require justification and approval from the Bureau).

Please take special note of the following items, which are required, when applicable, but are frequently missing in applications submitted to the Bureau:

- Datum upon which location (UTM) data are based (must be NAD83; UTM data based on NAD27 datum will not be accepted)
- Justification for background concentrations used in analyses for Standard No. 2
- Source of elevations (for emission sources, receptors, buildings or tanks) that are not extracted from NED via AERMAP. The elevations and their source should be explicitly stated. [For more information, see Section 5.10.]

5.6 URBAN / RURAL CLASSIFICATION

See Section 3.5.

5.7 SOURCE NOTES

An overview of source types is presented in Section 3.2 of these Guidelines.

In this section, source topics specific to AERMOD analyses are addressed. For clarity, actual source types in AERMOD are shown in all uppercase letters (e.g., AREA, VOLUME, etc.).

5.7.1 POINT Sources

- Non-vertical discharges and rain caps:
 - Horizontal or rain cap – Use the POINTHOR or POINTCAP source type option (enter actual stack parameters as if the release were a non-capped vertical point source).
 - Discharge oriented between vertical and horizontal – Use POINT source type with vertical component of exit velocity (see Section 3.4.2).
 - Discharge straight down – Use POINT source type with an adjusted exit velocity of 0.001 m/s.

- Ambient exit temperature -- If the emission point exit temperature is equal to that of (i.e., varies with) the ambient air, the exit temperature should be set to zero Kelvin. This triggers AERMOD to use the actual temperatures from the meteorological data input files.
 [Note: Non-combustion or non-process heated emissions that are released from an area that is climate controlled (e.g., temperature controlled paint booth, blasting booth, etc.) should use an estimated average temperature of the climate controlled area rather than zero Kelvin as these types of emissions are not at true ambient temperature.]

5.7.2 Area Sources

- Release height – This is the physical height above the ground of the emissions source for all 4 source types: AREA, AREAPOLY, AREACIRC and LINE (which uses the AREA source dispersion algorithms). For most area sources, the release height will be at or near zero (ground level).

- Emission Rate – All area source types (including LINE) use an emission rate per unit area rather than total emissions. [Note: vendor interface software may accept total hourly emission rate of the area from which the per-unit rate is automatically computed.]

- AREA source initial dimensions and orientation are defined as follows:
 - 1) X_{init} = length of X side of the area (in the east-west direction if Angle as defined in #3 below = zero degrees)
 - 2) Y_{init} = length of Y side of the area (in the north-south direction if Angle as defined in #3 below = zero degrees; Y_{init} is not required if area is a square)

- 3) Angle = orientation angle in degrees from north, measured positive in the clockwise direction (this is not required if the X side is oriented in the east-west direction)

Note: If Angle $\neq 0$, the X side is the one located counterclockwise along the perimeter from the vertex that defines the location of the area source, while the Y side corresponds to the side of the area that is clockwise from that same vertex. Angle is measured between north and the Y side. Angle may be positive (for clockwise rotation) or negative (for counterclockwise rotation). See EPA's *AERMOD User's Guide* (EPA, 2016a) for more details.

- Plume Meander caution -- The approach that AERMOD uses to address plume meander has not been implemented for area sources (including the LINE source). This may result in overestimation of model predictions under very light wind conditions for some sources. A VOLUME source characterization may be used in place of an area source where applicable, to counteract this effect. Please refer to the EPA *AERMOD Implementation Guide* (EPA, 2016b) for further guidance on this issue.

5.7.3 VOLUME Sources

- Horizontal shape (footprint) – The volume source(s) must be based on a square footprint. If the footprint is not square, one of the following methods can be used:
 - 1) If the emissions are relatively uniform across the source and the ratio of the length vs. width is less than 2, a side of an “equivalent square” footprint can be determined by taking the square root of the area (length x width) of a “rectangular” volume base.
 - 2) If the ratio of the length vs. width is 2 or greater, the source will have to be split into more than one volume source. In this case, the source can be represented by a series of adjacent VOLUME sources. (Note: Because many sources that would be modeled as volume sources have irregular footprints, the key point is to ensure that the volume sources input into the model have square footprints while also insuring that the total area of the source’s footprint is accounted for by the total area of the footprints of the volume sources modeled.)
- Line Source - A series of VOLUME sources can be used to represent a line source, such as a roof ridge vent. To do this:

- Determine the number (n) of VOLUME sources needed, where n is determined by dividing the length of the source by its width. An approximate representation can be obtained for long line sources by placing a smaller number of line sources along it. However, the spacing between VOLUME sources should not exceed twice the width of the line sources.
- Release height -- The default release height is the height of the center of the volume above ground. However, if all of the individual release points within the source are known, the use of some other reasonable release height may be justified (e.g., for a building under negative pressure exhausting through ridge or gable vents).
- Initial horizontal dimension (σ_{y0}) and initial vertical dimension (σ_{z0}) – these can be determined using Table 5.1 below.

Table 5.1	
ESTIMATING INITIAL HORIZONTAL AND VERTICAL DIMENSIONS FOR VOLUME AND LINE ⁽¹⁾ SOURCES	
Source ⁽²⁾	Procedure for Obtaining Initial Dimension
Initial Horizontal Dimension (σ_{y0})	
Single VOLUME Source	σ_{y0} = length of side divided by 4.3
Line Source Represented by Adjacent VOLUME Sources	σ_{y0} = length of side divided by 2.15
Line Source Represented by Separated VOLUME Sources	σ_{y0} = center to center distance divided by 2.15
Initial Vertical Dimension (σ_{z0})	
Surface-based Source (H ~ 0)	σ_{z0} = vertical dimension of source divided by 2.15
Elevated Source (H > 0) on or Adjacent to a Building	σ_{z0} = building height (of adjacent building) divided by 2.15
Elevated Source (H > 0) not on or Adjacent to a Building	σ_{z0} = vertical dimension of source divided by 4.3
1) Refers to a line source represented by a series of VOLUME sources.	
2) H = release height	

5.7.4 LINE Source (area)

This source type is an alternative option for modeling a linear source versus constructing a line source using a series of AREA sources.

The user specifies start-point, end-point and width of the line, and also may account for initial dilution of the emissions via an optional sigma-z parameter.

The LINE source type utilizes the same routines as the AREA source type, and will give identical results for equivalent source inputs. See Section 5.7.2.

5.7.5 BUOYANT LINE Source

This source type is based on the Buoyant Line and Point Source (BLP) model, which was developed to specifically address the parallel, low-level buoyant sources (“pot rooms”) associated with aluminum reduction plants. There may be other linear industrial sources, where plume rise and downwash effects are important, to which this source may apply.

See EPA’s *AERMOD User’s Guide (Appendix G)* (EPA, 2016a) for more information.

5.7.6 OPEN PIT Source

- Use - for below ground sources that are enclosed on all sides, such as coal mines and rock quarries
- Emission Rate – per unit area (note: vendor interface software may accept total hourly emission rate from which the per-unit rate is automatically computed)
- Shape (footprint) – rectangle with an aspect ratio (length to width) of up to 10:1
- Initial dimensions and orientation – see the Area source section above for guidance on specifying a rectangular area in terms of X_{init} , Y_{init} , and angle from north
- Release height:
 - Use the average height of emissions in the pit relative to the base (a value of zero indicates emissions are released from the base of the pit).
 - This should not exceed the effective depth of the pit, which is calculated in the model from the length, width and volume (supplied by user) of the pit.

5.7.7 Flare

Since there is no flare source type in AERMOD, flares should be modeled as POINT sources using the method in EPA's *AERSCREEN User's Guide* (EPA, 2016c) as outlined below.

The following information about the flare is required for input, or to compute input parameters for the POINT source modeling:

- Emission rate
- Stack height (actual height to point of flare release)
- Heat release rate (cal/sec)
- Radiative heat loss fraction (use 0.55 or the fraction specific to the flare, if known)

The stack height (H_{act}), heat release rate (HR) and radiative heat loss fraction (HL) are used to compute an effective stack height (H_{eff}) and effective stack diameter (D_{eff}) for input into AERMOD. Exit temperature and exit velocity are assumed to be 1273 K and 20 m/s, respectively. A summary of all the POINT source inputs needed, including equations to compute H_{eff} and D_{eff} , are shown in Table 5.2 below.

Table 5.2	
AERMOD POINT SOURCE INPUTS NEEDED TO MODEL A FLARE	
POINT Source Parameter	<u>Input for Flare:</u>
Emission Rate	Emission Rate
Exit Temperature	Assume 1273 K
Exit Velocity	Assume 20 m/s
Stack Diameter*	$D_{\text{eff}} = 9.88 \times 10^{-4} \times [\text{HR} \times (1 - \text{HL})]^{0.5}$
Stack Height*	$H_{\text{eff}} = H_{\text{act}} + 4.56 \times 10^{-3} \times \text{HR}^{0.478}$
<p>* <u>Definitions and units</u> D_{eff} = effective stack diameter (meters) HR = heat release rate (cal/sec) HL = radiative heat loss fraction (0.55 default) H_{eff} = effective stack height (meters) H_{act} = actual stack height (meters)</p>	

5.8 RECEPTORS

It is the responsibility of the applicant to use a receptor grid configured to ensure capture of the maximum offsite modeled concentration.

The configuration should include the following:

Spacing:

- 50 meter spacing along the property line, and along property not owned by the facility that crosses plant property (for example, public roads, rivers, and railroad tracks other than a spur servicing the specific facility)
- 100 meter spacing beyond the property line to a minimum range of 1500 meters.

Range:

- A minimum of 1500 meters. This is usually sufficient to capture the maximum concentration. However, a range greater than 1500 meters should be used if concentrations are not decreasing near the grid edge or if needed to account for complex terrain just beyond 1500 meters.

Grid Type:

- A Cartesian grid is preferred, but a polar grid is acceptable as long as receptor spacing does not exceed 100 meters within a range of 1500 meters.

5.9 METEOROLOGICAL DATA

Five consecutive years of representative National Weather Service (NWS; surface and upper air) data should be used.

One year of onsite data, i.e., measured from a tower at the location of the facility, may be used instead of a five-year data set. However, the use of onsite data must be approved in advance by the Bureau.

The Bureau maintains a collection of five-year NWS AERMOD-ready data sets for use in SC. Each data set has been deemed by the Bureau to be the most representative, in general, for a defined geographic area – one of 12 across the state – and should be used as the default data set for all facilities within that area.

[Note: EPA has integrated the ADJ_U* option into the AERMET meteorological processor to address AERMOD over prediction tendencies for some sources in stable, low wind speed conditions. The Bureau has processed two sets of meteorological data for each area: one that incorporated the ADJ_U* option in AERMET, and one that did not. The Bureau will accept the use of either data set. Please see EPA's *Appendix W* (EPA, 2017a) for information about the ADJ_U* option.]

The data can be downloaded at the Bureau's [Air Dispersion Modeling Data webpage](#) (SCDHEC, n.d.(b)). To obtain the applicable data, the user may click on the facility location on an interactive map or click on the county in which the facility is located in a download-by-county table.

These data are periodically updated, so the user should ensure they have the most current data set before modeling (the date of latest update is posted on the Bureau's download webpage).

A list of the NWS surface and upper air stations corresponding to each of the 12 areas/data sets, along with the elevations of the surface stations (for use as “profile base elevation” in AERMOD) is available at the Bureau’s [Air Dispersion Modeling webpage](#) (SCDHEC, n.d.(d)).

5.10 TERRAIN DATA

Digital terrain data from the National Elevation Dataset (NED) should be used to extract terrain elevations for all AERMOD modeling analyses.

Elevations for all objects (sources, receptors, buildings and tanks) should be extracted from the NED. However, it is encouraged to use elevations from an alternate source, preferably a site survey, if available, especially for cases where actual elevations may deviate substantially from those in the NED (for example, when a facility site has been leveled in hilly terrain). If alternate elevations are used, this must be explicitly stated in the application, and the elevation source(s) cited.

NED data for SC can be downloaded from the Bureau’s [Air Dispersion Modeling Data webpage](#) (SCDHEC, n.d.(b)) via an interactive map or download-by-county table. These data, with horizontal resolution of 1 arc-second (approximately 30 meters), were obtained from the USGS (U. S. Geological Survey) and divided into county partitions (“footprints”) for download.

These data are periodically updated, so the user should ensure they have the most current dataset(s) before modeling (the date of latest update is posted on the Bureau’s download webpage).

More information about using NED is in EPA’s *AERMOD Implementation Guide* (EPA, 2016b).

5.11 DOWNWASH

BPIP-Prime should be used to incorporate downwash effects of buildings, tanks, and other solid structures.

Any offsite structures that may produce a downwash effect should be included as well.

If the modeling project is divided into different runs (per pollutant, for example), all the buildings should be included in a comprehensive run of BPIP-Prime, and the output of that run used in each of the individual AERMOD runs.

5.12 AERMOD OUTPUT AND METEOROLOGICAL DATA FILE OPTIONS TO USE FOR COMPARISON TO AMBIENT STANDARDS

A summary of the appropriate model output concentration (ranking and/or form of the standard) to use for comparison to the allowable concentration (ambient standard), for each pollutant and averaging period is shown in Tables A.1 and A.2 in Appendix A. Standards No. 2 and 8 are addressed in these tables.

The corresponding meteorological data file options, e.g., five separate years or a five-year concatenated file, are also shown for each pollutant and averaging period.

For Standard No. 2, a more conservative, and in some cases, easier to obtain option of output rank and corresponding meteorological data file configuration are shown for each pollutant/averaging period (except NO₂-Annual, for which there is only one option).

5.13 MODELING NO₂ - MULTI-TIERED APPROACH

Tier 1, Tier 2 and Tier 3 are regulatory default options and may be used without prior approval from the Bureau. However, if a Tier 3 option (OLM (Ozone Limiting Method) or PVMRM (Plume Volume Molar Ratio Method)) is used, sufficient discussion, documentation and justification, as appropriate, should be provided to assist the Bureau in conducting a thorough and timely review.

A brief outline of the options is presented below.

- Tier 1 – assumes all NO_x is converted to NO₂
- Tier 2 -- ARM2 (Ambient Ratio Method 2)
 - Requires minimum and maximum limits of ambient NO₂/ NO_x; the minimum and maximum default limits are 0.5 and 0.9, respectively, but an alternate minimum value can be used with proper justification.

- Tier 3
 - The use of either OLM or PVMRM is acceptable.
 - OLM is most appropriate for near-surface releases, or scenarios with multiple sources where plume overlap is likely to occur.
 - PVMRM is more appropriate for elevated and relatively isolated sources.
 - OLM and PVMRM require In Stack (NO_2/NO_x) Ratio (ISR), ambient equilibrium NO_2/NO_x ratio, and background ozone data as input, as follows:
 - ISR – Site or source specific data should be used if known (stack test information, manufacturer’s data, etc. should be included in the application to support the ISR used). Otherwise, the default of 0.5 may be used.
 - Ambient equilibrium ratio – use default of 0.9.
 - Ozone data from a representative monitor should be used, and justified.

More information can be found in:

- EPA’s *AERMOD User’s Guide* (EPA, 2016a)
- EPA’s *NO₂ Modeling Clarification Memo* (EPA, 2014a)
- EPA’s *Appendix W* (EPA, 2017a)

6.0 REPORTING REQUIREMENTS

Compliance demonstrations submitted to the Bureau should include sufficient documentation to assist the Bureau in conducting a thorough and timely review. Failure to provide necessary information may result in a delay of the review process until missing information is supplied.

Reporting requirements for demonstrations based on exemption/deferral and non-PSD modeling are addressed in this section. Requirements associated with analyses based on other information are addressed in the Bureau's "other information" document (SCDHEC, 2017a) maintained at the Bureau's Air Dispersion Modeling webpage. Section 7 in these Guidelines addresses additional requirements that may apply to PSD modeling projects.

Only general guidance is presented here. Additional information may be required by the Bureau in special circumstances. When in doubt, facilities are encouraged to err on the side of providing more information, rather than less.

Each compliance demonstration submittal should include the items discussed below.

6.1 SUMMARY

This written discussion should summarize the overall project, including at least the following:

- A description of the facility project (construction of new emission sources, replacement of older equipment, etc.)
- Reason(s) an air quality analysis is required (emission rate increases, new pollutants emitted, stack height lowered, etc.)
- Overview of the methodology(ies) used to show compliance

6.2 FACILITY DESCRIPTION

This should include, but not be limited to the following:

- A description of the project-related equipment and processes, including the operating schedule (especially if emission rates are not based on 8760 hours

- of operation per year)
- Scaled map (with North arrow) of the facility location and layout clearly showing the emission points, property boundary and structures (including heights, and any nearby structures located offsite that are considered in the analysis)
- Any equipment or emission changes or corrections from previous modeling so that historical analyses can be verified with the current application. Historical construction dates should also be included (to assist the Bureau in maintaining a statewide PSD modeling emissions inventory relative to SC Standard No. 7 regulations).

6.3 EMISSION POINT DATA

This should include the following for each project-related emission point:

- Name/ID (which should match the name/ID used in any modeling analyses, and any existing permit name/ID)
- Location (UTM) data based on NAD83 datum (UTM data based on NAD27 will not be accepted)
- Dispersion parameters (for example, for a point source, this would include stack height, exit temperature, stack diameter, exit velocity, discharge orientation, whether there is a rain cap or not, and for a SCREEN3 modeling analysis, distance to nearest property line and building dimensions).
- Emission rate for each regulated pollutant and explanation/justification for the use of any emission rate less than the lb/hr maximum allowable rate (note that all bases/assumptions for emission rate calculations should be submitted with the application for review by the Bureau's Engineering Services Division).

Emission point information should be submitted using Form DHEC-2573, "Bureau of Air Quality Emission Point Information." This form contains detailed instructions and tables for entering the characteristics/parameters for all source types. It can be downloaded at the Bureau's [Air Dispersion Modeling - Forms, Guidelines, Software webpage](#) (SCDHEC, n.d.(c)).

6.4 ANALYSIS DETAILS

The following items that are applicable to the analysis should be addressed via discussion, tables, etc.

- 1) Exemption/deferral/de minimis analyses
 - Data and calculations supporting the conclusion for each of the sources/pollutants involved

- 2) All (SCREEN3 and AERMOD) modeling analyses
 - Justification for pollutant background concentrations used for Standard No. 2 compliance demonstrations
 - Urban/rural classification (and justification if using urban)
 - Receptor grid design
 - Merged stacks analysis (if applicable)

- 3) SCREEN3 modeling analyses (in addition to #2 above)
 - GEP stack height analysis
 - Downwash /cavity effects
 - Terrain description/classification and impact on results
 - Calculations used to convert maximum 1-hr model run results to final results used to compare to the air quality standard(s).

- 4) AERMOD modeling analyses (in addition to #2 above)
 - Meteorological data
 - NED (National Elevation Data) and discussion/justification for any site-specific elevations used
 - Model options and justification for any non-default options used
 - Discussion and justification for any temporal pairing of background concentrations with model results

6.5 MODEL RESULTS

Results should be presented in a tabular format and show the maximum modeled concentration and rank, and/or form of the standard, for each pollutant and averaging period compared to the allowable concentration for the applicable standard. Background values must be added to the modeled concentration when determining compliance with Standard No. 2.

6.6 MODELING FILES

The following should be included for SCREEN3 and AERMOD analyses:

- SCREEN3 - modeling output files
- AERMOD – all AERMOD and BPIP-Prime input and output files in digital format (CD, DVD, email, ftp, USB flash drive) (it is not necessary to submit meteorological or NED files unless files other than those supplied on the SCDHEC web site were used, which would require justification and approval from the Bureau)

7.0 PSD (PREVENTION OF SIGNIFICANT DETERIORATION) MODELING

7.1 INTRODUCTION

7.1.1 Background

An applicant for a PSD permit is required to conduct an air quality analysis of the ambient impacts associated with the construction and operation of the proposed new major source or major modification (EPA, 1990).

The purpose of the air quality analysis is to demonstrate that new emissions emitted from a proposed major stationary source or major modification, in conjunction with other applicable emissions from existing sources, will not cause or contribute to a violation of any applicable NAAQS (National Ambient Air Quality Standard) or PSD increment. Impacts on visibility, soils and vegetation, and impacts from growth associated with the construction are also assessed. Ambient impacts of any SC toxics must also be evaluated.

7.1.2 When is a facility subject to PSD Review?

Pollutants potentially subject to PSD review are those regulated under SC Regulation 61-62.5, Standard No. 7 (SCDHEC, n.d.(a)), and are listed on the left side of Table 7.1, below.

A PSD Review is required for a facility if the increase in emissions, as a result of the new or modified source(s), of any of the pollutants listed in Table 7.1 is greater than the applicable PSD threshold value. The PSD threshold value is:

- 100 TPY, if the facility is listed in one of 28 industrial categories defined in Standard No. 7, or
- 250 TPY, if the facility is not in one of the 28 industrial categories.

7.1.3 What pollutants are subject to PSD Review?

Pollutants considered “major” for PSD, i.e., that meet either of the following criteria, are subject to PSD review:

- Any pollutant for which the increase in emissions is greater than the PSD threshold value as discussed in Section 7.1.2 above.
- Any other pollutant listed in Table 7.1 for which the increase in emissions, as a result of the new or modified source(s), exceeds the Significant Emission Rate for that pollutant (also shown in Table 7.1).

Pollutants not meeting the above criteria will not require a PSD review; however, a compliance demonstration for those pollutants may still be required for SC Regulation 61-62.5, Standards No. 2 and 8.

Table 7.1	
PSD POLLUTANTS AND PSD SIGNIFICANT EMISSION RATES (SER)	
Pollutant	SER (TPY) ⁽¹⁾
TSP ⁽²⁾	25
PM ₁₀	15
PM _{2.5}	10
SO ₂	40
NO _x	40 ⁽³⁾
CO	100
Ozone (VOC or NO _x)	40 ⁽³⁾
Fluorides ⁽⁴⁾	3
Lead ⁽⁴⁾	0.6
Hydrogen Sulfide (H ₂ S) ⁽⁴⁾	10
Reduced sulfur compounds ⁽⁵⁾	10
Total reduced sulfur ⁽⁵⁾	10
Sulfuric Acid (H ₂ SO ₄) Mist ⁽⁴⁾	7
1) A PSD review is required for pollutants having emissions increases equal to or greater than the SER.	
2) A PSD air quality analysis is not required for this pollutant since there is no NAAQS or PSD increment standard to address.	
3) Major for VOC or NO _x (a net emissions increase of 40 TPY or more of either) is considered major for Ozone.	
4) Since there is no significant impact level (SIL) for this pollutant, neither a SIL nor a full impact analysis is required. However, this pollutant is addressed in the additional impact analysis (except for H ₂ S), and compliance demonstration for Standard No. 2 (Lead) or 8 (Fluorides, H ₂ S and H ₂ SO ₄).	
5) There is no ambient air quality standard for this pollutant. However, ambient monitoring requirements must be addressed if emissions are equal to or greater than the SER for this pollutant.	

Secondary formation of ozone and PM_{2.5}

Facilities that are major for VOC, SO₂ or NO_x should evaluate the effect of these precursor pollutants on secondary formation of ozone and PM_{2.5}, as applicable (VOC and/or NO_x for ozone; SO₂ and/or NO_x for PM_{2.5}).

As outlined in EPA's *Appendix W*, there is no preferred modeling system or technique for estimating ozone or secondary PM_{2.5} and a two-tiered approach, outlined below, is recommended to account for secondary formation of these pollutants.

- Tier 1 -- Consists of using existing technically credible and appropriate relationships between emissions and previous modeling results to evaluate a source's impacts.

Techniques include the use of the following:

- Modeled Emission Rates for Precursors (MERPs) (please refer to EPA's most recent MERPs guidance (EPA, 2016d) (EPA, 2017b) for more information on the use of MERPs)
 - Existing regional photochemical modeling that may exist for other purposes (such as regional State Implementation Plan modeling).
- Tier 2 -- Consists of the use of case-specific modeling. Should a Tier II analysis be necessary, a modeling protocol must be submitted for approval before the air quality analysis is submitted.

7.1.4 References

The sources cited in this (PSD Modeling) section are not intended to be a comprehensive list of PSD modeling references. Additional PSD guidance documents and clarification memos are available at EPA's website.

7.2 PSD PRE-APPLICATION MEETING AND MODELING PROTOCOL

7.2.1 PSD Pre-application Meeting

A PSD pre-application meeting is required prior to submitting the modeling protocol and modeling analyses. The pre-application meeting is held to discuss project specifics with the appropriate permitting and modeling staff to identify

project specific permitting and modeling requirements. The Bureau's "Simplifying the Air Permitting Process: PSD" publication (SCDHEC, 2016b) contains a summary of information that should be included in the application, and addressed at the PSD pre-application meeting.

7.2.2 PSD Modeling Protocol

Prior to submitting the PSD application and modeling analysis, the applicant is required to submit a modeling protocol to the Bureau's Modeling Section. While it may not be possible to fully explain every detail of the project in the early stages of development, the modeling protocol should provide as much detail as possible to facilitate a thorough and timely review by the Bureau.

The following is a list of suggested topics to be included in the modeling protocol for discussion and review:

- 1) Proposed model(s) and non-regulatory options (if any);
- 2) Modeling methodology;
- 3) Meteorology (see Section 7.4.1 for additional information);
- 4) Receptor network / ambient air / fence line;
- 5) Sources with locations given in UTM based on NAD83 datum (UTM data based on NAD27 will not be accepted);
- 6) Terrain;
- 7) Facility map with scale and direction of true north;
- 8) Pollutants / averaging periods / emission rates;
- 9) Significant impact modeling and significant impact area (SIA) details;
- 10) NAAQS full impact analysis and background source/facility inventory details;
- 11) PSD increment full impact analysis and background source/facility inventory details;
- 12) Background concentrations (see Section 7.4.3.2 for more information);
- 13) Preconstruction monitoring;
- 14) Class II additional impact analysis (growth, soils and vegetation, visibility impairment);
- 15) Class I area impact analysis (areas evaluated, model(s), model input assumptions, Class I increments, Air Quality Related Values (AQRV)).

The Bureau reserves the right to request a revised protocol if an EPA model or methodology update that would have a significant impact on the modeling project occurs prior to the submission of the modeling analysis.

7.3 CLASS II / CLASS I AREA ANALYSES

This guidance is divided into Class II Area analysis, which is reviewed by the Bureau, and Class I Area analysis which is reviewed by the appropriate Federal Land Manager (FLM) and the Bureau.

Class I areas are those regions where maintaining the existing air quality is determined to be of national importance, such as National Parks, National Wildlife Refuges, National Wilderness Areas, etc. All other areas to which the PSD provisions apply are designated as Class II.

Class II and Class I Area analyses are addressed in Sections 7.4 and 7.5, respectively.

7.4 CLASS II AREA ANALYSIS

The PSD Review requires pollutants that are determined to be “major” (Section 7.1.3) be evaluated by an Air Quality Impact Analysis and Additional Impacts Analysis.

In general, the Air Quality Impact Analysis consists of the following:

- Preliminary Modeling Analysis
 - Based on emissions from the PSD facility only
 - Determines whether a Full Impact Analysis is required
- Full Impact Analysis, if required
 - Based on emissions from PSD facility and other facilities as appropriate

The Additional Impacts Analysis evaluates the impacts on soils, vegetation, and visibility effects.

7.4.1 Model Notes for the Preliminary and Full Impact Analyses

AERMOD:

- The current version of AERMOD (and associated programs, such as AERMAP and BPIP-Prime) should be used.
- Use of alternative (non-regulatory default) model options is allowed on a case-by-case basis, with proper justification, but prior approval from the EPA Regional Administrator is required.

- General guidance on AERMOD receptors, meteorological data, terrain data and downwash presented in Sections 5.8 – 5.11 of these Guidelines applies to these analyses. However, additional notes on meteorological data (representativeness), and receptor grid design are presented below and in Section 7.4.3.3, respectively.

Meteorological Data – Representativeness

- It is the applicant’s responsibility to evaluate the selected set of surface and upper air meteorological data to ensure it is representative of the project location.
- The evaluation for representativeness should include a comparison/discussion of the following:
 - Proximity of the measurement station(s) to the project site;
 - Surface parameters (i.e., roughness, albedo, and Bowen ratio) between the measurement station and project location; and
 - Significant terrain features, meteorological regime, etc.

7.4.2 Preliminary Modeling Analysis

The preliminary modeling analysis is conducted to:

- 1) Determine if a full impact air quality analysis is needed (using Significant Impact Levels (SIL));
- 2) Define the domain of the full impact analysis (Significant Impact Area), if needed; and
- 3) Determine if the facility may be exempted from pre-construction ambient monitoring data requirements (via Significant Monitoring Analysis).

7.4.2.1 Preliminary Modeling Analysis Emissions

The modeling is based on potential emissions – from the facility only - for each “major” pollutant as follows:

- For a new source
 - Use the project emissions increase.
 - All facility emissions should be evaluated, including quantifiable fugitive emissions from the proposed source(s).

- For a source modification
 - Use the net emissions increase.
 - Consider contemporaneous emission increases and decreases from the modified source(s); a net emission decrease can be modeled as a negative emission rate.

Note: Worst case operating conditions for each source should be used. Start up and shut down operations and the operation of auxiliary boilers/equipment must be accounted for when determining worst case conditions.

7.4.2.2 Preliminary Modeling Analysis Receptor Grid

The receptor domain and resolution for the preliminary modeling analysis must be sufficient to identify all areas where the SIL might be exceeded (up to a maximum radius of 50 km).

Grid Domain

- This is case specific depending on the magnitude of the emissions, the emission point parameters, and the extent of any significant changes in terrain elevations surrounding the project facility.
- If a large grid is necessary, the receptor grid at locations farther away from the project facility may be modeled at a coarser spacing than those closer to the facility.

Grid Resolution

- Along the facility fence line (fence or other physical barrier that precludes public access to the property):
 - Receptors should be placed at 50 meter intervals
 - If the facility does not have a fence line, receptors should be located on the facility property at 100 meter intervals.
- Beyond the fence line, the following pattern should be sufficient in most cases:
 - 100 meters out to 1.5 km
 - 250 meters from 1.5 to 5 km
 - 500 meters from 5 to 10 km, and
 - 1000 meters from 10 km up to 50 km.

However, to ensure the maximum controlling concentration is determined for each pollutant and averaging period, modeling with grid resolutions of 100 meters should be performed in the area near the highest concentration and all concentrations within 10% of a SIL.

- Along public roads and railroads (other than rail spurs) that cross the facility property - receptors should be placed at 50 meter spacing

7.4.2.3 Significant Impact Levels (SIL)

The model results of the Preliminary Modeling Analysis are compared to the Significant Impact Levels (SIL), as shown in Table D.1 (Appendix D), to determine whether a Full Impact Analysis is required.

If the highest model concentration for a pollutant and averaging period is:

- **> SIL** -- A full impact air quality analysis is required for that pollutant/averaging period.
- **≤ SIL** -- A full impact air quality analysis is not required for that pollutant/averaging period.

7.4.2.4 Significant Impact Area (SIA)

If a Full Impact Analysis is required (Section 7.4.2.1), the domain of the Full Impact NAAQS and PSD increment analyses is defined by the Significant Impact Area (SIA).

The SIA is defined as a circular area with a radius extending from the source to the lesser of the following:

- The distance to the farthest point where the Preliminary Modeling Analysis predicts a significant ambient impact will occur (i.e., model result > SIL); or
- A modeling receptor distance of 50 kilometers.

[See Section 7.4.3.3 for information on the minimum receptor coverage required for a Full Impact Analysis.]

The SIA is established for each pollutant and averaging period, although the applicant may choose to use the largest SIA per pollutant for all modeling for that pollutant. [Note: This procedure is different than that used to determine the area that sets the minor source baseline date (i.e., the Baseline Area). The Baseline Area

is the area in which the major source or major modification would have an air quality impact of \geq one (1) microgram per cubic meter ($\mu\text{g}/\text{m}^3$) (based on an annual average) for SO_2 , NO_2 , or PM_{10} ; or $\geq 0.3 \mu\text{g}/\text{m}^3$ (based on an annual average) for $\text{PM}_{2.5}$.]

7.4.2.5 Significant Monitoring Analysis

This analysis determines whether pre-construction ambient monitoring is required.

Preliminary Modeling Analysis results are compared to the significant monitoring concentrations (SMC) as shown in Table D.1 (Appendix D).

If the modeled result for a pollutant is:

- **\geq SMC** -- Pre-construction monitoring is required. However, Section 2.4 of EPA's *Ambient Monitoring Guidelines for Prevention of Significant Deterioration* (EPA, 1987) permits the use of existing representative air quality data in place of preconstruction monitoring data, provided monitor location, quality of data, and currentness of data are acceptable.
- **$<$ SMC** -- Pre-construction monitoring is not required. However, a qualitative analysis/discussion is required that shows the chosen monitor data are adequately representative of background concentrations of the pollutant in the vicinity of the source location.

Notes:

- 1) If the source is major for ozone (determined in Table 7.1), ozone monitoring data must also be reviewed.
- 2) If the source is major for $\text{PM}_{2.5}$ (determined in Table 7.1), $\text{PM}_{2.5}$ ambient monitoring data representative of the area of concern must be included in the application (since the $\text{PM}_{2.5}$ SMC was vacated via court decision). These may be existing data if adequate justification is submitted and they are determined by the Bureau to represent air quality in the area of concern over a recent 12-month period prior to the submittal of the PSD application.
- 3) See Section 7.4.3.2 for additional information on background monitoring data.

7.4.3 Full Impact Air Quality Analysis

A Full Impact Analysis is required for any pollutant for which the Preliminary Modeling Analysis results exceeded the SIL (determined in Section 7.4.2.1).

A Full Impact Analysis consists of separate modeling analyses for NAAQS and PSD increments, and will consider emissions from the following:

- The proposed source(s) or source modifications;
- Any existing onsite sources;
- Offsite sources (as applicable, see below); and
- Background sources (via ambient monitor concentrations) for the NAAQS analysis only.

The following emission notes apply to the NAAQS and Increment analyses.

- Onsite sources:
 - Emission rates must reflect the maximum allowable operating conditions as expressed by the federally enforceable emissions limit, operating level, and operating factor for each applicable pollutant and averaging time.
 - Operating levels less than 100 percent of capacity may also need to be modeled for sources like large boilers or turbines where differences in stack parameters associated with the lower operating levels could result in higher ground level concentrations. In these situations, it is usually sufficient to evaluate alternative operating conditions of 50% and 75% in addition to the normal 100% load condition.
 - NAAQS analysis -- All facility emissions of the PSD criteria pollutant subject to PSD must be included unless justification of insignificant and/or intermittent emissions is provided (e.g., emergency generator emissions, etc.—see EPA March 1, 2011 clarification memo (EPA, 2011)).
 - Increment analysis -- All facility emissions of the PSD criteria pollutants subject to PSD and for which PSD increments have been established (PM₁₀, PM_{2.5}, SO₂ and NO₂) must be evaluated to determine which individual source emissions consume increment and must be included in the PSD increment modeling analysis.

- Offsite sources:
 - Actual emission rates may be used
 - Calculations/data supporting the actual emission rates should be included in the application.
 - If negative (increment-expanding) emissions are used for the increment analysis, they must be based on changes/decreases in actual emission rates.
 - Sources to include: All offsite sources within the SIA should be included unless sufficient justification is provided for exclusion. Sources in the Screening Area (usually an area extending beyond the SIA to a distance of 50km from the proposed source) should be included in the analysis unless sufficient justification is provided for exclusion (see “Justification for exclusion” below).
 - Justification for exclusion:
 - “20D” Screening
A source in the Screening Area may be excluded if:
 $Q < 20 \times D$

where
Q = facility-wide emission rate (TPY)
D = distance (km) from the offsite source to:
 - the PSD facility being modeled - for short term emissions
 - the nearest boundary of the SIA - for long term emissions

Note: Multiple emission points at a source, and separate sources within 2 km of each other, should be grouped together prior to applying the 20D screening.

 - Significant Concentration Gradient Analysis
EPA allows the exclusion of background sources based on significant concentration gradient criteria. See *Appendix W* (EPA, 2017a) and EPA’s March 2, 2011 clarification memo (EPA, 2011) for more details.
 - Initial offsite source emission inventories can be obtained from the Bureau’s modeling section. See Section 7.4.3.1 below for more information regarding inventory development for the Increment Analysis.

[Note: A list of sources included in the model analysis should be included in the submittal, as well as a list of the sources that were excluded and reasons they were excluded (e.g., tabulation of 20D results, significant concentration gradient results, etc.).]

7.4.3.1 Offsite Inventory for Increment Analysis

All source emissions or source emission increases that have occurred since the Minor Source Baseline Date (MSBD) was established for the county in which the PSD facility is located must be modeled unless a source was screened out (via “20D” or Significant Concentration Gradient Analysis, per Section 7.4.3) during the development of the NAAQS emissions inventory. A list of “[PSD Minor Source Baseline Date by County](#)” is provided on the Bureau’s website (SCDHEC, n.d.(c)).

Since the MSBD in SC is county-specific, and PSD increment consumption is receptor dependent, the modeling domain (usually the SIA) may contain either single or multiple MSBDs to apply to the source selection process. Single county and multiple county MSBDs are addressed below:

- Single County MSBD:
If the proposed project SIA is totally within the county where the proposed source will locate, only the single county MSBD is used to develop the pollutant dependent inventory of other emission sources that consume PSD increment.
- Multiple County MSBDs:
 - Applies when the SIA extends to adjacent counties with different MSBDs.
 - For each adjacent county with a different MSBD, a separate inventory of PSD increment-consuming sources must be developed for each pollutant. This may require separate program runs for each county receptor group.
 - Simplified, but conservative procedures can be used to establish just one inventory of PSD increment-consuming sources per pollutant as follows:
 - Use the earliest pollutant MSBD of any affected PSD baseline area (county); or
 - Use the full NAAQS inventory of the affected counties.

Additional notes:

- Major source emissions in existence prior to the EPA-established Major Source Baseline Date are excluded from the increment modeling analysis.
- The major source baseline dates are:
 - PM₁₀ - Jan 6, 1975
 - PM_{2.5} - Oct 20, 2010
 - SO₂ - Jan 6, 1975
 - NO₂ - Feb 8, 1988
- If the PSD permit application of concern establishes the MSBD for a county, there are no other PSD increment consuming sources that need to be included in the PSD increment compliance modeling for this pollutant other than those of the PSD project.

7.4.3.2 Background Data (NAAQS Analysis)

See Section 3.6 for information about selection, use and download of background data.

Unless preconstruction monitoring is the source of the background data, the following should be included in the modeling protocol (to the extent possible) and the final modeling report:

- Identification of the background data that will be used (SCDHEC monitor data, or monitor data from an adjoining state, if applicable and approved by the Bureau)
- A qualitative analysis/discussion that shows why these data are adequately (or conservatively) representative of background concentrations of the pollutant in the vicinity of the source location
- A discussion of alternative background data sites explaining why they were not used

7.4.3.3 Model Receptor Grid Notes (Full Impact Analysis)

- Minimum Coverage - Model impacts need to be assessed only for those receptors where the model results exceeded the SIL in the Preliminary Modeling Analysis. The maximum range of these receptors defines the SIA. While a default receptor grid can be used that extends to the radius of the

SIA in all directions from the PSD facility, a smaller grid may be used that covers just the receptors where the model result exceeded the SIL.

- No fence line (or other barrier to access) - If the facility does not have a fence line, receptors should be located on the facility property at 100 meter intervals.
- Modeled concentrations in grid spacing > 100 meters - If the maximum modeled concentration, or any concentration within 10% of a standard, is located in an area where grid spacing exceeds 100 meters, a second round of modeling should be conducted for areas near the location(s) of the aforementioned concentration(s) using a grid resolution of 100 meters.

7.4.4 Modeled Impacts and Standards

A summary of the appropriate model output concentration (ranking and/or form of the standard) to use for comparison to the appropriate NAAQS and PSD increment standard is shown in Tables A.1 and D.3 (Appendixes A and D), respectively, for each pollutant and averaging period.

7.4.5 Additional Impact Air Quality Analysis

The additional impact analysis assesses the impacts of air, ground and water pollution on soils, vegetation, and visibility caused by any increase in emissions of any regulated (i.e., "major") pollutant from the source or modification under review, and from associated growth.

The additional impacts analysis generally has three parts:

- 1) Growth;
- 2) Soil and vegetation; and
- 3) Visibility impairment.

Each part is briefly described below. Additional information can be found in EPA's New Source Review Workshop Manual (Draft) (EPA, 1990) and "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals" (EPA, 1980).

7.4.5.1 Growth

This refers to a projection of the associated industrial, commercial, and residential source growth that will occur in the area due to the new source/modification and an estimate of the air emissions generated by this growth. Significant increases in human population and associated activities (e.g., road traffic, support facilities, additional labor workforce, other industrial growth, etc.) may contribute to air shed pollution. The net growth in population and ancillary support activities should be quantified to the extent possible, and discussed.

7.4.5.2 Soil and Vegetation

The analysis of air pollution impacts on soil and vegetation should be based on an inventory of the soil and vegetation types found in the impact area. Only vegetation with commercial or recreational value should be addressed. This information may be available from conservation groups, state agencies, and universities.

EPA guidance states that, for most soils and vegetation, ambient concentrations of criteria pollutants below the secondary NAAQS will not result in harmful effects. Nevertheless, the secondary NAAQS may not adequately protect certain sensitive vegetation and soils, particularly for regulated non-criteria pollutants.

Maximum modeled offsite impacts from the preliminary modeling analysis or results from the full impact analysis should be compared to the secondary NAAQS or EPA screening levels as shown in Table D.4 (Appendix D). Background values, when available, should be added to the modeled impacts before the comparison (see Sections 3.6 and 7.4.3.2 for more information on background).

7.4.5.3 Visibility Impairment

The Class II visibility impairment analysis is distinct from a Class I area visibility analysis and is required only for visibility sensitive areas (airports, state parks with scenic vistas, etc.) located within the largest SIA defined by a 24-hr or annual averaging period. If no visibility sensitive areas are found, it should be so noted in the application.

The visibility impairment analysis consists of:

- 1) An initial screening of emission sources to assess the possibility of visibility impairment; and
- 2) If warranted, a more in-depth analysis involving computer models.

The FLAG 2010 Report (Federal Land Managers, 2010) along with EPA's *Workbook for Plume Visual Impact Screening and Analysis* (EPA, 1992) should be used to conduct the visibility impairment analysis.

7.5 CLASS I AREA ANALYSIS

Air quality impacts must be addressed for all Class I areas within 300 km of a PSD project. All Class I analyses are coordinated with the appropriate Federal Land Manager (FLM). Table D.5 (Appendix D) shows the Class I areas that could potentially be impacted by PSD sources in SC along with corresponding FLM contact information.

A Class I area analysis is typically comprised of the following components:

- SIL (Significant Impact Level) analysis;
- PSD increment analysis (if required via the SIL analysis); and
- AQRV (Air Quality Related Values) analysis, if requested by the FLM.

These components are addressed briefly in the 3 sections below.

7.5.1 Significant Impact Level (SIL) Analysis

Purpose

This analysis determines if a full impact PSD increment analysis is needed.

Model

- If the Class I area is ≤ 50 km from the facility, AERMOD should be used.
- If the Class I area is > 50 km from the facility, a long-range transport model, such as CALPUFF may be used. Alternatively, a conservative screening analysis can be done using AERMOD with an arc of receptors at a range of 50 km from the facility, in the direction of the Class I area(s) (the receptor spacing along the arc should not exceed 1 km).

Emissions

Project-only potential emissions should be used.

Results

Modeled impacts are compared to the Class I SILs, as shown in Table D.2 (Appendix D). If the highest model concentration for a pollutant and averaging period is:

- **> SIL** – A more comprehensive increment analysis is required for that pollutant and averaging period (see Section 7.5.2).
- **≤ SIL** -- An increment analysis is not required for that pollutant and averaging period, but an AQRV analysis may still be required per the FLM.

7.5.2 Increment Analysis

If the Class I SIL analysis showed a model impact exceeding a SIL, a full impact air quality increment analysis may be required.

The need to conduct a Class I increment analysis for PSD facilities in SC is infrequent, and such analyses, when required, can be quite complex and project-specific. Also, the decision on whether an increment analysis is needed is case and pollutant-specific. As such, the Bureau should be consulted prior to beginning a full impact increment analysis.

If the analysis is required, the following general items will apply:

Model

Depending on the range of receptors required, the analysis may use AERMOD (for range ≤ 50 km from the facility), or a long-range transport model such as CALPUFF.

Emissions

Increment-consuming emissions from the following should be used:

- The proposed project using maximum allowable emissions;
- Any existing onsite sources; and
- Offsite sources as appropriate (the inventory of offsite sources to include is determined on a case-by-case basis upon consultation with the Bureau).

Results

- Modeled impacts are compared to the Class I increments as shown in Table D.3 (Appendix D).
- Results may also be used to address AQRV analyses (addressed in Section 7.5.3), as appropriate and approved by the FLM.

7.5.3 AQRV Analysis

An AQRV is a resource that may be adversely affected by a change in air quality, such as visibility, or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified by the FLM for a particular area.

The FLM for each Class I area of concern evaluates the need for an AQRV analysis, and will specify which AQRVs should be evaluated, if any. Typically, a FLM will request evaluation of visibility and deposition impacts if they believe the project emissions and distance from the respective Class I area warrant an impact assessment.

Q/D Screening

If a facility is located beyond 50 km from a Class I area and the Q/D relation below is true, the facility is not required to perform an AQRV analysis.

$$Q/D \leq 10$$

where

Q = sum of the emissions (TPY)* of SO₂, NO_x, PM₁₀ and H₂SO₄

D = distance (km) from the Class I area

[*Note: Emissions should be based on the maximum allowable 24-hr emissions that have been extrapolated to TPY rather than using emissions based on an annual limit, etc.]

Models

For facilities that don't screen out using Q/D, or that were < 50 km from a Class I area, the analysis required is determined on a case-by-case basis in consultation with the FLM and may involve models such as VISCREEN, PLUVUE II, AERMOD and CALPUFF, as appropriate.

Reference

See the FLAG 2010 Report (Federal Land Managers, 2010) for more comprehensive information regarding AQRV analyses.

7.6 AIR QUALITY MODELING REPORT

The PSD modeling report is generally included as a part of the PSD permit application that is submitted to the Bureau's permitting section; however, since the modeling is reviewed by the Bureau's modeling section, it is preferred that the modeling report be a stand-alone document and should contain all the necessary documentation (e.g., site maps, survey, etc.) to allow for an independent review of the compliance demonstration.

Although the length and detail of the modeling report is dictated by the complexity and scope of the modeling effort, each report should include a discussion of the topics listed below and which were identified as a modeling requirement during the PSD pre-application meeting.

- 1) Purpose of the modeling demonstration
- 2) Model(s) and modeling methodology, including any non-default/non-regulatory options used
- 3) Digital modeling files (see Section 6.6)
- 4) Meteorological data representativeness
- 5) Facility map with scale and direction of true north
- 6) Receptor network/ambient air/fence line
- 7) Pollutants, emission rates, and emission point locations/parameters (UTM based on NAD83 datum; data based on NAD27 will not be accepted)
- 8) Building downwash
- 9) Terrain
- 10) Background concentrations justification (see Section 7.4.3.2)
- 11) Class II NAAQS / PSD Increment Analysis (preliminary and full impact analyses)
- 12) Additional impact analysis (i.e., growth, soils, vegetation, visibility impairment)
- 13) Class I Analysis (SIL, Increment and AQRV)
- 14) Non-PSD pollutant impact analysis (i.e., compliance with SC Standards No. 2 and 8)

APPENDIX A - Model Output and Meteorological Data File Options, SC Standards No. 2 and 8 (and PSD CLASS II NAAQS)

Table A.1						
SC Standard No. 2 AAQS (and PSD CLASS II NAAQS) Analyses						
Pollutant	Averaging Time	(N)AAQS ($\mu\text{g}/\text{m}^3$) ⁽¹⁾	SC/EPA Guideline		Conservative Option	
			AERMOD Rank	AERMOD MET File	AERMOD Rank	AERMOD MET File
PM ₁₀	24 Hour ⁽²⁾	150	6 th High ⁽³⁾	Concatenated ⁽⁸⁾	2 nd High	5 Separate Years
PM _{2.5}	24 Hour ⁽²⁾	35	8 th Hi Avg ⁽⁴⁾	Concatenated ⁽⁸⁾	8 th High	5 Separate Years
	Annual ⁽²⁾	12	1 st Hi Avg ⁽⁵⁾	Concatenated ⁽⁸⁾	1 st High	5 Separate Years
SO ₂	1 Hour ⁽²⁾	196	4 th Hi Avg ⁽⁶⁾	Concatenated ⁽⁸⁾	4 th High	5 Separate Years
	3 Hour	1300	2 nd High	5 Separate Years	1 st High	5 Separate Years or Concatenated ⁽⁸⁾
NO ₂	1 Hour ⁽²⁾	188	8 th Hi Avg ⁽⁷⁾	Concatenated ⁽⁸⁾	8 th High	5 Separate Years
	Annual	100	1 st High	5 Separate Years	N/A	N/A
CO	1 Hour	40,000	2 nd High	5 Separate Years	1 st High	5 Separate Years or Concatenated ⁽⁸⁾
	8 Hour	10,000	2 nd High	5 Separate Years	1 st High	5 Separate Years or Concatenated ⁽⁸⁾
Lead	3 Month (Rolling)	0.15	1 st Hi Monthly then LEADPOST for 3 month 1 st Hi rolling average ⁽⁹⁾	Concatenated	1 st High Monthly	5 Separate Years

1) The appropriate design value background values must be added to the modeled concentrations before compliance can be determined. If needed, temporally varying background may be used to demonstrate compliance with PM_{2.5} 24-hour, SO₂ 1-hr and NO₂ 1-hr where applicable.

2) Pollutant ID must be the appropriate special ID (i.e., PM10, PM-10, PM25, PM2.5, SO2, etc.) to trigger the model to calculate the correct form of the particular standard.

3) 6th high over the five years modeled (NOT highest 6th high)

4) 5-year average 98th percentile (8th high averaged over 5 years)

5) 5-year average of the 1st high

6) 5-year average 99th percentile (4th high averaged over 5 years) of the daily maximum concentrations.

7) 5-year average 98th percentile (8th high averaged over 5 years) of the daily maximum concentrations.

8) 5-year concatenated meteorological file or five separate year met files with use of MULTYEAR can be used

9) A POSTFILE with monthly averages at each receptor is required to process 3-month 1st high rolling averages using LEADPOST.

Table A.2			
SC Standard No. 8 Toxic Air Pollutants Analysis			
Pollutant	Averaging Time	South Carolina Guideline	
		AERMOD Rank	AERMOD MET File
Toxics ⁽¹⁾	24 hour	1 st High	5 Separate Years or Concatenated

1) Maximum allowable ambient concentrations for each pollutant are listed in Table B.1 (Appendix B).

APPENDIX B - Air Toxics Data (SC Standard No. 8)

Table B.1 shows all air toxics regulated under SC Regulation 61-62.5, Standard No. 8 along with CAS number, maximum allowable ambient concentration (MAAC), toxicity category and de minimis value for each.

Table B.2 lists the individual compounds that are covered by Polycyclic Organic Matter (POM) in Table B.1.

[Note: See Section 2.3 of these Guidelines for exemption and deferral information for air toxics.]

Table B.1				
AIR TOXICS (SC STANDARD NO. 8) - MAXIMUM ALLOWABLE AMBIENT CONCENTRATIONS AND DE MINIMIS EMISSION RATES				
Chemical Name	CAS ⁽¹⁾ Number	MAAC ⁽²⁾ (24-hr avg, ug/m³)	Cat. ⁽³⁾	De minimis (lb/day) ⁽⁴⁾
Acetaldehyde	75-07-0	1800.00	2	21.600
Acetamide	60-35-5	+	3	+
Acetic Anhydride	108-24-7	500.00	1	6.000
Acetonitrile (Methyl cyanide)	75-05-8	1750.00	1	21.000
Acetophenone	98-86-2	+	3	+
2-Acetylaminofluorine	53-96-3	+	3	+
Acrolein	107-02-8	1.25	3	0.015
Acrylamide	79-06-1	0.30	2	0.004
Acrylic Acid	79-10-7	147.50	3	1.770
Acrylonitrile	107-13-1	22.50	3	0.270
Aldicarb	116-06-3	6.00	2	0.072
Allyl Chloride	107-05-1	30.00	2	0.360
p-Aminodiphenyl (4-Aminobiphenyl)	92-67-1	0.00	3	0.000
Ammonium Chloride	12125-02-9	250.00	1	3.000
Aniline	62-53-3	50.00	3	0.600
o-Anisidine	90-04-0	2.50	3	0.030
p-Anisidine	104-94-9	2.50	3	0.030
Antimony Compounds	>	2.50	1	0.030
Arsenic	7440-38-2	1.00	3	0.012
Arsenic Pentoxide	1303-28-2	1.00	3	0.012
Benzene	71-43-2	150.00	3	1.800

Table B.1				
AIR TOXICS (SC STANDARD NO. 8) - MAXIMUM ALLOWABLE AMBIENT CONCENTRATIONS AND DE MINIMIS EMISSION RATES				
Chemical Name	CAS ⁽¹⁾ Number	MAAC ⁽²⁾ (24-hr avg, ug/m³)	Cat. ⁽³⁾	De minimis (lb/day) ⁽⁴⁾
Benzidine	92-87-5	0.00	3	0.000
Benzotrichloride	98-07-7	300.00	3	3.600
Benzyl Chloride	100-44-7	25.00	3	0.300
Beryllium	7440-41-7	0.01	3	0.000
Beryllium Oxide	1304-56-9	0.01	3	0.000
Beryllium Sulfate	13510-49-1	0.01	3	0.000
Biphenyl	92-52-4	6.00	3	0.072
Bis (Chloromethyl) Ether	542-88-1	0.03	3	0.000
Bis (2-ethylhexyl) phthalate (DEHP)	117-81-7	25.00	3	0.300
Bromoform	75-25-2	25.85	3	0.310
1,3-Butadiene	106-99-0	110.50	3	1.326
1-Butanethiol (n-Butyl Mercaptan)	109-79-5	15.00	2	0.180
n-Butylamine	109-73-9	75.00	3	0.900
Cadmium	7440-43-9	0.25	3	0.003
Cadmium Oxide	1306-19-0	0.25	3	0.003
Cadmium Sulfate	10124-36-4	0.20	3	0.002
Calcium Cyanamide	156-62-7	2.50	3	0.030
Caprolactam, dust	105-60-2	25.00	1	0.300
Caprolactam, vapor	105-60-2	500.00	1	6.000
Captan	133-06-2	25.00	3	0.300
Carbaryl	63-25-2	25.00	3	0.300
Carbon Disulfide	75-15-0	150.00	3	1.800
Carbon Tetrachloride	56-23-5	150.00	3	1.800
Carbonyl Sulfide	463-58-1	12250.00	3	147.000
Catechol	120-80-9	297.00	3	3.564
Chloramben	133-90-4	+	3	+
Chlordane	57-74-9	2.50	3	0.030
Chlorine	7782-50-5	75.00	1	0.900
Chloroacetic Acid	79-11-8	900.00	3	10.800
2-Chloroacetophenone	532-27-4	7.50	1	0.090
Chlorobenzene	108-90-7	1725.00	3	20.700
Chlorobenzilate	510-15-6	+	3	+
Chloroform	67-66-3	250.00	3	3.000

Table B.1

AIR TOXICS (SC STANDARD NO. 8) - MAXIMUM ALLOWABLE AMBIENT CONCENTRATIONS AND DE MINIMIS EMISSION RATES				
Chemical Name	CAS ⁽¹⁾ Number	MAAC ⁽²⁾ (24-hr avg, ug/m³)	Cat. ⁽³⁾	De minimis (lb/day) ⁽⁴⁾
Chloromethyl Methyl Ether	107-30-2	+	3	+
p-Chloronitrobenzene	100-00-5	5.00	3	0.060
Chloroprene	126-99-8	175.00	3	2.100
Chromium (+6) Compounds	>	2.50	3	0.030
Cobalt Compounds	>	0.25	3	0.003
Coke Oven Emissions	>	+	3	+
Cresols/cresylic acid and mixture	1319-77-3	220.00	3	2.640
m-Cresol	108-39-4	110.50	3	1.326
o-Cresol (2-Methylphenol)	95-48-7	110.50	3	1.326
p-Cresol	106-44-5	110.50	3	1.326
Cumene (Isopropylbenzene)	98-82-8	9.00	2	0.108
Cyanamide	420-04-2	50.00	1	0.600
Cyanic Acid	420-05-3	500.00	1	6.000
Cyanide	57-12-5	125.00	1	1.500
Cyanide compounds	>	+	1	+
Cyanoacetamide	107-91-5	125.00	1	1.500
Cyanogen	460-19-5	500.00	1	6.000
2,4-D,salts and esters	94-75-7	50.00	3	0.600
DDE (Dichlorodiphenyldichloroethylene)	3547-04-4	+	3	+
Diazomethane	334-88-3	2.00	3	0.024
Dibenzofuran	132-64-9	+	3	+
1,2-Dibromo-3-chloropropane	96-12-8	0.05	3	0.001
Dibutylphthalate	84-74-2	25.00	3	0.300
p-Dichlorobenzene (1,4-Dichlorobenzene)	106-46-7	4500.00	2	54.000
3,3-Dichlorobenzidine	91-94-1	0.15	3	0.002
1,3-Dichloropropene	542-75-6	20.00	3	0.240
Dichlorvos	62-73-7	4.52	3	0.054
Diethanolamine	111-42-2	129.00	2	1.548
Diethyl Phthalate	84-66-2	25.00	3	0.300
Diethyl Sulfate	64-67-5	+	3	+
Diisodecyl Phthalate	2671-40-0	50.00	2	0.600
3,3-Dimethoxybenzidine	119-90-4	0.30	3	0.004

Table B.1				
AIR TOXICS (SC STANDARD NO. 8) - MAXIMUM ALLOWABLE AMBIENT CONCENTRATIONS AND DE MINIMIS EMISSION RATES				
Chemical Name	CAS ⁽¹⁾ Number	MAAC ⁽²⁾ (24-hr avg, ug/m³)	Cat. ⁽³⁾	De minimis (lb/day) ⁽⁴⁾
n,n-Dimethylaniline (n,n-dimethylbenzenamine)	121-69-7	250.00	2	3.000
3,3'-Dimethyl Benzidine	119-93-7	+	3	+
Dimethyl Carbamoyl Chloride	79-44-7	+	3	+
Dimethyl Formamide	68-12-2	300.00	2	3.600
1,1-Dimethyl Hydrazine	57-14-7	5.00	3	0.060
1,2-Dimethyl Hydrazine	540-73-8	5.00	3	0.060
Dimethyl Phthalate	131-11-3	25.00	3	0.300
Dimethyl Sulfate	77-78-1	2.50	3	0.030
4-Dimethylaminoazobenzene	60-11-7	125.00	3	1.500
m-Dinitrobenzene	99-65-0	10.00	2	0.120
2,4-Dinitrophenol	51-28-5	+	3	+
2,4-Dinitrotoluene	121-14-2	1.50	3	0.018
4,6-Dinitro-o-cresol and salts	534-52-1	2.00	2	0.024
Diethyl Phthalate	117-84-0	50.00	2	0.600
1,4-Dioxane (1,4-Diethyleneoxide)	123-91-1	450.00	3	5.400
1,2-Diphenylhydrazine	122-66-7	+	3	+
Epichlorohydrin (l-Chloro-2,3-Epoxypropane)	106-89-8	50.00	3	0.600
1,2-Epoxybutane	106-88-7	+	3	+
Ethanethiol (Ethyl Mercaptan)	75-08-1	10.00	2	0.120
Ethanolamine	141-43-5	200.00	1	2.400
Ethyl Acrylate	140-88-5	102.50	3	1.230
Ethyl Benzene	100-41-4	4350.00	2	52.200
Ethyl Chloride (Chloroethane)	75-00-3	26400.00	2	316.800
Ethylene Dibromide (Dibromoethane)	106-93-4	770.00	2	9.240
Ethylene Dichloride (1,2-Dichloroethane)	107-06-2	200.00	3	2.400
Ethylene Glycol	107-21-1	650.00	3	7.800
Ethylene Imine (Aziridine)	151-56-4	5.00	3	0.060
Ethylene Oxide	75-21-8	10.00	3	0.120
Ethylene Thiourea	96-45-7	+	3	+
Ethylidene Dichloride (1,1-Dichloroethane)	75-34-3	2025.00	3	24.300
Formaldehyde	50-00-0	15.00	2	0.180
Formamide	75-12-7	750.00	1	9.000

Table B.1				
AIR TOXICS (SC STANDARD NO. 8) - MAXIMUM ALLOWABLE AMBIENT CONCENTRATIONS AND DE MINIMIS EMISSION RATES				
Chemical Name	CAS ⁽¹⁾ Number	MAAC ⁽²⁾ (24-hr avg, ug/m³)	Cat. ⁽³⁾	De minimis (lb/day) ⁽⁴⁾
Formic Acid	64-18-6	225.00	1	2.700
Furfural (2-Furaldehyde)	98-01-1	200.00	1	2.400
Furfuryl Alcohol	98-00-0	400.00	2	4.800
Glycidaldehyde	765-34-4	75.00	3	0.900
Glycol Ethers (mono- and di- ethers of diethylene glycol or triethylene glycol) ⁽⁵⁾	>	+	1	+
Glycol Ethers (mono- and di- ethers of ethylene glycol) ⁽⁵⁾	>	+	3	+
Heptachlor	76-44-8	2.50	3	0.030
Hexachlorobenzene	118-74-1	+	3	+
Hexachlorobutadiene	87-68-3	1.20	3	0.014
Hexachlorocyclohexane (multiple isomers)	608-73-1	5.00	2	0.060
Hexachlorocyclopentadiene	77-47-4	0.50	3	0.006
Hexachloroethane	67-72-1	48.50	3	0.582
Hexachloronaphthalene	1335-87-1	1.00	3	0.012
Hexamethylene-1,6-diisocyanate (HDI)	822-06-0	0.34	2	0.004
Hexamethylphosphoramide	680-31-9	14.50	3	0.174
Hexane	110-54-3	900.00	3	10.800
Hydrazine	302-01-2	0.50	3	0.006
Hydrochloric Acid	7647-01-0	175.00	1	2.100
Hydrogen Cyanide	74-90-8	250.00	1	3.000
Hydrogen Fluoride	7664-39-3	2.05	3	0.025
Hydrogen Sulfide	7783-06-4	140.00	2	1.680
Hydroquinone	123-31-9	20.00	2	0.240
Isophorone	78-59-1	250.00	2	3.000
Isopropylamine	75-31-0	300.00	1	3.600
Kepone (Chlordecone)	143-50-0	0.00	3	0.000
Ketene	463-51-4	4.50	3	0.054
Lead Arsenate	7645-25-2	0.75	3	0.009
Lead (+2) Arsenate	7784-40-9	0.75	3	0.009
Lindane	58-89-9	2.50	3	0.030
Malathion	121-75-5	100.00	2	1.200
Maleic Anhydride	108-31-6	10.00	2	0.120
Manganese Compounds	>	25.00	3	0.300

Table B.1				
AIR TOXICS (SC STANDARD NO. 8) - MAXIMUM ALLOWABLE AMBIENT CONCENTRATIONS AND DE MINIMIS EMISSION RATES				
Chemical Name	CAS ⁽¹⁾ Number	MAAC ⁽²⁾ (24-hr avg, ug/m³)	Cat. ⁽³⁾	De minimis (lb/day) ⁽⁴⁾
Mercury	7439-97-6	0.25	3	0.003
Methanol (Methyl Alcohol)	67-56-1	1310.00	3	15.720
Methoxychlor	72-43-5	50.00	3	0.600
Methyl Bromide (Bromomethane)	74-83-9	100.00	3	1.200
Methyl Chloride (Chloromethane)	74-87-3	515.00	3	6.180
Methyl Chloroform (1,1,1-Trichloroethane)	71-55-6	9550.00	3	114.600
Methyl Ethyl Ketone (2-Butanone) (MEK)	78-93-3	14750.00	1	177.000
Methyl Hydrazine	60-34-4	1.75	3	0.021
Methyl Iodide (Iodomethane)	74-88-4	58.00	3	0.696
Methyl Isocyanate	624-83-9	0.23	3	0.003
Methyl Mercaptan	74-93-1	10.00	2	0.120
Methyl Methacrylate	80-62-6	10250.00	1	123.000
Methylamine	74-89-5	300.00	1	3.600
Methylene Biphenyl Isocyanate (MDI)	101-68-8	2.00	2	0.024
4,4-Methylene Bis-2-chloroaniline	101-14-4	1.10	3	0.013
Methylene Chloride (Dichloromethane)	75-09-2	8750.00	1	105.000
4,4-Methylenedianiline	101-77-9	4.00	3	0.048
Methyl-Isobutyl Ketone (Hexone) (MIBK)	108-10-1	2050.00	2	24.600
Methyl-t-butyl Ether	1634-04-4	+	1	+
Mineral Fibers, Fine	>	+	3	+
Mineral Oil Mist (Paraffin Oil)	8012-95-1	25.00	3	0.300
Mirex	2385-85-5	4500.00	3	54.000
Naphthalene ⁽⁶⁾	91-20-3	1250.00	1	15.000
a-Naphthylamine	134-32-7	0.00	3	0.000
b-Naphthylamine	91-59-8	0.00	3	0.000
Nickel	7440-02-0	0.50	3	0.006
Nickel Carbonyl	13463-39-3	1.75	3	0.021
Nickel Oxide	1313-99-1	5.00	3	0.060
Nickel Sulfate	7786-81-4	5.00	3	0.060
Nitric Acid	7697-37-2	125.00	1	1.500
p-Nitroaniline	100-01-6	15.00	3	0.180
Nitrobenzene	98-95-3	25.00	3	0.300
4-Nitrobiphenyl	92-93-3	0.00	3	0.000

Table B.1				
AIR TOXICS (SC STANDARD NO. 8) - MAXIMUM ALLOWABLE AMBIENT CONCENTRATIONS AND DE MINIMIS EMISSION RATES				
Chemical Name	CAS ⁽¹⁾ Number	MAAC ⁽²⁾ (24-hr avg, ug/m³)	Cat. ⁽³⁾	De minimis (lb/day) ⁽⁴⁾
Nitrogen Mustard	51-75-2	0.00	3	0.000
Nitroglycerin	55-63-0	5.00	2	0.060
p-Nitrophenol	100-02-7	0.00	3	0.000
1-Nitropropane	108-03-2	2250.00	1	27.000
2-Nitropropane	79-46-9	182.00	3	2.184
n-Nitroso-n-methylurea	684-93-5	+	3	+
n-Nitrosodimethylamine	62-75-9	0.00	3	0.000
n-Nitrosomorpholine	59-89-2	5000.00	3	60.000
p-Nitrosophenol	104-91-6	0.00	3	0.000
p-Nitrotoluene	99-99-0	5.50	3	0.066
Octachloronaphthalene	2234-13-1	0.50	3	0.006
Oxalic Acid	144-62-7	10.00	2	0.120
Paraquat	1910-42-5	0.50	3	0.006
Parathion	56-38-2	0.50	3	0.006
Pentachloronitrobenzene (Quintobenzene)	82-68-8	+	3	+
Pentachlorophenol	87-86-5	5.00	2	0.060
Phenol	108-95-2	190.00	2	2.280
p-Phenylenediamine	106-50-3	1.00	2	0.012
Phenylhydrazine	100-63-0	200.00	2	2.400
Phosgene (Carbonyl Chloride)	75-44-5	4.00	2	0.048
Phosphine	7803-51-2	2.09	3	0.025
Phosphoric Acid	7664-38-2	25.00	1	0.300
Phosphorus	7723-14-0	0.50	2	0.006
Phthalic Anhydride	85-44-9	30.30	3	0.364
Picric Acid	88-89-1	1.00	2	0.012
Polychlorinated Biphenyls (PCB) (multiple compounds)	>	2.50	3	0.030
Polycyclic Organic Matter (POM) ⁽⁷⁾	>	160.00	3	1.920
1,3-Propane Sultone	1120-71-4	+	3	+
b-Propiolactone	57-57-8	7.50	3	0.090
Propionaldehyde	123-38-6	+	1	+
Propoxur (Baygon)	114-26-1	2.50	3	0.030
Propylene Dichloride (1,2-Dichloropropane)	78-87-5	1750.00	3	21.000

Table B.1				
AIR TOXICS (SC STANDARD NO. 8) - MAXIMUM ALLOWABLE AMBIENT CONCENTRATIONS AND DE MINIMIS EMISSION RATES				
Chemical Name	CAS ⁽¹⁾ Number	MAAC ⁽²⁾ (24-hr avg, ug/m³)	Cat. ⁽³⁾	De minimis (lb/day) ⁽⁴⁾
1,2-Propylene Oxide	75-56-9	250.00	3	3.000
1,2-Propylenimine (2-Methyl Aziridine)	75-55-8	23.35	3	0.280
Pyrethrin I	121-21-1	25.00	3	0.300
Pyrethrin II	121-29-9	25.00	3	0.300
Pyrethrum	8003-34-7	50.00	2	0.600
Quinoline	91-22-5	+	3	+
Quinone	106-51-4	2.00	3	0.024
Rotenone	83-79-4	50.00	2	0.600
Selenium Compounds	>	1.00	3	0.012
Sodium Hydroxide	1310-73-2	50.00	1	0.600
Styrene	100-42-5	5325.00	1	63.900
Styrene Oxide	96-09-3	+	3	+
Sulfuric Acid	7664-93-9	10.00	2	0.120
Tetrachlorinated Dibenzo-p-dioxins	1746-01-6	0.00	3	0.000
1,1,2,2-Tetrachloroethane (Acetylene Tetrachloride)	79-34-5	35.00	3	0.420
Tetrachloroethylene (Perchloroethylene)	127-18-4	3350.00	2	40.200
Titanium Tetrachloride	7550-45-0	2500.00	1	30.000
Toluene	108-88-3	2000.00	3	24.000
Toluene Diisocyanate (TDI)	26471-62-5	0.40	2	0.005
Toluene-2, 4-diisocyanate	584-84-9	0.40	2	0.005
2,4-Toluenediamine	95-80-7	+	3	+
o-Toluidine	95-53-4	43.85	3	0.526
Toxaphene (Chlorinated Camphene)	8001-35-2	2.50	3	0.030
1,2,4-Trichlorobenzene	120-82-1	400.00	2	4.800
1,1,2-Trichloroethane	79-00-5	273.00	3	3.276
Trichloroethylene	79-01-6	6750.00	1	81.000
2,4,5-Trichlorophenol	95-95-4	+	3	+
2,4,6-Trichlorophenol	88-06-2	+	3	+
Triethylamine	121-44-8	207.00	3	2.484
Trifluralin	1582-09-8	+	3	+
2,2,4-Trimethylpentane (Isooctane)	540-84-1	8750.00	1	105.000
Urethane (Carbamic Acid Ethyl Ester)	51-79-6	5000.00	2	60.000

Table B.1

AIR TOXICS (SC STANDARD NO. 8) - MAXIMUM ALLOWABLE AMBIENT CONCENTRATIONS AND DE MINIMIS EMISSION RATES				
Chemical Name	CAS ⁽¹⁾ Number	MAAC ⁽²⁾ (24-hr avg, ug/m³)	Cat. ⁽³⁾	De minimis (lb/day) ⁽⁴⁾
Vinyl Acetate	108-05-4	176.00	3	2.112
Vinyl Bromide	593-60-2	100.00	3	1.200
Vinyl Chloride	75-01-4	50.00	3	0.600
Vinyl Fluoride	75-02-5	19.00	2	0.228
Vinylidene Chloride (1,1-Dichloroethene) (1,1-Dichloroethylene)	75-35-4	99.00	3	1.188
Xylene (mixed isomers)	1330-20-7	4350.00	2	52.200
m-Xylene	108-38-3	4350.00	2	52.200
o-Xylene	95-47-6	4350.00	2	52.200
p-Xylene	106-42-3	4350.00	2	52.200
Xylidine	1300-73-8	50.00	3	0.600
1) Chemical Abstract Service				
2) Maximum Allowable (highest 24-hour average) Ambient Concentration (modeled concentrations should be rounded to two decimal places for comparison to the MAAC)				
3) Categories 1/2/3 correspond to toxicity levels of low/moderate/high, respectively.				
4) Maximum plant-wide emissions allowed that will not require further air quality analysis (emission rates should be rounded to three decimal places for comparison to the de minimis threshold).				
5) The glycol ethers category is defined by the following formula: R - (OCH ₂ CH ₂) _n - OR', where: N = 1, 2, or 3; R = Alkyl C7 or less, or phenyl or alkyl substituted phenyl; R' = H or alkyl C7 or less, or OR' consisting of a carboxylic acid ester, sulfate, phosphate, nitrate, or sulfonate				
6) Although Naphthalene is also a Polycyclic Organic Matter (POM) compound, for the purpose of demonstrating compliance with Standard No. 8, it needs to be addressed for only the Naphthalene standard (MAAC = 1250.00 ug/m ³). Naphthalene does not need to be addressed for the POM standard (MAAC = 160.00 ug/m ³), regardless of whether it is the sole POM compound emitted, or is emitted along with other POM compounds.				
7) Includes organic compounds with more than one benzene ring and which have a boiling point ≥ 100° C. See list of compounds in Table B.2.				
+ Not determined; any level of emissions qualifies as de minimis for this pollutant.				
> No CAS Number				

Table B.2**LIST of COMMON POLYCYCLIC ORGANIC MATTER (POM)
COMPOUNDS⁽¹⁾**

Chemical Name	CAS Number	Chemical Name	CAS Number
Acenaphthene	83-32-9	Dibenz(a,h)anthracene	53-70-3
Acenaphthylene	208-96-8	Fluoranthene	206-44-0
Anthracene	120-12-7	Fluorene	86-73-7
Benzo(a)anthracene	56-55-3	Indeno(1,2,3-cd)pyrene	193-39-5
Benzo(a)pyrene	50-32-8	2-Methylnaphthalene	91-57-6
Benzo(b)fluoranthene	205-99-2	Naphthalene ⁽²⁾	91-20-3
Benzo(e)pyrene	192-97-2	Perylene	198-55-0
Benzo(g,h,i)perylene	191-24-2	Phenanthrene	85-01-8
Benzo(k)fluoranthene	207-08-9	Pyrene	129-00-0
Chrysene	218-01-9	Tetrachlorinated Dibenzop-dioxins (2,3,7,8-TCDD)	1746-01-6

1) The term polycyclic organic matter (POM) defines a broad class of compounds that includes organic compounds with more than one benzene ring which have a boiling point greater than or equal to 212°F (100°C). This list is not intended to include all possible POM compounds as there are theoretically millions of possible POM compounds. Rather, this is a list of common POMs emitted at facilities. Applicants should include all known POMs emitted in their inventories and include all non-exempt POM emissions in the Standard 8 compliance demonstration.

2) Although Naphthalene is a POM compound, for the purpose of demonstrating compliance with Standard No. 8, it needs to be addressed for only the Naphthalene standard (MAAC = 1250.00 ug/m³). Naphthalene does not need to be addressed for the POM standard (MAAC = 160.00 ug/m³), regardless of whether it is the sole POM compound emitted, or is emitted along with other POM compounds.

APPENDIX C – Standard No. 8 (Air Toxic) Deferral Analysis Example

A facility plans to increase their emissions of toluene, a pollutant regulated under Standard No. 8, by increasing emissions from a current process and installing a new source of toluene emissions. The emissions increase will be an additional 8.0 pounds per hour. In their most recent toluene modeling demonstration, an emission rate of 20 pounds per hour showed an impact of 486.00 $\mu\text{g}/\text{m}^3$. This facility has already deferred an increase of 2.0 pounds per hour.

First, check that the new/modified stacks do not have significantly worse dispersion characteristics than the current stacks.

- Merged stack parameters (M values) were computed using the equation in Section 3.3 of these Guidelines and are shown in Table C.1.
- The M values for Stacks 2 and 3 are greater than 50% of the previous worst case M value (Stack 1), and Stack 3 (the only new stack) is less than 25% closer to the nearest property boundary. Thus, the deferral approach may be considered for this increase.

Analysis:

1) Divide the baseline modeled concentration by the maximum allowable concentration, then multiply the result by 100 to obtain the percent standard consumed in the modeling demonstration.

- Modeled concentration of toluene = 486.00 $\mu\text{g}/\text{m}^3$
- Maximum allowable concentration for toluene = 2000.00 $\mu\text{g}/\text{m}^3$
- $486/2000 = 0.24$
- $0.24 \times 100 = 24\%$ of the standard consumed in the modeling demonstration.

2) Round up the value found in Step 1 to the nearest higher percent standard value shown in Table 2.3, column A.

- For 24%, the next highest percent standard value in the table is 25%.

- 3) Using the value found in Step 2, determine the corresponding increase multiplier of the baseline emission rate in Table 2.3, column B.
 - Based on Table 2.3, a 25% consumption of the standard would correspond to an increase multiplier of 1.00.
- 4) Multiply the increase multiplier by the baseline emission rate. This value is the cumulative maximum emission rate increase that may be deferred from modeling.
 - $1.00 \times 20.0 \text{ lb/hr} = 20.0 \text{ lb/hr}$.
- 5) Add the proposed emission rate to any previously deferred emission rates that have not been modeled.

If the total is less than the maximum emission rate increase allowed, found in Step 4, modeling may be deferred up to five years after the date of the deferral, until operating permit renewal, or until the time of the next permit application for which a compliance demonstration is necessary for the pollutant in question, whichever comes first. Otherwise, steps must be taken by the facility to show compliance for this pollutant.

- $8.0 \text{ lb/hr proposed} + 2.0 \text{ lb/hr previously deferred} = 10.0 \text{ lb/hr total}$.
- Cumulative maximum emission rate increase = 20.0 lb/hr .

For this example, since the proposed emission increase plus previously deferred emissions are less than or equal to the cumulative maximum emission rate increase allowed, any further air quality analysis may be deferred. An additional 10.0 lb/hr increase is available for future deferral.

The information used in this deferral analysis example is summarized in Tables C.1 and C.2.

Table C.1			
STACK INFORMATION FOR USE IN DEFERRAL ANALYSIS EXAMPLE			
Stack Number	1	2	3
Is Stack New or Increasing Emissions?	No	Increase	New
Stack Height (m) ⁽¹⁾	18	18	16
Stack Diameter (m) ⁽²⁾	0.8	0.9	0.8
Stack Temperature (K)	394	338	422
Does Stack have a Rain cap or Horizontal Opening?	No	No	No
Stack Exit Velocity (m/s)	Actual	9	7
	Use in merged stack calculation ⁽³⁾	9	7
Distance to Property Line (m)	60	75	55
Baseline Air Toxic Emission Rate (lb/hr)	18.0	2.0	0.0
Previously Deferred Air Toxic Emission Rate (lb/hr)	0.0	2.0	0.0
Proposed Deferred Air Toxic Emission Rate (lb/hr)	0.0	4.0	4.0
Total Air Toxic Emission Rate (lb/hr)	18	8	4
M value	1782.4	3386.6	8484.6
1) Stack height above ground level.			
2) Stack inside diameter measured at point of discharge.			
3) Stack exit velocity of 0.001 m/s should be used to account for discharge from horizontal or rain capped stack.			

Table C.2	
DEFERRAL ANALYSIS SUMMARY	
For Pollutant Toluene	
Baseline Emission Rate (lb/hr)	20.0
Baseline Modeled Concentration ($\mu\text{g}/\text{m}^3$)	486.00
MAAC (Maximum Allowable Ambient Conc., $\mu\text{g}/\text{m}^3$)	2000.00
Percent Standard Consumed (%)	24
Increase Multiplier	1.00
Cumulative Maximum Emission Rate Increase (lb/hr)	20.0
Existing Deferred Emission Rate (lb/hr)	2.0
Proposed Deferred Emission Rate (lb/hr)	8.0
Remaining Available Deferral (lb/hr)	10.0
Is Deferral Allowed?	Yes

APPENDIX D – Additional PSD Information

Table D.1					
PSD CLASS II - Significant Impact Level (SIL) and Significant Monitoring Concentration (SMC) Modeling					
Pollutant	Averaging Time	SIL ⁽¹⁾ ($\mu\text{g}/\text{m}^3$)	SMC ⁽²⁾ ($\mu\text{g}/\text{m}^3$)	EPA AERMOD Guideline	
				Rank	MET File
PM ₁₀	24 Hour	5	10	1 st High	5 Separate Years or Concatenated
	Annual	1	--	1 st High	5 Separate Years
PM _{2.5}	24 Hour	1.2 ⁽³⁾	4 ⁽⁴⁾	1 st High Average	Concatenated
	Annual	0.2-0.3 ⁽³⁾	--	1 st High Average	Concatenated
SO ₂	1 Hour	8 ⁽⁵⁾	--	1 st High Average	Concatenated
	3 Hour	25	--	1 st High	5 Separate Years or Concatenated
	24 Hour	5	13	1 st High	
	Annual	1	--	1 st High	5 Separate Years
NO ₂	1 Hour	8 ⁽⁵⁾	--	1 st High Average	Concatenated
	Annual	1	14	1 st High	5 Separate Years
CO	1 Hour	2000	--	1 st High	5 Separate Years or Concatenated
	8 Hour	500	575	1 st High	
Ozone	8 Hour	1.0 ppb ⁽⁶⁾	--	--	--
<p>1) Note - there are no SILs for the following:</p> <ul style="list-style-type: none"> Fluorides, lead, H₂S, and H₂SO₄ (these pollutants are addressed under SC state regulations and guidance as applicable) TSP (not considered a criteria pollutant for this analysis) 					
2) SMC are from SC Regulation 61-62.5, Standard No. 7.					
3) Use of this draft SIL must be consistent with the current EPA PM _{2.5} modeling guidance (EPA, 2016e).					
4) The 2013 court decision vacating the PM _{2.5} SMC from the PSD regulations necessitates that ambient monitoring data representative of the area of concern be included in the application. These may be existing data if they are determined by the Bureau to represent the air quality in the area of concern over the 12-month period prior to the submittal of the PSD application.					
5) Interim SIL for use until EPA has finalized SIL for this averaging period.					
6) Use of this draft SIL must be consistent with the current EPA Ozone modeling guidance (EPA, 2016e).					

Table D.2				
PSD CLASS I - Significant Impact Levels (SIL)				
Pollutant	Averaging Time	SIL ($\mu\text{g}/\text{m}^3$)	EPA MODEL Guideline	
			Rank	MET File
PM ₁₀	24 Hour	0.3	1 st High	5 Separate Years or Concatenated
	Annual	0.2	1 st High	5 Separate Years
PM _{2.5}	24 Hour	0.27 ⁽¹⁾	1 st High Average	Concatenated
	Annual	0.05 ⁽¹⁾	1 st High Average	Concatenated
SO ₂	3 Hour	1.0	1 st High	5 Separate Years or Concatenated
	24 Hour	0.2	1 st High	
	Annual	0.1	1 st High	5 Separate Years
NO ₂	Annual	0.1	1 st High	5 Separate Years

1) Use of this SIL must be consistent with the current EPA PM_{2.5} modeling guidance (EPA, 2014b)

Table D.3					
PSD CLASS II and CLASS I Increment Analyses					
Pollutant	Averaging Time	Increment ($\mu\text{g}/\text{m}^3$)		EPA AERMOD⁽¹⁾ Guideline	
		Class II	Class I ⁽¹⁾	Rank	MET File
PM ₁₀	24 Hour	30	8	2 nd High	5 Separate Years
	Annual	17	4	1 st High	5 Separate Years
PM _{2.5}	24 Hour	9	2	2 nd High	5 Separate Years
	Annual	4	1	1 st High	5 Separate Years
SO ₂	3 Hour	512	25	2 nd High	5 Separate Years
	24 Hour	91	5	2 nd High	5 Separate Years
	Annual	20	2	1 st High	5 Separate Years
NO ₂	Annual	25	2.5	1 st High	5 Separate Years

1) A Class I analysis may use a long range transport model, such as CALPUFF, for receptor distances >50 km.

Table D.4					
PSD CLASS II Soils and Vegetation Analysis					
Pollutant	Averaging Time	EPA Screening Conc. ($\mu\text{g}/\text{m}^3$) ⁽¹⁾	Secondary NAAQS ($\mu\text{g}/\text{m}^3$) ⁽¹⁾	EPA AERMOD Guideline	
				Rank	MET File
PM ₁₀	24 Hour	--	150	1 st High	5 Separate Years or Concatenated
PM _{2.5}	24 Hour	--	35	1 st High	
	Annual	--	15.0	1 st High	5 Separate Years
SO ₂	1 Hour	917	196 ⁽²⁾	1 st High	5 Separate Years or Concatenated
	3 Hour	786	1300	1 st High	
	Annual	18	--	1 st High	5 Separate Years
NO ₂	4 Hour	3760	--	1 st High	5 Separate Years or Concatenated
	8 Hour	3760	--	1 st High	
	1 Month	564	--	1 st High	
	Annual	94	100	1 st High	5 Separate Years
CO	1 Week	1,800,000	--	1 st High 8 Hour ⁽³⁾	5 Separate Years or Concatenated
Lead	3 Month ⁽⁴⁾	0.15	0.15	1 st High Monthly then LEADPOST for 3 month 1 st High rolling average ⁽³⁾	Concatenated
Fluoride	10 Day	0.5	--	1 st High 24 Hour	5 Separate Years or Concatenated
Sulfuric Acid Mist	24 Hour	--	10 ⁽⁵⁾	1 st High	
1) The appropriate design value background values must be added to the modeled concentrations before compliance can be determined. If needed, temporally varying background may be used to demonstrate compliance with SO ₂ 1-hr and NO ₂ 1-hr where applicable.					
2) Primary NAAQS (no secondary standard available).					
3) The first high 8-hr result is a conservative option that can be used. The use of less conservative options are generally not required to pass this standard.					
4) A POSTFILE with monthly averages at each receptor is required to process 3-month 1 st high rolling averages using LEADPOST.					
5) Standard 8 allowable concentration (there is no NAAQS for this pollutant).					

Table D.5		
CLASS I AREAS POTENTIALLY IMPACTED BY PSD SOURCES IN SC AND FEDERAL LAND MANAGER (FLM) CONTACTS		
State	Class I Area	FLM Contact
SC	Cape Romain National Wildlife Refuge	Catherine Collins (USFWS) 303-914-3807 Catherine_Collins@fws.gov
NC	Great Smoky Mountains National Park	Andrea Stacy (NPS) 303-969-2816 andrea_stacy@nps.gov
	Linville Gorge National Wilderness Area	Bill Jackson (USDA Forestry Service) 828-257-4815 bjackson02@fs.fed.us
	Joyce Kilmer Slickrock National Wilderness Area	
	Shining Rock National Wilderness Area	Jill Webster (USFWS) 303-914-3804 jill_webster@fws.gov
GA	Cohutta Wilderness Area	Bill Jackson (USDA Forestry Service) 828-257-4815 bjackson02@fs.fed.us
	Okefenokee Swamp	Jill Webster (USFWS) 303-914-3804 jill_webster@fws.gov
	Wolf Island	Catherine Collins (USFWS) 303-914-3807 Catherine_Collins@fws.gov

APPENDIX E – References

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Log of Revisions (since original document of 10/15/2018)			
Revision Date	Section	Page	Change(s)
4/15/2019	Cover Page	--	Added "(Revised 4/12/2019)" at bottom
	4.7	30	Under "6) Building Downwash," changed "Section 4.3" to "Section 4.5"
	Appendix B	71	Table B.1: added "24-hr avg" to the "MAAC" column heading
	Appendix B	79	Table B.1: changed "Xylene (isomers and mixture)" to "Xylene (mixed isomers)"
	Appendix B	79	Table B.1, Note 2: <ul style="list-style-type: none"> • added "(highest 24-hour average)" • deleted "allowed offsite by Standard No. 8" • changed "concentrations" to "modeled concentrations"