

AIR QUALITY MODELING GUIDELINES

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1.0 INTRODUCTION

An air dispersion model is a set of mathematical equations that relates the release of air pollutants from emission sources to the corresponding concentration of pollutants in the ambient air. Ambient air is outside air to which people, structures, and vegetation are exposed. These models are tools used to determine if the emissions from a source can meet a specific ambient standard.

1.1 WHEN IS MODELING REQUIRED

Air dispersion modeling is one of the methods that may be used to show compliance with South Carolina Air Pollution Control Regulation 62.5, Standards No. 2, 3.1, 7, and 8. Other approaches may be allowed in these regulations, but air dispersion modeling is typically the least expensive and least time consuming of these approaches. A compliance demonstration for Standards No. 2, 7, and/or 8 is required for facilities that have never submitted a compliance demonstration and for facilities that increase emissions or make modifications in the parameters used in a previous compliance demonstration. Modifications that can cause a higher modeled impact require a new compliance demonstration. In terms of the air permitting process, a compliance demonstration would be required for most construction permits (including all Prevention of Significant Deterioration (PSD) construction permits) and for certain Title V major, conditional major, and state operating permit renewals. Section 1.2 contains details on which construction permit and operating permit renewal applications would be exempt from a compliance demonstration. Appendix D contains a copy of the [Air Toxic Modeling Procedures](#) which contains additional information and methods for demonstrating compliance with Standard No. 8. Appendix E contains additional information on some of the common issues concerning Standard No.2 compliance requirements.

1.2 FACILITIES/SOURCES EXEMPT OR DEFERRED FROM MODELING

A facility is not required to submit a compliance demonstration for construction permit applications that are replacing sources if the following criteria are met. The replacement sources must either be a replacement in kind or have lower emissions than the original source. The current compliance demonstration for the facility on file at the Bureau must be up to date and include the original source. If either of these criteria is not met, an updated compliance demonstration will be required with the construction permit application.

Facilities submitting Title V, conditional major, or state operating permit renewal applications are not required to submit a new compliance demonstration for the facility if no new emissions sources have been added, no stack or facility modifications have been made that would worsen dispersion, and no emissions increases have occurred since the facility's previous compliance demonstration. The Bureau has exempted the following facility types from air dispersion modeling requirements: cotton gins, country grain elevators, and concrete batch plants. This exemption is contingent upon the above facility not being a part of a larger facility and not having citizen or regulatory complaints against the facility. These facility types have been 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. **Please note, however, that sources and facilities exempt from modeling requirements may not also be exempt from permitting requirements.** Please contact the Bureau for guidance on whether a source exempt from air modeling requirements would also be exempt from permitting requirements.

Certain sources are exempt from permitting based on the size or operating characteristics of the source. As a result, the Bureau exempts from modeling requirements emergency power generators that are run less than 250 hours a year. This hour limitation only applies to the time the generator is run on a non-emergency basis; the time spent providing emergency power does not contribute to this time limit. Boilers and space heaters with a design heat input of 1.5 MMBTU/hr or less that burn either natural gas or propane are exempt from modeling requirements. **Please note, however, that all sources exempt from permitting may not be exempt from modeling requirements.** This exemption is not allowed for these sources when submitted with PSD permit applications. Please contact the Bureau for guidance on whether a permit-exempt source not listed in this paragraph would require modeling.

Facilities whose permitted sources emit a total of one pound per hour or less for each pollutant listed under Standard No. 2, with the exception of lead and fluorides (HF), are not required to submit a compliance demonstration for Standards No. 2 and 7. **This exemption does not apply to lead, fluorides (HF), and air toxic pollutants subject to Standard No. 8.** This exemption may be rescinded and a compliance demonstration required if there are citizen or regulatory complaints against the facility.

The Bureau allows criteria pollutant increases of less than a cumulative one pound per hour for each Standard No. 2 pollutant to be deferred from modeling at the time of the permit application. A demonstration showing compliance for these increases will be required at the time of permit renewal. If this modeling demonstration indicates noncompliance with the standards, the facility will be required to take steps to bring the facility back into compliance before a permit will be issued. If subsequent emission increases exceed the cumulative one pound per hour threshold, a modeling analysis will be required at that time. If the facility's previous modeling analysis indicates the facility is near the standard for the pollutant being increased, a compliance demonstration will be required. Please see the [Air Toxic Modeling Procedures](#), located in Appendix D, for information on deferral approaches for air toxics.

1.3 BUREAU MODELING ASSISTANCE

The Bureau may provide modeling assistance to facilities that have one hundred full time equivalent employees or less and are designated as a "small business stationary source" as defined in the federal Clean Air Act. The Bureau will also perform Air Dispersion Modeling for companies that can show modeling requirements will cause a hardship on them. This hardship will have to be verified through the submission of documentation such as balance sheets, income statements, etc.; showing the expense of modeling would be a hardship to the company. Modeling will also be performed for sources owned by Federal, State, and Local Governments, with the exception of extremely large, complex facilities such as the Savannah River Site. However, all of these sources are responsible for providing to the Bureau in a timely manner the facility/site data necessary for the modeling analysis.

Since the time involved in the development of the modeling analysis is not included in the permitting time frames, the time spent developing and reviewing the modeling analysis will not be counted toward the 90-day time clock for permit issuance. This assistance offer does not preclude a facility from conducting its own modeling analysis if desired by the facility.

1.4 DOCUMENT SCOPE

This document describes the current Bureau modeling procedures using primarily either the SCREEN model or the ISCST model. To reduce confusion and the need for additional revisions, the use of the terms SCREEN and ISCST in this document refer to the latest versions of these models. As of this document's printing SCREEN3 and ISCST3 are the latest EPA-approved versions of these models. When these models are superseded, their replacements will become the required models.

The guidelines presented in this document may change as new modeling techniques become available. It is the intention of the Bureau to review this document quarterly and update it, at a minimum, yearly. The Bureau reserves the right to require additional information to clarify the analysis that has been submitted or to address issues raised during the analysis.

This document divides the modeling requirements into two levels, screening and refined, with refined analyses being more difficult.

2.0 GENERAL MODELING CONSIDERATIONS

2.1 GOOD ENGINEERING PRACTICE (GEP) STACK HEIGHT ANALYSIS

The proper stack height is very important to achieving good dispersion of air pollutants. If the stack is too low, the air pollutants that are released are trapped in the wake of nearby obstructions (structures or terrain features) and are also brought down to ground level in the immediate vicinity of the release point (down-wash).

Good Engineering Practice Stack Height (GEP) is the minimum stack height needed to prevent the stack exhaust plume from being entrained in the wake of nearby obstructions. If a proposed stack is below the GEP height then the plume entrainment must be taken into account by modifying certain dispersion parameters used in air dispersion models. However, if the stack height equals or exceeds the calculated GEP stack height, then the stack is considered GEP, and plume entrainment within the wake of nearby obstructions is unlikely and need not be considered in the modeling.

In some situations the stack may be higher than the GEP stack height calculated using the GEP equation which appears in the next paragraph. In these situations if the actual stack height is less than 65 meters (213.5 feet) then the stack is still considered to be GEP. However, sources that were built or underwent major modifications after December 31, 1970 and have an actual stack height that is greater than 65 meters and greater than the calculated GEP value must use the calculated GEP stack height for modeling purposes. If the stack height is greater than 65 meters but less than the calculated GEP height, then the actual stack height is used in the modeling analysis. As an

alternative to the GEP equation, a source can use a fluid modeling study to determine the GEP stack height. Please refer to S.C. Air Pollution Regulations - Regulation No. 62.7, Good Engineering Practice Stack Height for further information.

The first stage of the Air Quality Analysis is the GEP analysis. This analysis is used to identify critical buildings to determine building dimensions to be used in the modeling analysis. A GEP analysis can also be used to show compliance with the GEP stack height regulation found in S.C. Air Pollution Control Regulation No. 62.7. The following equation is used to calculate GEP:

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

where

$$H_{\text{gep}} = \text{GEP stack height,}$$

$$H = \text{height above stack base of adjacent structure or nearby structure,}$$

$$L = \text{lesser dimension (height or projected width of nearby structures).}$$

A GEP analysis should be conducted for all structures within 5 L of each stack using the procedures contained in the EPA Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulation) - Revised EPA-450/4-80-023R. Identify the structure that results in the largest GEP stack height for each stack as the critical structure for that stack. **Sometimes it is necessary to run the SCREEN model several times to determine the building that has the worst influence on the stack or stacks being modeled.**

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

2.2 MERGED PARAMETERS FOR MULTIPLE STACKS

Sources that emit the same pollutant from several stacks with similar parameters and are located within 100 meters of each other may be analyzed by treating all of the emissions as coming from a single representative stack. If the stacks have stack heights or volumetric flow rates that differ by more than 20%, then they should be merged with caution. Stacks with designs that impede vertical flow (raincaps, horizontal or downward discharge) may not be merged with stacks that have unimpeded vertical flow. If a facility contains both raincapped/horizontal stacks and vertical stacks, a merged stack calculation containing only the vertical stacks and a merged stack calculation containing only the raincapped/horizontal stacks will be required if merged stack calculations are used.

The method for merging stacks is listed below:

- (1) Compute the dimensionless parameter M for each stack to be merged where:

$$M = (H_s * V_{fr} * T_s) / Q$$

where

M	=	dimensionless parameter
H _s	=	stack height above ground (m or ft),
V _{fr}	=	volumetric flow rate ($\Pi d^2/4$)v,
d	=	stack exit inside diameter (m or ft),
v	=	vertical stack gas exit velocity (m/s or ft/s),
T _s	=	stack gas exit temperature (°K or °R), and
Q	=	pollutant emission rate (g/s or lb/hr).

Please note either metric or English units may be used in the calculations. The only requirement is the units must be consistent for corresponding stack parameters.

- (2) Determine which of the stacks has the lowest value of M. This is the representative stack.
- (3) Sum the emissions (Q) from the stacks that are being merged. This summed emission rate, along with the stack parameters (with the exception of distance to the property line) for the representative stack, will be used in modeling these summed stacks. Use the shortest property line distance of the merged stacks in the modeling analysis.

2.3 SOURCE TYPES

There are five basic source types. These are:

- (1) Point sources, such as stacks, chimneys, exhaust fans, and vents. These are the most common and can be modeled with most dispersion models including SCREEN and ISCST.
- (2) Area sources, such as ponds, puddles, storage piles, and other sources that have low level or ground level releases with no plume rise. These sources can be modeled with most dispersion models including SCREEN and ISCST.
- (3) Volume sources that have initial dispersion prior to release. Volume sources differ from area sources in that they have an initial dispersion depth. Volume sources can be modeled with either SCREEN or ISCST.
- (4) Line sources, such as roads, runways or conveyor belts. These sources can be modeled with ISCST by representing the line source as either a series of

volume sources or area sources. Near ground level sources, such as a viaduct, may be modeled using a series of area sources. Line sources with an initial plume depth, such as a conveyor belt or rail line, may be modeled as a series of volume sources.

(5) Flares.

This document will primarily cover the point sources since they are the most common. Other source types will need to be considered on a case-by-case basis.

2.4 EMISSION RATES

Use of the proper emission rate is essential in air dispersion modeling. If a permitted emission rate exists for the stack and pollutant being considered, then the permitted emission rate should be used in the modeling analysis. If the permitted emission rate is not reflective of the actual emission rate then the actual emission rate can be used if the Bureau is requested to change the emission rate for that stack on the Operating Permit. Emission rates that are averaged due to limited hours of operation may require additional record keeping requirements in the permit. Emission rates that are averaged must take into account the averaging periods for the pollutants in question. For example, an air toxic pollutant emission rate that is averaged must be averaged over a 24 hour period since all air toxic standards are based on 24 hour concentration averages. For new sources or those that have not been assigned an emission limit, then the emission rate should be derived from published emission factors (AP-42 or Toxic Air Pollutant Emission Factors for Selected Air Toxic Compounds and Sources), stack test data, manufacturers test data, material balance, or other methods that the Bureau must approve on a case-by-case basis. For emission rates other than those permitted, all calculations and assumptions should be provided that were used to derive the emission rate. For sources using backup fuels, the fuel that produces the highest emission rate for each pollutant should be used when determining emission rates for modeling. For example, if a boiler primarily uses Natural Gas as a fuel but uses No. 6 oil as a backup fuel, then the fuel which produces the highest emission rate for each pollutant would be used in the modeling (No. 6 oil in this case), unless the state allowable emission rate is used.

2.5 HORIZONTAL DISCHARGES AND RAIN CAPS

In modeling, the exit velocity in the upward vertical direction is the one required. Many stacks have non-vertical discharges (horizontal or downward) or have raincaps that change the outlet velocity from vertical to horizontal. To model these stacks properly, use a vertical velocity of 0.01 m/sec, or calculate the vertical velocity component by using the following equation:

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

where

$$V_{\text{vert}} = \text{vertical exit velocity to use in the model}$$

V_s	=	exit velocity as reported
α	=	angle of the stack with the vertical (degrees)

Use the larger of V_{vert} or 0.01 m/sec as the exit velocity input to the model.

For non-vertical/raincapped discharges with a temperature greater than ambient, the stack diameter **may** be adjusted (**it does not have to be adjusted**) so that the volumetric flow rate is the same with the 0.01 m/sec velocity as it is with its actual non-vertical velocity. The equivalent diameter is calculated using the formula shown below:

$$d_{eq} = \sqrt{(V_{act} (d_{org})^2 / 0.01)}$$

where

d_{eq}	=	Equivalent diameter to be used in the model (in meters)
V_{act}	=	Stack velocity as measured in the stack tests (in meters per second)
d_{org}	=	Original stack diameter (in meters)
0.01	=	0.01 meters per second (modeled stack velocity)

2.6 RURAL/URBAN CLASSIFICATION

The procedure to determine whether to use urban or rural dispersion coefficients is found in the EPA's Guideline on Air Quality Models (Revised) dated July 1986, EPA-450/2-78-027R. This document lists two methods that can be used to determine the proper classification. They are:

- (1) Land Use Procedure - If more than 50% of the land within a 3 kilometer radius of the facility in question is of land use types heavy or medium industrial, commercial or multi-family residential then the Urban mode should be selected. Otherwise, use the Rural mode.
- (2) 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 selected.

With few exceptions, all of South Carolina is considered to be rural. Typically the areas in the large metropolitan areas of the state (Greenville/Spartanburg, Columbia, and Charleston) will meet one of the above definitions of urban.

2.7 COMPLEX TERRAIN

Complex terrain is defined as terrain that exceeds the top of the stacks for the sources being modeled. In complex terrain, the plume height can be lower than the nearby terrain. For PSD modeling, the terrain should be examined out to the extent of significant impact. (Table B-2 in Appendix B gives the significant values used to determine the extent of the impact area). For other modeling, terrain elevations for stacks less than 50 meters high should be examined up to 5 kilometers from the stack. For sources with stacks taller than 50 meters, then the terrain up to 20 km should be examined. Complex terrain models should be used to predict concentrations in this type of terrain. See also intermediate terrain listed below.

2.8 INTERMEDIATE TERRAIN

Intermediate terrain is terrain that exceeds the top of the stacks for the sources being modeled but does not exceed the plume height. Intermediate terrain may be modeled with both simple and complex terrain models on an hour-by-hour basis, and the higher of the two predictions chosen to represent the most conservative estimate for that hour. The SCREEN and ISCST models determine which calculation is higher when intermediate terrain is encountered. Use the procedures listed in Section 2.7 to determine how far out from the facility the terrain should be examined.

2.9 TERRAIN ELEVATIONS

If the terrain within five kilometers of the stack varies by more than 50% of the shortest, non-fugitive, on-site stack that is being modeled, then the terrain feature elevations should be included for the receptor grid. These elevations should be the difference between the terrain feature and the stack base elevation used in the model. In modeling, if the base elevation of the stack is used in the stack data section, then terrain elevations for each receptor should also be used. However, it is acceptable to use a zero stack base elevation and model the terrain feature receptors as the difference in the terrain elevation and the stack base elevation. Terrain elevations can be obtained from U. S. Geological Survey (USGS) or equivalent maps. These maps can be obtained from the S.C. Land Resources Conservation Commission, 2221 Devine Street, Suite 222, Columbia, SC 29205 ((803) 734-9100).

2.10 RECEPTOR GRID (NON PSD MODELING)

The receptor grid placement is important in determining the maximum impact from a source. The grid should be placed so that the maximum concentration off plant property can be determined. It is recommended that discrete receptors be placed along the **property line** at 50-meter maximum spacing. Discrete receptors should also be placed along property not owned by the facility that crosses plant property (i.e. public roads, rivers, and railroad tracks). The receptor grid should extend outward to a minimum of 1000 meters from the grid center and further if the source has maximum impacts occurring at or beyond 1000 meters. The receptor grid spacing should not exceed 100 meters.

2.11 RECEPTOR GRID (PSD MODELING)

PSD modeling has slightly different requirements from non-PSD modeling. First, the grid should be established such that the maximum impact at and beyond the fence line can be determined. It is recommended that discrete receptors be placed along the **fence line** at 100-meter maximum spacing.

Receptors should be placed out far enough to determine maximum ambient concentrations as well as the extent of significant impact area. The maximum grid spacing should be 100 meters. However, coarser grid spacing can be used to locate the general areas of maximum ambient impact and the extent of the significant impact area. This should then be followed by a fine grid with a maximum grid spacing of 100 meters for those areas noted above. For further information on PSD modeling please see the EPA's New Source Review Workshop Manual.

2.12 CONCENTRATION CONVERSION FACTORS FOR SCREEN MODELING

The EPA's SCREEN model predicts a maximum 1-hour ambient concentration in simple terrain mode and calculates a maximum 24-hr ambient concentration when in complex terrain mode. The conversion factors for converting different averaging periods are listed in table 2.1 below.

Table 2.1 Conversion Factors for Converting Model Results to Different Averaging Periods - Screening

Averaging Period	Simple Terrain ^a	Cavity	Complex Terrain	
			Simple ^b	Complex
1 hour	1.0	1.0	2.5	4.0
3 hour	0.9	0.9	2.5	4.0
8 hour	0.7	0.7	1.75	2.8
12 hour	0.6	0.6	1.5	1.5
24 hour	0.4	0.4	1.0	1.0
3 month	0.3	0.3	0.75	0.75
Annual	0.05	0.05	0.125	0.125

a These factors can also be used with the ISCST model.

b The simple terrain referred to is the simple terrain impact in the complex terrain portion of the SCREEN model.

2.13 CAVITY EFFECTS

If the stack height is not GEP as determined in section 2.1, then cavity effects need to be addressed.

One method to determine cavity effects is to use the SCREEN model, which makes the necessary calculations. A second method is to use the manual method discussed in Section 3.6.1 of the SCREEN Model User's Guide. Both methods give maximum 1-hour concentrations in the cavity. Use Table 2.1 in Section 2.12 to convert to other averaging periods. If the cavity concentrations are calculated to be $0.0 \mu\text{g}/\text{m}^3$ or the cavity does not extend off plant property, then no further cavity analysis is required. Note there are refined modeling techniques proposed for cavity concentrations using ISC-PRIME. The Bureau may accept this modeling technique on a case by case basis. If cavity concentrations at or beyond the property line exceed a standard, then stack modifications or emission controls are two possible approaches that may be used to meet the appropriate standard.

2.14 MODELING PROTOCOL

A modeling protocol is only required for sources undergoing a PSD review and sources demonstrating compliance with Standard 3.1. However, complicated facilities should submit a modeling protocol for approval before beginning a modeling analysis. Facilities that use modeling methods not covered in this document or referenced documents should also submit a modeling protocol for approval before beginning the modeling analysis. The following example may be used for both PSD and non-PSD applications; items that are specific to PSD applications are noted as such. A protocol should include the following information:

- (1) A diagram of the industrial site including locations of all existing and proposed stacks and associated buildings.
- (2) A list of on-site building dimensions (heights, widths, and lengths).
- (3) A diagram showing property boundaries, a scale, and a direction arrow indicating true north.
- (4) The location of the site superimposed on a U.S. Geological Survey (USGS) map.
- (5) Discussion of techniques for calculating Good Engineering Practice (GEP) stack height for each stack.
- (6) Discussion of techniques for evaluating cavity effects, impacts on rolling and complex terrain, building wake effects, urban / rural considerations, etc.
- (7) Discussion of reasons for model selection.
- (8) Discussion of other nearby (off-site) sources to include in the modeling analysis. (PSD only)

- (9) Discussion of meteorological data proposed for use.
- (10) Stack parameters for each source. Also when using merged stacks, discussion of merged stack parameter calculations.
- (11) Discussion of receptor locations and elevations, including critical receptors (i.e. schools, hospitals, etc.)
- (12) Discussion of PSD baseline dates and PSD sources for PSD modeling, discussion of PSD minor source baseline dates and sources subject to Class II PSD standards.
- (13) Discussion of any non-attainment areas.
- (14) Discussion of impact on any Class I areas. (PSD only)
- (15) Emission rates and calculations showing how the emission rates were derived.

For major or large sources, a meeting with the Bureau is strongly recommended to discuss the proposed modeling analysis.

After approving the modeling protocol, the Bureau reserves the right to require additional information.

3.0 MODEL SELECTION

All models used by the Bureau are those recommended by the EPA. The following table summarizes these models. Models other than those listed in Table 3.1 should be approved on a case-by-case basis.

Table 3.1 Summary of Recommended Models

Category	Screening Analysis	Refined Modeling	
		Short Term	Long Term
Cavity	SCREEN	NONE	NONE
Flat Terrain	SCREEN	ISCST	ISCST/ISCLT
Rolling Terrain	SCREEN	ISCST	ISCST/ISCLT
Complex Terrain	SCREEN/CTSCREEN/ VALLEY/COMPLEX I/ RTDM/ISCST	CTDMPLUS	CTDMPLUS

4.0 SCREENING

The data required to perform a simple screening analysis are stack height above ground, stack inside diameter, vertical exit velocity (see Section 2.5), exit temperature, maximum hourly emission rates, minimum distance from stack to property boundaries, and detailed information about any structure within 0.5 mile from each stack. If the facility is located in an area where terrain features are greater than 50% of the shortest stack, then a detailed topographic map is required to determine terrain elevations (see Sections 2.7 through 2.9).

4.1 CAVITY EFFECTS

The SCREEN model calculates 1-hour cavity concentrations using the worst-case building dimensions as determined in the GEP analysis (Section 2.1). Emission rates for other averaging periods can be calculated by using the conversion factors contained in Table 2.1 in Section 2.12. If the SCREEN model shows that the cavity concentration is $0.0 \mu\text{g}/\text{m}^3$ or that the cavity does not extend beyond the property line, then no further cavity calculations are necessary. If the cavity impacts exceed the appropriate pollutant standard, there are proposed refined modeling techniques available for estimating cavity concentrations. These refined modeling techniques may be accepted on a case by case basis. Please see section 5.1 of this document for details.

4.2 SIMPLE TERRAIN

If the terrain within 5 kilometers of the facility being modeled is less than 50% of shortest non-fugitive stack, the SCREEN model is the preferred model. However, the ISCST model in the screening mode is the recommended model to use for line sources which can be represented as a series of volume or area sources (see Section 2.3). Please refer to Section 2 for general modeling considerations.

4.2.1 SCREEN MODEL

The SCREEN model is an interactive model and is relatively simple to use. This model can be used for point, area, flare, and volume sources. The model has been designed for single source calculations. It was developed to perform all single source, short-term calculations found in the EPA's Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised, EPA-450/R-92-019. These calculations include estimating maximum ground-level concentrations and the distance to the maximum, incorporating building down-wash 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 using the methods in Section 2.2 to merge nearby stacks into a single representative stack and also by adding the maximum impacts for multiple runs. However, this method is very conservative and the user is encouraged to use the ISCST model for facilities with many emission points. Please refer to the SCREEN3 Model User's Guide, EPA-454/B-95-004 for further information on the SCREEN model.

4.2.1.1 PREPARING INPUT DATA

Prepare data for input in model - Note: All required inputs are metric:

Point Source:

Source type - Point Source (P)
 Emission Rate - maximum (g/s) (see Section 2.4)
 Stack height above ground (m)
 Stack inside diameter (m)
 Stack gas exit velocity (m/s) (see Section 2.5)
 Stack gas exit temperature (°K)
 Ambient temperature (°K) (Use default of 293°K if unknown)
 Urban/Rural option (Usually Rural) (See Section 2.6)
 Building Height, Width, and Length (m) Use worse case dimensions or building dimensions that result in the largest GEP height for the stack
 (See section 2.1 and Section 4.4.1)
 Receptor height above ground - flagpole receptors (Usually 0)
 Distance from the stack to the nearest plant boundary (m)

Flare:

Source type - Flare (F)
 Emission rate (g/s)
 Flare stack height above ground (m)
 Total heat release rate (cal/s)
 Receptor height above ground - flagpole receptors (Usually 0)
 Urban/Rural option (Usually Rural) (See Section 2.6)
 Distance from the stack to the nearest plant boundary (m)

Area Source:

Source type - Area (A)

Emission rate (g/s per square meter) Note: Divide emissions in g/s by the total area of the area source

Source release height (m)

Length and width of the rectangular area (m)

Receptor height above ground - flagpole receptors (Usually 0)

Urban/Rural option (Usually Rural) (See Section 2.6)

Distance from the stack to the nearest plant boundary (m)

Volume Source:

Source Type - Volume (V)

Emission rate (g/s)

Source release height (m)

Initial lateral dimension (σ_{y0}) of volume (m)

All sources:

σ_{y0} = length of side (m) divided by 4.3

Initial vertical dimension (σ_{z0}) of volume (m)

Surface based source:

σ_{z0} = vertical dimension of source (m) divided by 2.15

Elevated source on or adjacent to a building:

σ_{z0} = building height (m) divided by 2.15

Elevated source not on or adjacent to a building:

σ_{z0} = vertical dimension of source (m) divided by 4.3

Receptor height above ground - flagpole receptors (Usually 0)

Urban/Rural option (Usually Rural) (See Section 2.6)

Distance from the stack to the nearest plant boundary (m)

4.2.1.2 MODEL EXECUTION CONSIDERATIONS

Run the SCREEN model - Keep in mind the following:

- (1) Source Type - P (point), F (flare), A (area), or V (volume)
- (2) Use 293°K for the ambient air temperature.
- (3) Enter zero for receptor height above ground unless elevated impacts (e.g. air intakes, windows, balconies, etc.) on nearby buildings, bridges, fire towers, etc. are being considered.
- (4) Urban / Rural Option - Use Rural (2) for most locations in the South Carolina (see Section 2.6).

- (5) Enter Y(es) when asked whether to consider building downwash. Use the building information gathered for each stack.
- (6) Answer N(o) to Complex Terrain question unless there is terrain within 5 kilometers of the facility that is higher than the shortest stack for the pollutant being considered. If there is complex terrain see the complex terrain section (Section 4.3) for instructions in modeling this type of terrain.
- (7) Answer N(o) to "Simple Terrain Above Stack Base" question unless terrain within 5 kilometers of the source exceeds 50% of the stack height. However, if there is terrain that falls into this category then this section should be used to evaluate all terrain areas that fit into this category.
- (8) Use Full Meteorology (All Stabilities & Wind Speeds). Exceptions to this may occur on a case-by-case basis (e.g. for daylight operations only).
- (9) Use the automated receptor array. Begin with the nearest property line and extend outward to ensure that the maximum ambient concentration is calculated (see Section 2.10). Make sure that you use discrete distances to consider property not owned by the plant such as roads and railroad tracks.
- (10) Do not calculate fumigation concentrations unless source is within 3 km of the ocean.
- (11) Use discrete receptors to calculate concentrations at nearby critical areas (i.e. schools, churches, residences, etc.).

The impacts predicted by the SCREEN model are for a 1-hour averaging period (except for complex terrain, which predicts a 24-hour average impact). Use the conversion factors discussed in Section 2.12 to convert to averaging periods that correlate with applicable standards. Please review the Screening Analysis Example in Section 4.4 for further information on how to use this model.

4.2.2 INDUSTRIAL SOURCE COMPLEX SHORT TERM (ISCST) MODEL

The User's Guide for the Industrial Source Complex (ISC3) Dispersion Models (EPA-454/B-95-003a) should be used to ensure proper use the ISCST model. The ISCST model in the screening mode uses what are known as "worst-case" meteorological conditions. These meteorological conditions are listed below in Table 4.1.

Table 4.1 Worst-Case Meteorological Data for the ISCST Model

Stability Class	Wind Speed (m/s)	Mixing Height (m)
A	1, 1.5, 2, 2.5, 3	

B	1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5	320 times Wind Speed ^a
C	1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 8, 10	
D	1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 8, 10, 15, 20	
E	1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5	10000 ^a
F	1, 1.5, 2, 2.5, 3, 3.5, 4	10000 ^a
Temp = 293°K; Wind Direction along the line of receptors for each hour.		

- a For plumes higher than the estimated mixing height, the mixing height should be set to plume height plus 1 meter.

The wind direction chosen can have a significant impact on the maximum impact predicted by the ISCST model due to the relationship between the sources being modeled as well as the relationship of the sources to the property boundary. In order to insure that the highest ambient impact is found with this model, the wind direction should be rotated every hour a minimum of ten degrees (from 10 to 360 degrees), and care should be exercised when choosing a receptor grid. Please note that the Bureau has a screening meteorological data set for use with the ISCST model. Please contact the Bureau for additional information on this meteorological data set.

4.2.2.1 POINT SOURCES

- (1) Determine "worst-case" building dimensions to input into the model (see Section 2.1). Use the building height as determined in Section 2.1 but use the following EPA guidance shown in Table 4.2 to determine the proper building dimensions to input into the ISCST model. For sources that have stacks and plume rise that are less than 1.5 times the height of the critical building that was found in Section 2.1, the ISCST model uses the Schulman-Scire building wake effects algorithms. The ISCST model requires the input of 36 direction specific building dimensions for both the Schulman-Scire and Huber-Snyder building wake effects algorithms. Unless a comprehensive analysis is used to find the critical dimensions for each 10 degree segment, input the critical building dimensions found above for each of the 36 directions (building dimensions are the same for each direction). Note: There are programs available from US EPA that aid in this analysis.

Table 4.2 ISCST "Worst-Case" Building Dimensions

Building Type	Building Length = Building Width (for ISCST Input)
---------------	---

Squat	(Building Height \leq Maximum Projected Building Width)	Lesser of Minimum Projected Width or Building Height
Very Squat	(Minimum Projected Width > 5 times the Building Height)	Minimum Projected Width
Tall	(Building Height > Maximum Projected Width)	Maximum Projected Width

- (2) If you are modeling more than one source, place them all at the center of the receptor grid. Place receptors downwind along a single radial with the first receptor placed at the nearest property line. See Section 2.10 for further information on receptor placement.
- (3) Use proper settings for the ISCST Model. The settings that are changed for running the ISCST model in a screening mode are summarized in Table 4.3. This table is not an inclusive list of all commands needed to run ISCST; this table only contains the commands that have a different setting from refined modeling. Please see chapter 2 in Volume I of the User's Guide for the Industrial Source Complex (ISC3) Dispersion Models for further information.

Table 4.3 ISCST Model Input Changes for Screening Purposes Only

Model Input	PATHWAY	KEYWORD	PARAMETER
Compute Avg. Concentration for Hourly (1 hr) Time Period.	CO	AVERTIME	1
Program Calculates Final Plume Rise Only (No)	CO	MODELOPT	GRDRIS

Regulatory Default Option Chosen (No)	Screening Only	Screening Only	Screening Only
Height Above Ground at which Wind Speed is Measured	ME	ANEMHGT	10 meters

The impacts, calculated by the ISCST model using the "worst-case" meteorological conditions, are for a 1-hour averaging period. Use the conversion factors discussed in Section 2.12 to convert to averaging periods that correlate with applicable standards.

4.2.2.2 VOLUME AND LINE SOURCES

The ISC volume source model is used to simulate the effects of emissions from sources such as building roof monitors and line sources (i.e. conveyor belts and rail lines) along with other sources that have an initial dispersion prior to release. Volume sources are discussed in Section 1.2 of Volume II of the ISC user's guide. It should be noted that the north-south and east-west dimensions must be the same. Line sources can be represented by either a series of volume sources or a series of area sources. Line sources that are located close to or on the ground should be modeled as a series of area sources; line sources that are located above the ground should be modeled as a series of volume sources. For line sources that are made of volume sources use the instructions below; for line sources made up of area sources see Section 4.2.2.3 for instruction.

- (1) 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.
- (2) Assign the emission height (H) the value representing the height above ground level of the center of the volume source.
- (3) Find Initial Lateral Dimensions (σ_{y0}):
 - (a) Single Volume Source:

$$\sigma_{y0} = \text{length of a side (square) divided by 4.3}$$
 - (b) Line Source Represented by Adjacent Volume Sources:

$$\sigma_{y0} = \text{length of a side (square) divided by 2.15}$$
 - (c) Line Source Represented by Separated Volume Sources:

$$\sigma_{y0} = \text{center to center distance between volume}$$

sources divided by 2.15

- (4) Find Initial Vertical Dimensions (σ_{z0}):
 - (a) Surface-Based Source ($H \approx 0$):
 $\sigma_{z0} =$ vertical dimensions of source divided by 2.15
 - (b) Elevated Source ($H > 0$) on or Adjacent to a Building:
 $\sigma_{z0} =$ building height divided by 2.15
 - (c) Elevated Source ($H > 0$) not on or Adjacent to a Building:
 $\sigma_{z0} =$ vertical dimension of source divided by 4.3
- (5) Emission Rate (Q) is expressed in g/sec.
- (6) Refer to the Point Source Section (Section 4.2.2.1) for the remainder of the ISCST Screening instructions. Note that building dimension data is not required for volume sources.

4.2.2.3 AREA SOURCES

The ISCST area source model is used to simulate the effects of emissions from sources such as storage piles, slag dumps, and other sources that have low level or ground level releases. Area sources are discussed in Section 1.2 of Volume II of the ISC user's guide. Individual area sources may be represented as rectangles with aspect ratios (length/width) of up to 10 to 1. In addition, the rectangles may be rotated relative to a north-south and east-west orientation. An irregular shape can be simulated by dividing the area source into several rectangular area sources that they approximate the geometry of the area. Area sources may also be used to represent line sources that are located at or near ground level.

- (1) Determine the number and location of area sources to use to properly model the emission source in question. Remember that each area source must be a rectangle with an aspect ratio of less than 10 to 1.
- (2) Assign the emission height (H) the value representing the physical height of the source of emissions.
- (3) Find Initial Dimensions and Orientation:
 - (a) $X_{init} =$ length of X side of the area (in the east-west direction if Angle is 0 degrees)
 - (b) $Y_{init} =$ length of Y side of the area (in the north-south direction if Angle is 0 degrees) (optional -- not required if the area is a square)

- (c) Angle = orientation angle for the rectangular area in degrees from North, measured positive in the clockwise direction (optional -- not required if the X side is located in the east-west direction)
- (4) The emission rate for the area source (Q) is expressed as g/sec/square meter.
- (5) Refer to Section 4.2.2.1 above for the remainder of the ISCST Screening instructions. Note that building dimension data is not required for area sources.

4.3 COMPLEX TERRAIN

If the facility is located in an area where terrain features within 5 kilometers of the facility exceed the stack height of the shortest, non-fugitive, on-site stack, then complex terrain modeling is required in addition to the modeling in the simple / intermediate terrain situations previously discussed. Consider terrain features out to 20 kilometers for stack heights of 50 meters or greater. Use the SCREEN, COMPLEX I in the Valley screening mode, or the Valley model for complex terrain modeling. The latest version of ISCST incorporates the COMPLEX I algorithms and may also be used in complex terrain modeling. The following sections describe the procedures that should be used for SCREEN and ISCST.

4.3.1 SCREEN MODEL

- (1) Determine the final stable plume height (H_f) in meters by running the SCREEN model for each stack and referring to the output produced.
- (2) Find the elevation above sea level (H_b) in meters for each stack base by using the appropriate USGS map.
- (3) Compute the final critical terrain feature height (Z_{fc}) for each emission point ($Z_{fc} = (H_b + H_f) - 10$). Note that all elevations are in meters for this calculation. If the critical terrain feature height (Z_{fc}) is less than the stack height, then set $Z_{fc} = \text{stack height (meters)} + 1 \text{ meter}$.
- (4) Using the USGS map in step 2, find the nearest location of Z_{fc} . Calculate the distance from each stack to this terrain feature (X_c).
- (5) Model each source for each critical terrain feature. Model each source at the critical terrain height for all other sources and sum each pollutant concentration for each critical terrain feature.

- (6) The SCREEN model calculates two complex terrain concentrations. One is the maximum complex terrain concentration and the other is the maximum simple terrain concentration. The larger of the two 24-hr concentrations is identified by the model. Convert the 24-hr concentrations to averaging periods that correlate with applicable standards by using Table 2.1 in Section 2.12.

4.3.2 ISCST MODEL

The current version of the ISCST model contains the COMPLEX I algorithm for evaluating impacts in complex terrain. Use of the ISCST model will allow multiple sources to be considered in the modeling analysis.

4.4 SCREENING ANALYSIS EXAMPLE

The XYZ Company which is located in Lancaster County has three process stacks and a 6×10^6 BTU/hr boiler fired primarily with natural gas. The boiler, built in 1982, uses No. 2 fuel oil as the backup or secondary fuel. Methyl ethyl ketone (MEK), benzene, and benzyl chloride are emitted from the process stacks. The boiler emits total suspended particulate (TSP), particulate matter that is 10 microns or less in size (PM_{10}), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO). These emissions are summarized in Table 4.4. Tables 4.5 and 4.6 give the stack parameters for the four stacks at the facility. The plot plan for the facility is shown in Figure 4.1. The XYZ Company only operates a maximum of two shifts or 16 hours per day, but they are unwilling to take a permit condition limiting the hours per day that they can operate.

The Minor Source PSD Baseline Date for Lancaster County has been set for PM_{10} and SO_2 . A listing of Counties and Minor Source Baseline Dates can be found in Table B-1 located in Appendix B. The PSD Minor Source Baseline Date was set on 12/1/81 for PM_{10} and SO_2 . However, it has not been set for NO_2 . Since the boiler was built after the PSD Minor Source Baseline Date for PM_{10} and SO_2 was set, then the PM_{10} and SO_2 emissions from all sources at the XYZ Company built after this date must be compared to the Class II PSD Increments which can be found in Standard No. 7 as well as in Appendix A.

A USGS map of the area surrounding the XYZ Company reveals that there are terrain elevations within five kilometers of the facility that exceed stack top elevations. Therefore, the analysis will consist of screening in both complex and simple terrain. This facility was modeled using the SCREEN model. The printouts of the modeling runs can be found in Appendix C. Please note that each stack was modeled at an emission rate of 1 g/s, and the maximum ambient impact was obtained by multiplying the model result by the actual emission rate and the proper averaging period conversion factor found in Table 2.1.

4.4.1 GEP ANALYSIS

See Figure 4.1 for the plot plan of this facility, which shows the relationship between the four emission points and the building. Please note that this drawing is not to scale. The GEP calculations for each structure are shown in Table 4.7. Please note that for any given stack the building (structure) with the largest GEP calculation which influences that stack is identified as the critical building for it. The critical building (structure) for each stack is listed in Table 4.6 with the rest of the stack parameters.

4.4.2 CAVITY EFFECTS

The concentrations resulting from each stack in the cavity area of all critical buildings were estimated using the SCREEN model. The modeling input parameters are shown in Tables 4.4 and 4.6. The cavity results are shown in Table 4.7.

4.4.3 SIMPLE TERRAIN

The SCREEN model was used to calculate ambient concentrations in the vicinity of the XYZ Company. All terrain elevations in the immediate vicinity of the facility were less than 50% of the shortest non-fugitive stack height and therefore no receptor elevations were used except as noted in the analysis. However, all stacks were modeled for simple as well as complex terrain. The modeling input parameters used are shown in Tables 4.4 and 4.6. The results are given in Table 4.9.

4.4.4 COMPLEX TERRAIN

Examination of the USGS map indicated that there was terrain that exceeded the stack heights of all stacks within five kilometers of the facility. Section 4.3.1 describes the method of determining the critical terrain feature height to use in the complex terrain screening analysis. For the spray booth and storage tank stacks, it is noted that the critical terrain feature height (Z_{fc}) calculated is less than the elevation at the top of their stacks. Therefore, Z_{fc} was calculated by adding 1 meter to the stack height plus the stack base elevation height ($Z_{fc} = 86\text{m} + 15\text{m} + 1\text{m} = 102\text{m}$). The USGS map was examined to locate the nearest location of Z_{fc} . It was noted that a terrain height of 102 meters occurred at a distance of 200 meters from the stack (See Table 4.8). Values of Z_{fc} for Stack 3 and Stack 4 were also calculated using the methods discussed in Section 4.3.1 ($Z_{fc}(3) = 86\text{m} + 63.1\text{m} - 10\text{m} = 139\text{m}$ & $Z_{fc}(4) = 86\text{m} + 44.9\text{m} - 10\text{m} = 121\text{m}$). The USGS map was examined to locate the nearest location of $Z_{fc}(3)$ and $Z_{fc}(4)$. It was noted that a terrain elevation of 139 meters occurred at a distance of 3500 meters from Stack 3 and a terrain elevation of 121 meters occurred at a distance of 2500 meters from Stack 4 (See Table 4.8). The SCREEN model was initially used to calculate the final plume rise for each stack. The final plume rise is required to calculate the critical terrain heights calculated in Section 4.3.1. The final plume rise for each stack is shown in Table 4.8. The calculations in the vicinity of the XYZ Company where terrain exceeded the stack top elevations were calculated using the complex terrain section of the SCREEN model. The results are shown in Table 4.9.

4.4.5 COMPARISON WITH STANDARDS

The estimated ambient concentrations from the various emissions of XYZ Company must be compared with various standards to determine if they are in compliance with them. This comparison is summarized in Table 4.10. These standards have various averaging periods. However, the SCREEN model predicts 1-hour concentrations except for complex terrain modeling which calculates a 24-hour averaging period. Table 2.1 should be used to convert the 1-hour concentrations found with simple terrain and the 24-hour complex terrain concentrations to other averaging periods. For the multiple stacks used for MEK emissions in this example, the total impact of MEK was found by summing the concentration for each of the three stacks emitting MEK in the simple terrain, complex terrain, and cavity regions to obtain a grand total in each. Also, for each pollutant modeled there were three concentrations determined (simple terrain, complex terrain and cavity). The highest of the three concentrations is the maximum impact for that pollutant and is then compared against the appropriate standard for it. Please note; however, if the maximum concentration occurred in the cavity region then refer to Section 2.13.

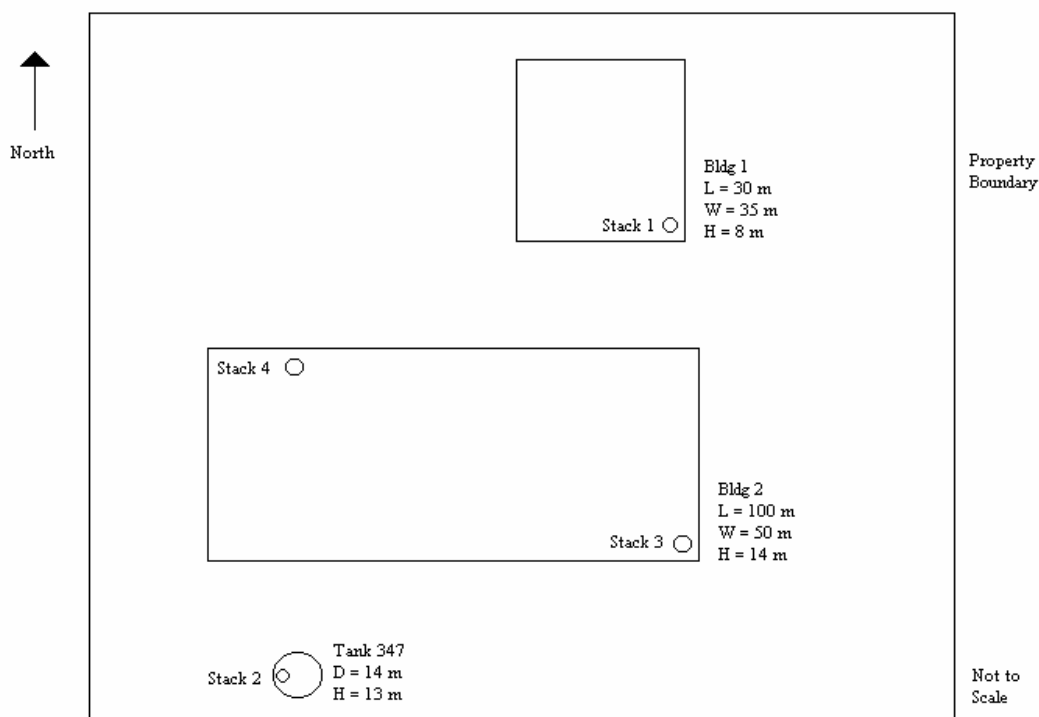


Figure 4.1 XYZ Property Layout

Table 4.4 Emission Rates for the XYZ Company

Pollutant:	Maximum Emission Rates			
	Stack 1	Stack 2	Stack 3	Stack 4
	lbs/hr	lbs/hr	lbs/hr	lbs/hr
MEK	8 ^a (1.01 g/s)	1 ^b (0.126 g/s)	10 ^a (1.26 g/s)	
Benzene			0.2 ^a (0.0252 g/s)	
Benzyl Chloride			1.2 ^a (0.151 g/s)	
TSP				3.6 ^c (0.454 g/s)
PM ₁₀				0.09 ^d (0.011 g/s)
SO ₂				21.0 ^e (2.65 g/s)
NO ₂				0.9 ^d (0.113 g/s)
CO				0.2 ^d (0.0252 g/s)

a Calculated using mass balance.

b Calculated from AP-42 emission factors for storage tanks.

c A Particulate emission rate of 0.6 lb/10⁶ BTU (3.6 lb/hr) is allowed under State regulations for this boiler.

d Calculated from AP-42 emission factors for boilers fired with No. 2 fuel oil.

e An SO₂ emission rate of 3.5 lb/10⁶ BTU (21 lb/hr) is allowed under State regulations for this boiler.

Table 4.5 Stack Descriptions for the XYZ Company

Stack #	Source Description	Type ^a	Stack Dir ^b	Raincap ^c
1	Spray Booth	Point	Hor.	No
2	Storage Tank	Point	Vert.	No
3	Process	Point	Vert.	No
4	Boiler	Point	Vert.	No

a Source Type (Point, Volume, or Area Source).

b Stack Direction (Vertical, Horizontal, or Downward). Non-vertical discharges should be adjusted (See Section 2.5).

c Does the stack have a raincap (Yes or No)? If the stack has a raincap then the exit velocity should be adjusted (See Section 2.5).

Table 4.6 XYZ Company Stack Parameters (Point Sources)

Stack Number		1	2	3	4
Stack Height (meters) ^a		15.0	15.0	25.0	25.0
Stack Diameter (meters) ^b		0.30	0.20	1.0	0.50
Stack Temperature (°Kelvin)		293.0	293.0	350.0	505.0
Stack Exit Velocity (m/sec)	Actual	10.0	0.1	23.0	5.1
	Use in modeling ^c	0.01	0.1	23.0	5.1
Building Height (meters)		14.0	13.0	14.0	14.0
Building Width (meters)		50.	14.	50.	50.
Building Length (meters)		100.	14.	100.	100.
UTM Coordinates (meters)	Horizontal (E)	531000	531000	531000	531000
	Vertical (N)	3830000	3830000	3830000	3830000
Distance to Nearest Property Boundary (meters)		40	30	60	35
Stack Base Elevation Above MSL ^d		282	282	282	282

- a Stack height above ground level.
b Stack inside diameter measured at point of discharge.
c Stack exit velocity of 0.01 m/sec used to account for non-vertical discharge from horizontal discharge and rain cap.
d MSL = mean sea level.

Table 4.7 XYZ Company GEP Analysis Results

Structure	Height (m)	Width (m)	Length (m)	GEP (m)	Region of Influence (5L ^a ,m)	Stacks Within 5L ^a
Building # 1	8	30	35	20 ^b	40	1
Building # 2	14	50	100	35 ^c	70	1,3,4
Storage Tank	13	14	14	32.5 ^d	65	2

a See Section 2.1.

b $GEP = 8 + (1.5 \times 8)$.

c $GEP = 14 + (1.5 \times 14)$.

d $GEP = 13 + (1.5 \times 13)$.

Table 4.8 Complex Terrain Modeling Variables

Stack No.	Final Plume Rise (m) (H _f)	Stack Base Elev. (m) (H _b)	Critical Terrain Elev. (m) (Z _{fc})	Distance to Z _{fc} (m)
1	14.1	86	102	200
2	14.4	86	102	200
3	63.1	86	139	3450
4	44.9	86	121	2500

Table 4.9 Screening Model Results - Maximum Modeled Concentration

Pollutant/ Stack No.	Averaging Period	Simple Terrain ($\mu\text{g}/\text{m}^3$)	Cavity ($\mu\text{g}/\text{m}^3$)	Complex Terrain ($\mu\text{g}/\text{m}^3$)
MEK/Stack 1	24 hrs	739.9	192.0	12.7
MEK/Stack 2	24 hrs	57.6	184.6	1.6
MEK/Stack 3	24 hrs	50.3 ^a	0.0	50.3 ^b
MEK/Total	24 hrs	847.8	376.6	64.6
Benzene/ Stack 3	24 hrs	1.0 ^a	0.0	0.2
Benzyl Chloride/St. 3	24 hrs	6.0 ^a	0.0	1.3
TSP/Stack 4	24 hrs	48.5	0.0	11.7
	Annual	6.1	0.0	2.3
PM ₁₀ /Stack 4	24 hrs	1.2	0.0	0.3
	Annual	0.2	0.0	0.1
SO ₂ /Stack 4	3 hrs	636.8	0.0	273.9
	24 hrs	282.9	0.0	68.3
	Annual	35.6	0.0	13.4
NO ₂ /Stack 4	Annual	1.5	0.0	0.6
CO/Stack 4	1 hour	6.7	0.0	2.6
	8 hrs	4.7	0.0	1.8

a The highest simple terrain value was found at the critical terrain feature located 200 meters from the facility. A receptor elevation of 15 meters was used to evaluate this feature since it has an elevation above the stack base which was greater than 50% of the shortest non-fugitive stack height (See Section 2.9).

b Stack No. 3 was evaluated at the critical terrain feature in footnote a. This feature was complex terrain for Stacks 1 & 2 but not 3. It was modeled as simple terrain with a receptor elevation of 15 meters.

Table 4.10 Comparison with Standards

Pollutant	Avg. Time	Max Modeled Conc. ($\mu\text{g}/\text{m}^3$)	Back-ground Conc. ^a ($\mu\text{g}/\text{m}^3$)	Total Conc. ($\mu\text{g}/\text{m}^3$)	Allowable Conc. ($\mu\text{g}/\text{m}^3$)	Shows Compliance?
S.C. Regulation No. 62.5 - Standard No. 8 – Toxic Air Pollutants:						
MEK	24 hrs	847.8	-	847.8	14750	Yes
Benzene	24 hrs	1.0	-	1.0	150	Yes
Benzyl Chloride	24 hrs	6.0	-	6.0	25	Yes
S.C. Regulation No. 62.5 - Standard No. 2 - Ambient Air Quality Standards:						
TSP	Annual	6.1	49 ^b	55.1	75	Yes
PM ₁₀	24 hrs	1.2	56 ^b	57.2	150	Yes
	Annual	0.2	34 ^b	34.2	50	Yes
SO ₂	3 hrs	636.8	40 ^b	676.8	1300	Yes
	24 hrs	282.9	18 ^b	300.9	365	Yes
	Annual	35.6	4 ^b	39.6	80	Yes
NO ₂	Annual	1.5	13.2 ^b	14.7	100	Yes
CO	1 hour	6.7	9700 ^b	9707	40000	Yes
	8 hrs	4.7	6600 ^b	6605	10000	Yes
S.C. Regulation 62.5 - Standard No. 7 – Prevention of Significant Deterioration:						
PM ₁₀	24 hrs	1.2	-	1.2	30	Yes
PM ₁₀	Annual	0.2	-	0.2	17	Yes
SO ₂	3 hrs	636.8	-	636.8	512	No
SO ₂	24 hrs	282.9	-	282.9	91	No
SO ₂	Annual	35.6	-	35.6	20	No

a Background values to account for other nearby sources should be used when determining compliance with Standard No. 2 - Ambient Air Quality Standards. These values are provided by the Bureau.

b Background data provided by the Bureau.

There are three different standards that the modeling results from the XYZ Company must be compared against for this example. First, MEK, benzene, and benzyl chloride are listed under S.C. Regulation 62.5, Standard No. 8 for Toxic Air emissions. Their maximum predicted off-site ambient

concentrations for a 24-hour averaging period were compared with the maximum allowable ambient concentration for each pollutant found in the Standard. A copy of Standard No. 8 appears in Appendix A. Each of these pollutants complied with their applicable standards.

Secondly, the ambient impact of TSP, PM₁₀, SO₂, NO₂, and CO from the XYZ Company are covered under S.C. Regulation 62.5, Standard No. 2, Ambient Air Quality Standards. A copy of this standard appears in Appendix A. Each of the pollutants was compared with the applicable standard to determine compliance with it. Please note that a background value should be added to the modeled concentration for each averaging period for each pollutant listed under this standard. The background values can be found in the Bureau of Air Quality's Annual Report and on the Bureau's web site, and they are used to account for the impact from other sources in the area. For this example, the sources were in compliance with each of these standards.

The third standard that applies to this example is S.C. Regulation No. 62.5, Standard No. 7, Prevention of Significant Deterioration (PSD). There is a great deal of misunderstanding concerning this standard. Many people falsely think that this standard applies only to major source construction for which a PSD construction permit would be required. While this is the main purpose of the Standard, an often overlooked portion of the standard deals with minor sources in counties for which the Minor Source Baseline Date for PM₁₀, SO₂, or NO₂ has been set. In many counties the Minor Source Baseline Date has not been set for PM₁₀, SO₂, or NO₂. In these cases, this standard does not apply. However, if the Minor Source Baseline Date has been set for either PM₁₀, SO₂, or NO₂ in the county where a facility is located, then all sources built after the baseline date must show compliance with this standard for the applicable pollutant(s). PM₁₀, SO₂, and NO₂ each have their own Minor Source Baseline Date in each county. One should determine compliance with the standards only for the pollutants that have the PSD Minor Source Baseline Date set. For more information on the minor source baseline date, please see S.C. Regulation No. 62.5, Standard No. 7, part M.

In our example for XYZ Company, which is located in Lancaster County, Table B-1 in Appendix B indicates that the Minor Source Baseline Date for Lancaster County was set for PM₁₀ (12/1/81) and SO₂ (12/1/81). However, it was not set for NO₂. Therefore, the XYZ Company had to determine compliance with Standard No. 7 for PM₁₀ and SO₂ emissions. Compliance is determined by modeling all sources of PM₁₀ and SO₂ at the facility that have been constructed after the Baseline Date was set (12/1/81 in our example). For the XYZ Company the boiler is the only emission source of either PM₁₀ or SO₂ that was constructed after 12/1/81 and therefore was the only emission source that had to determine compliance with Standard No. 7. It should be noted, if there were additional sources of PM₁₀ or SO₂ constructed prior to 12/1/81 at the XYZ Company, then these sources would not be included in the determination of compliance with Standard No. 7. However, all PM₁₀, SO₂, and NO₂ sources should be used to determine compliance with Standard No. 2.

Compliance with Standard No. 7 for PM₁₀ and SO₂ was determined by comparing the modeled maximum concentration for each with the ambient standards for the Class II increments which can be found in Appendix A. The Class I increments only apply to areas that were given the Class I designation by Congress. The only Class I area in South Carolina is the Cape Romain Wildlife Area which is located on the coast between Charleston and Georgetown. Standard No. 7 also has increments for Class III areas, but there are no Class III areas in South Carolina. Therefore, these increments were not included in the listing found in Appendix A. If a facility meets all of the

standards for the various pollutants, but are close to a standard, then the Bureau reserves the right to require additional modeling which would include other nearby sources identified by the Bureau to determine if the interaction of sources in that area can achieve the ambient standards found in Standard No. 7. This additional modeling requirement is determined on a case-by-case basis by the Bureau .

In our example, the SO₂ 3 hour, 24 hour, and annual averages all exceeded their allowable values. This has to be corrected because a modeled exceedance can not be permitted. In this case the correction is simple. The emission rates for SO₂ (21 lb/hr) used in the model were based on the State allowable emission rates for this source found in Standard No. 1. The actual maximum emission rates calculated using the AP-42 emission factors for a boiler burning No. 2 fuel oil which contains a maximum of 0.5% sulfur (maximum allowed for No. 2 fuel oil by ASTM specifications) are 3.04 lb/hr for SO₂. Since the actual emission rates for SO₂ are substantially lower than the modeled emission rates, the XYZ Company can demonstrate compliance with Standard No. 7 by requesting that the maximum AP-42 emission rates be used as allowable emission rates for the boiler on the air operating permit for their facility instead of the State allowable emission rates that were previously used.

If a pollutant from a facility exceeds a standard then several possible alternatives are suggested. One alternative would be to repeat the process with refined modeling, which is discussed in Section 5, to obtain more realistic estimates of off-site concentrations. Refined modeling would be required to address cavity effects, simple terrain, and complex terrain. Another alternative would be to address the problems caused from poor stack design (short stacks relative to nearby structure and problems caused by horizontal (non-vertical) discharges and raincaps) which can cause high modeled concentrations due to down-wash and cavity effects that these poor designs cause. Still another alternative would involve lowering the emissions emitted to the air by process changes and/or the installation of control equipment.

5.0 REFINED MODELING

Refined modeling is used in two cases: complex sources with many emission points in which screening techniques are not practical, and sources that did not pass the screening procedures described in Section 4.0.

5.1 CAVITY EFFECTS

At the present time, ISC-PRIME is up for recommendation as a refined model that can calculate cavity effects. This model will be accepted on a case by case method for cavity concentration calculation. If concentrations calculated by Section 4.1 and ISC-PRIME are not acceptable, then emission controls or stack modifications may be necessary to reduce these cavity concentrations. However, a fluid modeling demonstration or a field study may be used to demonstrate compliance with the applicable standard. If these options are used, the Bureau must give prior approval of the plan and method proposed.

If the 3-hour, 8-hour, 24-hour, or annual average concentration is the period of concern the following procedure can be performed to obtain a more accurate estimate of the concentrations in the cavity region:

- (1) Follow the procedures described in the following section. Use the ISCST model to estimate the maximum 1-hour plus other averaging periods of concern (i.e. 3-hour, 8-hour, 24-hour, and annual average).
- (2) Divide the maximum concentration for the period of concern (i.e. 3-hour, 8-hour, 24-hour, and annual average) by the maximum 1-hour concentration to obtain a factor for the averaging period of concern.
- (3) Multiply the factor obtained in Step 2 by the 1-hour cavity concentration estimated in Section 4.1 that is obtained using the SCREEN model. This will give a more accurate cavity concentration for the averaging period that was analyzed by Steps 1 through 3.

5.2 SIMPLE TERRAIN

5.2.1 ISCST

The latest version of the ISCST model is the preferred model for refined modeling for all averaging periods, including annual average.

5.2.1.1 METEOROLOGICAL DATA

The ISCST model requires the use of actual meteorological data from an appropriate National Weather Station (NWS) or on site data. Refer to Table 5.1 for the appropriate NWS to use for modeling in South Carolina. Table 5.2 gives the anemometer heights for the NWS listed in Table 5.1. Use these anemometer heights instead of the default 10-meter height that the model assumes. If modeling with the most recent year of meteorological data shows the maximum concentrations are less than 50% of the ambient standard for all averaging periods, then no further modeling is necessary. This test is performed before the background concentrations are added. If the modeled concentrations are greater than 50% of the ambient standard, then use five consecutive years of meteorological data in the modeling analysis. **Please note that the maximum modeled concentration should be added to a background value for the pollutants listed in Standard No. 2 (TSP, PM₁₀, SO₂, NO₂, CO, and Lead) prior to comparison with Standard No. 2.**

5.2.1.2 RECEPTORS

Either a polar or rectangular coordinate receptor grid must be used in the coarse or refined grid modeling. Terrain features should be included if the terrain feature has elevations that exceed stack base elevations plus 50% of the shortest non-fugitive stack height being modeled (See Section 2.9). The receptor grid must show the location of the maximum off-property impact.

5.2.1.2.1 COARSE GRID ARRAY (Polar)

The polar coarse grid consists of "rings" of receptors, placed along 36 directional spokes. The spokes start at 10° and go clockwise in 10° increments up to 360 degrees. The first receptor ring in the coarse grid array is determined by either of the following approaches. The first approach is to run the SCREEN model for each stack in order to identify the distance to the highest estimated concentration for each combination of atmospheric stability and wind speed. Execute the model separately for each stability class and identify the distance to the highest concentration. The smallest of these distances for any of these stacks modeled is the first ring in the coarse grid receptor array. Select eight additional ring distances by multiplying the first receptor distance by 1.3, 1.8, 2.3, 3.0, 3.9, 4.2, 6.8, and 9.0. The second approach is to choose the first receptor ring beginning with the nearest location of the contiguous property line. Additional rings should be placed out 100, 250, and 500 meters from the first ring, and also at 1000, 2000, 3000, 4000, and 5000 meters from the center of the grid. These rings should extend beyond 5000 meters for sources with tall stacks or cases where the maximum concentrations occur on the 5000-meter ring.

Table 5.1 National Weather Service Data to Use with ISCST

County	Data Set	County	Data Set
Abbeville	E	Greenwood	D
Aiken	A	Hampton	F
Allendale	A	Horry	G
Anderson	E	Jasper	F
Bamberg	A	Kershaw	B ^b
Barnwell	A	Lancaster	B
Beaufort	F	Laurens	E
Berkeley	C	Lee	D
Calhoun	D	Lexington	D
Charleston	C	McCormick	A
Cherokee	B	Marion	G
Chester	B	Marlboro	D
Chesterfield	B	Newberry	D
Clarendon	D	Oconee	E
Colleton	C	Orangeburg	D
Darlington	D	Pickens	E
Dillon	D	Richland	D
Dorchester	C	Saluda	D
Edgefield	A	Spartanburg	E
Fairfield	B	Sumter	D
Florence	D	Union	B
Georgetown	C	Williamsburg	C
Greenville	E	York	B

- a
- A - Augusta/Athens 1987-1991
 - B - Charlotte/Greensboro 1987-1991
 - C - Charleston/Charleston 1987-1991
 - D - Columbia/Athens 1987-1991
 - E - Greenville/Athens 1987-1991
 - F - Savannah/Charleston 1987-1991
 - G - Wilmington/Charleston 1987-1991
- b
- Areas in the southern half of Kershaw County should use Columbia / Athens meteorological Data.

Table 5.2 Anemometer Heights & Station ID Numbers

Data Set Number	Surface Station Name / ID Number	Upper Air Station Name / ID Number	Anemometer Height (m)
A	Augusta, GA / 03820	Athens, GA / 13873	6.1
B	Charlotte, NC / 13881	Greensboro, NC / 13723	10.0
C	Charleston, SC / 13880	Charleston, SC / 13880	6.1
D	Columbia, SC / 13883	Athens, GA / 13873	6.1
E	Greenville, SC / 03870	Athens, GA / 13873	7.0
F	Savannah, GA / 03822	Charleston, SC / 13880	9.1
G	Wilmington, NC / 13748	Charleston, SC / 13880	10.0

Place discrete receptors in addition to the ones placed above either at the property boundary along each 10° arc for polar discrete receptors or every 50 meters along the property boundary for rectangular discrete receptors. Place additional discrete receptors on property not owned by the facility such as train tracks (except rail spurs serving only the facility), public roadways, and rivers that traverse the property as well as non-contiguous plant property located beyond these areas. Generally, smaller sources with short stacks do not require receptors to be placed beyond 1 kilometer.

5.2.1.2.2 COARSE GRID ARRAY (Rectangular)

Begin the receptor grid with the nearest location of the contiguous property line. Place rectangular discrete receptors along the property boundary spaced no more than 50 meters apart. Place additional discrete receptors on property not owned by the facility such as train tracks (except rail spurs serving only the facility), public roadways, and rivers that traverse the property as well as non-contiguous plant property located beyond these areas. Extend the receptor grid far enough to ensure the maximum concentration is calculated. Place receptors 100, 250, and 500 meters distance from the property line receptors at 100, 250, and 500 meters spacing, respectively, and at 1000 meter spacing starting at 1000 meters from the property line, extending out to 5000 meters. If modeling indicates that maximum concentrations occur at 5 kilometers, then modeling should be repeated with the receptor grid extending beyond 5 kilometers. Place additional receptors at terrain features. Generally, smaller sources with short stacks do not require receptors to be placed beyond 1 kilometer.

5.2.1.2.3 REFINED GRID ARRAY

After running the ISCST model with one year of the latest meteorological data using the coarse receptor grid, model a refined receptor grid with a 100 meter spacing around the receptors where the maximum concentrations occurred for each averaging period. Fill in the gaps in the coarse receptor grid with the refined 100-meter receptor grid. Since the location of modeled impacts can change due to different meteorological conditions, this step must be repeated for each year that is modeled.

5.2.1.3 MODEL OPTIONS

Table 5.3 shows the proper option settings to use for the ISCST model. These settings do not include the inputs used for source parameters or receptor grids. For further information on these settings please see the ISC User's Guide. Please note that some of the topics covered in Section 2 as well as topics covered in Section 4.2.2 are not repeated in this section. However, these sections should be referred to before using the ISCST model for a refined modeling analysis. Note that if deposition or chemical transformation is available for certain pollutants this information may be incorporated in the refined modeling analysis on a case-by-case basis. However, the Air Dispersion Modeling Section of the Bureau of Air Quality should be contacted and approval given before using this information in a modeling analysis.

Table 5.3 ISCST Model Input for Refined Modeling

Description	Pathway	Keyword	Parameter
Run title	CO	TITLEONE	(RUN IDENTIFIER)
Regulatory default option chosen	CO	MODELOPT	DFAULT
Calculate concentration	CO	MODELOPT	CONC
Rural-urban option	CO	MODELOPT	RURAL
Compute concentration for an averaging period	CO	AVERTIME	(AVERAGING PERIOD)
Type of pollutant to be modeled	CO	POLLUTID	(UP TO 8 CHAR)
Debug option chosen	CO	RUNORNOT	RUN NOT
Meteorological data input file	ME	INPUTFIL	(FILE NAME)
Height above ground at which wind speed is measured	ME	ANEMHGHT	(VALUE FROM TABLE 5.2)
Surface air data file	ME	SURFDATA	(STATION NUMBER, YEAR)
Upper air data file	ME	UAIRDATA	(STATION NUMBER, YEAR)
Print highest and second highest tables	OU	RECTABLE	(AVERAGING PERIOD) FIRST SECOND
Print maximum 50 tables	OU	MAXTABLE	(AVE PER) 50

5.3 COMPLEX TERRAIN

CTDMPLUS has been proposed by the EPA to be the refined complex terrain model. However, this model requires extensive data collection that cannot be summarized in this document. Before this model is used in a refined mode its use should be discussed with the Air Modeling Section of the Bureau of Air Quality.

5.4 COMPARISON TO STANDARDS

Compare the sum of the maximum predicted concentrations for each source and pollutant for each averaging period with the appropriate Standard (Standard No. 2 - Ambient Air Quality Standards, Standard No. 7 - Prevention of Significant Deterioration (for PSD and minor source increment consuming sources only), and Standard No. 8 - Toxic Air Pollutants). The appropriate portions of these standards are included in the appendix. If modeling with the most recent year of meteorological data shows the maximum concentrations are less than 50% of the ambient standard for all averaging periods, then no further modeling is necessary. If not, then the modeling must be redone using a five consecutive year set of meteorological data. **Please note that the maximum modeled concentration should be added to a background value for the pollutants listed in Standard No. 2 (TSP, PM₁₀, SO₂, NO₂, CO, and Lead) prior to comparison with Standard No. 2.**

6.0 REPORTING REQUIREMENTS

Modeling that is submitted to the Bureau of Air Quality should include a written discussion of the modeling project, the modeling technique(s) used, the results of the modeling analysis, and the modeling analysis. **Please note that for refined modeling the data and output files should be submitted in an IBM PC compatible format (3.5 inch floppy, CD-ROM) instead of sending printed files.** Each modeling submittal should include the items discussed below. Failure to provide these items may result in work on the application being delayed until the missing information is submitted.

6.1 EXECUTIVE SUMMARY

This summary should be an abstract of the results of the dispersion modeling analysis. It should include an explanation of why the modeling analysis is being submitted, such as an operating permit renewal, construction permit application, air toxic compliance demonstration, etc. There should also be a statement of whether or not compliance has been demonstrated. If compliance is not demonstrated, a plan must be submitted for attaining compliance.

6.2 PLANT DESCRIPTION

A description of the facility's processes should be included in this section. The operating schedule for the facility/equipment may be of need and should also be included. A key to abbreviations used to describe equipment should also be included.

Example: EV1SP = Evaporator Number 1, South plant

6.3 MODELING CONSIDERATIONS

This section should describe the methodology used in performing the dispersion analysis. Subjects to be covered should include GEP stack height analysis, merged stacks, downwash, horizontal discharges and rain caps, rural/urban classification, PSD minor source applicability, complex/intermediate/simple terrain, terrain elevations, receptor grid design and cavity effects. Include a scaled map that clearly shows all buildings (dimensions including building heights should be indicated), stack locations, and property boundaries. Also indicate the plant center and show either the Latitude / Longitude or UTM coordinates for each stack and an arrow indicating true north.

6.4 MODELING RESULTS SUMMARY

This should include summary tables of a type similar to those in Tables 6.1 through 6.6.

6.5 OUTPUT FILES

Include in this section SCREEN output files, and the ISCST output files for the years of highest concentration. The ISCST input files, building downwash files, point files, and output files should be included on a diskette.

6.6 CALCULATIONS

This section should include all de minimis and deferral calculations for air toxics. Also the calculations used with the SCREEN model and merging stacks should be included. It is very important to include the calculations for emission rates. Include all assumptions used in determining the emission rates. Examples of preferred methods to calculate emission rates include mass balances, stack test data, AP-42 emission factors, and AIRS emission factors. Other methodologies will be accepted on a case by case basis. Modeling should be done at permitted emission rates such as those found in the appropriate standards of Regulation 61-62 or which appear on the air operating or construction permits for sources already permitted. If a lower emission rate is used in the modeling, then the source must be willing to accept this new emission rate as the maximum allowable on their operating / construction permit.

6.7 MODELING QUESTIONNAIRES

This section should include the modeling questionnaires (DHEC form No. 3555) for the emission points at the facility. A table of source parameters containing all of the information requested on the questionnaires may be substituted for the modeling questionnaires. The construction permit application forms and Material Safety Data Sheets (MSDS) should be included in this section if they are applicable.

Table 6.1 Emission Rates

Pollutant:	Maximum Emission Rates			
	Stack 1	Stack 2	Stack 3	Stack 4
	lbs/hr	lbs/hr	lbs/hr	lbs/hr

Table 6.2 Stack Descriptions

Stack #	Source Description	Type ^a	Stack Dir ^b	Raincap ^c
1				
2				
3				
4				

- a Source Type (Point, Volume, or Area Source).
 b Stack Direction (Vertical, Horizontal, or Downward). The velocities of non-vertical discharges should be adjusted (See Section 2.5).
 c Does the stack have a raincap (Yes or No)? If the stack has a raincap then the exit velocity should be adjusted (See Section 2.5).

Table 6.3 GEP Analysis Results

Structure	Height (m)	Width (m)	Length (m)	GEP (m)	Region of Influence (5L, m)	Source Width 5L

Table 6.4 Stack Parameters (Point Sources)

Stack Number	1	2	3	4
Stack Height (meters) ^a				
Stack Diameter (meters) ^b				
Stack Temperature (°Kelvin)				
Stack Exit Velocity (m/sec)	Actual			
	Use in modeling ^c			
Building Height (meters)				
Building Width (meters)				
Building Length (meters)				
UTM Coordinates (meters)	Horizontal (E)			
	Vertical (N)			
Stack Base Elevation Above Mean Sea Level (MSL)				

- a Stack height above ground level.
b Stack inside diameter measured at point of discharge.
c Stack exit velocity of 0.01 m/sec used to account for non-vertical discharge from horizontal discharge and rain cap.

Table 6.6 Comparison with Standards

Pollutant	Avg. Time	Max Modeled Conc. (µg/m ³)	Back-ground Conc. ^a (µg/m ³)	Total Conc. (µg/m ³)	Allowable Conc. (µg/m ³)	Shows Compliance?
S.C. Regulation No. 62.5 – Standard No. 8 - Toxic Air Pollutants:						
	24 hrs		-			
	24 hrs		-			
	24 hrs		-			
S.C. Regulation No. 62.5 – Standard No. 2 - Ambient Air Quality Standards:						
S.C. Regulation 62.5 - Standard No. 7 - Prevention of Significant Deterioration:						
			-			
			-			
			-			
			-			
			-			

a Background values to account for other nearby sources should be used when determining compliance with Standard No. 2 - Ambient Air Quality Standards. These values are available in the Bureau’s Annual Report.

7.0 PREVENTION OF SIGNIFICANT DETERIORATION MODELING REQUIREMENTS

The Bureau requests that the guidance provided in the New Source Review Workshop Manual, published by the US EPA, be used in developing modeling analyses for PSD applications. For sources that may have an impact on Class I areas, the Federal Land Managers' AQRV Work Group (FLAG) report should also be consulted in addition to contacting the appropriate Federal Land Manager for additional guidance. The FLAG report is available at <http://www2.nature.nps.gov/ard/flagfree/index.htm>. For additional information please contact the Air Modeling Section.

8.0 MODELS, DOCUMENTATION, AND METEOROLOGICAL DATA SETS

All of the models referred to in this document are available from the EPA through the SCRAM web page; its address is <http://www.epa.gov/scram001>. This information is also available through the EPA's World Wide Web page, <http://ttnwww.rtpnc.epa.gov/>. The SCREEN and ISCST models are also available on the DHEC web page located at <http://www.scdhec.net/baq>.

Model documentation is available from the EPA's web pages. The South Carolina Air Quality Modeling Guidelines and other documentation, including a list of consultants, are available on the DHEC web page.

If a refined modeling analysis is required, most of the meteorological data sets are available from the EPA. These EPA data sets are in an unprocessed format. The processed meteorological data sets for South Carolina are available on the DHEC web page.

9.0 REFERENCES

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APPENDIX A - Air Quality Standards

SOUTH CAROLINA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

AIR POLLUTION CONTROL REGULATIONS
REGULATION NO. 62.5

AIR POLLUTION CONTROL STANDARDS
STANDARD NO. 2

AMBIENT AIR QUALITY STANDARDS

The following table constitutes the ambient air quality standards for the State of South Carolina. The analytical methods to be used will be those applicable Federal Reference Methods published in 40 CFR 50, Appendices A-H as revised July 1, 1986. In the case of fluorides either the double paper tape sampler methods (ASTM D-3266-79) or the sodium bicarbonate-coated glass tube and particulate filter method (ASTM D3268-78) may be used.

<u>POLLUTANT</u>	<u>MEASURING INTERVAL</u>	<u>MICROGRAMS PER CUBIC METER UNLESS NOTED OTHERWISE</u> ⁽¹⁾⁽²⁾
Sulfur Dioxide	3 hour	1300 ⁽⁴⁾
	24 hours	365 ⁽⁴⁾
	annual	80
Total Suspended Particulate	Annual Geometric Mean	75
PM ₁₀	24 hours	150 ⁽³⁾
	annual	50 ⁽³⁾
Carbon Monoxide	1 hour	40,000
	8 hours	10,000
Ozone	1 hour	0.12 ppm ⁽³⁾
Gaseous Fluorides (as HF)	12 hr. avg.	3.7
	24 hr. avg.	2.9
	1 wk. avg.	1.6
	1 mo. avg.	0.8
Nitrogen Dioxide	annual	100
Lead	Calendar Quarterly Mean	1.5

(1) Arithmetic Average except in case of total suspended particulate matter.

(2) At 25° C and 760 mm Hg.

(3) Attainment determinations will be made based on the criteria contained in Appendices H and K, 40 CFR 50, July 1, 1987.

(4) Not to be exceeded more than once a year.

SOUTH CAROLINA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

AIR POLLUTION CONTROL REGULATIONS
REGULATION NO. 62.5

AIR POLLUTION CONTROL STANDARDS
STANDARD NO. 7

PREVENTION OF SIGNIFICANT DETERIORATION
AMBIENT AIR INCREMENTS

Class I Areas

<u>POLLUTANT</u>	<u>MEASURING INTERVAL</u>	<u>MAXIMUM ALLOWABLE INCREASE (Micrograms per cubic meter)</u>
Particulate Matter - PM ₁₀ ^a	Annual arithmetic Mean	4
	24-hr maximum	8
Sulfur dioxide	Annual arithmetic mean	2
	24-hr maximum	5
	3-hr maximum	25
Nitrogen Dioxide	Annual arithmetic mean	2.5

Class II Areas

<u>POLLUTANT</u>	<u>MEASURING INTERVAL</u>	<u>MAXIMUM ALLOWABLE INCREASE (Micrograms per cubic meter)</u>
Particulate Matter - PM ₁₀ ^a	Annual arithmetic Mean	17
	24-hr maximum	30
Sulfur dioxide	Annual arithmetic mean	20
	24-hr maximum	91
	3-hr maximum	512
Nitrogen Dioxide	Annual arithmetic mean	25

Note: For any period other than an annual period, the applicable maximum allowable increase may be exceeded during one such period per year at any one location.

61-62.5, Standard No. 8, Toxic Air Pollutants.

I. GENERAL APPLICABILITY. This Standard is applicable to sources of toxic air pollutants as provided below. This Standard does not apply to fuel burning sources which burn only virgin fuel or specification used oil. The terms in this Standard are used as defined in South Carolina Air Pollution Control Regulations and Standards Regulation 62.1, Section I, "Definitions". The effective date of this Standard is June 28, 1991.

A. EXISTING SOURCES:

(1) Any person with an existing source of any toxic air pollutant shall be required to show compliance with this standard not later than two years after the effective date of this standard. These sources must provide the Department with the name and Chemical Abstract Service(CAS) number of the chemical, stack parameters, and emission rate data. If potential emissions of any single toxic air pollutant are 1000 lbs/month or greater an operating permit will be required. An operating permit may or may not be required for sources with emissions less than 1000 lbs/month. This determination will take into consideration, but not be limited to, the nature and amount of the pollutants, location, proximity to commercial establishments and residences.

(2) Any person holding an operating permit prior to the effective date of this standard shall be required to demonstrate compliance with this standard for all toxic air pollutant emissions prior to renewal of the operating permit. The compliance demonstration must include all sources of toxic air pollutants at the facility, including sources not previously subject to permit requirements. Methods for compliance demonstration may be found in the *Air Quality Modeling Guidelines* as prepared pursuant to paragraph II (A) of this regulation.

B. NEW SOURCES: Any person who constructs, alters, or adds to a source of toxic air pollutants after the effective date of this standard, shall comply with this standard. These sources must provide the Department with the name and Chemical Abstract Service (CAS) number of the chemical, stack parameters, and emission rate data. If potential emissions of any single toxic air pollutant are 1000 lbs/month or greater a construction permit will be required. A permit may or may not be required for sources with emissions less than 1000 lbs/month; however, all sources are required to demonstrate compliance with this standard for all toxic emissions. This determination will take into consideration, but will not be limited to, the nature and amount of the pollutants, location, proximity to residences and commercial establishments. Methods for compliance demonstration may be found in the *Air Quality Modeling Guidelines* as prepared pursuant to paragraph II(A) of this regulation.

C. This standard will not supersede any requirements imposed by Federal National Emission Standards for Hazardous Air Pollutants nor any special permit conditions, unless this standard would impose a more restrictive emission limit.

D. Facilities are exempt from the requirements of this standard as follows:

(1) Affected sources that emit Hazardous Air Pollutants (HAPs) (42 U.S.C. 112(b)) and are subject to one or more Federal Maximum Achievable Control Technology (MACT) standards (42 U.S.C. 112(d), (g), (h), or (j)) are exempt. This exemption shall only apply to toxic air pollutants regulated by this standard that are also federally regulated HAPs, except as provided below. This exemption shall apply once the emission sources are in compliance with a proposed or final MACT standard. Affected source, for the purposes of this part, means the stationary source, the group of stationary sources, or the portion of a stationary source that is regulated by a relevant standard or other requirement established pursuant to Section 112 of the Act (42 U.S.C 7401 et seq.). Each relevant standard will define the "affected source" for the purposes of that standard.

(2) Emission points that emit HAPs which are not exempt from this standard according to (1) above are granted an exemption once a federally required Residual Risk analysis (42 U.S.C. section 112(f)) that accounts for all facility-wide HAPs has been completed. Such emission points may be exempted prior to a Residual Risk analysis on a case-by-case basis after review by the Department. Exemptions may be granted in cases where off-site impacts from HAP emissions are significantly below levels established by this standard (less than 50% of the standard).¹

(3) Sources that emit toxic air pollutants regulated by this standard which are not federally regulated HAPs can request an exemption from this standard on a case-by-case basis after review by the Department. Exemptions may be granted in cases where non-HAP emissions are controlled (reduced) by MACT controls applied to reduce HAP emissions and in cases where off-site impacts from non-HAP emissions are significantly below levels established by this standard (less than 50% of the standard).¹

¹ If future construction/modifications cause off-site impacts to exceed 50% of the appropriate standard, the exemption is no longer valid.

E. Additions and deletions to the list of Toxic Air Pollutants may be made following normal administrative procedures.

II. TOXIC AIR EMISSIONS.

A. The Department will prepare Air Quality Modeling Guidelines to provide assistance to facilities concerning compliance demonstrations and modeling issues. These guidelines may be updated periodically as new models and/or modeling procedures are developed by the Environmental Protection Agency. Detailed procedures for showing compliance with this standard may be found in the Air Quality Modeling Guidelines. Required modeling must use the latest versions of United States Environmental Protection Agency air dispersion models to determine the concentration of the toxic air pollutant in the ambient air at or beyond the plant property line, using 24-hour averaging.

B. The Bureau may provide modeling assistance to facilities that are designated as “small business stationary source” as defined in the Federal Clean Air Act (42 U.S.C. Sect. 507 (c)). However, the facility is still responsible for submitting the emission and facility data needed for the modeling analyses. Nothing in this section precludes a facility from conducting its own modeling if desired by the facility.

C. Changes in the following parameters will require a review by the facility to determine if they have an adverse impact on the compliance demonstration:

- (1) Decrease in stack height
- (2) Decrease in stack exit temperature
- (3) Increase in stack diameter
- (4) Decrease in stack exit velocity
- (5) Increase in building height or building additions at the facility
- (6) Increase in emission rates
- (7) Decrease in distance between stack and property line
- (8) Changes in stack orientation from vertical
- (9) Installation of a rain cap that impedes vertical flow

Exemptions to this requirement may be granted on a case-by-case basis. A revised compliance demonstration will not be required when air dispersion modeling software programs are updated.

D. The air toxics, emission rates, and other information used in the compliance determination will be listed in Attachment A -- Modeling Parameters Used in Compliance Determination of the construction and/or operating permit for the facility. Changes that increase maximum modeled concentrations may be administratively incorporated in these permits provided a compliance demonstration using these changes is submitted to the Department. Variations from the input parameters shall not constitute a violation unless the maximum allowable ambient concentrations identified in this standard are exceeded.

E. The allowable ambient air concentrations of a toxic air pollutant beyond the plant property line as determined by modeling under Part A shall be limited to the value listed in the following table. The pollutants are divided into three categories based on chronic exposure as follows: Category 1: Low Toxicity - Those pollutants which cause readily reversible changes which disappear after exposure ends. Category 2: Moderate Toxicity - Those pollutants which may cause chronic reversible or irreversible changes that are not severe enough to result in death or permanent injury. Category 3: High Toxicity - Those pollutants which may cause chronic effects that result in death or permanent injury after very short exposure to small quantities.

MAXIMUM

CHEMICAL NAME	CAS NO.	CATEGORY	ALLOWABLE CONCENTRATION ($\mu\text{g}/\text{m}^3$)
Acetaldehyde	75-07-0	2	1800.00
Acetamide	60-35-5	3	+
Acetic Anhydride	108-24-7	1	500.00
Acetonitrile	75-05-8	1	1750.00
Acetophenone	98-86-2	3	+
2-Acetylaminofluorne	53-96-3	3	+
Acrolein	107-02-8	3	1.25
Acrylamide	79-06-1	2	0.30
Acrylic Acid	79-10-7	3	147.50
Acrylonitrile	107-13-1	3	22.50
Aldicarb	116-06-3	2	6.00
Allyl Chloride	107-05-1	2	30.00
p-Aminodiphenyl (4-Aminobiphenyl)	92-67-1	3	0.00
Ammonium Chloride	12125-02-9	1	250.00
Aniline	62-53-3	3	50.00
o-Anisidine	90-04-0	3	2.50
p-Anisidine	104-94-9	3	2.50
Antimony Compounds	>	1	2.50
Arsenic Pentoxide	1303-28-2	3	1.00
Arsenic	7440-38-2	3	1.00
Benzene	71-43-2	3	150.00
Benzidine	92-87-5	3	0.00
Benzotrichloride	98-07-7	3	300.00
Benzyl Chloride	100-44-7	3	25.00
Beryllium Oxide	1304-56-9	3	0.01
Beryllium Sulfate	13510-49-1	3	0.01
Beryllium	7440-41-7	3	0.01
Biphenyl	92-52-4	3	6.00
Bis(Chloromethyl) Ether	542-88-1	3	0.03
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	3	25.00
Bromoform	75-25-2	3	25.85
1,3-Butadiene	106-99-0	3	110.50
1-Butanethiol (n-Butyl Mercaptan)	109-79-5	2	15.00
n-Butylamine	109-73-9	3	75.00
Cadmium Oxide	1306-19-0	3	0.25
Cadmium Sulfate	10124-36-4	3	0.20
Cadmium	7440-43-9	3	0.25
Calcium Cyanamide	156-62-7	3	2.50
Caprolactam, vapor	105-60-2	1	500.00
Caprolactam, dust	105-60-2	1	25.00

Captan	133-06-2	3	25.00
Carbaryl	63-25-2	3	25.00
Carbon Disulfide	75-15-0	3	150.00
Carbon Tetrachloride	56-23-5	3	150.00
Carbonyl Sulfide	463-58-1	3	12250.00
Catechol	120-80-9	3	297.00
Chloramben	133-90-4	3	+
Chlordane	57-74-9	3	2.50
Chlorine	7782-50-5	1	75.00
Chloroacetic Acid	79-11-8	3	900.00
2-Chloroacetophenone	532-27-4	1	7.50
Chlorobenzene	108-90-7	3	1725.00
Chlorobenzilate	510-15-6	3	+
Chloroform	67-66-3	3	250.00
Chloromethyl Methyl Ether	107-30-2	3	+
p-Chloronitrobenzene	100-00-5	3	5.00
Chloroprene	126-99-8	3	175.00
Chromium(+6) Compounds	>	3	2.50
Cobalt Compounds	>	3	0.25
Coke Oven Emissions	>	3	+
Cresols/cresylic acid and mixture	1319-77-3	3	220.00
m-Cresol	108-39-4	3	110.50
o-Cresol	95-48-7	3	110.50
p-Cresol	106-44-5	3	110.50
Cumene	98-82-8	2	9.00#
Cyanamide	420-04-2	1	50.00
Cyanic Acid	420-05-3	1	500.00
Cyanide	57-12-5	1	125.00
Cyanide compounds ¹	>	1	+
Cyanoacetamide	107-91-5	1	125.00
Cyanogen	460-19-5	1	500.00
2,4-D,salts and esters	94-75-7	3	50.00
DDE	3547-04-4	3	+
Diazomethane	334-88-3	3	2.00
Dibenzofuran	132-64-9	3	+
1,2-Dibromo-3-chloropropane	96-12-8	3	0.05
Dibutylphthalate	84-74-2	3	25.00
p-Dichlorobenzene	106-46-7	2	4500.00
3,3 -Dichlorobenzidine	91-94-1	3	0.15
1,3-Dichloropropene	542-75-6	3	20.00#
Dichlorvos	62-73-7	3	4.52
Diethanolamine	111-42-2	2	129.00
n,n-Diethylaniline (n,n-Dimethylaniline)	121-69-7	2	250.00
Diethyl Phthalate	84-66-2	3	25.00

Diethyl Sulfate	64-67-5	3	+
Diisodecyl Phthalate	2671-40-0	2	50.00
3,3-Dimethoxybenzidine	119-90-4	3	0.30
3,3'-Dimethyl Benzidine	119-93-7	3	+
Dimethyl Carbamoyl Chloride	79-44-7	3	+
Dimethyl Formamide	68-12-2	2	300.00
1,1-Dimethyl Hydrazine	57-14-7	3	5.00
1,2-Dimethyl Hydrazine	540-73-8	3	5.00
Dimethyl Phthalate	131-11-3	3	25.00
Dimethyl Sulfate	77-78-1	3	2.50
4-Dimethylaminoazobenzene	60-11-7	3	125.00
m-Dinitrobenzene	99-65-0	2	10.00
4,6-Dinitro-o-cresol and salts	534-52-1	2	2.00
2,4-Dinitrophenol	51-28-5	3	+
2,4-Dinitrotoluene	121-14-2	3	1.50
Dioctyl Phthalate	117-84-0	2	50.00
1,4-Dioxane	123-91-1	3	450.00
1,2-Diphenylhydrazine	122-66-7	3	+
Epichlorohydrin	106-89-8	3	50.00
1,2-Epoxybutane	106-88-7	3	+
Ethanethiol	75-08-1	2	10.00
Ethanolamine	141-43-5	1	200.00
Ethyl Acrylate	140-88-5	3	102.50
Ethyl Benzene	100-41-4	2	4350.00
Ethyl Chloride	75-00-3	2	26400.00
Ethylene Dibromide	106-93-4	2	770.00
Ethylene Dichloride	107-06-2	3	200.00
Ethylene Glycol	107-21-1	3	650.00
Ethylene Oxide	75-21-8	3	10.00
Ethylene Thiourea	96-45-7	3	+
Ethylene Imine	151-56-4	3	5.00
Ethylidene Dichloride	75-34-3	3	2025.00
Formaldehyde	50-00-0	2	15.00
Formamide	75-12-7	1	750.00
Formic Acid	64-18-6	1	225.00
Furfural	98-01-1	1	200.00
Furfuryl Alcohol	98-00-0	2	400.00
Glycidaldehyde	765-34-4	3	75.00
Glycol Ethers ²	>	1	+
(mono- and di- ethers of diethylene glycol or triethylene glycol)			
Glycol Ethers ²	>	3	+
(mono- and di- ethers of ethylene glycol)			
Heptachlor	76-44-8	3	2.50
Hexachlorobenzene	118-74-1	3	+

Hexachlorobutadiene	87-68-3	3	1.20
Hexachlorocyclohexane (multiple isomers)	608-73-1	2	5.00
Hexachlorocyclopentadiene	77-47-4	3	0.50
Hexachloroethane	67-72-1	3	48.50
Hexachloronaphthalene	1335-87-1	3	1.00
Hexamethylene-1,6-diisocyanate	822-06-0	2	0.34
Hexamethylphosphoramide	680-31-9	3	14.50
Hexane	110-54-3	3	900.00
Hydrazine	302-01-2	3	0.50
Hydrochloric Acid	7647-01-0	1	175.00
Hydrogen Cyanide	74-90-8	1	250.00
Hydrogen Sulfide	7783-06-4	2	140.00
Hydroquinone	123-31-9	2	20.00
Isophorone	78-59-1	2	250.00
Isopropylamine	75-31-0	1	300.00
Kepone (Chlordecone)	143-50-0	3	0.00
Ketene	463-51-4	3	4.50
Lead Arsenate	7645-25-2	3	0.75
Lead(+2) Arsenate	7784-40-9	3	0.75
Lindane	58-89-9	3	2.50
Malathion	121-75-5	2	100.00
Maleic Anhydride	108-31-6	2	10.00
Manganese Compounds	>	3	25.00
Mercury	7439-97-6	3	0.25
Methanol	67-56-1	3	1310.00
Methoxychlor	72-43-5	3	50.00
Methyl Bromide	74-83-9	3	100.00
Methyl Chloride	74-87-3	3	515.00
Methyl Chloroform (1,1,1- Trichloroethane)	71-55-6	3	9550.00
Methylene Biphenyl Isocyanate	101-68-8	2	2.00
4,4-Methylene Bis(2-chloroaniline)	101-14-4	3	1.10
4,4-Methylenedianiline	101-77-9	3	4.00
Methyl Ethyl Ketone (2-Butone)	78-93-3	1	14750.00
Methyl Hydrazine	60-34-4	3	1.75
Methyl Iodide	74-88-4	3	58.00
Methyl Isobutyl Ketone	108-10-1	2	2050.00
Methyl Isocyanate	624-83-9	3	0.23
Methyl Mercaptan	74-93-1	2	10.00
Methyl Methacrylate	80-62-6	1	10250.00
Methylamine	74-89-5	1	300.00
Methylene Chloride	75-09-2	1	8750.00
Methyl-t-Butyl Ether	1634-04-4	1	+

Mineral Fibers, Fine ³	>	3	+
Mineral Oil Mist (Paraffin Oil)	8012-95-1	3	25.00
Mirex	2385-85-5	3	4500.00
Naphthalene	91-20-3	1	1250.00
a-Naphthylamine	134-32-7	3	0.00
b-Naphthylamine	91-59-8	3	0.00
Nickel Carbonyl	13463-39-3	3	1.75
Nickel Oxide	1313-99-1	3	5.00
Nickel Sulfate	7786-81-4	3	5.00
Nickel	7440-02-0	3	0.50
Nitric Acid	7697-37-2	1	125.00
p-Nitroaniline	100-01-6	3	15.00
Nitrobenzene	98-95-3	3	25.00
4-Nitrobiphenyl	92-93-3	3	0.00
Nitrogen Mustard	51-75-2	3	0.00
Nitroglycerin	55-63-0	2	5.00
p-Nitrophenol	100-02-7	3	0.00
1-Nitropropane	108-03-2	1	2250.00
2-Nitropropane	79-46-9	3	182.00
p-Nitrosophenol	104-91-6	3	0.00
n-Nitroso-n-methylurea	684-93-5	3	+
n-Nitrosodimethylamine	62-75-9	3	0.00
n-Nitrosomorpholine	59-89-2	3	5000.00
p-Nitrotoluene	99-99-0	3	5.50
Octachloronaphthalene	2234-13-1	3	0.50
Oxalic Acid	144-62-7	2	10.00
Paraquat	1910-42-5	3	0.50
Parathion	56-38-2	3	0.50
Pentachloronitrobenzene (Quintobenzene)	82-68-8	3	+
Pentachlorophenol	87-86-5	2	5.00
Phenol	108-95-2	2	190.00
p-Phenylenediamine	106-50-3	2	1.00
Phenylhydrazine	100-63-0	2	200.00
Phosgene (Carbonyl Chloride)	75-44-5	2	4.00
Phosphine	7803-51-2	3	2.09
Phosphoric Acid	7664-38-2	1	25.00
Phosphorus	7723-14-0	2	0.50
Phthalic Anhydride	85-44-9	3	30.30
Picric Acid	88-89-1	2	1.00
Polychlorinated Biphenyls (PCB) (multiple compounds)	>	3	2.50
Polycyclic Organic Matter ⁴	>	3	160.00
1,3-Propane Sultone	1120-71-4	3	+

b-Propiolactone	57-57-8	3	7.50
Propionaldehyde	123-38-6	1	+
Propoxur	114-26-1	3	2.50
Propylene Dichloride	78-87-5	3	1750.00
Propylene Oxide	75-56-9	3	250.00
1,2-Propylenimine	75-55-8	3	23.35
Pyrethrin I	121-21-1	3	25.00
Pyrethrin II	121-29-9	3	25.00
Pyrethrum	8003-34-7	2	50.00
Quinoline	91-22-5	3	+
Quinone	106-51-4	3	2.00
Rotenone	83-79-462	2	50.00
Selenium Compounds	>	3	1.00
Sodium Hydroxide ⁵	1310-73-2	1	50.00
Styrene	100-42-5	1	5325.00
Styrene Oxide	96-09-3	3	+
Sulfuric Acid	7664-93-9	2	10.00
Tetrachlorinated Dibenzo-p-dioxins	1746-01-6	3	0.00
1,1,2,2-Tetrachloroethane (Acetylene Tetrachloride)	79-34-5	3	35.00
Tetrachloroethylene (Perchloroethylene)	127-18-4	2	3350.00
Titanium Tetrachloride	7550-45-0	1	2500.00
Toluene	108-88-3	3	2000.00
2,4-Toluenediamine	95-80-7	3	+
Toluene Diisocyanate	26471-62-5	2	0.40
Toluene-2,4- diisocyanate	584-84-9	2	0.40
o-Toluidine	95-53-4	3	43.85
Toxaphene	8001-35-2	3	2.50
1,2,4-Trichlorobenzene	120-82-1	2	400.00
1,1,2-Trichloroethane	79-00-5	3	273.00
Trichloroethylene	79-01-6	1	6750.00
2,4,5-Trichlorophenol	95-95-4	3	+
2,4,6-Trichlorophenol	88-06-2	3	+
Triethylamine	121-44-8	3	207.00
Trifluralin	1582-09-8	3	+
2,2,4-Trimethylpentane	540-84-1	1	8750.00
Urethane (Carbamic Acid Ethyl Ester)	51-79-6	2	5000.00
Vinyl Acetate	108-05-4	3	176.00
Vinyl Bromide	593-60-2	3	100.00
Vinyl Chloride	75-01-4	3	50.00
Vinyl Fluoride	75-02-5	2	19.00
Vinylidene chloride	75-35-4	3	99.00

Xylene	1330-20-7	2	4350.00
m-Xylene	108-38-3	2	4350.00
o-Xylene	95-47-6	2	4350.00
p-Xylene	106-42-3	2	4350.00
Xylidine	1300-73-8	3	50.00

* For the purpose of this standard, these values shall be rounded to the nearest hundredth of a $\mu\text{g}/\text{m}^3$. For example, a test or modeled value of 0.005 through 0.01 would be rounded to 0.01 but values less than 0.005 would be rounded to 0.00.

+ to be determined

> No CAS number.

Verified reference concentration(RfC) established by the United States Environmental Protection Agency.

1. XCN where X = H⁺ or any other group where a formal dissociation may occur. For example KCN or Ca(CN)₂.

2. Includes mono- and di- ethers of ethylene glycol, diethylene glycol and triethylene glycol R-(OCH₂CH₂)_n-OR', where:

n = 1, 2, or 3

R = alkyl or aryl groups

R' = R, H, or groups which, when removed, yield glycol ethers with the structure: R-(OCH₂CH₂)_n-OH

Polymers are excluded from the glycol category.

Mono- and di- ethers of ethylene glycol are category 3 air toxics; mono- and di- ethers of diethylene glycol and triethylene glycol are category 1 air toxics.

3. Includes mineral fiber emissions from facilities manufacturing or processing glass, rock, and slag fibers (or other mineral derived fibers) of average diameter 1 micrometer or less.

4. Includes organic compounds with more than one benzene ring and which have a boiling point greater than or equal to 100° C.

5. The use of sodium hydroxide in a scrubber for air pollution control purposes is exempt from this standard.

Note: For all listings above that contain the word "compounds" and for glycol ethers the following applies: Unless otherwise specified, these listings are defined as including any unique chemical substance that contains the named element (i.e. antimony, arsenic, etc.) as part of that chemical infrastructure

III. CONTROLS. If modeling by the source indicates that the maximum allowable concentration is exceeded, the Department may allow approved, site specific modeling/ambient monitoring on a case-by-case basis. If this approach does not demonstrate that the public health will be adequately protected, the source will be required to reduce emissions by implementing controls, altering the process, or limiting production.

IV. SOURCE TEST REQUIREMENTS. The owner or operator of all sources of toxic air pollutants shall conduct such tests as required by the Department to verify toxic air pollutant emission rates. An owner or operator shall ensure that source tests are conducted in compliance with the requirements of R.61-62.1, Section IV, Source Tests.

V. RECORDKEEPING.

A. Copies of all records and reports required under this Standard shall be available for inspection by the Department during normal business hours and copies shall be provided to the Department within ten working days of receipt of a written request by the Department.

B. Copies of all records and reports required under this Standard shall be maintained by the owner/operator for three years after the date on which the record was made or the report submitted.

APPENDIX B - PSD Information

Table B-1 PSD MINOR SOURCE BASELINE DATE BY COUNTY¹

County	PM ₁₀ BASELINE DATE	SO ₂ BASELINE DATE	NO ₂ BASELINE DATE
Abbeville			
Aiken			
Allendale			
Anderson	06/08/99	06/08/99	06/08/99
Bamberg			
Barnwell			
Beaufort	07/08/78	07/08/78	
Berkeley	11/30/77	11/30/77	04/26/90
Calhoun	10/30/00	05/20/81	10/30/00
Charleston	11/30/77	11/30/77	03/07/89
Cherokee	06/18/99	06/18/99	06/18/99
Chester	05/28/87	05/28/87	
Chesterfield	05/02/88	05/02/88	05/02/88
Clarendon		07/27/78	
Colleton			
Darlington	10/19/93	10/19/93	05/02/88
Dillon			
Dorchester	06/05/81	11/30/77	
Edgefield			
Fairfield			
Florence	09/28/78	9/28/78	
Georgetown	08/07/77	08/07/77	
Greenville			07/18/95

Table B-1 PSD MINOR SOURCE BASELINE DATE BY COUNTY¹
(CONTINUED)

County	PM ₁₀ BASELINE DATE	SO ₂ BASELINE DATE	NO ₂ BASELINE DATE
Greenwood			
Hampton			
Horry			
Jasper			
Kershaw			
Lancaster	12/01/81	12/01/81	
Laurens			
Lee		07/09/80	
Lexington	3/20/00	05/23/96	05/23/96
McCormick			
Marion		03/13/80	
Marlboro	05/02/88	05/02/88	05/02/88
Newberry			
Oconee			
Orangeburg	05/23/80	05/23/80	2/28/00
Pickens			
Richland	05/20/81	05/20/81	10/26/88
Saluda			
Spartanburg	12/21/92		12/21/92
Sumter	05/20/81	05/20/81	10/26/88
Union			
Williamsburg			
York	12/01/81	12/01/81	

1 Updates to this table are kept on the SC DHEC web page, <http://www.scdhec.net/baq>.

APPENDIX C - Example Problem - SCREEN Model Output Data

12/02/96
13:11:37

*** SCREEN3 MODEL RUN ***
 *** VERSION DATED 96043 ***

Example Problem / Stack 1 / Modeled at 1 g/s emission rate & ratio to actual

COMPLEX TERRAIN INPUTS:

SOURCE TYPE = POINT
 EMISSION RATE (G/S) = 1.00000
 STACK HT (M) = 15.0000
 STACK DIAMETER (M) = .3000
 STACK VELOCITY (M/S) = .0100
 STACK GAS TEMP (K) = 293.0000
 AMBIENT AIR TEMP (K) = 293.0000
 RECEPTOR HEIGHT (M) = .0000
 URBAN/RURAL OPTION = RURAL

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = .000 M**4/S**3; MOM. FLUX = .000 M**4/S**2.

FINAL STABLE PLUME HEIGHT (M) = 14.1
 DISTANCE TO FINAL RISE (M) = 151.3

TERR HT (M)	DIST (M)	MAX 24-HR CONC (UG/M**3)	*VALLEY 24-HR CALCS*		**SIMPLE TERRAIN 24-HR CALCS**				
			CONC (UG/M**3)	PLUME HT ABOVE STK BASE (M)	CONC (UG/M**3)	PLUME HT ABOVE STK HGT (M)	U10M SC	USTK (M/S)	
16.	200.	12.55	12.55	14.1	.0000	.0	0	.0	.0

12/02/96

13:11:37

*** SCREEN3 MODEL RUN ***
 *** VERSION DATED 96043 ***

Example Problem / Stack 1 / Modeled at 1 g/s emission rate & ratio to actual

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT
 EMISSION RATE (G/S) = 1.00000
 STACK HEIGHT (M) = 15.0000
 STK INSIDE DIAM (M) = .3000
 STK EXIT VELOCITY (M/S) = .0100
 STK GAS EXIT TEMP (K) = 293.0000
 AMBIENT AIR TEMP (K) = 293.0000
 RECEPTOR HEIGHT (M) = .0000
 URBAN/RURAL OPTION = RURAL
 BUILDING HEIGHT (M) = 14.0000
 MIN HORIZ BLDG DIM (M) = 50.0000
 MAX HORIZ BLDG DIM (M) = 100.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = .000 M**4/S**3; MOM. FLUX = .000 M**4/S**2.

*** FULL METEOROLOGY ***

 *** SCREEN AUTOMATED DISTANCES ***

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
40.	.0000	0	.0	.0	.0	.00	.00	.00	NA
100.	1354.	4	1.0	1.1	320.0	15.00	8.79	13.20	SS
200.	730.1	6	1.0	1.2	10000.0	15.00	13.96	16.68	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 40. M:

42.	1835.	4	1.0	1.1	320.0	15.00	4.97	9.51	SS
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 *** SCREEN AUTOMATED DISTANCES ***

*** TERRAIN HEIGHT OF 15. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
200.	1094.	6	1.0	1.2	10000.0	.00	13.96	16.68	SS
300.	842.9	6	1.0	1.2	10000.0	.00	17.30	17.46	SS
400.	678.8	6	1.0	1.2	10000.0	.00	20.58	18.23	SS
500.	563.6	6	1.0	1.2	10000.0	.00	23.81	18.98	SS
600.	478.7	6	1.0	1.2	10000.0	.00	27.00	19.71	SS
700.	413.7	6	1.0	1.2	10000.0	.00	30.15	20.42	SS
800.	362.6	6	1.0	1.2	10000.0	.00	33.26	21.12	SS
900.	330.6	6	1.0	1.2	10000.0	.00	36.35	21.19	SS
1000.	295.9	6	1.0	1.2	10000.0	.00	39.40	21.84	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 200. M:
 200. 1094. 6 1.0 1.2 10000.0 .00 13.96 16.68 SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

 * SUMMARY OF TERRAIN HEIGHTS ENTERED FOR *
 * SIMPLE ELEVATED TERRAIN PROCEDURE *

TERRAIN HT (M)	DISTANCE RANGE (M)	
	MINIMUM	MAXIMUM
0.	40.	200.
15.	200.	1000.


```

*****
*** REGULATORY (Default) ***
PERFORMING CAVITY CALCULATIONS
WITH ORIGINAL SCREEN CAVITY MODEL
(BRODE, 1988)
*****

```

```

*** CAVITY CALCULATION - 1 ***          *** CAVITY CALCULATION - 2 ***
CONC (UG/M**3) = 476.2                  CONC (UG/M**3) = .0000
CRIT WS @10M (M/S) = 1.00              CRIT WS @10M (M/S) = 99.99
CRIT WS @ HS (M/S) = 1.08             CRIT WS @ HS (M/S) = 99.99
DILUTION WS (M/S) = 1.00              DILUTION WS (M/S) = 99.99
CAVITY HT (M) = 14.22                  CAVITY HT (M) = 14.00
CAVITY LENGTH (M) = 62.82             CAVITY LENGTH (M) = 46.23
ALONGWIND DIM (M) = 50.00             ALONGWIND DIM (M) = 100.00

```

CAVITY CONC NOT CALCULATED FOR CRIT WS > 20.0 M/S. CONC SET = 0.0

```

*****
END OF CAVITY CALCULATIONS
*****

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*****
*** SUMMARY OF SCREEN MODEL RESULTS ***
*****

```

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	1835.	42.	0.
COMPLEX TERRAIN	12.55	200.	16. (24-HR CONC)
BLDG. CAVITY-1	476.2	63.	-- (DIST = CAVITY LENGTH)
BLDG. CAVITY-2	.0000	46.	-- (DIST = CAVITY LENGTH)

```

*****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
*****

```

12/02/96
13:17:48

*** SCREEN3 MODEL RUN ***
 *** VERSION DATED 96043 ***

Example Problem / Stack 2 / Modeled at 1 g/s emission rate & ratio to actual

COMPLEX TERRAIN INPUTS:

SOURCE TYPE = POINT
 EMISSION RATE (G/S) = 1.00000
 STACK HT (M) = 15.0000
 STACK DIAMETER (M) = .2000
 STACK VELOCITY (M/S) = .1000
 STACK GAS TEMP (K) = 293.0000
 AMBIENT AIR TEMP (K) = 293.0000
 RECEPTOR HEIGHT (M) = .0000
 URBAN/RURAL OPTION = RURAL

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = .000 M**4/S**3; MOM. FLUX = .000 M**4/S**2.

FINAL STABLE PLUME HEIGHT (M) = 14.4
 DISTANCE TO FINAL RISE (M) = 151.3

TERR HT (M)	DIST (M)	MAX 24-HR CONC (UG/M**3)	*VALLEY 24-HR CALCS*		**SIMPLE TERRAIN 24-HR CALCS**				
			CONC (UG/M**3)	PLUME HT ABOVE STK BASE (M)	CONC (UG/M**3)	PLUME HT ABOVE STK HGT (M)	U10M SC	USTK (M/S)	
16.	200.	12.55	12.55	14.4	.0000	.0	0	.0	.0

12/02/96

13:17:48

*** SCREEN3 MODEL RUN ***
 *** VERSION DATED 96043 ***

Example Problem / Stack 2 / Modeled at 1 g/s emission rate & ratio to actual

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT
 EMISSION RATE (G/S) = 1.00000
 STACK HEIGHT (M) = 15.0000
 STK INSIDE DIAM (M) = .2000
 STK EXIT VELOCITY (M/S) = .1000
 STK GAS EXIT TEMP (K) = 293.0000
 AMBIENT AIR TEMP (K) = 293.0000
 RECEPTOR HEIGHT (M) = .0000
 URBAN/RURAL OPTION = RURAL
 BUILDING HEIGHT (M) = 13.0000
 MIN HORIZ BLDG DIM (M) = 14.0000
 MAX HORIZ BLDG DIM (M) = 14.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = .000 M**4/S**3; MOM. FLUX = .000 M**4/S**2.

*** FULL METEOROLOGY ***

 *** SCREEN AUTOMATED DISTANCES ***

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
30.	.0000	0	.0	.0	.0	.00	.00	.00	NA
100.	1044.	4	1.0	1.1	320.0	15.00	11.02	12.15	SS
200.	651.6	6	1.0	1.2	10000.0	15.00	15.81	14.98	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 30. M:
 65. 1143. 3 1.0 1.0 320.0 15.00 8.74 10.05 SS

 *** SCREEN AUTOMATED DISTANCES ***

*** TERRAIN HEIGHT OF 15. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
200.	1076.	6	1.0	1.2	10000.0	.00	15.81	14.98	SS
300.	842.6	6	1.0	1.2	10000.0	.00	19.11	15.81	SS
400.	685.1	6	1.0	1.2	10000.0	.00	22.36	16.62	SS
500.	572.2	6	1.0	1.2	10000.0	.00	25.57	17.41	SS
600.	487.7	6	1.0	1.2	10000.0	.00	28.73	18.17	SS
700.	422.4	6	1.0	1.2	10000.0	.00	31.86	18.92	SS
800.	370.7	6	1.0	1.2	10000.0	.00	34.96	19.65	SS
900.	328.8	6	1.0	1.2	10000.0	.00	38.03	20.37	SS
1000.	294.3	6	1.0	1.2	10000.0	.00	41.07	21.07	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 200. M:
 200. 1076. 6 1.0 1.2 10000.0 .00 15.81 14.98 SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

 * SUMMARY OF TERRAIN HEIGHTS ENTERED FOR *
 * SIMPLE ELEVATED TERRAIN PROCEDURE *

TERRAIN HT (M)	DISTANCE RANGE (M)	
	MINIMUM	MAXIMUM
0.	30.	200.
15.	200.	1000.

```

*****
*** REGULATORY (Default) ***
PERFORMING CAVITY CALCULATIONS
WITH ORIGINAL SCREEN CAVITY MODEL
(BRODE, 1988)
*****

```

```

*** CAVITY CALCULATION - 1 ***          *** CAVITY CALCULATION - 2 ***
CONC (UG/M**3)      =      3663.          CONC (UG/M**3)      =      3663.
CRIT WS @10M (M/S) =      1.00          CRIT WS @10M (M/S) =      1.00
CRIT WS @ HS (M/S) =      1.08          CRIT WS @ HS (M/S) =      1.08
DILUTION WS (M/S)  =      1.00          DILUTION WS (M/S)  =      1.00
CAVITY HT (M)      =      18.13          CAVITY HT (M)      =      18.13
CAVITY LENGTH (M)  =      19.45          CAVITY LENGTH (M)  =      19.45
ALONGWIND DIM (M)  =      14.00          ALONGWIND DIM (M)  =      14.00

```

```

*****
END OF CAVITY CALCULATIONS
*****

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*****
*** SUMMARY OF SCREEN MODEL RESULTS ***
*****

```

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	1143.	65.	0.
COMPLEX TERRAIN	12.55	200.	16. (24-HR CONC)
BLDG. CAVITY-1	3663.	19.	-- (DIST = CAVITY LENGTH)
BLDG. CAVITY-2	3663.	19.	-- (DIST = CAVITY LENGTH)

```

*****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
*****

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12/02/96
13:24:57

*** SCREEN3 MODEL RUN ***
 *** VERSION DATED 96043 ***

Example Problem / Stack 3 / Modeled at 1 g/s emission rate & ratio to actual

COMPLEX TERRAIN INPUTS:

SOURCE TYPE = POINT
 EMISSION RATE (G/S) = 1.00000
 STACK HT (M) = 25.0000
 STACK DIAMETER (M) = 1.0000
 STACK VELOCITY (M/S) = 23.0000
 STACK GAS TEMP (K) = 350.0000
 AMBIENT AIR TEMP (K) = 293.0000
 RECEPTOR HEIGHT (M) = .0000
 URBAN/RURAL OPTION = RURAL

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 9.183 M**4/S**3; MOM. FLUX = 110.712 M**4/S**2.

FINAL STABLE PLUME HEIGHT (M) = 63.1
 DISTANCE TO FINAL RISE (M) = 151.3

TERR HT (M)	DIST (M)	MAX 24-HR CONC (UG/M**3)	*VALLEY 24-HR CALCS*		**SIMPLE TERRAIN 24-HR CALCS**				
			CONC (UG/M**3)	PLUME HT ABOVE STK BASE (M)	CONC (UG/M**3)	PLUME HT ABOVE STK HGT (M)	U10M SC	USTK (M/S)	
53.	3450.	8.863	1.815	63.1	8.863	43.7	6	1.0	1.7

12/02/96
13:24:57

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 96043 ***

Example Problem / Stack 3 / Modeled at 1 g/s emission rate & ratio to actual

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT
EMISSION RATE (G/S) = 1.00000
STACK HEIGHT (M) = 25.0000
STK INSIDE DIAM (M) = 1.0000
STK EXIT VELOCITY (M/S) = 23.0000
STK GAS EXIT TEMP (K) = 350.0000
AMBIENT AIR TEMP (K) = 293.0000
RECEPTOR HEIGHT (M) = .0000
URBAN/RURAL OPTION = RURAL
BUILDING HEIGHT (M) = 14.0000
MIN HORIZ BLDG DIM (M) = 50.0000
MAX HORIZ BLDG DIM (M) = 100.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 9.183 M**4/S**3; MOM. FLUX = 110.712 M**4/S**2.

*** FULL METEOROLOGY ***

*** SCREEN AUTOMATED DISTANCES ***

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
60.	12.80	4	20.0	22.9	6400.0	26.78	5.17	11.03	HS
100.	25.37	6	4.0	6.6	10000.0	35.90	5.12	14.04	HS
200.	18.23	6	4.0	6.6	10000.0	42.31	9.17	17.97	HS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 60. M:

140.	33.36	6	4.0	6.6	10000.0	38.71	6.83	17.26	HS
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 *** SCREEN AUTOMATED DISTANCES ***

*** TERRAIN HEIGHT OF 16. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
200.	99.84	6	4.0	6.6	10000.0	26.31	9.17	17.97	HS
300.	49.37	6	4.0	6.6	10000.0	31.68	12.97	19.17	HS
400.	38.27	4	5.0	5.7	1600.0	28.70	29.99	24.96	HS
500.	32.01	4	5.0	5.7	1600.0	28.70	36.58	27.63	HS
600.	27.14	4	5.0	5.7	1600.0	28.70	43.09	30.26	HS
700.	23.58	4	5.0	5.7	1600.0	28.70	49.51	30.68	HS
800.	21.39	4	4.0	4.6	1280.0	33.63	56.02	27.69	NO
900.	19.85	4	4.0	4.6	1280.0	33.63	62.28	30.29	NO
1000.	18.79	6	3.5	5.8	10000.0	37.76	34.87	23.78	HS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 200. M:

200.	99.84	6	4.0	6.6	10000.0	26.31	9.17	17.97	HS
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DWASH= MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

 * SUMMARY OF TERRAIN HEIGHTS ENTERED FOR *
 * SIMPLE ELEVATED TERRAIN PROCEDURE *

TERRAIN HT (M)	DISTANCE RANGE (M)	
	MINIMUM	MAXIMUM
0.	60.	200.
16.	200.	1000.

 *** REGULATORY (Default) ***
 PERFORMING CAVITY CALCULATIONS
 WITH ORIGINAL SCREEN CAVITY MODEL
 (BRODE, 1988)

*** CAVITY CALCULATION - 1 ***	*** CAVITY CALCULATION - 2 ***
CONC (UG/M**3) = .0000	CONC (UG/M**3) = .0000
CRIT WS @10M (M/S) = 99.99	CRIT WS @10M (M/S) = 99.99
CRIT WS @ HS (M/S) = 99.99	CRIT WS @ HS (M/S) = 99.99
DILUTION WS (M/S) = 99.99	DILUTION WS (M/S) = 99.99
CAVITY HT (M) = 14.22	CAVITY HT (M) = 14.00
CAVITY LENGTH (M) = 62.82	CAVITY LENGTH (M) = 46.23
ALONGWIND DIM (M) = 50.00	ALONGWIND DIM (M) = 100.00

CAVITY CONC NOT CALCULATED FOR CRIT WS > 20.0 M/S. CONC SET = 0.0

 END OF CAVITY CALCULATIONS

 *** SUMMARY OF SCREEN MODEL RESULTS ***

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	99.84	200.	16.
COMPLEX TERRAIN	8.863	3450.	53. (24-HR CONC)

 ** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 96043 ***

Example Problem / Stack 4 / Modeled at 1 g/s emission rate & ratio to actual

COMPLEX TERRAIN INPUTS:

SOURCE TYPE = POINT
EMISSION RATE (G/S) = 1.00000
STACK HT (M) = 25.0000
STACK DIAMETER (M) = .5000
STACK VELOCITY (M/S) = 5.1000
STACK GAS TEMP (K) = 505.0000
AMBIENT AIR TEMP (K) = 293.0000
RECEPTOR HEIGHT (M) = .0000
URBAN/RURAL OPTION = RURAL

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 1.312 M**4/S**3; MOM. FLUX = .943 M**4/S**2.

FINAL STABLE PLUME HEIGHT (M) = 44.9
DISTANCE TO FINAL RISE (M) = 151.3

TERR HT (M)	DIST (M)	MAX 24-HR CONC (UG/M**3)	*VALLEY 24-HR CALCS*		**SIMPLE TERRAIN 24-HR CALCS**				
			CONC (UG/M**3)	PLUME HT ABOVE STK BASE (M)	CONC (UG/M**3)	PLUME HT ABOVE STK HGT (M)	U10M SC	USTK (M/S)	
35.	2500.	25.88	2.993	44.9	25.88	22.8	6	1.0	1.7

12/02/96

13:34:24

*** SCREEN3 MODEL RUN ***
 *** VERSION DATED 96043 ***

Example Problem / Stack 4 / Modeled at 1 g/s emission rate & ratio to actual

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT
 EMISSION RATE (G/S) = 1.00000
 STACK HEIGHT (M) = 25.0000
 STK INSIDE DIAM (M) = .5000
 STK EXIT VELOCITY (M/S) = 5.1000
 STK GAS EXIT TEMP (K) = 505.0000
 AMBIENT AIR TEMP (K) = 293.0000
 RECEPTOR HEIGHT (M) = .0000
 URBAN/RURAL OPTION = RURAL
 BUILDING HEIGHT (M) = 14.0000
 MIN HORIZ BLDG DIM (M) = 50.0000
 MAX HORIZ BLDG DIM (M) = 100.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 1.312 M**4/S**3; MOM. FLUX = .943 M**4/S**2.

*** FULL METEOROLOGY ***

 *** SCREEN AUTOMATED DISTANCES ***

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
35.	.0000	0	.0	.0	.0	.00	.00	.00	NA
100.	74.83	6	4.0	6.6	10000.0	29.97	4.38	13.78	HS
200.	71.67	4	2.0	2.3	640.0	36.45	15.90	18.88	HS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 35. M:

140.	85.79	6	4.0	6.6	10000.0	31.44	5.96	16.93	HS
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 *** SCREEN AUTOMATED DISTANCES ***

*** TERRAIN HEIGHT OF 16. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
200.	267.4	4	1.5	1.7	480.0	24.26	16.16	19.10	HS
300.	198.6	4	1.5	1.7	480.0	24.26	23.03	21.94	HS
400.	167.7	6	1.0	1.7	10000.0	31.83	16.02	19.89	HS
500.	147.9	6	1.0	1.7	10000.0	31.83	19.11	20.59	HS
600.	132.8	6	1.0	1.7	10000.0	31.83	22.21	21.27	HS
700.	120.9	6	1.0	1.7	10000.0	31.83	25.31	21.94	HS
800.	108.4	6	1.0	1.7	10000.0	31.83	28.39	22.05	HS
900.	100.7	6	1.0	1.7	10000.0	31.83	31.46	22.69	HS
1000.	93.91	6	1.0	1.7	10000.0	31.83	34.51	23.25	HS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 200. M:
 200. 267.4 4 1.5 1.7 480.0 24.26 16.16 19.10 HS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

 * SUMMARY OF TERRAIN HEIGHTS ENTERED FOR *
 * SIMPLE ELEVATED TERRAIN PROCEDURE *

TERRAIN HT (M)	DISTANCE RANGE (M)	
	MINIMUM	MAXIMUM
0.	35.	200.
16.	200.	1000.

 *** REGULATORY (Default) ***
 PERFORMING CAVITY CALCULATIONS
 WITH ORIGINAL SCREEN CAVITY MODEL
 (BRODE, 1988)

*** CAVITY CALCULATION - 1 ***	*** CAVITY CALCULATION - 2 ***
CONC (UG/M**3) = .0000	CONC (UG/M**3) = .0000
CRIT WS @10M (M/S) = 99.99	CRIT WS @10M (M/S) = 99.99
CRIT WS @ HS (M/S) = 99.99	CRIT WS @ HS (M/S) = 99.99
DILUTION WS (M/S) = 99.99	DILUTION WS (M/S) = 99.99
CAVITY HT (M) = 14.22	CAVITY HT (M) = 14.00
CAVITY LENGTH (M) = 62.82	CAVITY LENGTH (M) = 46.23
ALONGWIND DIM (M) = 50.00	ALONGWIND DIM (M) = 100.00

CAVITY CONC NOT CALCULATED FOR CRIT WS > 20.0 M/S. CONC SET = 0.0

 END OF CAVITY CALCULATIONS

 *** SUMMARY OF SCREEN MODEL RESULTS ***

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	267.4	200.	16.
COMPLEX TERRAIN	25.88	2500.	35. (24-HR CONC)

 ** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **

APPENDIX D - Air Toxic Modeling Procedures

INTRODUCTION

One of the major concerns expressed with South Carolina Air Pollution Regulation 62.5 Standard No. 8, "Toxic Air Pollutants", was the need to establish a procedure to find an emission level below which an air dispersion modeling analysis would not be required. There is no simple method to determine these values since stack and release parameters, location of release, and building size and location are all factors that can affect the ambient off-site concentrations caused by the emission(s). After considerable study, the Bureau of Air Quality has proposed a two level method to establish a de minimis modeling value to use with Standard No. 8 to determine if modeling is needed. In addition, the Bureau has developed an approach that allows facilities that have shown compliance with Standard No. 8 to defer modeling at the time of a construction permit application that increases emissions of a previously modeled air toxic.

The first established de minimis approach uses a general worst case approach and is the simplest to use. This approach uses the maximum hourly facility-wide emission rate for a pollutant (lb/hr) and divides this rate by the Maximum Allowable Ambient Concentration (MAAC) allowed for that pollutant in Standard No. 8. If the result is less than 5.0×10^{-4} then no further analysis will be required. The approach has been expressed in table form for each chemical listed in Standard No. 8 (See Table 1).

The second de minimis approach is derived from the EPA's **A Tiered Modeling Approach for Assessing the Risks Due to Sources of Hazardous Air Pollutants**, EPA-450/4-92-001, March 1992. This document sets forth methods for conducting a series of tests to assess the residual risks for air toxics in Title III of the Clean Air Act Amendments (CAAA) of 1990. A simplified screening procedure from this document is the basis for the Bureau of Air Quality's Level II de minimis approach. This approach allows the use of stack height and distance to property boundary to be used in the analysis to determine if the pollutant emissions will be below a de minimis modeling level requiring no further analysis.

If the Level I approach predicts off-site concentrations which are less than the MAAC for that air toxic as listed under Standard No. 8, then the facility can stop its analysis at this point. If the first level fails, then the facility applies the Level II analysis. Likewise, the facility stops if this level predicts concentrations that are less than the MAAC. Otherwise, the facility is required to use the latest EPA-approved screening models such as the SCREEN model or refined models such as the ISCST model to complete the air toxic analysis. As this document's printing SCREEN3 and ISCST3 are the latest EPA-approved versions of these models. When these models are superseded, their replacements will become the required models. **If a pollutant passes the Level I or Level II analysis, no further modeling is required to show compliance with Standard No. 8. However, the information relating to the analysis must still be submitted to this Bureau for review. There are also some cases where the pollutant passes the Level I or Level II screening but emits over 1000 pounds per month of an air toxic. A permit would still be required for this case even though no further modeling analysis would be required.**

To reduce the time and expense of construction permit applications at facilities that have shown compliance with Standard No. 8, the Bureau has developed an approach that defers the need for

modeling at the time of the application. The deferral approach is dependent upon the results of the previous modeling; consequently this approach may **only** be used for air toxics that have shown compliance through modeling. A larger increase in emissions will be allowed for sources that have previously consumed a smaller portion of the air toxics standard. These increases must be modeled at the time of the plant's operating permit renewal.

Multiple increases are allowed, but these increases are cumulative in nature. Once the increases equal the calculated maximum emission rate increase, the facility can not further increase the emission rate for this air toxic until modeling is done to show compliance. Once the facility is remodeled and compliance shown, a new deferral level would be set based on the emission rate and modeling results. When the facility's operating permit is up for renewal, all deferred increases will be modeled for compliance with the air toxics standards. Please see the deferral instructions for further explanation. **The information relating to the deferral analysis must be submitted to the Bureau for review.**

This deferral approach only applies to air toxics that have been previously modeled. Air toxics that have not been modeled before must use either the de minimis approaches or air dispersion modeling to show compliance with standard no. 8.

DEFINITIONS & GENERAL MODELING GUIDANCE

Point Source - A point source is an emission discharged from a specific point such as a smokestack or a vent.

Area Source - An area source for modeling purposes is an emission that is given off from a specific and well-defined surface such as a lagoon, storage pile, or open tank. Sources referred to as having "fugitive" emissions (e.g., multiple leaks within a specified area) are usually modeled as an area source. Emissions from storage piles and lagoons do not have to be considered in determining compliance with Standard No. 8 at this time.

Complex Terrain - Complex terrain is defined as terrain that exceeds the top of the shortest non-fugitive stack being modeled. If air toxic emissions are emitted from stacks that are less than 50 meters tall, then the terrain within 5 kilometers of the source should be examined to determine if complex terrain is present. For stacks taller than 50 meters, then the terrain within 20 kilometers of the source should be examined for complex terrain. Complex terrain situations cannot be evaluated using the Level I or Level II procedures. The South Carolina **Air Modeling Guidelines** should be used to assist with these situations.

Exemptions from Standard No. 8 - Affected sources that emit Hazardous Air Pollutants (HAPs) and are subject to one or more Federal Maximum Achievable Control Technology (MACT) standards are exempt from Standard No. 8. This exemption shall only apply to toxic air pollutants regulated by this standard that are also federally regulated HAPs, except as provided below. This exemption shall apply once the emission sources are in compliance with a proposed or final MACT

standard. Affected source, for the purposes of this part, means the stationary source, the group of stationary sources, or the portion of a stationary source that is regulated by a relevant standard or other requirement established pursuant to Section 112 of the Act (42 U.S.C 7401 et seq.). Each relevant standard will define the “affected source” for the purposes of that standard.

Emission points that emit HAPs which are not exempt from this standard according to the above paragraph are granted an exemption once a federally required Residual Risk analysis (42 U.S.C. section 112(f)) that accounts for all facility-wide HAPs has been completed. Such emission points may be exempted prior to a Residual Risk analysis on a case-by-case basis after review by the Department. Exemptions may be granted in cases where off-site impacts from HAP emissions are significantly below levels established by this standard (less than 50% of the standard). If future construction/modifications cause off-site impacts to exceed 50% of the appropriate standard, the exemption is no longer valid.

Sources that emit toxic air pollutants regulated by this standard which are not federally regulated HAPs can request an exemption from this standard on a case-by-case basis after review by the Department. Exemptions may be granted in cases where non-HAP emissions are controlled (reduced) by MACT controls applied to reduce HAP emissions and in cases where off-site impacts from non-HAP emissions are significantly below levels established by this standard (less than 50% of the standard). If future construction/modifications cause off-site impacts to exceed 50% of the appropriate standard, the exemption is no longer valid.

The use of sodium hydroxide in a scrubber for air pollution control purposes is exempt from Standard No. 8.

Determination of Trace Air Emissions - Many chemical mixtures used in the manufacturing process may contain trace amounts of hazardous chemicals which are not required to be listed on a Material Safety Data Sheet (MSDS). 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. Therefore, the following guidance should be used to determine what trace emissions should be included in emission estimates for an air emission point:

- (1) If the toxic chemical is classified as a 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 reported as an air emission.
- (2) 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 reported as an air emission.

- (3) If reasonable process knowledge should indicate the presence of intermediate reaction products, then the guidance in No. 1 & 2 above should be used to determine if these emission(s) can be considered true trace emission(s) and need not be reported as air emission(s).

These are the same de minimis levels used by *EPA 745-K-94-001, Toxic Chemical Release Inventory Reporting Form R and Instructions, Section 313 of the Community Planning and Community Right-to-Know Act* concerning the determination of notifications to include on MSDS sheets. The list of OSHA carcinogens can be found in Table II of the same document. These are noted by a 0.1% entry in the de minimis concentration column of this table.

Determining Emission Rates - Emission rates can be determined by using mass balances, engineering calculations, EPA emission factors, or stack tests. **However, as noted in Section IV of Standard No. 8, if stack tests are used to determine emission rates, then the methods and procedures used shall be approved by the Bureau's Source Evaluation Section prior to testing.** The source evaluation section shall also be notified two weeks before a test to allow personnel from this Bureau an opportunity to observe it.

Emission Rate - Standard No. 8 expresses the MAAC in concentrations that are averaged over a 24-hour period (day). For continuous type sources, the emission rate should be the maximum hourly rate that it can emit expressed as pounds per hour (lb/hr), and this should be multiplied by 24 hours/day to obtain a maximum lb/day emission rate. For intermittent or batch type sources, the Level I emission rate is found by determining the total pounds that can be emitted in a day. For Level II intermittent or batch type sources the maximum total emissions pounds emitted for a day should be determined to obtain a lb/day emission rate. The actual number of hours that the emission occurred (hours of emissions) must also be determined for Level II analysis. **For both Level I and Level II analysis, emissions which represent less than 24-hour operation or those that represent less than the maximum daily emissions for a process will not be allowed without a permit restriction limiting the hours of operation or other process limits. To prevent permit restrictions, the modeling process should use maximum emissions that could occur in a 24-hour day.**

Emissions Increases Not Involving New Equipment - Numerous processes may be able to use different materials in the manufacture of products. To assist facilities in adjusting to market demands, the Bureau has adopted the following procedures for air toxics emissions increases in operating scenarios that will not require the installation of new equipment.

- (1) The facility has an approved current operating or construction air permit from the Bureau.
- (2) (Title V permitted facilities only) The emission rates for each emission point are less than or equal to the rates listed in the maximum potential to emit

tables located in the Title V permit application. For facilities that are not required to have a Title V permit, this step does not apply.

- (3) The facility may commence with the new operating scenario once the Bureau has received a modeling analysis showing compliance using the new emission rates.
- (4) The modeling analysis must also be on file at the facility and available for SCDHEC inspection prior to the facility's use of the new emission rates.
- (5) The facility assumes the risk and potential consequences if the modeling analysis is found to be incorrect **and** the actual emissions indicate an exceedance of the appropriate standard.

This approach may only be used for existing, permitted equipment. Emissions increases involving new equipment will require a construction permit be obtained first.

Fugitive Emissions Occurring Inside a Plant - One common type of emission question concerns how to treat toxic emissions that occur inside the plant which are not directly captured and discharged through a stack. These emissions, which are predominately volatile organic emissions, are common; and they can be very large in many processes. These emissions leave the building through nearby roof vents, fans, windows, air handling systems, or doorways. The proper method is to inspect the building and identify the most likely exit point(s) and then use this point or points as the discharge point(s) for the associated toxic emissions.

Hours of Emissions Adjustment Factor - The hours-of-emission factor is used to adjust for emissions from batch or non-continuous operations. This factor adjusts the averaging-time conversion factor for emissions that are non-continuous in nature.

Leaks from Pipes, Flanges, Pumps, and Valves - Equipment leaks include leaks from compressors, pressure relief devices, sampling connection systems, open-ended valves or lines, and flanges and connectors. Emissions from equipment leaks should be minimized through the use of a well-organized preventative maintenance program. If a federally required preventative maintenance program is in place, emissions from equipment leaks do not have to be considered in determining compliance with Standard Number 8 at this time. For those facilities not covered by a federally required preventive maintenance program, the Bureau of Air Quality has established a set of guidelines for acceptable leak detection and repair (LDAR) programs. These guidelines are available from the Bureau. **Please note participation in the LDAR program for showing compliance with Standard No. 8 is voluntary; this program is only designed as an option to quantifying and modeling air toxic emissions from equipment leaks.**

Nearest Property Boundary - The MAAC is determined for impacts from a source at its property line and beyond. For each emission point for Level II analysis, the distance to the nearest property line must be determined. This distance is the shortest straight-line distance from an emission source

to a property boundary or area of public access (e.g. public highway, river, etc.). For area sources, this distance should be measured from the nearest edge or side of the area source and not from the center.

FIRST LEVEL (Level I) ANALYSIS

The Level I analysis is the simplest procedure to use. It does not take into account the stack height or the distance to the nearest property line as does the Level II analysis.

Information Required:

- (1) Total maximum plant-wide air emissions for a pollutant covered under Standard No. 8 in pounds per day.
- (2) Maximum Allowable Ambient Concentration for the pollutant listed in Standard No. 8 ($\mu\text{g}/\text{m}^3$) or Table 1.

Procedure:

- (1) From Table 1 find the de minimis modeling level for the pollutant (far right column).
- (2) If the total plant-wide emissions for a pollutant are less than or equal to the de minimis level for that pollutant, then the analysis for this air toxic can stop at this point. Otherwise proceed to the Level II analysis.

This approach uses the equation listed at the end of this section. It has been further simplified by solving each chemical listed in Standard No. 8 for the maximum amount of emissions that can be emitted from a facility and still qualify for meeting the Level I requirements. **If a pollutant passes the Level I or Level II analysis, then further modeling is not required. However, summary information relating to the analysis should still be submitted to this Bureau for review, and complete information relating to the calculations should be maintained on-site and made available to personnel from this Bureau upon request.**

Table 1 Modeling De Minimis Levels for Air Toxics Listed in Standard No. 8

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
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	75-05-8	1750.00	1	21.000
Acetophenone	98-86-2	+	3	+
2-Acetylaminofluorine	53-96-3	+	3	+
Acetylene Tetrachloride	79-34-5	35.00	3	0.420
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
Benzidine	92-87-5	0.00	3	0.000

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
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	+

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
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
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	95-48-7	110.50	3	1.326
p-Cresol	106-44-5	110.50	3	1.326
Cumene	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

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
DDE	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	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	+
n,n-Diethylaniline (n,n-Dimethylaniline)	121-69-7	250.00	2	3.000
Diisodecyl Phthalate	2671-40-0	50.00	2	0.600
3,3-Dimethoxybenzidine	119-90-4	0.30	3	0.004
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	+

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
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
Dioctyl Phthalate	117-84-0	50.00	2	0.600
1,4-Dioxane	123-91-1	450.00	3	5.400
1,2-Diphenylhydrazine	122-66-7	+	3	+
Epichlorohydrin	106-89-8	50.00	3	0.600
1,2-Epoxybutane	106-88-7	+	3	+
Ethanethiol	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	75-00-3	26400.00	2	316.800
Ethylene Dibromide	106-93-4	770.00	2	9.240
Ethylene Dichloride	107-06-2	200.00	3	2.400
Ethylene Glycol	107-21-1	650.00	3	7.800
Ethylene Imine	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	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
Formic Acid	64-18-6	225.00	1	2.700
Furfural	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

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
Glycol Ethers (mono- and di- ethers of diethylene glycol or triethylene glycol)		+	1	+
Glycol Ethers (mono- and di- ethers of ethylene glycol)		+	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	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 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

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
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
Mercury	7439-97-6	0.25	3	0.003
Methanol	67-56-1	1310.00	3	15.720
Methoxychlor	72-43-5	50.00	3	0.600
Methyl Bromide	74-83-9	100.00	3	1.200
Methyl Chloride	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-Butone)	78-93-3	14750.00	1	177.000
Methyl Hydrazine	60-34-4	1.75	3	0.021
Methyl Iodide	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	101-68-8	2.00	2	0.024
4,4-Methylene Bis-2-chloroaniline	101-14-4	1.10	3	0.013
Methylene Chloride	75-09-2	8750.00	1	105.000
4,4-Methylenedianiline	101-77-9	4.00	3	0.048
Methyl-Isobutyl Ketone	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

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
Mirex	2385-85-5	4500.00	3	54.000
Naphthalene	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
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

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
Parathion	56-38-2	0.50	3	0.006
Pentachloronitrobenzene (Quintobenzene)	82-68-8	+	3	+
Pentachlorophenol	87-86-5	5.00	2	0.060
Perchloroethylene	127-18-4	3350.00	2	40.200
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		160.00	3	1.920
1,3-Propane Sultone	1120-71-4	+	3	+
b-Propiolactone	57-57-8	7.50	3	0.090
Propoxur	114-26-1	2.50	3	0.030
Propionaldehyde	123-38-6	+	1	+
Propylene Dichloride	78-87-5	1750.00	3	21.000
1,2-Propylene Oxide	75-56-9	250.00	3	3.000
1,2-Propylenimine	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

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
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	79-34-5	35.00	3	0.420
Tetrachloroethylene	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	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	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

CHEMICAL NAME	CAS No. ^a	MAAC ^b ($\mu\text{g}/\text{m}^3$)	Cat. ^c	de minimis ^d (lb/day)
Trifluralin	1582-09-8	+	3	+
2,2,4-Trimethylpentane	540-84-1	8750.00	1	105.000
Urethane (Carbamic Acid Ethyl Ester)	51-79-6	5000.00	2	60.000
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	75-35-4	99.00	3	1.188
Xylene	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

a Chemical Abstract Service Number

b Maximum Allowable Ambient Concentration allowed off-site by Standard No. 8.

c Category 1: Low Toxicity, Category 2: Moderate Toxicity, and Category 3: High Toxicity.

d Maximum plant-wide air emissions (lb/day) of the toxic chemical that will not require further modeling review.

+ to be determined

Note: For the purpose of this standard, MAAC values of $0.00 \mu\text{g}/\text{m}^3$ shall be rounded to the nearest hundredth of a $\mu\text{g}/\text{m}^3$. For example, a test or modeled value of 0.005 through 0.01 would be rounded to 0.01 but values less than 0.005 would be rounded to 0.00.

LEVEL I ALTERNATE APPROACH - FORMULA 1

Information Required:

- (1) Total maximum plant-wide air emissions for a pollutant covered under Standard No. 8 in pounds per hour.

- (2) Maximum Allowable Ambient Concentration for the pollutant listed in Standard No. 8 ($\mu\text{g}/\text{m}^3$).

Procedure:

- (1) Divide the total pounds per hour by the MAAC to obtain Results.
- (2) If the Results from step 1 are less than or equal to 5.0×10^{-4} then the analysis for this air toxic can stop at this point. Otherwise proceed to the Level II analysis. **If a pollutant passes the Level I or Level II analysis and further modeling is not required, then summary information relating to the analysis must still be submitted to this Bureau for review. Complete information relating to the calculations should be maintained on-site and made available to personnel from this Bureau upon request.**

SECOND LEVEL (Level II) ANALYSIS:

The Level II analysis uses more parameters than the Level I analysis and is therefore more difficult to calculate than Level I. The Level II analysis, however, is not as intensive as using EPA's screening and refined models.

Information Required:

- (1) Maximum daily emission rate (pounds/day) for each source being evaluated. See the definition of emission rate for further information.
- (2) Hours of Emissions for each source being evaluated (hrs).
- (3) Height of each emission release point above ground level (ft) for point sources.
- (4) Source types - point or area sources.
- (5) Maximum horizontal distance across each area source (ft).
- (6) Distance to closest property line for each source (ft). For an area source this distance should be measured from the nearest edge of the area source.

Once the above information is determined for each emission point, then Table 2 and Table 3 can be used to determine the maximum 24-hr concentrations from each release using the following procedure:

Procedure:

- (1) For area sources, select the "side length" in Table 3 (33 ft, 65 ft, or 98 ft) which is less than or equal to the maximum horizontal distance across each source.
- (2) For point sources, select the largest "emission height" in Table 3 (0 ft, 6 ft, 16 ft, 33 ft, 65 ft, 115 ft, or 164 ft) that is less than or equal to the estimated height of release.
- (3) For each source, select the largest distance in Table 3 (33 ft, 98 ft, 164 ft, 328 ft, 656 ft, or 1,640 ft) that is less than or equal to its nearest distance to the property line.
- (4) Take the maximum 24-hr average concentration in Table 3 for this release and property line distance, and multiply by the emission rate of each toxic pollutant (lb/day) in the release to obtain the maximum unadjusted off-site 24-hr average concentration estimates ($\mu\text{g}/\text{m}^3$).
- (5) Adjust for non-continuous emissions by using the Hours-of-Emissions Adjustment Factor found in Table 2. Multiply the maximum off-site 24-hr average concentration found in step 4 above by the adjustment factor. This becomes the maximum off-site 24-hr average concentration ($\mu\text{g}/\text{m}^3$) for this emission source.
- (6) Sum up the off-site concentrations for each emission point for the air toxic being analyzed. If the sum of these off-site concentrations is less than the MAAC for that air toxic, then no further analysis will be required. Otherwise, the analysis should proceed with the use of EPA approved models. See the South Carolina [Air Modeling Guidelines](#) for additional information on models to use and procedure to follow for a modeling analysis.

Please note that if a toxic chemical listed under Standard No. 8 has a high allowable MAAC, it is possible for it to pass the Level I and/or Level II screening and not require a formal modeling analysis. The chemical may still need to be permitted, particularly if its total plant-wide emissions exceed 1000 pounds per month. Also, if a pollutant passes the Level I or Level II analysis, further modeling is not required. However, summary information relating to the analysis must still be submitted to this Bureau for review. Complete information relating to the calculations should be maintained on-site and made available to personnel from this Bureau upon request.

Table 2 Hours of Emissions Adjustment Factor

Hours	0 < 3	3 < 6	6 < 8	8 < 12	12 < 17	17 < 24	24
Adjust. Factor	2.50	2.25	2.00	1.75	1.50	1.25	1.00

Table 3 Normalized Maximum 24-hour Average Concentrations ($\mu\text{g}/\text{m}^3$)/(lb/day)

Source Type	Emission height (ft)	Side length ^a (ft)	Normalized Maximum Concentration at or Beyond: ^b					
			33 ft	98 ft	164 ft	328 ft	656 ft	1640 ft
Area	0	33	697.	221.	120.	47.3	16.9	4.03
Area	0	65	376.	134.	78.1	34.9	13.9	3.68
Area	0	98	256.	95.3	57.8	27.3	11.7	3.34
Point	0	--	3950.	578.	237.	70.6	21.2	4.43
Point	6	--	137.	103.	98.5	53.1	19.3	4.35
Point	16	--	70.1	54.4	37.8	19.8	10.8	3.78
Point	33	--	20.2	17.8	15.5	9.89	5.23	2.10
Point	65	--	5.15	3.30	3.30	2.77	1.78	0.771
Point	115	--	1.65	1.65	0.827	0.809	0.655	0.321
Point	164	--	0.806	0.806	0.806	0.342	0.309	0.184

a Side length of square area source.

b Distance downwind of an area source indicates distance from downwind edge of the area source.

DO NOT INTERPOLATE TABLE VALUES

ADDITIONAL ANALYSIS

If the analysis did not pass the Level I or Level II analysis, then a modeling analysis will be required. Consult the Bureau's [Air Quality Modeling Guidelines](#) for the proper models and procedures to use in the analysis.

DE MINIMIS ANALYSIS EXAMPLE PROBLEM

A facility has two emission points of Benzene, one of the toxic chemicals covered under Standard No. 8. The following information describe their emission points:

Emission A: A Vent-Pipe 131 feet tall and 213 feet from the nearest property line. The emissions are intermittent with a maximum emission rate of 3.3 pounds per day while operating at full capacity. The emissions are emitted over an 8-hour period and the process operates 24 hours/day.

Emission B: A stack with continuous emissions 50 feet tall and 131 feet from the nearest property line. Maximum hourly emission rate = 0.11 pounds per hour while operating at full capacity. The process operates 24 hours/day.

For Stack A: Emissions = 3.3 pounds/day
 = 3.3 lb/day / 24 hrs/day = 0.14 lb/hr
 Hours of Emissions = 8 hours
 Emission Height = 131 feet
 Nearest Property Boundary = 213 feet
 MAAC for Benzene from Standard No. 8 = 150 $\mu\text{g}/\text{m}^3$

For Stack B: Emissions = 0.11 lb/hr
 = 0.11 lb/hr x 24 hrs/day = 2.64 lb/day
 Hours of Emissions = 24 hours
 Emission Height = 50 feet
 Nearest Property Boundary = 131 feet
 MAAC for Benzene from Standard No. 8 = 150 $\mu\text{g}/\text{m}^3$

Level I Analysis Using Table 1:

- (1) Find the total plant-wide daily maximum air emissions of Benzene for the facility: Emissions = 3.3 + 2.64 = 5.94 lb/day.
- (2) In Table 1, find the de minimis modeling value for Benzene. This value is 1.8 lb/day.

- (3) Compare the value obtained in step 1 (5.94 lb/day) to the value obtained in step 2 from Table 1 (1.8 lb/day). The results from step 1 are greater than the de minimis modeling value found in step 2.
- (4) Since the emissions determined in step 1 are greater than the de minimis modeling value found in step 2, the analysis must continue with Level II.

Level I Analysis Using Equation 1:

- (1) Find the total air emission rate of Benzene for the facility:
Emissions = $0.14 + 0.11 = 0.25$ lb/hr.
- (2) Find the MAAC for Benzene from Standard No. 8 (MAAC = $150 \mu\text{g}/\text{m}^3$)
- (3) Divide the total emission rate found in step 1 by the MAAC for Benzene found in step 2. Results = $(0.25 \text{ lb/hr}) / (150 \mu\text{g}/\text{m}^3) = 0.0017$
- (4) Since the results found in step 3 are greater than 0.0005 then the analysis must continue with Level II.

Level II Analysis:

- (1) Find the hourly emission rate for stacks A & B along with their stack height and distance to property boundary.

Stack A: Stack Ht. = 131 feet
 Dist. to Nearest Property Line = 213 feet
 Emission Rate = 3.3 lb/day
 Hours of Emissions = 8 hours

Stack B: Stack Ht. = 50 feet
 Dist. to Nearest Property Line = 131 feet
 Emission Rate = 2.64 lb/day
 Hours of Emissions = 24 hours

- (2) For each source, select the largest stack height in Table No. 3 that is less than or equal to the release height. Both sources are point sources.

Stack A: Use Emission Ht. = 115 feet in Table 3.

Stack B: Use Emission Ht. = 33 feet in Table 3.

- (3) For each source, select the largest distance in Table 3 that is less than or equal to its nearest distance to the property line.

Stack A: Use Dist. = 164 feet in Table 3.
 Stack B: Use Dist. = 98 feet in Table 3.

- (4) Go to Table 3 for point sources and for stack A (Ht.= 115 ft, Dist.= 164 feet) and stack B (Ht.= 33 ft, Dist.= 98 feet) find the estimated impact (24 hr averaging period) for a 1 lb/day emission rate.

Stack A: $0.827 \mu\text{g}/\text{m}^3$
 Stack B: $17.8 \mu\text{g}/\text{m}^3$

- (5) For each source go to Table 2 and find the Hours of Emissions Adjustment Factor for Stack A (8 hours) and Stack B (24 hours).

Stack A: 1.75
 Stack B: 1.00

- (6) For each concentration found in step 4, multiply it by the emission rate for that source (step 1) and the Hours of Emissions Adjustment Factor found in Step 5. Next, sum up the total of all sources of that toxic chemical.

Stack A: $0.827 \times 3.3 \times 1.75 = 4.78 \mu\text{g}/\text{m}^3$
 Stack B: $17.8 \times 2.64 \times 1.00 = 47.0 \mu\text{g}/\text{m}^3$

Total = 51.8 $\mu\text{g}/\text{m}^3$

- (7) Compare the sum of the Benzene emissions with the MAAC found in Standard No. 8 and also in Table 2. The MAAC for Benzene is $150 \mu\text{g}/\text{m}^3$. Since the impact from the Benzene emissions for this test case ($51.8 \mu\text{g}/\text{m}^3$) is less than the MAAC ($150 \mu\text{g}/\text{m}^3$), no further analysis will be required. If the Benzene impact were greater than the MAAC, then further analysis would be required using EPA approved models. The information from the screening procedure or full modeling analysis should be submitted to this Bureau for review.

MODELING DEFERRAL APPROACH FOR AIR TOXIC EMISSION INCREASES

The deferral approach for air toxic emission increases may only be used for air toxics that have been previously modeled to show compliance. Information from the previous modeling analysis is used in the deferral determination.

This deferral approach is based on the increased emissions being emitted from sources with similar emission parameters and locations as those in the baseline compliance modeling demonstration. Proposed sources with significantly worse dispersion characteristics or locations closer to the property boundaries than the sources in the baseline modeling demonstration may need to be modeled to show compliance. For point sources the merged stack equation discussed in section 2.2 of the South Carolina **Air Quality Modeling Guidelines** may be used to determine if the proposed emission source will have worse dispersion characteristics than the sources included in the baseline compliance demonstration. If the merged stack parameter (M) value for the new stack(s) is less than 50% of the current worst case M value, modeling will be required. If the new stack(s) are 25% closer to the property boundary than the old stacks, modeling will be required.

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.

Information Required:

- (1) Stack parameter information for both proposed sources and previously modeled sources of the air toxic(s) to be increased.
- (2) Plant wide emission rate from the most recent air toxic demonstration of air toxic(s) to be increased. This emission rate is considered the baseline emission rate.
- (3) Modeled concentrations from the most recent air toxic demonstration of air toxic(s) to be increased.
- (4) Proposed emission rate from sources in the construction permit application.
- (5) Emission rates for increases that were previously deferred (if applicable).

Procedure:

- (1) Check that the proposed new/modified stack(s) is not significantly different than the existing stacks. If the merged stack parameter for the new/modified stack(s) is less than 50% of the current worst case merged stack parameter,

modeling is required. If the new stack(s) is 25% closer to the property boundary than the existing stacks, modeling will be required.

- (2) Divide the modeled concentration by that air toxic's maximum allowable concentration and multiply this fraction by 100 to obtain the percent standard consumed in the modeling demonstration.
- (3) Round the value found in step 2 up to the nearest higher percent standard value shown in Table 4.
- (4) Using the value found in step 3, determine the corresponding increase multiplier of the baseline emission rate in Table 4.
- (5) Multiply the increase multiplier by the baseline emission rate. This value is the cumulative maximum emission rate increase that may be deferred from modeling.
- (6) Total the proposed emission rate plus any previously deferred emission rates that have not been modeled. Compare this total to the maximum emission rate increase found in step 5. If the total of the proposed emission rate and deferred emission rates is less than the maximum emission rate increase, modeling is deferred for this construction permit application until a new baseline demonstration is completed or the facility's operating permit is up for renewal.

In the unlikely event the facility-wide modeling shows noncompliance, steps must be taken by the company to show compliance with the air toxics standard(s) before an operating permit or additional construction permits will be issued. **The information relating to the deferral analysis must be submitted to the Bureau for review. A table for providing this information is located after the example problem.**

This deferral approach only applies to air toxics that have been previously modeled. Air toxics that have not been modeled before must use either the de minimis approaches or air dispersion modeling to show compliance with standard no. 8.

Table 4 Deferral Increase Levels

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

DEFERRAL ANALYSIS EXAMPLE PROBLEM

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 pounds per hour. In their most recent toluene modeling demonstration, an emission rate of 20 pounds per hour showed an impact of $486.5 \mu\text{g}/\text{m}^3$. This facility has already deferred an increase of 2 pounds per hour.

- (1) Check that the new/modified stacks do not have significantly worse dispersion characteristics than the current stacks.

Table 5 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) ^a		18.29	18.29	16.77
Stack Diameter (m) ^b		0.76	0.91	0.76
Stack Temperature (°K)		394.3	338.7	422
Does Stack have a Raincap or Horizontal Opening?		No	No	No
Stack Exit Velocity (m/sec)	Actual	9.15	7.62	10.67
	Use in merged stack calculation ^c	9.15	7.62	10.67
Distance to Property Line (m)		60.98	76.22	54.88
Baseline Air Toxic Emission Rate (g/s)		2.27 (18 lb/hr)	0.25 (2 lb/hr)	0
Previously Deferred Air Toxic Emission Rate (g/s)		0	0.25 (2lb/hr)	0
Proposed Deferred Air Toxic Emission Rate (g/s)		0	0.505 (4 lb/hr)	0.505 (4 lb/hr)
Total Air Toxic Emission Rate (g/s)		2.27 (18 lb/hr)	1.01 (8 lb/hr)	0.505 (4 lb/hr)
M value		13242.9	30717.5	68221.8

a Stack height above ground level.

b Stack inside diameter measured at point of discharge.

c Stack exit velocity of 0.01 m/sec used to account for non-vertical discharge from horizontal discharge and rain cap.

Based on the information in Table 5, the following merged stack parameters (M values) are determined using the equation in section 2.2 of the South Carolina **Air Modeling Guidelines**:

Stack 1: 13242.9

Stack 2: 30717.5

Stack 3: 68221.8

The M values for Stacks 2 and 3 are greater than 50% of the worst case M value, and stack 3 is less than 25% closer to the property boundary. The deferral approach may be used for this increase.

- (2) Divide the modeled concentration by that air toxic's maximum allowable concentration and multiply this fraction by 100 to obtain the percent standard consumed in the modeling demonstration.

Modeled concentration of toluene = $486.5 \mu\text{g}/\text{m}^3$

Maximum allowable concentration for toluene $2000 \mu\text{g}/\text{m}^3$

$$486.5/2000 = 0.24$$

$0.24 \times 100 = 24\%$ of the standard consumed in the modeling demonstration.

- (3) Round the value found in step 2 up to the nearest higher percent standard value shown in Table 4.

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

- (4) Using the value found in step 3, determine the corresponding increase multiplier of the baseline emission rate in Table 4.

Based on Table 4, a 25% consumption of the standard would allow a 100% increase of the baseline emission rate.

- (5) Multiply the increase multiplier by the baseline emission rate. This value is the cumulative maximum emission rate increase that may be deferred from modeling.

$$100\% \times 20 \text{ lb/hr} = 20 \text{ lb/hr.}$$

- (6) Total the proposed emission rate plus any previously deferred emission rates that have not been modeled. Compare this total to the maximum emission rate increase found in step 5. If the total of the proposed emission rate and deferred emission rates is less than the maximum emission rate increase,

modeling is deferred for this construction permit application until a new baseline demonstration is completed or the facility's operating permit is up for renewal.

2 lb/hr previously deferred + 8 lb/hr proposed = 10 lb/hr.
Cumulative emission rate increase = 20 lb/hr.

Since the proposed emissions increases are less than or equal to the maximum emission rate increase, modeling is deferred at the time of the construction permit. An additional 10 lb/hr increase may be used after this deferral.

The following table summarizes the information used in the deferral analysis.

Table 6 Deferral Analysis Example Information

Pollutant	Toluene
Baseline Emission Rate (lb/hr)	20
Baseline Modeled Concentration ($\mu\text{g}/\text{m}^3$)	486.5
MAAC ($\mu\text{g}/\text{m}^3$)	2000
Percent Standard Consumed (%)	24
Increase Multiplier	1.00
Cumulative Maximum Emission Rate Increase (lb/hr)	20
Existing Deferred Emission Rate (lb/hr)	2
Proposed Deferred Emission Rate (lb/hr)	8
Remaining Available Deferral (lb/hr)	10
Is Deferral Allowed?	Yes

The following tables are reproductions of Tables 5 and 6 for use in submitting deferral information to the Bureau for verification. The table formats may also be replicated in a spreadsheet program to facilitate calculations.

Table 7 Stack Information for Use in Deferral Analysis

Stack Identification					
Is Stack New or Increasing Emissions?					
Stack Height (m) ^a					
Stack Diameter (m) ^b					
Stack Temperature (°K)					
Does Stack have a Raincap or Horizontal Opening?					
Stack Exit Velocity (m/sec)	Actual				
	Use in merged stack calculation ^c				
Distance to Property Line (m)					
Baseline Air Toxic Emission Rate (g/s)					
Previously Deferred Air Toxic Emission Rate (g/s)					
Proposed Deferred Air Toxic Emission Rate (g/s)					
Total Air Toxic Emission Rate (g/s)					
M value					

a Stack height above ground level.

b Stack inside diameter measured at point of discharge.

c Stack exit velocity of 0.01 m/sec used to account for non-vertical discharge from horizontal discharge and rain cap.

Table 8 Deferral Analysis Information

Pollutant				
Baseline Emission Rate (lb/hr)				
Baseline Modeled Concentration ($\mu\text{g}/\text{m}^3$)				
MAAC ($\mu\text{g}/\text{m}^3$)				
Percent Standard Consumed				
Increase Multiplier				
Cumulative Maximum Emission Rate Increase (lb/hr)				
Existing Deferred Emission Rate (lb/hr)				
Proposed Deferred Emission Rate (lb/hr)				
Remaining Available Deferral (lb/hr)				
Is Deferral Allowed?				

APPENDIX E - Air Modeling Issues

**SC DHEC Bureau of Air Quality Response to
“STANDARD NO. 2 MODELING ISSUES - Feb. 20, 1998”**

NOTE: *Text from Chamber of Commerce Environmental Technical Committee Position paper noted by italic text. DHEC responses are noted by normal text.*

Issue: *DHEC is currently requiring Modeling under Standard No. 2 for permit issuance and modifications, including construction permits.*

DHEC Response: DHEC does not specifically “require” modeling for permitting activities. DHEC does require proper demonstration that activities do not interfere with attainment or maintenance of state and federal standards. Modeling is an acceptable method of demonstration.

Position: *There is no legal basis for DHEC to require modeling to show compliance with Standard No. 2, a portion of the analysis required under the PSD program of Title I, and this modeling places an unreasonable burden on industry.*

DHEC Response: A demonstration of compliance with Standard 2 for new construction in SC is a preventative measure consistent with SC Regulation 61-62.1, Section II, C. The method of demonstration that has been used is modeling although alternative scenarios are acceptable. Other reasons for modeling are: (1) The PSD regulations require major new construction to demonstrate that they will not cause a NAAQS violation. This is accomplished by means of modeling their emissions along with emissions from other facilities within a 50-km radius. In the past, there have been many cases involving PSD applications where emissions from other facilities showed modeled NAAQS violations which had to be resolved before a PSD permit could be issued. DHEC’s approach to modeling identifies and corrects these problems and thus minimizes delays during the PSD permitting process. (2) 40 CFR Section 51.110(k)(2) requires individual states to determine at least every 5 years if their State Implementation Plan (including regulations) is adequate to meet the NAAQS in all areas of the state. This reassessment must take into account future growth and be demonstrated via the use of modeling. Currently DHEC has used the approach of modeling compliance of individual facilities to meet this requirement. If DHEC decides to depart from this approach, then DHEC would be obligated to model the entire state using current models to demonstrate the adequacy of the current emissions limits in the air regulations to meet the NAAQS throughout the state. This large scale modeling approach would result in regulations requiring lower allowable emission limits for many source categories. This would negate flexibility currently provided to individual facilities and would be much more burdensome on industry than the current modeling approach. Subsequent to the receipt of this position paper, DHEC

informally surveyed other southern states concerning NAAQS modeling and found the approach used by SC to be similar to approaches used by other states.

Rationale: *Under South Carolina Regulation 61-62.5, Standard No. 2, the ambient air quality standards for the State of South Carolina are listed. The following air pollutants are included in this list: sulfur dioxide, total suspended particulates, PM10, carbon monoxide, ozone, gaseous fluorides, nitrogen dioxide, and lead. In addition, this standard makes reference to "analytical methods to be used" in the lone paragraph of this standard.*

DHEC Response: DHEC concurs. However, it should be noted that SC Regulation 62.1 defines ambient air quality standards as “that standard for the quality of ambient air at or beyond a property line on which a source of pollution is emitting.”

When the Clean Air Act was originally developed, certain air pollutants were identified and ambient air quality standards were established for these criteria pollutants. The States were required to develop State Implementation Plans (SIPs) that set forth strategies for maintenance and/or attainment of these National Ambient Air Quality Standards ("NAAQS"). The SIP consists of regulations that must be uniformly satisfied by sources throughout the state. It is through these SIP requirements, which apply to all sources in South Carolina, that DHEC has an enforceable mechanism to maintain compliance with the NAAQS. It is only through enforceable SIP requirements that DHEC can enforce measures to maintain the NAAQS.

Applying ambient air standards on a source-by-source basis is not the approved method by EPA for demonstrating compliance with Standard No. 2. The ambient air quality standards are not source specific standards. There are many different sources of air pollution which contribute to the ambient air concentrations, including industrial sources, mobile sources (vehicles), biogenics (trees), and area sources (small commercial and residential operations). All of these sources should be taken into account when determining compliance with the ambient air quality standards. Direct measurement of air quality by a properly situated monitor within a network of monitors is the proper method used by most states. The requirements for monitoring ambient air quality are found at 40 CFR part 58, Subpart C. South Carolina has located monitoring stations throughout the state to determine the concentrations of the various pollutants in ambient air.

DHEC Response: DHEC’s responsibility to ensure compliance with the NAAQS is currently demonstrated through the monitoring network (showing attainment statewide). Applying source by source measurement via modeling demonstration is a means to ensure state compliance with ambient standards and to comply with EPA’s requirement to reevaluate the SIP periodically. DHEC recognizes that sources

other than industry contribute to pollutants listed in Standard No.2 and that some pollutants are formed only after complex chemical reactions. Modeling at a particular facility for compliance is directed at the pollutants that are directly measurable (sulphur dioxide, total suspended particulate, PM₁₀, nitrogen dioxide, carbon monoxide, lead, and gaseous fluorides as hydrogen fluoride). A facility seeking a permit may provide another acceptable demonstration such as monitors, wind tunnel studies, and other site specific approaches.

In addition, South Carolina has identified Standard No. 2 as a federally enforceable condition in recently distributed draft Part 70 air quality permits. This appears to indicate that the air dispersion modeling performed by industrial facilities, as improperly required by SC DHEC, outside of a PSD analysis, can be enforced by the U.S. EPA. However, no regulation has been developed to explain the details of air dispersion modeling related to this Standard; only guidance documents have been developed. When SC DHEC is questioned on this issue, the only response is a reference to SC Regulation 61-62.1, Section II, A. Construction Permit, 2. - Permit Application, g. - "Other information as may be necessary for proper evaluation of the proposed source as determined by the Department." This may be valid when necessary to evaluate a sources compliance with a SIP requirement, such as during a PSD analysis. However, our review indicates that NAAQS modeling, outside of PSD analysis, is not required by the SIP.

DHEC Response: DHEC will remove the reference to Standard No. 2 in Table 4.1 used in Title V and Conditional Major permits. However, it will contain a statement to reflect the measure that industry used to show compliance with Standard No. 2. In addition to the required modeling for PSD permits, DHEC still has an obligation under SC Regulation 62.1, Section II(A)(3) to ensure no emissions interfere with attainment or maintenance of any state or federal standard. Site specific modeling has been and remains a preferred method to demonstrate that this requirement is met. The emission rates in the demonstration become a part of the permit, although higher rates can be incorporated administratively into Attachment A of the permit, provided a valid demonstration does not interfere with the attainment and maintenance of any state or federal standard. DHEC recognizes that modeling may be a conservative approach for compliance demonstrations. For that reason, DHEC does allow revised demonstrations to be incorporated administratively. DHEC also does not consider variations from input parameters used in the modeling demonstration to constitute a violation unless modeling or another acceptable method predicts that the ambient standards were exceeded offsite.

Modeling to show compliance with ambient standards is required for construction permit applications. Section 48-1-100 of the Pollution Control Act states that "The Department may, if sufficient ... environmental information is not available for it to make a determination of the effect of such a discharge, require the person

proposing to make such discharge to conduct studies that will enable the Department to determine that its quality standards will not be violated.” Furthermore, Section 8 (New Source Review and Source Permit System) of the State Implementation Plan requires DHEC to make certain that the proposed new emissions would not cause or contribute to a violation of any NAAQS before issuing a permit to construct. Also, SC Regulation 61-62.1, Section II, A (3) states that “No permit to construct or modify a source will be issued if emissions interfere with attainment or maintenance of any state or federal standard.”, and SC Regulation 61-62.1, Section II A(2)(g) requires applicants to submit “Other information as may be necessary for proper evaluation of the proposed source as determined by the Department.” Air dispersion modeling, or an acceptable alternative, is the only means that DHEC has to determine if all state and federal ambient standards can be met before a permit to construct is issued. Without the use of modeling (or some other acceptable demonstration) to evaluate impacts of new construction, DHEC would have no way of determining if the proposed new construction will meet all applicable standards. DHEC would have to issue permits blindly without knowing the impact of emissions from the facility on the public and the environment.

Finally, the guidance for modeling requires a facility to add a background concentration to the modeled concentration. This background data is from the State's ambient air monitoring network and sometimes "double counts" the facility's contribution to the ambient air concentration. Because of the manner in which the dispersion modeling is performed when following the DHEC guidelines, modeled concentrations almost always over estimate actual fence-line concentrations. In at least one case, an ambient air monitoring station was installed to contradict a modeled concentration and the actual concentration was significantly lower.

DHEC Response: DHEC agrees that the method used provides conservative and protective numbers. In fact, that very theme is a positive point made numerous times over the years to concerned citizens to reflect the safeguards of the permit process. Further, DHEC contends that the process has been a contributing factor to the attainment status in SC and provides protection while allowing flexibility for industrial growth. Background values are added to account for the contribution from other industries and mobile sources, as well as those from other sources such as biogenics, land clearing activities, emissions from homes and buildings, etc. There are approaches documented in the US EPA's Guideline on Air Quality Models (Revised) (EPA-450/2-78-027R-C) that address the “double counting” issue. These approaches have been submitted by companies in support of permit applications, and DHEC has approved their use.

In conclusion, the SC Chamber of Commerce's Environmental Technical Committee believes that there is no legal basis for requiring source-specific air dispersion modeling to demonstrate compliance with SC Regulation 61-62.5, Standard No. 2, except pursuant to PSD analysis. We request that SC DHEC discontinue the requirement to perform air dispersion modeling to show "compliance" with this Standard.

DHEC Response: DHEC will:

- a. -remove the reference to Standard No. 2 in Table 4.1 of the Title V & Conditional Major permits.
- b. -reflect in attachment A, as a state enforceable limit, any emissions rate established when demonstrating that the source will not interfere with the attainment and maintenance of any state or federal standard.
- c. -continue to allow higher emission rates to be incorporated administratively into Attachment A, provided a demonstration using these higher emission rates will not interfere with the attainment or maintenance of any state or federal standard or with any other applicable requirements.
- d. -provide a statement in the permit (construction and/or operating) to reflect the method (modeling or site specific approach) that the facility used to show the activity will not interfere with the attainment and maintenance of any state or federal standard.
- e. -deem state permitting applications incomplete without an adequate demonstration that the activity will not interfere with the attainment or maintenance of any state or federal standard, including Standard No. 2.