GUIDELINE FOR AMBIENT IMPACT ASSESSMENT
OF TOXIC AIR POLLUTANT EMISSIONS

GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

AIR PROTECTION BRANCH

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Historical Background and Scope

The previous Georgia Air Toxic Guideline document was approved by the Director of the Environmental Protection Division (EPD) on September 10, 1984 under the provisions 391-3-1.-02(2)(a)3.(ii) of the Georgia Rules for Air Quality Control. The 1984 guidelines were subsequently revised and approved for use on June 28, 1998. The 1998 guidelines have been further revised as presented in this document and have been approved for use under the above stated provisions in May 2017. This current version of the guidelines supersedes all previous versions.

The guidelines will be used in the review of air quality permit applications to construct/modify potential sources which emit any Toxic Air Pollutant (TAP) listed in Appendix A of this guideline document with emissions above the Minimum Emission Rate (MER) and in other cases at the Director's discretion. The Appendix A provides a list of TAPs, corresponding Acceptable Ambient Concentrations (AACs) and MERs. The list of TAPs in Appendix A will be updated periodically as new data becomes available. In addition, the guidelines may also be employed to estimate the environmental impact of TAP in any situation where approved ambient monitoring data is not available.

Section 1 Overview of Risk Assessment

1.0 Introduction

The purpose of this document is to provide a guide for facility owners to demonstrate to the Air Protection Branch of the Georgia Environmental Protection Division (EPD) that any toxic air pollutant (TAP) listed in Appendix A of this guideline document will comply with Georgia Rules for Air Quality Control 391-3-1.02(2)(a)1. and 391-3-1.02(2)(a)3. A TAP is defined as any substance which may have an adverse effect on public health, excluding any specific substance that is covered by a State or Federal ambient air quality standard.

1.1 Hazard Identification

In compiling the list of toxic air pollutants, EPD looked at the approach used by other states. EPD found that most of the states were regulating compounds listed on the EPA's list of 187 Hazardous Air Pollutants (HAPs). However, in addition to the 187 HAPs Georgia has historically regulated other TAPs based on IRIS, OSHA and NIOSH data. In this version, EPD is providing the regulated community with a definitive list of pollutants. In order to compile this list of TAPs, EPD considered the following resources:

- EPA list of Hazardous Air Pollutants (HAPs) which is available at https://www.epa.gov/haps/initial-list-hazardous-air-pollutants-modifications

- EPA Integrated Risk Information System (IRIS) database which is available at https://www.epa.gov/iris

- Occupational Safety and Health Administration (OSHA) Table Z1 thru Z3 which is available at https://www.osha.gov/dsg/annotated-pels/tablez-1.html

In developing the final list, EPD eliminated all the duplicates and also compounds listed in IRIS and OSHA/NIOSH database that had no inhalation toxicity data. The final list of toxic air pollutants is provided in Appendix A of this document.

1.2 Exposure Assessment

A considerable amount of time is spent by both EPD and the regulated community in establishing the Allowable Ambient Concentration (AAC) during the permit review process. This version provides AACs for all the TAPs listed in Appendix A. The procedures for establishing AAC are provided in Appendix D.

In addition to AAC, EPD has also provided in Appendix A of this guideline document, the Minimum Emission Rate (MER) for each TAP. The MER was established by using worst case dispersion scenarios based on EPD experience and SCREEN3 air dispersion model. SCREEN3 is considered a very conservative dispersion model and is available at https://www3.epa.gov/ttn/scram/dispersion_screening.htm#screen3.

In establishing MER, EPD considered both short term and long term exposure. The short term exposure was based on 15-min AAC while the long term exposure is based on continuous exposure to the TAP for 8760 hours per year for 70 years. The long term and short term AACs are combined with the SCREEN3 results to characterize the potential risk to receptors and establish MER for each TAP.

If the facility-wide emissions are below the MER then no further analysis is required for that pollutant. The basis for establishing MER is provided in Appendix C.

Note: MER does not apply when the major emissions are from volume and/or area sources.

Section 2 Determination of Toxic Air Pollutant Impact

2.1 Who is Required to Demonstrate Compliance with AAC?

The applicant is required to demonstrate compliance with AAC when the facility emits any one of TAPs listed in Appendix A of this document.

A demonstration is required for:

(a) All new facilities that require a State Implementation Plan (SIP) Permit.

(b) All existing facilities that are adding new equipment that require a SIP permit and emit toxic air pollutant listed in Appendix A.

(c) All existing facilities that are modifying existing equipment that increases the emission of toxic air pollutant listed in Appendix A.

(d) All existing facilities that are modifying existing equipment or making process changes that result in emission of toxic air pollutant listed in Appendix A not previously emitted from the facility.

(e) In some cases a demonstration may be required for sources that have never demonstrated compliance with the AAC.

(f) Case by case as determined by the Division.

2.2 Procedures for Demonstrating Compliance with AAC

The general procedure for determination of TAPs impact is a simple comparative method.

- For a pollutant that has a facility-wide emission rate below the MER established in the table in Appendix A, no further analysis is required.
- For pollutant that has a facility-wide emission rate above the MER established in the table in Appendix A, further analysis is required.

If facility-wide emissions are mainly emitted as volume or area sources, MER should not be used for screening out of the modeling analysis.

The maximum ground-level concentration (MGLC) found by dispersion analysis (Section 4) is compared to the AAC (Appendix A) for the pollutant. If the MGLC is less than the AAC, TAP impact is determined to be insignificant.

If the facility wide TAP emissions are greater than MER, follow the steps below:

STEP 1: Locate the long term and/or short term AAC for the toxic air pollutant emitted from the facility from the list in Appendix A.

STEP 2: Derive MGLC using SCREEN3 dispersion analysis. Adjust to the appropriate averaging time (24 hours, 15 minutes and annual).

STEP 3: Compare MGLC from SCREEN3 dispersion analysis with AAC

   (i)   If MGLC is less than AAC, proceed with application review, pollutant impact is determined to be insignificant.

   (ii)   If MGLC is greater than AAC, proceed to Step 4.

STEP 4: Perform AERMOD or ISCST3 analysis for MGLC per the procedures provided in Section 4 and 6.

STEP 5: Compare MGLC from AERMOD or ISCST3 with AAC

   (i)   If MGLC is less than AAC, proceed with application review, pollutant impact is indicated to be insignificant.

   (ii)   If MGLC is greater than AAC, it indicates potential adverse toxic air pollutant impact. Reduction in pollutant emission rate, additional controls, and/or increase in stack height may be considered. If these options fail to demonstrate compliance then a site specific risk analysis is required.

STEP 6: Perform a site specific risk analysis. The Division accepts the following approaches:

   • Model the nearest (or worst case) receptor located in a residence area and compare with the annual AAC value;
   • Model the nearest (or worst case) receptor located in a business area and compare with 8-hour AAC value (OSHA based);
   • Model all other receptors in grids and compare with 15 minute short term AAC value (STEL or Ceiling based).

In addition to demonstrating compliance with AACs, the Division reserves the right to request the applicant to evaluate additive/synergistic effects from multiple pollutant exposure. In cases when two or more pollutants are known to have the same effect (e.g. reproductive effects, kidney toxicity, CNS stimulant, etc.) upon the same organ system of the body, the impacts of simultaneous exposure are considered "additive". The following formula shall be used to evaluate additive effect:

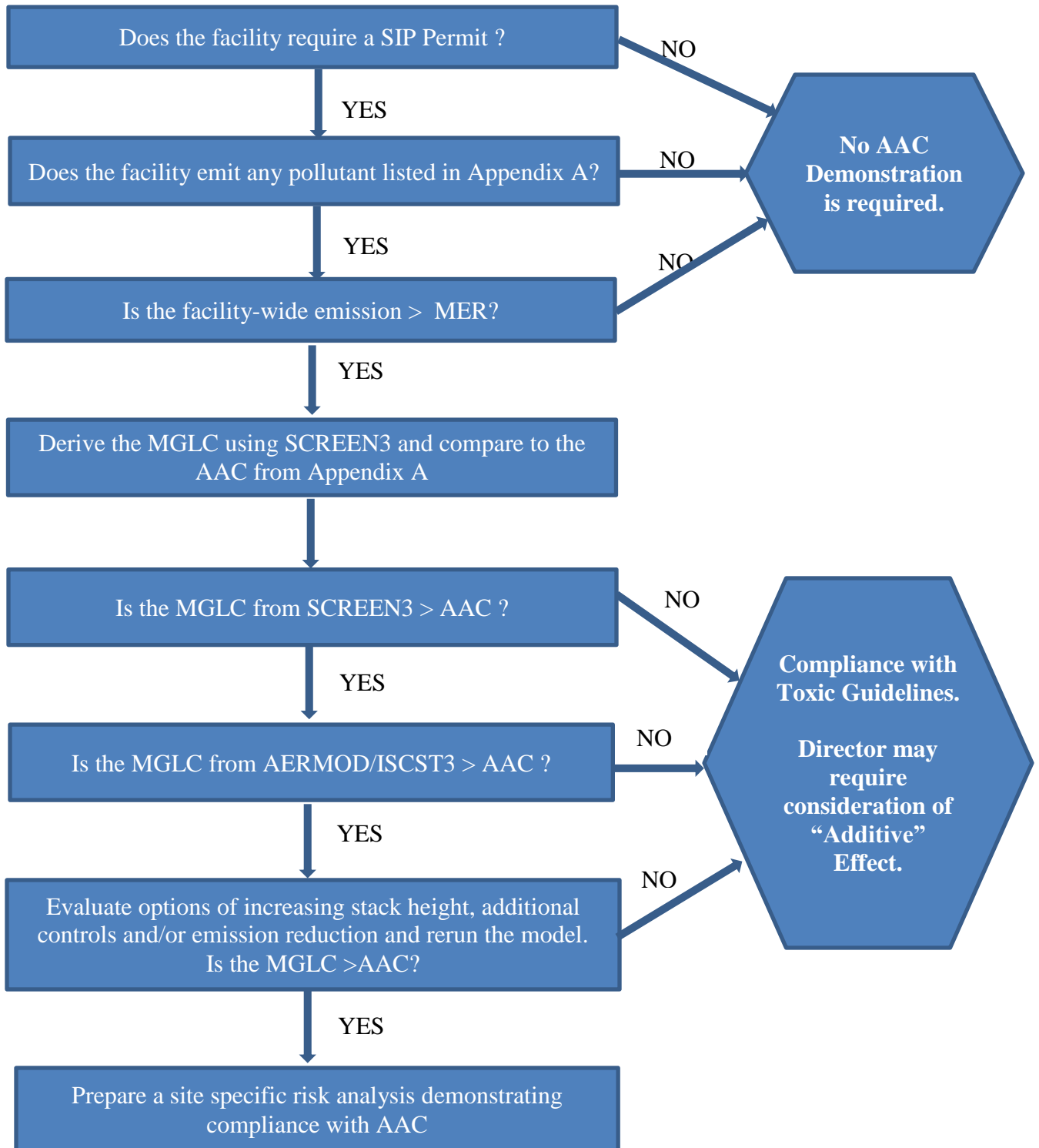$$\frac{MGLC1}{AAC1} + \frac{MGLC2}{AAC2} + \cdots\cdots + \frac{MGLCn}{AACn} > 1$$

Where,
MGLC 1, 2, …, n are the maximum ground level concentration of each pollutant
AAC 1, 2, …, n are the acceptable ambient concentration of each pollutant.

If the result is greater than one, then further risk assessment would be necessary. The applicant should be able to demonstrate that annual air emissions from the facility would result in a cumulative non-cancer hazard and excess lifetime cancer risks that fall within the acceptable USEPA risk range/limits of 1E-06 to 1E-04 and below the cumulative hazard risk index of 1.

After performing a site specific risk assessment, if it is infeasible for the applicant to comply with the AACs found in this guideline or the applicant is unable to demonstrate that the cumulative hazard risk index is below 1, the Director at his/her discretion may approve an application that includes the installation of New Source Maximum Available Control Technology (MACT). For the purpose of this guideline, "New Source MACT" is defined as the control technology which reflects the maximum degree of reduction in emissions of hazardous air pollutants that the Director determines is achievable by the source, provided that such control technology is no less effective than the level of emission control which is achieved in practice by the best controlled similar source.

Does the facility require a SIP Permit ?

NO → **No AAC Demonstration is required.**

YES ↓

Does the facility emit any pollutant listed in Appendix A?

NO → **No AAC Demonstration is required.**

YES ↓

Is the facility-wide emission > MER?

NO → **No AAC Demonstration is required.**

YES ↓

Derive the MGLC using SCREEN3 and compare to the AAC from Appendix A

↓

Is the MGLC from SCREEN3 > AAC ?

NO → **Compliance with Toxic Guidelines. Director may require consideration of "Additive" Effect.**

YES ↓

Is the MGLC from AERMOD/ISCST3 > AAC ?

NO → **Compliance with Toxic Guidelines. Director may require consideration of "Additive" Effect.**

YES ↓

Evaluate options of increasing stack height, additional controls and/or emission reduction and rerun the model. Is the MGLC >AAC?

NO → **Compliance with Toxic Guidelines. Director may require consideration of "Additive" Effect.**

YES ↓

Prepare a site specific risk analysis demonstrating compliance with AAC

Section 3 Required Data for Dispersion Analysis

The following information is needed to perform an impact assessment of toxic air pollutant:

3.1 Identification of Toxic Air Pollutants to be Emitted

The pollutants should be identified by the standard chemical nomenclature of the Chemical Abstract Service (CAS) with only a few substances that don't have a CAS number. Use of standard nomenclature provides information on elemental composition, and is the nomenclature most often used in reference materials on toxicity.

3.2 Emission Source Parameters

For required parameters for each dispersion model, please refer to Section 4, 5, and 6 for details.

3.3. Maximum Toxic Air Pollutant Emission Rate

This should be in the units of grams per second (g/s) for use in dispersion analysis (Some models allow lb/hr). This value should be the maximum emission rate expected under normal worse case conditions. This maximum emission rate is determined using the following methods:

A. When Performing 24-hour and 15-minute Evaluations:

    (i)   For processes whose emissions are relatively constant (continuous processes) - The maximum emission rate is the maximum 1-hr average emission rate during worse case conditions. If 1-hr average maximum emission rates are not available, use the shortest time period available.

    (ii)   For processes whose emissions vary significantly over time (batch processes)

        a.   24-hour evaluations - The maximum emission rate is total emissions during the worst case batch divided by the length of the batch. The length of the batch does not include down time between batches.

        b.   15-minute evaluations - The maximum emission rate is the emission rate during the highest emitting portion of the batch. For facilities which have multiple batch processes, the maximum emission rate should be based on the batch process which has the highest emission rate. Batch processes which routinely emit simultaneously should be considered together when determining the maximum emission rate to use in the evaluation. When a process emits more than one toxic pollutant, a maximum emission rate should be determined for each pollutant separately.

B. When Performing Annual Evaluations:

(i)   For processes whose emissions are relatively constant (continuous processes) - the maximum emission rate is the total annual emission that would occur if the process is operating under worse case conditions for the entire year divided by 8760 hr/yr.

(ii)   For processes whose emissions vary significantly over time (batch processes) - the maximum emission rate is the total emissions from the worst case batch times the maximum number of batches per year divided by 8760 hr/yr.

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Section 4 Air Dispersion Analysis

The Division accepts screening analysis using the SCREEN3 and refined modeling analysis using AERMOD and ISCST3. Use of models other than those referred to in this Guideline must be approved by the Division. In addition, if the source is located in an area with complex terrain, AERMOD must be used. The computer models may be obtained from the following website https://www.epa.gov/scram/air-quality-dispersion-modeling. The latest versions of these models should be used where possible. The Division also allows the use of third party modeling software from Trinity Consultants (BREEZE), Lakes Environmental (AERMOD view) and Oris-Solution (BEEST). The Division requires the model to be run with the regulatory default options. If any non-default options are proposed to be used in the modeling, those options should be thoroughly discussed in the application.

4.1   General Notes on Dispersion Modeling Analysis

All guidance discussed in this document adheres to EPA guidance (U.S. Environmental Protection Agency, Guidelines on Air Quality Models – Appendix W to Part 51, U.S. EPA, Research Triangle Park, NC, 2005, and Revised, 2017) for determining the impact of any pollutant. The guidelines presented in this document may change at any time as new guidance or new air quality modeling techniques become available.

A.   Building Downwash

Due to safety factors built into this Guideline, the Division does not require the use of building downwash calculations if the ISCST3 model is used in the TAP ambient impact assessment, while the building downwash effect should be included when the AERMOD model is used. The Division reserves the right to require the inclusion of downwash calculations if they are warranted by specific conditions.

B.   Capped and Horizontal Stacks

For capped and horizontal stacks that are NOT subject to building downwash influences, a simple screening approach can be applied, based on a procedure for ISCST3 that was approved by the Model Clearinghouse in July 1993. This approach is summarized below:

(i)   Set the exit velocity to 0.001 m/s

(ii)   Calculate an adjusted stack diameter (ds) that keeps the volume flow unchanged using the equation:

$$ds = 31.6 \, d \, \sqrt{V}$$

Where,
   ds = adjusted stack diameter (m)

d = original stack diameter (m)
V = original stack exit velocity (m/s)

(iii) To appropriately account for stack-tip downwash, the user should first apply the non-default option of no stack-tip downwash (i.e., the NOSTD option on the MODELOPT keyword). Then, for capped stacks, the stack release height should be reduced by three actual stack diameters to account for the maximum stack-tip downwash adjustment, while for horizontal releases no adjustment to release height should be made. More details can be found at https://www3.epa.gov/ttn/scram/7thconf/aermod/aermod_implmtn_guide_3August2015.pdf

C. Non-Circular Stacks

For noncircular stack, use equivalent dimensions to calculate the inner diameter (d) of the circular stack using the formula

$$A = (\pi / 4) \ d^2$$

Where $A =$ area of the noncircular stack

D. Industry Specific – Lumber Kilns

When modeling the continuous drying lumber kilns, the following procedures will be used:

- For continuous kilns with powered vents, the total air toxic emissions should be split assuming 80 percent exit through powered vents and 20 percent exit through doors.

- For continuous kilns without powered vent, assume all emissions exit through the doors.

- Model the powered vent as a stack.

- The emission via the kiln door can be modeled in two ways:

As a volume source: Release height is set at the midpoint of the door. Initial lateral and vertical dimension are calculated from the actual door size plus the initial plume spread/rise (usually 2 ft for spread and 5 ft for rise), and divided by 4.3 and 2.15 respectively.

As a point source: Release height is set at the midpoint of the door. Effective diameter is the equivalent diameter calculated based on the equal area. Exit velocity is set to 0.001 m/s, similar to horizontal discharge.

Note: In addition, the default option is with stack-tip downwash. Use non-default option (without the stack-tip downwash) only if all gases exit through the kiln door.

<u>When modeling batch kilns</u>, assume all the emissions are exiting through the doors and model such release as volume source or point source adhering to same criteria as continuous kiln.

Section 5 SCREEN3 Modeling Procedures

An initial simplified evaluation of air toxic impacts can be made with the SCREEN3 model. For merging multiple stacks in SCREEN3 see section below.

Recommendations for each SCREEN3 run are as follows:

- The maximum toxic pollution emission rate (expressed as a 1-hour average) for each pollutant should be used.

- The option for flagpole receptors should generally not be used.

- Choose the rural or urban dispersion option based on the procedure in EPA's "Guideline on Air Quality Models (2005 and Revised, 2017)" which is available at https://www3.epa.gov/ttn/scram/guidance_permit.htm. The rural option is appropriate for most locations in Georgia.

- Choose the default atmospheric temperature of 293K.

- For each release, exercise the automated distance array choosing as the minimum receptor distance the appropriate nearest fence line distance for that release. The maximum concentration for that release will then be chosen as the maximum calculated concentration at or beyond the nearest fence line distance.

- For each release, the maximum 1-hour concentration should be noted. The maximum ground-level concentrations produced from the Gaussian dispersion model by the SCREEN3 computer program are estimated to be valid for an averaging period of 1 hour. Factors for adjusting the 1-hour average concentrations to applicable averaging periods are listed below:

Averaging Time	Multiplying Factor
15 minutes	1.32
24 hours	0.40
Annual	0.08

  Further information on adjusting 1-hour concentrations to different averaging periods can be found in Appendix D of EPA-454/R-92-024, "Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants (Revised)".

- In the case where emissions occur less than 24 hours per day, an additional adjustment to the 24-hour concentration can be made by using the formula described below.

$$C_e = C_c(y/1440)(1440/y)^{0.2} = C_c (y)^{0.8} (2.97 \times 10^{-3})$$

Where,

Ce is emission adjusted 24-hour concentration,

Cc is calculated 24-hour concentration, and

y is minutes of emissions per 24 hours.

- Merged Sources

These procedures are generally used during the use of SCREEN3 to minimize model runs for a facility that may emit two or more pollutants simultaneously from a single emission point. There will also be cases where the facility under review contains two or more emission points, each emitting two or more pollutants. If necessary, each pollutant from each emission point may be assessed for toxic impact. Such a procedure will certainly be time consuming if the facility under review has many emission points emitting many different pollutants. The following abbreviated toxic impact review schemes are recommended to be employed as time saving measures.

A single representative stack may be used to represent several sources that are identified as "similar". "Similar" stacks are those that are located less than 100 m apart, emit the same pollutants, and have stack heights and gas exit velocities differing by less than 20 percent. The procedure of merging sources identifies **one** worst case representative stack from which all of the emissions from the sources involved are modeled. The merged stack is typically located at the closest location, of all the stacks involved, to the property line. This location, if all other parameters were the same, would result in the maximum modeled off-site concentrations. Dissimilar stacks may also be merged, but the merged source technique will result in conservatively high off-site concentrations. Therefore, merging dissimilar stacks should be done with caution. To determine which stack should be used as the representative stack, compute the parameter, M, for each stack, using the following equation:

$$M = (Hs\ V\ Ts) / Q$$

Where,

M = parameter accounting for the relative influence of stack height, plume rise, and emission rate on concentrations;

Hs = stack height (m);

V = stack gas volume flow rate parameter;

Ts = stack gas exit temperature (K); and

Q = pollutant emission rate (g/s).

$$V = (\pi/4)\ v^2 d^2$$

Where,

d = stack exit diameter (m); and

v = stack gas exit velocity (m/s).

Note: Since it is possible for two stacks to have the same flow rate (V) and "M" value, while still having a large difference in momentum flux and predicted ambient

concentrations, the stack exit velocity (v) is squared when calculating the stack flow rate (V). This is consistent with the algorithms used by the SCREEN3 model to calculate momentum flux and will ensure a conservative emission point is used as the representative stack.

The stack with the lowest "M" value is used as the representative stack. The sum of the emissions from all merged stacks is assumed to be emitted from the representative stack; i.e. the merged source is characterized by Hs_1, Vs_1, Ts_1, and Q, where subscript "1" indicates the representative stack and $Q = Q_1 + Q_2 + \ldots + Q_n$ (the combined emissions). The location of the representative stack is at the actual stack location closest to the property line.

To conservatively estimate ambient impacts using SCREEN3, the worst-case stack is determined using the lowest "M" factor calculated assuming a "Q" value of 1. The stack with the lowest "M" factor is then used as the representative stack. The sum of the facility-wide emissions and the parameters for the worst-case stack are then input into the model.

Section 6 Refined Modeling Procedures

If the screening modeling evaluation results in pollutant concentrations exceeding the AAC, the source emissions should be modeled using a refined dispersion model. The refined modeling analysis using either AERMOD or ISCST3 is acceptable. Use of other dispersion models needs to be approved on a case-by-case basis before application is submitted.

AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. ISCST3 is a steady-state Gaussian plume model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. Effective December 9, 2005, AERMOD is the preferred and recommended refined dispersion model by EPA. As of December 9, 2006, AERMOD is fully promulgated as a replacement to ISCST3. The applicant is encouraged to use the preferred AERMOD as the refined dispersion modeling tool, though application using ISCST3 is also acceptable. The user may wish to review the material in the individual refined model user's guide and the EPA Guideline on Air Quality Models - Supplement C.

Both AERMOD and ISCST3 may be obtained from the EPA website https://www3.epa.gov/scram001/dispersionindex.htm. The latest versions of these models shall be used with the regulatory default options. Any non-default option proposed to be used in the modeling need to be approved by Georgia EPD before application is submitted. The approved use of non-default options need to be documented in the application.

The following section listed the required input information and procedures for conducting refined modeling.

A. **Plant layout information**

Plant layout information for all facility buildings, emission sources and fence lines should be clearly provided within 2 meters of their actual locations.

B. **Emission Source information**

In general, industrial emission sources can be characterized in four different types:

1. Point sources

Examples include stacks, chimneys, exhaust fans, vents, and flares. The following input parameters are required:

Ptemis – point source emission rate in g/s,
Relhgt – release height above ground in meters,

Stktmp – stack gas exit temperature in degrees K,
Stkvel – stack gas exit velocity in m/s, and
Stkdia – stack inside diameter in meters.

2. Volume sources

Examples include open buildings, open storage tanks, building roof monitors, multiple vents, and conveyor belts. The following input parameters are required:

Vlemis – volume source emission rate in g/s,
Relhgt – release height (center of volume) above ground in meters,
Syinit – initial lateral dimension of the volume source in meters which is calculated by dividing the length of the side by 4.3, and
Szinit – initial vertical dimension of the volume source in meters which is calculated by dividing the vertical dimension by 2.15 for surface-based sources and elevated sources on or adjacent to a building. For elevated sources not on or adjacent to a building, the vertical dimension is divided by 4.3.

3. Area sources

Area sources refer to sources with low level or ground level releases with no plume rise such as storage piles, slag dumps, open pits, and lagoons. The following input parameters are required:

Aremis – area source emission rate in $g/s/m^2$,
Relhgt – release height above ground in meters,
Xinit – length of X side of the area source (in the east-west direction if Angle is 0 degrees) in meters,
Yinit – length of Y side of the area source (in the north-south direction if Angle is 0 degrees) in meters (optional),
Angle – orientation angle for the rectangular area in degrees from North, measured positive in the clockwise direction (optional), and
Szinit – initial vertical dimension of the area source plume in meters (optional).

4. Line sources

Examples include roadways and streets (motor vehicle sources) or lines of roof vents or stacks. In many cases, the line sources can be simulated using AERMOD as multiple point or volume sources. The applicant should contact the EPD before choosing this type of source.

C. **Receptor Grids**

1. Coordinate system

The Universal Transverse Mercator (UTM) system with NAD83 datum should be used for all coordinates in the refined modeling such as stack emission locations, fugitive

emission locations, building locations, and receptors.

2. Receptor location and spacing

The applicant can use a combination of coarse and refined receptor grids to determine the maximum ground level concentration (MGLC) for each pollutant and averaging period evaluated. The receptors setup should provide sufficient resolution to identify the maximum pollutant impact. General guidelines are:

Receptors should be placed on the facility boundary and in the ambient area outside the facility provided that the general public does not have ready access to any portion of the property. Examples of areas with ready access to the public are: commonly used roads; rivers used by boaters or fishermen; areas with picnic tables or jogging trails, etc.

Refined receptor grid should be placed at the facility fence-line and extending out to 2km with 100 meter spacing.

Coarse receptor grid should be set with 200 meter or 250 meter spacing extending from 2km to 5km.

In designing the receptor grid, emphasis should be placed on resolution and location and not on the total number of receptors. The MGLC must be resolved on the 100 m resolution grid. In addition, the refined grid should be of sufficient size to ensure that the refined receptor indicating the MGLC has at least one receptor on all sides showing a lower concentration.

3. Terrain elevations

Terrain elevations for receptors should be processed from USGS National Elevation Dataset (NED) data by the AERMAP program. The 1 or 1/3 arc-second NED data can currently be retrieved from the Multi-Resolution Land Use Characteristics Consortium website at https://www.mrlc.gov/nlcd92_data.php.

If the source is located in an area with complex terrain, AERMOD must be used.

D. Meteorological data

For AERMOD modeling, the EPA guidelines recommend the use of meteorological data from the closest and most representative NWS station. The Division has prepared five years meteorological data for various combinations of ASOS surface and upper air station pairings. The data can be located at https://epd.georgia.gov/air/georgia-aermet-meteorological-data. Assignment of station pairings to each county was based on distance to the centroid of the county, climatological zone, data collection period, and data completeness criteria. The data online will be updated periodically. For ISCST3 modeling analysis, five years of meteorological data from the nearest NWS station should be used. The data was prepared by the Division and can be downloaded via link https://epd.georgia.gov/air/georgia-isc-meteorological-data. Due to the fact that ISCST3

is no longer a preferred model by EPA, the Division no longer provides updated meteorological data for this model.

E. Adjustment of Off-Property Maximum Pollutant Concentration to Correct Averaging Time

The model concentration outputs from ISCST3 and AERMOD are usually for averaging periods of 1-hour and longer. The 1-hour average concentrations should multiply by a factor of 1.32 when they are compared with a STEL or ceiling value for 15 minutes averaging period.

When the modeled concentration outputs are based on emissions which occur less than 24 hours per day, the modeled 24-hour concentration outputs are recommended to be adjusted using the following formula:

$$Ce = Cc(y/1440) (1440/y)^{0.2} = Cc (y)^{0.8} (2.97 \times 10^{-3})$$

Where;
    Ce is the 24-hour concentration after adjustment,
    Cc is the modeled 24-hour concentration outputs, and
    y is minutes of emissions per 24 hours.

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APPENDIX A

LIST OF TAP, AAC and MER

APPENDIX B

REFINED MODELING CHECKLIST

Refined Modeling Check List (including general information)

- **Description of New Source or Source / Process Modification**: provide a short description of the new or modified source(s) and a brief discussion of how this change affects facility production or process operation.
- **Source / Pollutant Identification**: provide a table of the affected pollutants, by source, which identifies the source type (point, area, or volume), maximum pollutant emission rates over the applicable averaging period(s), and, for point sources, indicate if the stack is capped or non-vertical (C/N).
- **Pollutant Emission Rate Calculations**: indicate how the pollutant emission rates were derived (e.g., AP-42, mass balance, etc.) and where applicable, provide the calculations.
- **Site / Facility Diagram**: provide a diagram or drawing showing the location of all existing and proposed emission sources, buildings or structures, public right-of-ways, and the facility property (toxics) / fence line boundaries. The diagram should also include a scale, true north indicator, and the UTM or latitude/longitude of at least one point.
- **Topographic Map**: A topographic map covering approximately 5km around the facility must be submitted. The facility boundaries should be annotated on the map as accurately as possible.
- **Model**: The latest version of AERMOD or ISCST3 should be used.
- **Source / Source Emission Parameters**: Provide a table listing the sources modeled and the applicable source emission parameters.
- **Terrain**: Use digital elevation data from the USGS NED database.
- **Coordinate System**: Specify the coordinate system used to identify the source, building, and receptor locations.   A North American Datun of 1983 (NAD83) is recommended to use in AERMAP input file.
- **Receptors**: The receptor grid should be of sufficient size and resolution to identify the maximum pollutant impact.
- **Meteorology**: Indicate the Division pre-processed, 5-year dataset used in the modeling demonstration.
- **Modeling Results**: For each affected pollutant and averaging period, modeling results should be summarized and presented in tabular format indicating compliance status with the applicable AAC.
- **Modeling Files:** Submit input and output files for AERMOD, AERMAP or ISCST3. Also include the plot files and raw meteorological data.

APPENDIX C

BASIS OF MINIMUM EMISSION RATE

Basis for Minimum Emission Rate Determination

The minimum emission rate (MER) was developed using 50% of AAC and dilution factor (DF) based on SCREEN3 modeling. Use of the 50% of AAC indicated a violation occurred when modeled Maximum Ground Level Concentration (MGLC) was greater than 50% of AAC. This assumption can ensure extra safety margin for MER.

Calculation of Dilution Factor

The following criteria were used to perform a SCREEN3 modeling to calculate DF. These criteria provide poor dispersion and hence a worst case ground level concentration.
- Stack Height = 20 ft
- Stack Gas Velocity = 10 ft/sec
- Stack Gas Temperature = 77 degrees F
- Stack Inside Diameter = 1 ft
- No Downwash

The MGLC modeled by SCREEN3 with the above parameters and a 1 lb/hr emission rates is 225 $\mu g/m^3$. DF was calculated as the ratio of emission rate and MGLC adjusted with respective factors for different average periods in accordance with the SCREEN3 guidance.

DF 1hr   = 1 lb/hr / 225 $\mu g/m^3$
DF 15-min = 1 lb/hr / (225 x 1.32) $\mu g/m^3$
DF 24-hr   = 1 lb/hr / (225 x 0.40) $\mu g/m^3$
DF Annual = 1 lb/hr / (225 x 0.08) $\mu g/m^3$

Calculating the MER

The MER for each averaging period was calculated by multiplying 50% of the established AAC for each averaging period with their respective dilution factors.

Based on a 15-minute AAC
MER (lb/yr)   = 50% x (15-min AAC) x (DF 15-min) x 8760 hr/yr
                 = (15-min AAC) x 14.75

Based on a 24-hour AAC
MER (lb/yr)   = 50% x (24-hour AAC) x (DF 24-hr) x 8760 hr/yr
                 = (24-hour AAC) x 48.67

Based on an Annual AAC
MER (lb/yr)   = 50% x (Annual AAC) x (DF Annual) x 8760 hr/yr
                 = (Annual AAC) x 243.33

The lowest of the MERs for different averaging periods was selected as the MER for a TAP. The MER was rounded to one significant digit.

APPENDIX D

PROCEDURES FOR ESTABLISHING AAC

The list of Toxic Air Pollutants in Appendix A will be updated periodically as new data becomes available.

An acceptable ambient concentration (AAC) must be developed for each toxic air pollutant added or revised. It is recommended that toxicity data should be used according to the following priority schedule. The reviewer should use the most recent version of each reference that is available at the time of the review.

STEP 1: Acquisition of Pollutant Toxicity Data

- IRIS – Inhalation Unit Risk (IUR) presented as the upper bound estimate of the probability of cancer formation per unit concentration of chemical, expressed in risk per microgram of TAP in a cubic meter of air ($\mu g/m^3$)$^{-1}$ and/or reference concentration (RfC) that is not likely to cause deleterious health effects during a chronic exposure period, expressed in mg-TAP/m^3 air (mg/m^3). IUR estimates are used to calculate the RBAC that provides a cancer risk of 1 in 1,000,000 for pollutants with an IRIS weight-of-evidence classification of A, 1 in 100,000 for pollutants with an IRIS weight-of-evidence classification of B, and 1 in 10,000 for pollutants with an IRIS weight-of-evidence classification of C. The RBAC is calculated by dividing the cancer risk by the IUR. The results of this calculation are generally presented in IRIS. Both the RfC and RBAC are given an annual average. If both values exist, use the lower one.

- Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL) – PELs should be converted to units of mg/m^3. These are found in 29 CFR Part 1910 Subpart Z. Ceiling limits should be used for acute sensory irritant and toxic evaluations based on a 15-minute average. Eight-hour Time Weighted Average (TWA) are used for chronic effect evaluations based on a 24-hour average.

- American Conference of Governmental Industrial Hygienist (ACGIH) - Recommended Threshold Limit Values (TLV's) should be converted to units of mg/m^3. Use short term exposure limits (STEL) or ceiling limits (CL) for acute sensory irritant and toxic evaluations based on a 15-minute average. Eight-hour TWA are used for chronic effect evaluations based on a 24-hour average.

- National Institute of Occupational Safety and Health (NIOSH) - Recommended Standards (REL's) - The 8-hour TWAs should be converted to units of mg/m^3. Use STEL or CL for acute sensory irritant and toxic evaluations based on a 15-minute average. Some of the NIOSH TWAs are available in the NIOSH Pocket Guide to Chemical Hazards (NPG). EPD did not consider any LD50 data since we are setting the standards for Inhalation exposure. All of the NIOSH TWAs are available in the Registry of Toxic Effects of Chemical Substances (RTECS) Database.

- The recommended conversion formula to be used when the limit is given in units of parts per million (ppm) is:

$$C \ (mg/m^3) = C \ (ppm) \ x \ (MW) \div 24.45$$

Where:

C   =   Concentration of pollutant in air in units of mg/m^{3}or ppm
MW   =   Molecular weight of the pollutant in units of gram/mole
24.45   =   Molar volume at 25 ℃ and 760 mmHg

STEP 2: Adjustment of Toxicity Data for Potential Public Exposure in Excess of Occupational Exposure

The pollutant toxicity data acquired from RBAC and/or RfC has already been determined as an annual average pollutant exposure limit. For purposes of evaluating the pollutant impact using these estimates, the toxicity data acquired does not need to be converted.

The TWA data acquired from OSHA, NIOSH or ACGIH are usually based on a 40 hour per week pollutant exposure. Many sources operate more than 40 hours per week subjecting the public exposure to toxic pollutant emissions for more than 40 hours per week.

Therefore, it is required that this type of toxicity data be adjusted to account for emissions that occur more than 40 hours per week. The adjustment accounts for potential public pollutant exposure and uptake in excess of that exposure (40 hours per week) upon which the TWA's are based. The recommended adjustment formula is:

TA = TO (40/X)

Where:

X   =   Number of hours per week emissions occur. Use 168 for all initial analysis (24 hours per day x 7 days per week). Use actual hours when performing a site specific risk analysis.
TO   =   TWA data
TA   =   Toxicity data adjusted for exposure greater than 40 hours per week

The toxicity data should not be adjusted in cases where emissions occur less than 40 hours per week or when using a STEL or ceiling limit.

STEP 3: Applying Safety Factor to Establish AAC

A Safety factor is applied to account for pollutant exposure to members of the public who may be more sensitive to pollutant effects (persons with respiratory maladies, suppressed immune systems, and/or genetic susceptibilities, young children or the elderly) than the average citizen. No safety factors are applied to toxicity data acquired from IRIS (IUR and/or RfC) since RfC account for effects to the sensitive population over 70 year period; and in case of IUR safety factor is already accounted for. Therefore, the acceptable ambient concentration (AAC) is the same value as the RBAC or RfC.

The exposure adjusted toxicity data acquired from TWA as calculated in Step 2, is further

adjusted by application of a safety factor. The recommended formula for application of the safety factor is:

AAC = TA / safety factor

Where,

AAC - acceptable ambient pollutant concentration
TA - exposure adjusted toxicity data from Step 2 of this Part.

The following safety factor are used

- For pollutants which are not known human carcinogen (From IRIS database) - 100.
- For known human carcinogens (From IRIS database) - 300.
- For acute sensory irritants (those pollutants with ceiling limits or STELs) -10.

The averaging period for the AAC using TWA will be 24 hours. The averaging period for the AAC is defined to be 15 minutes when using a STEL or ceiling limit value.

SUMMARY

An AAC is developed for each toxic air pollutant. Toxicity data is acquired from a priority list of references (Step 1). The toxicity data is adjusted for potential public exposure if the emissions are emitted in excess of 40 hours per week (Step 2) when using the pollutant toxicity data acquired from an 8-hour TWA. A further adjustment is made by application of a safety factor (Step 3.) when using the pollutant toxicity data acquired from TWA's, STEL's, and ceiling limits. This results in the AAC. A safety factor is not necessary when using pollutant toxicity data acquired from RBAC and/or RfC data since safety factors have already been incorporated (the AAC has the same value as the RBAC or RfC). The result of the Step 3 is the AAC.

APPENDIX E

LIST OF ACRONYMS

LIST OF ACRONYMS

AAC:	Acceptable Ambient Concentration
ACGIH:	American Conference of Governmental Industrial Hygienist
AERMOD:	AMS/EPA Regulatory Model
CAS:	Chemical Abstract Service
BACT:	Best Available Control Technology
CL:	Ceiling Limit
EPD:	Georgia Environmental Protection Division
HAP:	Hazardous Air Pollutant
ISC:	Industrial Source Complex
IRIS:	Integrated Risk Information System
MACT:	Maximum Available Control Technology
MGLC:	Maximum Ground Level concentration
MER:	Minimum Emission Rate
NED:	National Elevation Database
NIOSH:	National Institute for Occupational Safety and Health
NWS:	National Weather Service
OSHA:	Occupational Safety and Health Administration
PEL:	Permissible Exposure Limit
PSD:	Prevention of Significant Deterioration
RBAC:	Risk Based Air Concentration
RfC:	Reference Inhalation Concentration
STEL:	Short Term Exposure Limit
TAP:	Toxic Air Pollutant
TWA:	Time Weighted Average
USEPA:	United States Environmental Protection Agency