Ohio EPA

Division of Air Pollution Control

Air Quality Modeling and Planning Section

Engineering Guide #69

Air Dispersion Modeling Guidance

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The Division of Air Pollution Control has received several questions concerning computer modeling of air pollution sources. This guide is intended to respond to those questions. Below is a list of all of the questions. The rest of the Guide contains the Division's responses. The Division welcomes comments on the application of this Guide and additional questions related to air dispersion modeling.

This document will answer the most commonly asked questions to provide a basis for consistent model application although many other questions require case-specific responses. The answers in this document do not reflect a rule or regulation, are not intended to be treated as a rule or regulation, and are subject to change on a case-by-case basis. The information within is provided so that permitting personnel, regulated entities and the public will have an understanding of the expected outcome of the situations described in this document. If you have additional questions on modeling, or comments on this guide, you should contact the Division of Air Pollution Control (614-644-2270).

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Question 1: What specific modeling requirements are incorporated by Ohio EPA in the review of air contaminant sources?

Answer 1: The following is intended to identify current Ohio EPA, Division of Air Pollution Control requirements for air pollution control modeling applications within Ohio. Where applicable, Ohio EPA is consistent with U.S. EPA guidance. In real world applications, the US EPA Guideline on Air Quality Models and supplementary guidance does not always address detailed problems that confront modelers.

The purpose of air dispersion modeling is to predict pollutant concentrations resulting from a source or group of sources under various meteorological conditions. Modeling is necessary to demonstrate that the subject source or sources will not 1) cause or significantly contribute to a violation of the National Ambient Air Quality Standards (NAAQS); 2) cause ambient concentrations which exceed allowable PSD increments; 3) comply with Ohio EPA's policy of no new source consuming more than one half of the available PSD increment (one half the increment is the effective goal for all new source modeling of criteria pollutants, regardless of the size or location of the new source.); and/or 4) cause ground level concentrations which exceed Ohio EPA's maximum allowable ground level concentration (MAGLC) for toxic air pollutants. For criteria pollutants which do not have identified PSD increments, maximum incremental impact of new source emissions is limited to one quarter of the NAAQS.

The combined emission increases from all of the new or modified sources must be evaluated to determine the maximum incremental impact if the total emissions exceed the amounts indicated in Table 3. For criteria pollutants, the incremental impact cannot exceed one half of any PSD increment or, if no PSD increment exists, one quarter of the NAAQS. There is no requirement to model VOC emissions for incremental impact on ozone concentrations (although specific VOC constituents may require air toxic modeling). **For exceptions to the one half PSD increment policy, see Answer 18.**

New or increased emissions of toxics that exceed the levels identified in Table 3 must be evaluated to determine the maximum incremental impact of these emissions for comparison with the MAGLC as described in Ohio EPA's current procedure for reviewing new sources of air toxics.

Where the permit includes both emission increases and decreases (generally restricted to a contemporaneous 5-year period), the net increase should be modeled. Ohio EPA must approve the 'netting' emissions prior to modeling.

Question 2: What models are to be used?

Answer 2: The specific source/receptor situation dictates the appropriate model for determining ambient concentrations for comparison with NAAQS, PSD increments, short or long term exposure limits, etc. The size and complexity of the source, the toxicity of the emissions along with other factors will dictate whether a screening model or a refined model is appropriate.

Screening models are generally the first level tools for evaluating air quality impacts. High predicted concentrations from a screening model may indicate the need for further refined modeling. Larger more significant sources and groups of sources will require the application of a refined model.

Sources in areas where terrain elevation is significant relative to the stack height will require evaluation using receptor elevations. Where terrain exceeds the stack height, a complex or intermediate terrain modeling analysis is necessary. This applies to both criteria and toxic pollutants.

Generally, the most recent version of a model is to be used. The most recent model versions of models contained in The Guideline on Air Quality Models (GAQM) can be obtained by accessing the U.S. EPA Support Center for Regulatory Air Models (SCRAM), Technology Transfer Network at http:\\www.epa.gov\ttn\scram. The SCRAM web page also provides model users manuals, ancillary programs, meteorological data and additional model application information. This Engineering Guide and meteorological data for Ohio sources are available on the Ohio EPA DAPC web page located at http://www.epa.state.oh.us/dapc/aqmp/aqmp.html

Note: The Guideline on Air Quality Models (Appendix W of 40 CFR Part 51) will be revised. AERMOD has been identified as the replacement for the ISC models. Federal guidance has indicated that both AERMOD and ISC will be acceptable for no more than one year after the final rule is published. At which time ISC will no longer be acceptable for PSD and SIP related modeling. Ohio EPA will continue to accept ISC for state-only permits and modeling projects until further notice.

Screening models:

Note: There is currently no screening version of AERMOD to replace SCREEN3. Until further notice, SCREEN3 will still be accepted by Ohio EPA for state-only permit modeling.

The current recommended model for screening point or area sources in simple terrain is the most recent version of SCREEN3 (or its successor), for criteria pollutants or for applications where maximum ambient concentrations of neutral buoyancy pollutants are desired. A fundamental assumption for pollutants being modeled with traditional Gaussian models is that the concentration of the pollutant in the plume will not make the plume disperse or diffuse differently than air.

Applications requiring an evaluation of emergency release scenarios or sources emitting 'light' or 'heavy' plumes may use one of the commercially available toxic release models to determine if ambient impacts exceed the applicable MAGLC. Most routine releases, even of heavy compounds, will have a density close to that of air due to high dilution.

Point sources with stacks less than good engineering height (discussed below) must be evaluated for downwash impacts using the SCREEN3 or SCREEN3C model (or their successors).

Initial screening estimates of source impacts involving intermediate or complex terrain should utilize SCREEN3 or CTSCREEN (or their successors). SCREEN3 is available as an interactive program by itself or within the TSCREEN model set.

The output from these models identifies short term (1-hour) maximum impacts. The following are the conversion factors to be used to convert these short term estimates to the averaging time of concern. Separate conversion factors have been recommended by U.S. EPA for terrain below stack tip (simple terrain) and terrain above stack tip (complex terrain).

Conversion Factors

	Desired Averaging Period						
Model output	1-hr	3-hr	8-hr	24-hr	month	qtr	ann
Simple 1-hr:	1.000	0.900	0.700	0.400	0.180	0.130	0.080
Complex 1-hr	1.000	0.700	0.500	0.150		0.060	0.030

Additional guidance on the use of SCREEN and TSCREEN is provided in Appendix A of this document.

Complex and intermediate terrain screening for state-only permit requirements can also be performed using ISC3 with five years of NWS data.

Refined models:

The most commonly used refined models for point, area and volume sources involving simple, intermediate and complex terrain are the most recent versions of ISCST3 and ISCLT3 (or their successors) using representative meteorological data in the regulatory default modes. Several commercial versions of these models have been granted model equivalency by U.S. EPA and are therefore also acceptable. For refined toxic analyses, the same procedures used for criteria pollutants are used to determine ambient concentrations. There are currently no requirements for deposition calculations**.** Modeling involving pollutant transformations (ozone, nitrates, sulfates) is not generally required for new or modified sources and is not addressed in this guide.

Question 3: What meteorological data sets are to be used?

Answer 3: Short Term: ISC Data Sets: Hourly surface observations are combined with twice-daily mixing height measurement to create a RAMMET meteorological input file. RAMMET data files can be created using on-site tower measurements or off-site National Weather Service (NWS) surface data sets.

If the modeling is for NAAQS or PSD analyses, at least one year of on-site or the most recent available five years of representative off-site NWS data are required. If the source of concern is located in intermediate or complex terrain, U.S. EPA believes that NWS data are not representative for the above stack portion of the analysis and are therefore not acceptable. For state-only modeling requirements, 5 years of NWS data are considered acceptable for use in a conservative screening analysis.

The most recent five-year off-site NWS data sets currently available from Ohio EPA are for the period 1987-1991. These data are acceptable. Later NWS data are also acceptable but not required. Off-site NWS data sets are assigned by county. Table 1 identifies the appropriate data set for each county in Ohio.

Certain southeastern counties of the state have been assigned Parkersburg/Huntington RAMMET and STAR data for modeling. For counties assigned 'Parkersburg' surface data, 1973-1977 data are the most recent available. This surface site is the most representative available for modeling in this region of Ohio and the older data set is considered more representative for these counties than more recent Huntington or Pittsburgh data.

NOTE: While the State of Ohio accepts NWS data for use in modeling in both simple and complex terrain for state-only modeling requirements, U.S. EPA has a more restrictive interpretation of ‘representative’ meteorological data when modeling impacts at receptors with elevations above the stack tip. For this and other reasons, it is important when preparing to model major PSD or nonattainment sources, that a protocol is developed and approved to assure that acceptable model calculations will be obtained for each source/receptor relationship.

AERMOD Data Sets: On-site or NWS surface data sets are combined with local surface characteristics and upper air observations within the AERMET preprocessor program to create the needed modeling meteorological data sets for AERMOD. The latest five-year data sets for use in Ohio will be provided on the Ohio EPA web page at http://www.epa.state.oh.us/dapc/aqmp/aqmp.html after Appendix W is finalized and final guidance is issued by U.S. EPA.

Long term: Long term (e.g., monthly, quarterly, annually) meteorological data sets are developed from short term on-site or off-site (NWS) surface data sets. These long term STAR (STability ARray) data sets are necessary to run ISCLT3 or other ISCLT3-based long term models.

ISCST3 and AERMOD can also be used for long term modeling periods by modeling specific blocks of days and selecting appropriate n-day average concentrations.

Question 4: What modeled emission rate(s) should be used?

Answer 4: Tables 9-1 and 9-2 in the Guideline on Air Quality Models (Appendix W of 40 CFR Part 51) identify the various emission rates to be used in modeling a source. In general, the short term maximum potential (allowable) emission rate is used in the evaluation of a short term standard. For an existing source, a representative long term actual emission rate can be used to evaluate a longer term (quarterly or annual) standard. An annual permit restriction can also be used to develop a long term average emission rate to be used in evaluating a long term standard for a new source.

For state permit modeling, including Ohio air toxics modeling, the peak short term increase which the permit will allow is the emission rate to be modeled to determine the peak ambient impact this permit action will allow. This could involve the combined peak impact of several sources if there are several sources included in the same project.

For a federal netting or synthetic minor permit, the difference between existing actuals emissions and permit allowable emissions, as determined in the netting calculation, is modeled for comparison to the Ohio acceptable incremental impacts. For state-only netting modeling evaluations, the allowable to allowable difference is usually acceptable. For PSD or federal netting, though, modeled emissions should be consistent with the netting evaluation performed for the permit.

For a modification which involves an emission increase only, the net change allowed by the permit is evaluated. For PSD and other federal analyses, the net change is the difference between the existing actual emissions and the new potential allowable emissions. For state-only review, modeling the difference in allowables is usually acceptable.

For a modification involving a change in stack parameters which could increase the ambient impact due to the source(s), the emissions affected by the modification (potential allowable) are modeled to determine if the impact of the modification is below the Ohio acceptable incremental impacts. If necessary, the present (before modification) emissions can be modeled as negatives in a refined analysis to determine the net impact of the permitted modification for comparison to the Ohio acceptable incremental impacts.

Like-kind replacements would not need modeling if all emissions parameters remain the same since there would be no increase in impact due to the permit action. If, however, the replacement involves the use of a shorter stack, lower temperatures, etc., the replacement may cause an increased peak impact which would need evaluation. As noted above, if the replacement, when viewed alone, exceeds the Ohio acceptable incremental impacts as identified in Table 3, the source being replaced can be modeled with a negative emission rate in a refined modeling analysis to determine the net peak impact for comparison to the Ohio acceptable incremental impacts. Also, see Question 14 for additional information on emission inventories.

Question 4.1: Are fugitive emissions modeled?

Answer 4.1: Major new source PSD and Nonattainment Review includes all significant sources, including fugitive sources such as storage piles and roadways.

In minor source state permit modeling, though, only the boiler or process source criteria and toxic emissions increases (both controlled and fugitive) are to be modeled. Non-process fugitive sources such as roadways and parking lots, material storage and material transfer operations are not modeled. Grinding, crushing, mixing and screening operations are considered processes and should be modeled. An evaluation of all project emissions may be required in a state analysis if circumstances warrant.

Question 4.2: Are there any exceptions to the modeling thresholds for modeling criteria pollutants and toxics contained in Table 3?

Answer 4.2: There are several new source emissions scenarios which Ohio EPA has historically not reviewed for state-only permits. These scenarios generally involve fugitive emissions from parking lots, roadways, material handling and storage piles. These scenarios usually represent situations where modeling results often indicate potential problems due to unreliable emission factors and/or unusual or extreme source configurations. Field experience with these sources, though, indicates that normal operating practices and compliance with required controls result in acceptable ambient impacts as demonstrated by ambient monitoring, field measurements of visible emissions or a lack of verified complaints by local citizens.

Therefore, the following list of source/pollutant scenarios will not be required to perform an air quality analysis in support of a state-only permit **unless factors such as source size, tons of emissions, particle size, pre-existing concerns or proximity to other sources or citizen populations indicate that a modeling review is warranted**:

Toxic or criteria pollutants from parking lots
Toxic or criteria pollutants from storage piles
Toxic or criteria pollutants from storage tanks
Toxic or criteria pollutants from transfer operations
Toxic or criteria pollutants from grain silos or dryers

Toxic or criteria pollutants from emergency generators
Toxic or criteria pollutants from gasoline dispensing

In addition, the following pollutants will be treated as PM but not as a toxic for modeling purposes:

Wood dust
Sand
Glass dust
Coal dust
Silica
Grain dust

Source/Toxic Pollutant combinations subject to a MACT, NESHAP or an NSPS that would restrict the amount of that pollutant that could be released are not subject to toxics modeling. Toxics modeling is also not required for pollutants subject to a NAAQS (e.g., lead).

Question 4.3: Should sources be modeled that emit pollutants listed in the ACGIH book, do not have a TWA, but do have a Ceiling or STEL?

Answer 4.3: Yes, pollutants not having a listed TWA are addressed by multiplying the Ceiling or STEL by 0.737 and then following the procedures in 'Option A' to develop a MAGLC.

Question 4.4: Are minor and exempt sources included in the modeling for a project which exceeds the thresholds in Table 3?

Answer 4.4: All sources or units contained in the permits that make up a project are initially considered significant with respect to the potential impact due to the project. Many small sources, while individually insignificant, could combine to cause or contribute to an ambient problem. Smaller sources can be removed from the modeling analysis if it can be demonstrated that their emissions are insignificant relative to the rest of the project.

Question 4.5: Do you model sources within a building that have no direct vent to the outside or do not have an identified control device for capture, control and release of the emissions from the unit?

Answer 4.5: Sources can be located within an enclosure or building with no obvious control and/or vent moving the emissions to the outside. It must be assumed that all emissions coming from the device are either captured and controlled or are escaping to ambient air. If they are not being captured and controlled (with the cleaned air being reintroduced to the work area), the emissions must be escaping the building and the modeler must determine how the emissions are being removed from the building or enclosure to the ambient air. The emission rate leaving the building or enclosure is assumed to be the same as the emission rate from the source(s). Any credit for some portion of the emissions being retained in the building due to "building capture" must be supportable and will be evaluated on a case-by-case basis.

Often the emissions are removed by the building ventilation system. In other situations, the only exchange between indoor and outdoor air occurs through open doors and windows. In any event, the modeler must identify the egress point(s) and characterize the releases as one of the available modeling release scenarios (i.e., point, area or volume). If best engineering judgement justifies assigning a fraction of the total emissions through specific egress points, the individual points can be modeled with their assigned emission rates. When using a single source screening model, the individual modeled peaks are then added together.

If it is unclear which potential egress point the emissions are actually venting through, the worst case egress point is assumed. If it is not clear which egress point is worst case, each scenario should be tested.

Question 5: Is building downwash required for state modeling?

Answer 5: Any stack source file must include building dimension data if the stack is not at or above good engineering practice (GEP) stack height. GEP is determined by evaluating all nearby structures using the formula GEP = H + 1.5L where H is the height of the structure and L is the lesser of the height or projected width of the structure. The GEP height is the highest height calculated for any nearby structure (a structure is 'nearby' if it is within five times the lesser of its height or width from the stack). If direction specific building dimensions (discussed below) are not calculated, the most conservative dimensions should be used for all directions. The most conservative building dimensions are usually associated with the height and diagonal width of the tallest nearby building.

Direction specific building dimensions may be determined for 36 wind directions for ISCST or AERMOD and 16 wind directions for ISCLT. This allows the model to include the effects of the critical structure for each wind direction. Direction specific building dimensions are calculated using facility plot plans and manually determining the dominant structure dimensions for each wind direction for each stack. Alternatively, the BPIP program provided by the U.S. EPA as well as several commercial software packages are available which will calculate the dimensions for each wind direction from a single building or group of buildings for each stack.

Buildings with multiple segments can be viewed as multiple buildings. For example, a predominantly flat one story building is interrupted by a three-story tower, the flat, one story building is evaluated and the ‘four story’ building (1 + 3), with lateral dimensions of the tower is also evaluated.

Building dimensions are not contained in state or federal emissions data bases. These data need to be obtained from facility personnel if sources at that facility are subject to building downwash. Distant background sources might be modeled without downwash with Ohio EPA permission since this would most likely maximize those sources' impact in the study area and therefore be 'conservative'.

Question 5.1: What building height do I use if the building has a pitched roof?

Answer 5.1: Pitched roofs present a nonstandard modeling scenario. The horizontal dimensions at the peak are reduced to a single line. A conservative approach is to assume that the entire horizontal dimensions are covered by a flat roof at the elevation of the peak of the pitched roof. An acceptable alternative is to assume a building height one half the distance up the pitched roof and the corresponding horizontal dimensions below that 'roof' (i.e., one horizontal dimension would also be halved)**.**

Question 7: Is there any special guidance for nonstandard point source emissions?

Answer 7: Nonstandard source emissions are not specifically addressed in the above screening or refined models. For example, if emissions do not exit the stack in an upward (vertical) direction, alternative characterizations of the source should be developed to more accurately represent the release point. If a 'point source' is still assumed, even though the exit velocity is blocked or diverted sideways or downward (such as in a rain cap, discussed below), an exit velocity of 0.001 m/s should be input to the model so that a fictitious upward momentum is not credited to that source.

If the temperature of the release is near ambient, a characterization as an area or volume source might be appropriate. If temperature is significant, a virtual stack might be created to represent the emission point. Alternative characterizations should be discussed with Ohio EPA staff prior to modeling.

Question 7.1: How do I model rain caps and horizontal releases?

Answer 7.1: U.S. EPA has provided a specific solution to address hot stack plumes that are interrupted by a rain cap or which are released horizontally. U.S. EPA requires that these sources reduce their stack exit velocity to 0.001 m/s.

While it would be conservative to simply reduce the velocity, the source would lose the effect of the buoyancy that the volume of hot gas would normally have. The Ohio EPA recommended adjustment provides for retention of the buoyancy while addressing the impediment to the vertical momentum of the release. The procedure is as follows (stack parameters' units are assumed to be in metric units):

1) The stack exit velocity (V_s) is set equal to 0.001 m/s (V_s')

2) Stack diameter (d_s) is adjusted using the equation

$$d_s' = 31.6 * d_s * (V_s)^{0.5}$$

(Where V_s is the actual stack exit velocity, NOT 0.001 m/s)

3) Use V_s' and d_s' in the model

The results of this approach can create an extremely large modeled stack diameter. Receptors should not be placed within the calculated diameter, d_s'.

Question 7.2: How do I model flares?

Answer 7.2: For screening purposes, the flare option in SCREEN3 or TSCREEN is acceptable. For refined modeling, it is necessary to compute equivalent emission parameters, i.e., adjusted values of temperature and stack height and diameter. Several methods appear in the literature, none of which seems to be universally accepted. Ohio EPA/DAPC has used the following procedure, which is believed to be consistent with SCREEN3:

1) compute the adjustment to stack height as a function of heat release Q in MMBtu/hr:

$$H_{equiv.} = H_{actual} + 0.944(Q)^{0.478} \quad \text{(a)}$$

Where H has units of meters;

2) assume temperature of 1273 deg. K;

3) assume exit velocity of 20 meters/sec;

4) assume the following buoyant flux:

$$F_b = 1.162(Q)$$

5) back-calculate the stack diameter that corresponds to the above assumed parameters. Recall the definition of buoyant flux:

$$F_b = 3.12(V)(T_{stack} - T_{ambient})/T_{stack}$$

Where V is the volumetric flow rate, actual m^3/sec.

Substituting for F_b and solving for the equivalent stack diameter $d_{equiv.}$:

$$d_{equiv.} = 0.1755(Q)^{0.5}$$

This method pertains to the "typical" flare, and will be more or less accurate depending on various parameters of the flare in question, such as heat content and molecular weight of the fuel, velocity of the uncombusted fuel/air mixture, presence of steam for soot control, etc. Hence, this method may not be applicable to every situation, and the applicant may submit his own properly documented method.

(a) Beychok, M., 1979. Fundamentals of Stack Gas Dispersion, Irvine, CA.

Question 7.3: What special modeling considerations are necessary for modeling combustion turbines?

Answer 7.3: Combustion turbines are unique in that stack temperatures and flow rates, as well as emission rates, are dependant on ambient conditions, especially ambient temperature. Determining a worst case operating scenario resulting in peak source impacts involves evaluating the source at multiple loads (50%, 75% and 100%) as well as average and extreme ambient temperatures. Three general approaches are normally followed to establish the worst case operating scenario. The approaches described below address a PSD application.

Approach 1: Each scenario is modeled using SCREEN3. If each scenario results in insignificant impact, then the demonstration is complete. If one or more scenarios result in significant impact, the worst case scenario is carried forward into the PSD and NAAQS analyses using ISC or AERMOD. If there is no clear cut worst case scenario, multiple scenarios may need to be carried forward into the subsequent comprehensive analyses. All other things being equal, it is preferable to move forward with a 100% load scenario rather than a reduced load scenario.

Approach 2: Each scenario is modeled with ISC or AERMOD using the latest year of meteorology. The worst case scenario(s) is then run with five years of meteorology to determine if the proposed project will have a significant impact. If there is a significant impact, then the worst case scenarios are carried forward into the PSD and NAAQS analyses.

Approach 3: Worst case emission rates and stack parameters from all scenarios are used to estimate a worst case impact. This virtual worst case stack can be used through all phases of the analysis.

The same approaches can be followed for state-only (e.g., synthetic minors) modeling, with the only goal to be achieved being the Ohio Acceptable Incremental Impacts.

Question 9:What receptor grids must I use?

Answer 9: Sufficient receptors are necessary in the vicinity of projected maximum concentrations to assure that the peak concentration(s) has been found. For most applications, the spacing should be 100 meters at the 'hotspot', determined from the preliminary modeling results (either ISC, AERMOD or a screening model), out to a distance sufficient to assure that the maximum concentration has been found. Additional receptors should also be placed in areas of special concern (e.g., areas of source interaction and areas of significant terrain). It is also important that the extent of the grid covers the entire area of significant impact from the proposed project.

Receptor elevations are required unless a demonstration that the study area is flat is made. The absence of terrain above stack height is not sufficient to ignore terrain heights. 'Simple' terrain does not mean 'flat' terrain. Topographical data indicating no significant terrain features in the expected significant impact area of the source(s) or indicating flat but gently sloping terrain could justify not including terrain heights for the receptors in that study area**.**

Receptor elevation information as well as source and receptor location information can be derived from information contained on United States Geological Service topographical maps as well as from internet sources such as www.topozone.com**.** Information is also available from Digital Elevation Model (DEM) files which are also available from various host sites on the internet. DEM files are available free of charge at http://data.geocomm.com/dem/.

AERMOD receptor grids must be exclusively developed using the AERMAP preprocessor using DEM data. Receptor information must contain calculated information concerning the relative height of the nearby terrain (receptor height scales) in addition to the location and elevation of the receptor.

Question 10: What are the state significant emission rates which trigger modeling?

Answer 10: A comprehensive list of emission rates which trigger state and federal modeling requirements is contained in Table 3 under the heading “Ohio Modeling Significant Emission Rates.” The emissions increase which will be allowed by this permit action (potential allowable increase) are compared to these levels.

Question 10.5: Can a source modification trigger a requirement for modeling even where there is no increase in emission rate?

Answer 10.5: OAC 3745-31-01(VV)(1)(b) defines "modification" to include "Any physical change in, or change in the method of operation of any significant air contaminant source that, for the specific air contaminant . . . for which the source is classified as significant, results in an increase in the ambient air quality impact . ." greater than certain values specified in the rule. Thus, if the source is "significant" (as defined in OAC 3745-31-01(RRR)) and the proposed incremental impact at any receptor exceeds the specified value (listed under the "3745-31-01(VV)(1)(b)" heading in Table 3) then the change is a modification requiring a permit-to-install, notwithstanding the fact that it may entail no increase in emissions.

It should be kept in mind that the provisions for OAC 3745-31-01(VV)(1)(b) were promulgated for the sole purpose of ensuring that the ambient air quality standards are protected. If this provision is triggered, BAT is not required. Also, this provision is not required under any federal regulation and has not been submitted to U.S. EPA for approval as part of the SIP.

It should also be noted that the concentrations in (VV) are only trigger concentrations and are not maximum allowable impacts. The ambient air quality standards and, if applicable, the PSD increments would be the limiting factor.

An example is a coal-fired boiler where a scrubber is proposed to be installed to remove sulfur dioxide. Even though the actual and allowable emissions of NOx might not increase, the reduced stack temperature and velocity associated with the scrubber could result in an increase of ambient concentration at some receptor exceeding the 15 ug/m^3 limit under (VV)(1)(b), thereby triggering the requirement to obtain a PTI before beginning construction. Another example is any reduction of stack height. For either example the need for modeling is apparent, to resolve the PTI question. A screening model may be used, or if a refined model is selected, the controlling concentration will be the high-high increase of concentration anywhere on the receptor grid, for the relevant averaging period, using five years of off-site or one-year of on-site meteorological data.

Question 11: What are the state target concentrations for acceptable incremental impacts?

Answer 11: Table 3 also contains a listing of national ambient air quality standards and PSD increments as well as state target ambient concentrations for criteria pollutants and specific toxic emissions subject to the state air toxic policy. The state target concentrations for criteria and toxic pollutants listed under the heading "Ohio Acceptable Incremental Impact" represent the acceptable incremental impact of the new emissions which are the subject of a state permit requirement. The Ohio significant impacts under OAC 3745-31-01 (VV)(1)(b) identify modeled impact levels which trigger permit to install requirements for a source modification (including stack height changes).

Question 12: What special requirements exist for sources of fluoride?

Answer 12: The potential for secondary impacts due to fluorides is greater than the probability for primary human health effects. Therefore, there may be observable impacts and actual complaints of damage to plants and property when the MAGLC has not been exceeded.

The approach to follow when evaluating the secondary impacts due to fluorides is as follows. The secondary ' target' is 0.5 ug/m^3 as a 30-day average. The screening approach is to model a 1-hour concentration using SCREEN and convert it to a 'monthly' average using the 0.18 conversion. Monthly averages can also be modeled directly using ISCST or ISCLT or AERMOD. The incremental impact of the new emissions is modeled.

This 'secondary' approach would also be appropriate for any other pollutants where it is determined that there may be significant non health related impacts at levels below the MAGLC.

Question 13: How do I obtain background values when performing NAAQS analyses in Ohio?

Answer 13: Modeling analyses which must estimate total concentrations of a pollutant (e.g., PSD analyses which evaluate the NAAQS) must account for those sources which are either too small or too distant to be included in the modeling analysis. This is accomplished by adding a background value to the modeled concentrations.

A separate background value is needed for each NAAQS pollutant and for each NAAQS averaging time. Actual monitored data for the most recent year, from a representative monitoring site(s) are the basis for acceptable background values. Ideally, the monitor should not be impacted by any major sources or any local smaller sources. If an unimpacted monitor is available, the second highest value for each short-term period would represent the short term backgrounds. The annual average is the annual background. The highest quarterly average would be used for lead.

If an unimpacted monitor is not available, nonimpacted values from monitors which are near a limited number of sources and which have nonimpacted sectors (no upwind sources) can be used to develop background values. **Unadjusted impacted monitor values can also be used as a conservative background**.

A nonimpacted value is a monitored value measured during a period when the wind was not blowing from a 90-degree sector centered on a line between the monitor and the potentially impacting source. For a 3-hour value, no winds should be from the impacting sectors. For 24-hour values, no more than two hours should have winds from the impacting sectors. For short term backgrounds, the second highest nonimpacted value is chosen as a fixed background. Long term background values are the average of the nonimpacted values for the specific averaging time period.

Question 14: What sources do I include in a major source PSD and/or NAAQS analysis?

Answer 14: Major Source NAAQS Analysis: All sources within the significant impact area (SIA) of the emissions increase with potential allowable emissions greater than the PSD significant emission rates (listed in Table 3), must be included in a new source review NAAQS analyses. SIA is defined as the region over which any exceedance of a PSD significant impact increment (listed in Table 3) occurs, based on each high-high concentration over five years of modeling (one year if on-site, representative data are available). In addition, all major sources with potential allowable emissions greater than 100 tons/yr outside of the SIA and within 50 km must also be included if they interact with the new source.

Whether to include a potentially interacting source can be determined using the '20D' approach. Under this approach, the modeler may exclude sources whose potential allowable emissions in tons/yr are less than 20 times the distance between the two sources in kilometers. Prior to commencement of final modeling, though, Ohio EPA must be advised as to what sources the modeler chooses to exclude using the 20D method. Ohio EPA reserves the right to require any or all of these sources to be included in a final analysis if Ohio EPA believes that any or all are potentially significant**.**

Major Source PSD Increment Analysis: All PSD sources located within an area where PSD baseline has been triggered or within the SIA of the new source, whichever is larger, must be included in the PSD increment analysis modeling inventory. PSD sources located outside of the baseline area or SIA which interacts with the new source must also be included. These sources may be screened using the 20D approach.

Inventory data should be obtained from the state emissions inventory system or the AIRS national data base system. Basic modeling source parameters (stack height or release height, diameter, temperature, exit velocity or volume flow, emission rate, etc.) are contained in these data systems.

The DAPC emissions inventory unit has placed several data sets on the Ohio EPA web page at: http://www.epa.state.oh.us/dapc/aqmp/eiu/eiu.html. While the later data sets have significant amounts of current information, it is important to check the 1990 and 1995 data bases which contain information on short term allowable emission rates.

The short term allowable rates and source capacities are included in these earlier data sets. These are important for determining maximum short term allowable emission rates for the significant sources consistent with Section 9.1 of the GAQM. If source information is missing or is suspect, you will need to contact the local air pollution agency or field office to obtain current, correct information.

Question 15: How do I model major sources in nonattainment areas to demonstrate net air quality improvement?

Answer 15: OAC 3745-31-25 discusses the requirements for determination of net air quality benefit for major sources wishing to locate in a nonattainment area (NAA). Both the rule and U.S. EPA guidance indicate the need for demonstrating area-wide benefit and progress toward attainment.

VOC emissions are not required to be modeled for net air quality benefit. All major PM and SO2 emissions increases and corresponding offsetting emissions will need to be modeled for a net air quality benefit. The entire state is attainment for CO, NOx and Pb so no net air quality benefit modeling is required.

In general, PM and SO2 NAAs have undergone SIP modeling at some time and the state has identified receptor areas which were key for the SIP attainment demonstrations. In cases where the potential offsets could impact critical receptors, those receptors must show impacts less than or equal to zero. For the remaining receptors, the receptors within the significant impact area of the increasing emissions must, on average, show no net increase for each averaging period.

If greater than zero impacts at critical receptors or net area-wide increases are modeled, the applicant may present a complete NAAQS demonstration for the significant impact area of the project.

Question 16: Can I use SCREEN to model multiple sources?

Answer 16: While the SCREEN model is a single-source model, it can be used to develop a conservative estimate of the peak potential impact of emissions from multiple egress locations.

A conservative approach combines the peak impact from each individual SCREEN run as if the peak impact from each emission point occurred at the same point in space.

In the case of multiple identical stacks, all of the emissions can be assumed to come from one stack (modeled using the combined emission rate with the stack flow parameters for a single stack).

If the egress points are not identical, all of the emission could be to assume to be emitted from the ‘worst case’ emission point. Sometimes the determination of worst case is straightforward (e.g., shortest, coldest, lowest flow stack). In other situations, the choice may not be clear and the Local Air Agency, District Office or Central Office should be consulted.

The approaches described above will result in conservative estimates. If the source(s) does not pass using the above assumptions, less conservative approaches can be considered in consultation with the Local Air Agency, District Office or Central Office. A multisource refined model may also be appropriate to use to model the actual separation of emission points and estimate their combined peak impact.

Question 17: If multiple pollutants are being emitted, does an individual model run have to be performed for each pollutant?

Answer 17: If the emission characteristics are identical for each pollutant (all of the pollutants are emitted in the same proportion from each of the egress points) one run can be performed and the results can be adjusted. Gaussian models such as AERMOD, SCREEN and ISC are ‘linear’ models in that the impacts will vary proportionally to the emission rate. Therefore, in this example case, if one pollutant is being emitted at twice the rate of another pollutant, the impact of the second pollutant will be twice as high.

In the case of multiple pollutants being emitted from a single emission point, an emission rate of 1 gram per second can be modeled and the results multiplied by each allowable emission rate (expressed in grams per second) to determine the predicted ambient concentration of each of the pollutants.

If emission characteristics vary for different pollutants, or the pollutants do not vary proportionately from each egress point, then a separate modeling analysis for each pollutant is necessary.

Question 18: For PSD and non-PSD sources, can facilities be installed if modeling shows that more than ½ the available PSD increment is consumed?

Answer 18: The purpose of PSD is to keep clean areas clean. The intent of the one half increment portion of the policy is to allow future growth by preventing any single emissions increase from consuming all of the available increment.

Non-PSD sources still consume increment and increase background concentrations. Therefore, these emissions can also threaten future growth.

As such, it is Ohio EPA's practice that any new source, whether PSD or not, will not consume more than one half the available PSD increment (In application, state-only permits do not involve modeling which would assess available increment, therefore, one half the increment is the effective goal.) .

In some cases, Ohio EPA will grant exceptions to this policy for new PSD or non-PSD sources where modeling predicts exceedances of one half of, but less than 83 percent of the available increment. (For example: If the available increment were 30 ug/m3, between 15 and 25 ug/m3.) Exceptions will be granted on a case-by-case basis (but only when public health will not be adversely affected or where modeling ~~is~~ results are suspect). The following are examples of where exceptions will be granted:

1) Modeling shows that the exceedance of the one half of the available increment occurs in a very localized area near the emissions source either due to the source parameters or due to downwash and, in the Ohio EPA's judgement, it is unlikely that other new sources located near the facility will significantly impact the same exceedance locations. In other words, if it is unlikely that another source would be negatively impacted by the exceedance then the Ohio EPA may grant the exception. An example of this would be a fugitive source with low release points having close proximity maximum impact areas that in the Ohio EPA's judgement would not be areas that other facilities would impact.

2) If the source is located such that it is unlikely in the Ohio EPA's judgement that any other major source would locate in the same area (for instance, in an extremely remote, rural area).

3) If the source is temporary and the increment consumed will become available in the near future for future growth (for instance, at a clean up site where the source will be operated for only a couple of years.)

4) If the source is locating in a 'brownfield' area and otherwise would locate in a greenfield site.

Question 19: What determines whether a locale is rural or urban?

Answer 19: The Guideline on Air Quality Models (Appendix W of 40 CFR Part 51) outlines two methods by which an area can be categorized as either 'urban' or 'rural'. These methods rely on evaluating either the land use or population density within a three-kilometer radius circle around the subject source. Either of these methods is acceptable for the determination of the proper classification for that source, although the land use approach is preferred.

In Ohio, many counties have had significant SIP development modeling performed which included sources from across the county. Due to the inability of the models used to incorporate both rural and urban in a single run, a single, predominate classification was assigned for the entire county. Therefore, if multiple facilities over a wider area are being modeled as part of a PSD or NAAQS analysis, the Central Office should be consulted as to the historic classification for the overall analysis so that a consistent approach will be maintained.

WFS/JTT/wfs

July 1, 2003

TABLES

Table 1

METEOROLOGICAL ASSIGNMENTS

(meteorological years 1987-1991 unless otherwise specified)

COUNTY	SURFACE	MIXING HEIGHT
ADAMS	Huntington	Huntington
ALLEN	Dayton	Dayton
ASHLAND	Akron	Pittsburgh
ASHTABULA	Erie	Buffalo
ATHENS	Parkersburg	Huntington (1973-1977)
AUGLAIZE	Dayton	Dayton
BELMONT	Pittsburgh	Pittsburgh
BROWN	Cincinnati	Dayton
BUTLER	Cincinnati	Dayton
CARROLL	Pittsburgh	Pittsburgh
CHAMPAIGN	Dayton	Dayton
CLARK	Dayton	Dayton
CLERMONT	Cincinnati	Dayton
CLINTON	Cincinnati	Dayton
COLUMBIANA	Pittsburgh	Pittsburgh
COSHOCTON	Columbus	Pittsburgh
CRAWFORD	Columbus	Dayton
CUYAHOGA	Cleveland	Buffalo
DARKE	Dayton	Dayton
DEFIANCE	Fort Wayne	Flint
DELAWARE	Columbus	Dayton
ERIE	Cleveland	Buffalo
FAIRFIELD	Columbus	Dayton
FAYETTE	Columbus	Dayton
FRANKLIN	Columbus	Dayton
FULTON	Toledo	Flint
GALLIA	Huntington	Huntington
GEAUGA	Cleveland	Buffalo
GREENE	Dayton	Dayton
GUERNSEY	Pittsburgh	Pittsburgh
HAMILTON	Cincinnati	Dayton
HANCOCK	Toledo	Dayton
HARDIN	Dayton	Dayton

METEOROLOGICAL ASSIGNMENTS

HARRISON	Pittsburgh	Pittsburgh
HENRY	Toledo	Flint
HIGHLAND	Cincinnati	Dayton
HOCKING	Columbus	Huntington
HOLMES	Akron	Pittsburgh
HURON	Cleveland	Buffalo
JACKSON	Huntington	Huntington
JEFFERSON	Pittsburgh	Pittsburgh
KNOX	Columbus	Dayton
LAKE	Cleveland	Buffalo
LAWRENCE	Huntington	Huntington
LICKING	Columbus	Dayton
LOGAN	Dayton	Dayton
LORAIN	Cleveland	Buffalo
LUCAS	Toledo	Flint
MADISON	Columbus	Dayton
MAHONING	Youngstown	Pittsburgh
MARION	Columbus	Dayton
MEDINA	Akron	Pittsburgh
MEIGS	Parkersburg	Huntington (1973-1977)
MERCER	Fort Wayne	Dayton
MIAMI	Dayton	Dayton
MONROE	Parkersburg	Pittsburgh (1973-1977)
MONTGOMERY	Dayton	Dayton
MORGAN	Parkersburg	Huntington (1973-1977)
MORROW	Columbus	Dayton
MUSKINGUM	Columbus	Pittsburgh
NOBLE	Parkersburg	Pittsburgh (1973-1977)
OTTAWA	Toledo	Flint
PAULDING	Fort Wayne	Dayton
PERRY	Columbus	Huntington
PICKAWAY	Columbus	Dayton
PIKE	Huntington	Huntington
PORTAGE	Akron	Pittsburgh
PREBLE	Dayton	Dayton
PUTNAM	Fort Wayne	Dayton
RICHLAND	Columbus	Dayton
ROSS	Columbus	Dayton

METEOROLOGICAL ASSIGNMENTS

SANDUSKY	Toledo	Flint
SCIOTO	Huntington	Huntington
SENECA	Toledo	Dayton
SHELBY	Dayton	Dayton
STARK	Akron	Pittsburgh
SUMMIT	Akron	Pittsburgh
TRUMBULL	Youngstown	Pittsburgh
TUSCARAWAS	Akron	Pittsburgh
UNION	Columbus	Dayton
VAN WERT	Fort Wayne	Dayton
VINTON	Huntington	Huntington
WARREN	Cincinnati	Dayton
WASHINGTON	Parkersburg	Huntington (1973-1977)
WAYNE	Akron	Pittsburgh
WILLIAMS	Toledo	Flint
WOOD	Toledo	Flint
WYANDOT	Columbus	Dayton

Table 2

National Weather Service Anemometer Heights and Station Number

Site	Anemometer Height	Station Number
Akron/Canton	20 feet	14895
Cincinnati/Covington	20 feet	93814
Cincinnati/Abbe Obs.	51 feet	93890
Cleveland	10 meters	14820
Columbus	20 feet	14821
Dayton	22 feet	93815(surface)
Dayton (Wright Pat)	NA	13840(upper air)
Mansfield	20 feet	14891
Toledo	30 feet	94830
Youngstown	20 feet	14852
Buffalo, NY	10 meters	14733
Erie, Pa.	20 feet	14860
Flint, Mi.	21 feet	14826
Fort Wayne, In.	20 feet	14827
Huntington, WV	20 feet	03860
Charleston WV	117 feet	13866
Elkins WV	20 feet	13729
Pittsburgh, Pa.	20 feet	94823
Parkersburg, WV	100 feet	13867

Table 3
Federal and State Modeling Standards and Significant Emission Rates

POLLUTANT	AVERAGING PERIOD	National Ambient Air Quality Standards (NAAQS) (ug/m^3)		CLASS II PSD INCREMENTS	PSD SIGNIFICANT EMISSION RATES	PSD SIGNIFICANT IMPACT INCREMENTS	PSD MONITORING DE MINIMIS CONC	OHIO MODELING SIGNIFICANT EMISSION RATES	OHIO SiGNIFICANT IMPACTS UNDER 3745-31-01(vv)	OHIO ACCEPTABLE INCREMENTAL IMPACT
		PRIMARY	SECONDARY	(ug/m^3)	(tons/year)	(ug/m^3)	(ug/m^3)	(tons/year)	(ug/m^3)	(ug/m^3)
PM10	Annual	50 a	c	17 a	15	1 h	-	10		8.5 a
	24-Hour	150 b	c	30 b	--	5 h	10 h	--	10 (24-hr TSP) i	15 b
Sulfur Dioxide	Annual	80 a	c	20 a	40	1 h	--	25		10 a
	24 Hour	365 b	c	91 b	--	5 h	13 h	--	15 i	45.5 b
	3-Hour	--	1300 b	512 b	--	25 h	--	--		256 b
Nitrogen Dioxide	Annual	100 a	c	25 a	40	1 h	14 h	25	15 (24-hr) i	12.5 a
Ozone	1-Hour	244 d	c	--	40 e	--	--			
Carbon Monoxide	8-Hour	10,000 b	c	--	100	500 h	575 h	100	575ia	2500 b
	1-Hour	40,000 b	c	--	--	2000 h		--		10000 b
Lead	Calendar Quarter	1.5 a	c	--	0.6	--	0.1 h	0.6	0.1 i	0.375 a
Toxics Listed by ACGIH f	1-Hour	--	--	--	--	--	--	1		g, a

a Concentration not to be exceeded
b Concentration not to be exceeded more than once per year
c Same as primary NAAQS.
d Not to be exceeded on more than one day per year, three year average.
e Emissions of volatile organic compounds.
f Any toxics included in the latest handbook of The American Conference of Governmental Industrial Hygienists.
g Value calculated by procedure outlined in current version of the Ohio EPA Division of Air Pollution Control document entitled "Review of New Sources of Air Toxic Emission"
h Peak concentration.
I Concentration that initiates PTI requirements

Appendix A

SCREEN/TSCREEN
Model Application Guidance

The type of SCREEN source to be chosen is dependant on how the emissions leave the source (if the source is not enclosed) or how they leave the building or enclosure if emitted within a building or enclosure. Once the egress points are identified and characterized, one of the following source types is applied to the emissions at the point of egress (stack, window, vent, etc.)

The following information identifies the SCREEN/TSCREEN model choices to be used when modeling for Ohio new source review. Since the TSCREEN model does not directly identify which release scenarios lead to the use of the SCREEN model, "TSCREEN pathways" are identified to assist TSCREEN users in making scenario choices that will lead to the SCREEN model and the desired source type.

Point Source

TSCREEN pathways; There are several TSCREEN release scenarios which utilize the SCREEN3 point source option including Gaseous Release Type, Stacks, Vents, Conventional Point Sources or Particulate Matter Release Type, Stacks, Vents.

- Emission rate (g/s)
- Stack Height (above ground, not roof (m))
- Stack inside diameter (m, diameter of equivalent area circle if stack is not round)
- Stack exit velocity (m/s) or flow rate (ACFM or m^3/s)
- Stack gas temperature (K)
- Ambient temperature (use default of 293 K)
- Receptor height above ground (use 0, ground level)
- Urban/Rural (based on land use within 3 km of the source)
- Building downwash (Building information is necessary if stack is within the influence of a building: i.e., within five times the lesser building dimension)
- Do not consider building cavity calculations. **Note:** After mmm dd, 2002, AERMOD will replace ISC and be the only acceptable refined model. This model does incorporate building wake and cavity effects. After mmm dd, 2002, users of SCREEN will also need to consider the building cavity calculations when determining peak impacts.
- Complex terrain (yes if terrain above stack height is present in the potential impact area of the source)
- Simple or flat (yes for simple: if terrain above stack base is present in the potential impact area of the source. When in doubt, say yes and perform the analysis)
- Choice of meteorology (option 1, full meteorology)
- Automated distance array (yes, minimum distance (m) begins at "ambient air" (usually the fence line) and should extend to a point which ensures that the

maximum concentration has been found, up to a maximum of 50,000 m)
- Discrete distance option (used for informational purposes only)
- Fumigation Option (fumigation calculations are not used for state permit modeling)

Area Source

TSCREEN pathway; There are several TSCREEN pathways which utilize the SCREEN3 area source option including Particulate Matter Release Type, Fugitive/Windblown Dust Emissions or Storage Piles or Gaseous Release Type, Multiple Fugitive Sources. The TSCREEN pathways **do not** allow the characterization of non-square area sources which is now an option with SCREEN3.

General option choices are the same as for point source except for the following;
- Emission rate ($g/s/m^2$)
- Source height (mean height of source, m)
- Length of longer side of rectangular area, (m)
- Length of shorter side of rectangular area, (m)
- Wind direction search (yes)

Volume Source

TSCREEN pathway:(the SCREEN volume source option is not available through TSCREEN)

General options choices are the same as for point source except for the following;
- Initial lateral dimension (modified per table below (m))
- Initial vertical dimension (modified per table below (m))
- Height of release (the midpoint of the opening (m))

SUMMARY OF SUGGESTED PROCEDURES FOR ESTIMATING
INITIAL LATERAL DIMENSIONS (σ_{yo}) AND
INITIAL VERTICAL DIMENSIONS (σ_{zo}) FOR VOLUME SOURCES

Description of Source		Initial Dimension
(a) Initial Lateral Dimensions (σ_{yo})		
Single Volume Source	σ_{yo} =	length of side divided by 4.3
(b) Initial Vertical Dimensions (σ_{zo})		
Surface-Based Source ($h_e \sim 0$)	σ_{zo} =	vertical dimension of source divided by 2.15
Elevated Source ($h_e > 0$) on or Adjacent to a Building	σ_{zo} =	building height divided by 2.15

Elevated Source ($h_e > 0$) not on or Adjacent to a Building	$\sigma_{zo} =$	vertical dimension of source divided by 4.3