DAR-10:
NYSDEC Guidelines on Dispersion Modeling Procedures for Air Quality Impact Analysis

New York State Department of Environmental Conservation

DEC Program Policy

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I. SUMMARY:

This guide sets forth the New York State Department of Environmental Conservation (Department) Division of Air Resources' recommended air dispersion modeling procedures for conducting ambient air quality impact analyses. These procedures summarize significant aspects of the Environmental Protection Agency's (EPA) approved methodologies, as referenced in 40 CFR Part 51, Appendix W, "Guideline on Air Quality Models"; hereinafter also referred to as "*EPA's Modeling Guidelines*". Additional specific recommendations are provided herein to augment EPA methods or interpret New York specific regulations. This document replaces the DAR -10 guidance issued on May 9, 2006 and includes the latest regulatory guidance and compliance methodologies.

II. POLICY:

This policy outlines the Department's recommended techniques and procedures to be used in dispersion modeling analyses submitted to support air permit applications and other air quality impact analyses required by the Department.

References and weblinks provided in this document are current at the time of publishing. For latest updates call the IAM section of NYSDEC's Division of Air Resources at 518-402-8402.

Consultation with Department staff is necessary for any modeling techniques which vary from the guidance contained in this document. The Department's approach specific to the evaluation of toxic air contaminants is contained in policy document DAR-1. A list of pertinent federal and New York State statutes and regulations which provide a basis for the Division of Air Resources' (DAR) air quality impact analysis requirements is provided in Appendix A of this document.

III. **PURPOSE AND BACKGROUND:** The Division of Air Resources' Impact Assessment and Meteorology (IAM) section staff developed this guidance document to streamline the dispersion modeling procedures, minimize modeling efforts, and ensure compliance with both State and National Ambient Air Quality Standards (NAAQS) and regulations. It is intended for use by specialists in air dispersion modeling and assumes familiarity with EPA modeling procedures and guidance documents such as:

• 40 CFR Part 51, Appendix W ("Guideline on Air Quality Models"), January 2017
• *AERMOD Implementation Guide*, EPA-454/B-16-013, December 2018
• *AERMOD User's Guide*, EPA-454/B-16-011, December 2018
• *Guideline for Determination of Good Engineering Practice Stack Height* (Technical Support Document for the Stack Height Regulations). EPA, 1985
• Guidance and clarification memoranda issued by the EPA Office of Air Quality Planning and Standards (OAQPS). Guidance posted on EPA Support Center for Regulatory Atmospheric Modeling (SCRAM) at https://www.epa.gov/scram

While EPA guidance documents address a broad range of modeling issues, this document focuses on modeling procedures that pertain to short-range (< 50 kilometers) stationary source modeling in New York State.

IV. **RESPONSIBILITY:** The responsibility for implementation, interpretation, and maintenance of this document rests with the IAM section of the Bureau of Air Quality Analysis and Research, Division of Air Resources (tel. 518-402-8402).

Facility owners and their consultants are responsible for providing all the information necessary for Department staff to carry out a complete review of any submitted Dispersion Modeling Analysis and Permit Application. For facilities subject to 6 NYCRR Section 212-1.5(e)(2) and 6 NYCRR Subpart 231-12, a modeling protocol must be submitted for review and approval prior to executing a full modeling analysis. In all other instances, submitting a modeling protocol is not mandatory but it is highly recommended. A modeling protocol check list is provided in Section 7 of this document.

V. PROCEDURE: This section outlines specific recommendations and guidelines for performing dispersion modeling and air quality impact analysis for the purpose of demonstrating compliance with the NAAQS and Prevention of Significant Deterioration (PSD) increments. These modeling guidelines are also applicable for estimating impacts of toxic pollutants, locating air quality monitoring sites, and performing visibility analyses for facilities subject to 6 NYCRR Part 231. In some cases, proposed modeling procedures may need to address issues beyond the guidelines specified below and/or incorporate non-guideline aspects in order to meet applicable regulatory requirements. Thus, the Department highly recommends consulting with the staff of the IAM section and submitting a modeling protocol for review and concurrence prior to executing a modeling analysis. This step reduces the need for possible revisions to the modeling assessment and may provide applicants with certain assurances on the acceptable procedures to be followed when developing support documents for permit applications.

The following sections provide details of Department-approved modeling procedures:

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1. Model Selection

Dispersion modeling analyses typically begin with the use of a screening model. A screening model uses simplified inputs and assumptions to calculate conservative (worst case) estimates of air quality impacts near the facility. The screening or preliminary modeling only includes emissions from the proposed new facility or the proposed modification to an existing facility. If the predicted pollutant impacts are below the level of concern (such as PSD increment, Significant Impact Level (SIL), NAAQS, or a DAR-1 guideline concentration), refined modeling may not be necessary. The current recommended model for screening facilities in simple and complex terrain is the most recent version of EPA's AERSCREEN model. (https://www.epa.gov/scram/air-quality-dispersion-modeling-screening-models#aerscreen).

The Department provides access to AERSCREEN modelling software, including an operation manual, on its website: https://www.dec.ny.gov/chemical/8568.html

Per *EPA's Modeling Guidelines,* if the screening model predicts impacts exceeding the level(s) of concern, a second level of more sophisticated models should be applied unless appropriate controls or operational restrictions are implemented based on the screening modeling. The second level consists of refined models that provide more detailed treatment of physical and chemical atmospheric processes, require more detailed and precise input data, and provide more sophisticated, spatially and temporally resolved concentration estimates. The results of the refined modeling must demonstrate that impacts due to the proposed facility do not cause or contribute to exceedances of the NAAQS or guideline concentrations. In certain cases (described in Section 3), a cumulative analysis is required in which the refined modeling includes emissions from nearby facilities in addition to those from the facility for which a permit is sought.

The preferred model used for refined single and multi-source modeling and predicting impacts in simple or complex terrain is the latest version of AERMOD. https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod

If these two recommended models are used in "regulatory default" mode, their predicted ambient air impacts are acceptable for purposes of demonstrating compliance with ambient air quality standards and guidelines. AERMOD also includes options that are not considered regulatory defaults but are appropriate to use in certain circumstances. Any use of the non-default options should be discussed with IAM section staff in advance and justified in the modeling protocol.

2. Modeling Analysis Features

2.1 Emissions

Permit applicants are required to calculate emissions for the proposed project and compare these values to threshold values defined in 6 NYCRR Subpart 231-13. The calculations and rationale utilized in determining the modeled emission rates for each emission point at the facility should be clearly explained in the permit application and modeling report. In order to expedite the Department's review, the facility's emissions inventory should be organized in table(s) displaying potential emission rates in TPY, lb/hr, and g/s for all modeled averaging times. The emissions tables should also include any operational limits in hours per day (hr/day) or hours per year (hr/yr) and production material throughputs and/or unit ratings for each emission source.

If equipment is to be operated under different conditions, such as reduced or altered operating hours, different load factors or fuel type, each emission scenario must be evaluated. For example, for dual-fuel combustion engines, the fuel type that would generate the highest emissions should be modeled. Another example is for gas-fired turbines which will have different emission rates and stack parameters (exit velocity and exit temperature) under different operating loads. A load analysis should be performed to determine the operating conditions that cause the worst-case modeled impacts. The highest impacts may not always correspond with the highest emission rate. The screening modeling for the compliance demonstration should be based on the stack parameters associated with the worst-case operating scenario.

Section 8.2 and Tables 8.1 and 8.2 of *EPA's Modeling Guidelines* describe the emission input requirements for facilities performing refined modeling. It also provides these requirements for the “nearby” and “other” point sources that are included in a cumulative analysis. Per Section 8.2.2 of *EPA's Modeling Guidelines*, new or modifying stationary facilities are required to model with “allowable” emissions, while the “nearby” existing permitted facilities can be modeled using emissions from their actual operating conditions or representative design/capacity factors. The “other” existing point sources/facilities are best represented by air quality monitoring data. Additional guidance from EPA on the development of a facility's emissions source inventory for a cumulative analysis is contained in *Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standards (March 1, 2011)* (*NO_2 Clarification Memo*).

Emission sources defined as ‘exempt’ or ‘trivial activities’ per 6 NYCRR Subpart 201-3 may need to be included in analyses for comparison to the NAAQS as determined by the Department. Emission sources or operating scenarios which can be justified as ‘intermittent’ may be excluded from 1-hour NO_2 or SO_2 modeling on a case-specific basis. Facility owners are strongly encouraged to consult with IAM staff to seek clarification and approval for 1-hour modeling exclusions prior to undertaking modeling analyses.

2.2 Building Downwash/Cavity Considerations and GEP Stack Height

The presence of structures in the vicinity of a stack can influence the behavior of the plume emitted from that stack. EPA's *Guideline for the Determination of Good Engineering Practice Stack Height* (June1985) provides the recommended procedure to assess whether emissions from a stack will be influenced by the turbulent wake zones created by nearby buildings or terrain. If a stack height is less than its formula-derived Good Engineering Practice (GEP) height, then the stack is subject to building downwash. However, there can be some building downwash even for stacks above formula GEP height. According to *EPA's Modeling Guidelines* Section 7.2.2.1: “… the potential air quality impacts associated with cavity and wake effects should also be considered for stacks that equal or exceed the EPA formula height for GEP.” The latest version of EPA's Building Profile Input Program for PRIME (BPIPPRM) program must be used to generate wind direction-specific building dimensions for calculating downwash impacts in AERMOD from each emission point subject to building downwash.

Proposals to construct or modify a facility must address the GEP height specifications of any associated stack. If a GEP stack height is not feasible, documented justification for the proposed stack height must be presented in the permit application. Such a justification may include aesthetic considerations, Federal Aviation Administration regulations, engineering, or local zoning restrictions, and should not be based solely on acceptable ambient impact determinations. Note that EPA regulations do not preclude the construction of stacks greater than GEP. However, stack heights greater than GEP must be modeled at GEP height.

When documenting a GEP stack height analysis, a scaled plot plan of the facility that shows the location of each structure and stack with the facility layout must be included. Aerial photographs/orthoimages using GIS software or an online mapping application are useful resources, especially for existing facilities. The facility layout should also include: a North arrow, an accurate scale ruler, all structure dimensions, terrain on the facility property, and facility property boundaries, including any fenced areas in/around the facility. Great care must be taken with photocopied plot plans or maps created with an online mapping application to ensure that the scale is accurate and correct across the entire plot plan.

2.3 Land Use Classification

The selection of urban or rural land use is a critical step as it will determine which dispersion coefficients will be used in AERMOD calculations. Section 7.2.1.1 of *EPA's Modeling Guidelines* describes methods to be used in determining urban/rural dispersion coefficients within 3 km of the facility. Note that most of the facilities in New York State are expected to be appropriately modeled using rural dispersion coefficients. Only facilities located in the New York City metro area may have sufficiently high population density and urban heat island effects to justify the use of urban dispersion coefficients. Selection of the appropriate population for these applications should be determined in consultation with IAM section and the latest version of the *AERMOD Implementation Guide*.

2.4 Receptor Data

The goal of designing a receptor network is to effectively capture the maximum air quality impacts over an area. The horizontal extent of receptor coverage surrounding a facility is usually handled on a case-by-case basis since the area's dispersion characteristics, topography, and meteorological conditions differ from facility to facility. It is suggested that the initial receptor grid is centered on the facility and constructed with the following receptor spacing:

70 m receptor spacing from the fence line out to a distance of 1 km,
100 m spacing from 1 km to 2 km,
250 m spacing from 2 km to 5 km,

500 m spacing from 5 km to 10 km, and
1000 m spacing out to 20 km if necessary.

The Department recommends a maximum receptor spacing of 25 m for calculating impacts along the facility fence line, in cavity regions of structures, and within property boundaries (if these areas allow public access). If modeling results show significant impacts at the outer edge of the initial grid, then the grid should be extended accordingly to ensure that the area of maximum modeled impacts is captured. If necessary, nested receptor grid(s) with 100 m receptor spacing could be added to provide additional details for any area of maximum impacts beyond the inner receptor grid of 2 km. Additional discrete receptors may be required at sensitive locations such as schools, hospitals, or in Environmental Justice communities.

Note that, for modeling purposes, the Department interprets the term “ambient air” as outdoor air in all locations except where public access is precluded by means of a fence or other physical barrier. In other words, modeling receptors should be placed in all areas except those portions of the facility property that are bounded by a fence or other physical barrier (solid wall, etc.). At the same time, however, the Department acknowledges that in certain limited circumstances, this interpretation may be overly restrictive or there may be measures other than physical barriers that are effective in precluding public access. These circumstances will be addressed on a case by case basis and they must be discussed with the Department (and EPA Region 2 for PSD projects) prior to starting any modeling.

Once a receptor grid is created, AERMOD’s terrain pre-processor AERMAP is used to determine an elevation and height scale (the terrain height and location that has the greatest influence on dispersion) for each receptor. AERMAP is designed to process terrain data extracted from the National Elevation Dataset (NED). The Department recommends using the 1/3 arc-second (approximately 10-meter) resolution terrain data for AERMAP processing. Helpful instructions on obtaining and reformatting the terrain data into an AERMAP-friendly format can be found on EPA’s SCRAM page: https://www.epa.gov/scram/interim-access-and-process-use-1992-nlcd-and-ned

Note that any State Plane Coordinates must be converted to UTM/NAD83 coordinates for use in modeling. The U.S. National Geodetic Survey provides a Coordinate Conversion and Transformation Tool (NCAT) on their website. New York State UTM values can be found at https://orthos.dhses.ny.gov/.

2.5 Meteorological Data

EPA guidance requires the use of at least one year of on-site (site-specific) data or five consecutive years of the most recent, readily available off-site data. On-site data are preferred, particularly in areas with complex terrain, provided that those data are acquired with appropriate instrumentation and that proper quality assurance procedures are followed in the collection of the data. EPA's guidance on the proper acquisition of site-specific data is provided in *Meteorological Monitoring Guidance for Regulatory Modeling Applications* (EPA-454/R-99-005, revised February 2000). Additional guidance is provided in the Division of Air Resources' policy guide DAR-2: Oversight of Private Air Monitoring Networks at http://www.dec.ny.gov/chemical/8533.html. If site-specific meteorological data are proposed for use in modeling, all raw data (AERMET and AERSURFACE input files, etc.) must be provided for the Department's review and approval.

If on-site data is unavailable, five years of recent meteorological data from a representative National Weather Service (NWS) site may be used. The modeling protocol should include a discussion of the representativeness of the chosen meteorological data site for the project being modeled. Note that the Department's IAM section maintains and makes available upon request pre-processed five-year data sets for certain NWS sites in New York State. These have been processed using sub-hourly wind data and the latest versions of AERMET, AERMINUTE, and AERSURFACE. A map of available NWS sites in New York State is shown in Figure 1.

In unusual cases where neither on-site data nor representative NWS data are suitable, EPA guidance allows for the use of prognostic meteorological data in AERMOD. These data are to be developed using a prognostic meteorological model such as Weather Research and Forecasting model (WRF) or Mesoscale Model 5 (MM5). The output from the prognostic model can be processed using EPA's Mesoscale Model Interface Program (MMIF) to generate AERMET/AERMOD-ready data for the project location. Any proposed use of this technique must be discussed with Department staff and approved prior to conducting a modeling analysis. For a detailed discussion of meteorological input data options and requirements see Section 8.4 of *EPA's Modeling Guidelines*.

3. Modeling Results and Facility Impact Analysis

Depending on the applicability of regulatory requirements for a particular facility (given project size, criteria pollutant emission levels, etc.), the modeled air quality impacts will be evaluated against the NAAQS, SILs and/or PSD increments shown in Table 1.

3.1 Significant Impact Area Determination and Cumulative Impact Analysis

The first step in refined modeling analysis is running AERMOD in a single source mode, including only emissions from the proposed project. If a significant impact is calculated (i.e. the maximum model-predicted concentration exceeds the SIL value in Table 1) for any pollutant or averaging time, the Significant Impact Area (SIA) should be determined for cumulative (multi-facility) modeling of that pollutant.

SIA is defined as the circular area which extends from the facility to the farthest receptor distance at which the facility has a significant impact for a given pollutant, or a default 50 km distance, whichever is less. The SIA is used to determine which facilities should be included in a cumulative modeling analysis.

Note that the Department’s staff will assist in the development of an emissions inventory for cumulative impact analysis, but it is ultimately the applicant's responsibility to assure the adequacy of this data.

3.2 Modeled Design Concentrations

In a NAAQS compliance demonstration, the applicable modeled design concentration must be calculated. The appropriate methodology for calculating the modeled design concentration will depend on the pollutant modeled and years of meteorological data used. Table 2 provides a summary of modeled design concentrations for individual criteria pollutants.

3.3 Background Air Quality Data and Compliance Determination

Background concentrations are essential in constructing the “design concentration”, or ambient air quality concentration that is used to determine compliance with NAAQS.

Typically, background concentrations should be determined based on the air quality measurements collected in the vicinity of the proposed project site. Ideally, the background monitor should be upwind from the facility area so that double-counting of the facility’s impact is avoided. Additional considerations in selecting a background site should be data quality (completeness) and whether recent data is available. If a "regional monitor" (further away from the source) is used to determine background air quality, an explanation should be provided comparing the topography, climatology, and emissions sources in the area of the proposed project and the area where the "regional monitor" is located.

Maps showing the Department's current ambient air monitoring locations can be found at: https://www.dec.ny.gov/chemical/115828.html
Tabulated data summaries for each measured pollutant/site can be obtained from Air Quality Reports at: https://www.dec.ny.gov/chemical/8536.html or by request from the Bureau of Air Quality Surveillance.

The appropriate methodology for incorporating background concentrations in any air quality impact analysis will depend on the pollutant modeled, the averaging period and the form of the NAAQS for that pollutant (see Table 3). For a more refined temporal pairing of background and modeled data, which is sometimes desired for 1-hour NO_2 and SO_2 modeling, background data can be averaged by season and hour-of-day and incorporated in the AERMOD run via the SEASHR keyword. Details of this are described in Section 4.1.5 of this document.

If a NAAQS exceedance is modeled in a cumulative impact analysis, a facility contribution analysis must be performed. The MAXDCONT option in AERMOD allows users to determine whether a facility or a group of facilities contributes significantly to a modeled exceedance of the NAAQS, paired in time and space. AERMOD has other output options (such as MxDyByYr) which may be useful for this analysis.

4. Special Modeling Issues

4.1 Modeling 1-hour NO_2 and 1-hour SO_2

To assist facility owners and permitting authorities in carrying out the required air quality analysis for 1-hour NO_2 and 1-hour SO_2 compliance demonstrations, EPA has issued several guidance memorandums:

- *Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard*, June 28, 2010;
- *Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard,* August 23, 2010;
- *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard*, March

1, 2011;

- *Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard,* September 30, 2014.

4.1.1 Emission Rate

Emission rates for 1-hour NO_2 and SO_2 NAAQS modeling should be computed consistent with the recommendations of Section 8.1 of *EPA's Modeling Guidelines* and the guidance memorandums referenced above. A load analysis is typically necessary to determine the load or operating condition that causes the maximum ground-level pollutant concentration. Operating scenarios of relatively short duration such as "startup" and "shutdown" should also be assessed since these conditions may result in maximum hourly ground-level concentrations. The control efficiency of emission control devices during these operating conditions may also need to be considered in the emission estimation.

4.1.2 Significant Impact Level

The EPA's interim SIL levels (4 ppb or 7.5 µg/m^3 for 1-hour NO_2 and 3 ppb or 7.8 µg/m^3 for 1-hour SO_2) should be used until EPA promulgates official 1-hour SIL values. To determine whether a cumulative impact assessment is needed for PSD-applicable sources, the interim SIL should be compared to the highest of the multi-year average of the maximum modeled 1-hour concentrations predicted at each receptor if multi-year meteorological data are used, or the highest modeled 1-hour concentration, if one year of on-site meteorological data are used.

4.1.3 Three-tiered Approach for 1-hour NO_2 Modeling

The EPA guidance and memorandums recommend a three-tiered modeling approach. Each approach accounts for increasingly complex considerations of NO_2/NO_x chemistry as summarized below.

- Tier 1 is the most conservative approach - assumes full conversion of NO_x emissions to NO_2.

- Tier 2 is the Ambient Ratio Method 2 (ARM2) which assumes ambient equilibrium between NO and NO_2. AERMOD multiplies Tier 1 impacts with default ambient ratios, or source-specific NO_2/NO_x in-stack ratio (ISR) data. The national default minimum and maximum ambient ratios for the primary facility are 0.5 and 0.9, respectively. In a cumulative modeling analysis, for any facilities located within the immediate vicinity (1-3 km) of the primary facility, the default ratio is 0.5. For any facilities beyond 1-3 km of the primary facility, the default ratio is 0.2. It is preferred that the source-specific (measured) NO_2/NO_x ISR data is used if all quality assurance requirements on this data have been satisfied. Alternatively, EPA's NO_2/NO_x ISR database, manufacturer test data, and peer-reviewed literature can be used to justify an emission source's NO_2/NO_x ISR.

- Tier 3 consists of two methods: Plume Volume Molar Ratio Method (PVMRM) or Ozone Limiting Method (OLM). Tier 3 analyses require default or source-specific ISRs of NO_2/NO_x emissions, and hourly ozone background data. Since the EPA's memorandums do not indicate any preference between PVMRM and OLM, it is the facility's responsibility to justify which method is more suitable and receive approval from IAM staff prior to conducting a full modeling analysis. Typically, PVMRM is preferred for tall stacks and OLM for short stacks. The background ozone data must be in units of $\mu g/m^3$ and concurrent with the meteorological data. The default ISR and equilibrium ratios are 0.5 and 0.9 respectively.

4.1.4 In-Stack NO_2/NO_X Ratio

The in-stack ratio of NO_2/NO_X is a critical piece of data since it defines the portion of NO_X emissions that will be converted to NO_2 and used in modeling to predict ground level concentrations of NO_2. The hierarchy below should be followed when choosing in-stack ratio data:

1. Use equipment-specific testing data (emission measurements) reviewed and verified by a local authority, State, and/or EPA;
2. If equipment-specific testing ratios are unavailable, find data for a similar emission point reported in the literature (peer-reviewed papers, vendor guarantee or EPA's SCRAM page: https://www3.epa.gov/scram001/no2_isr_database.htm). The facility owner should provide detailed data analysis and literature review to justify the in-stack ratio selection;
3. If neither option above is available, use a default in-stack ratio of 0.5 without justifications as per EPA's *NO_2 Clarification Memo*.

4.1.5 Background Concentration for 1-hour NO_2 and 1-hour SO_2 Compliance Demonstrations

As previously mentioned, either a uniform monitored background concentration or temporally varying monitored background concentrations may be used in the modeling compliance demonstration for the 1-hour NAAQS. Monitored 1-hour NO_2 and SO_2 data sets can be obtained from:

- EPA AirData: http://www.epa.gov/airdata/;
- EPA Air Quality System (AQS) raw data: EPA provides hourly data sets in raw format that can be downloaded at https://www.epa.gov/aqs;
- By request from the IAM section and from the Department's air quality reports at: https://www.dec.ny.gov/chemical/8536.html.

If a uniform monitored background concentration is used for 1-hour NO_2, AERMOD is run by setting POLLUTID to NO_2 and the RECTABLE to the 8th-highest value. AERMOD will provide a summary table with the maximum 8th-highest (98th percentile) maximum daily 1-hour results averaged over the years modeled. This value represents the *modeled* 1-hour NO_2 design concentration (as in Table 2). This value is added to most recent *monitored* design concentration (per Table 3) and the sum is compared to the 1-hour NO_2 NAAQS (in Table 1) to determine compliance. Similarly, in case of 1-hour SO_2, AERMOD is run by setting POLLUTID to SO_2 and the RECTABLE to the 4th-highest value. The modeled output design value is added to the monitored design concentration and the sum compared to the 1-hour SO_2 NAAQS (Table 1).

If temporally varying (seasonal by hour-of-day) monitored background concentrations are used, the following steps should be followed to calculate a design value to compare against the standard:

- Use the BACKGRND keyword on the SO pathway to input temporally varying background concentrations. The total number of inputs for seasonal by hour-of-day monitored background concentrations is 96 (4 seasons × 24 hours);
- Set the RECTABLE to the 8th-highest (4th-highest for SO_2) value;
- Set POLLUTID to NO_2 (or SO_2).

AERMOD will process each of the modeled years and determine the design value which includes the user specified background concentrations. This design value is then compared to the 1-hour NAAQS (Table 1).

It should be noted that the Department's IAM section has pre-processed seasonal hour-of-day background concentration tables for several locations and can provide them upon request. Alternatively, information on appropriate methodology for calculating temporally varying background concentration tables can be found in the EPA's *NO_2 Clarification Memo*. All data processing calculations and substitution methodology for missing data should be clearly described in the modeling protocol.

Note that hour-by-hour pairing of monitored concentrations is not allowed because this approach would assume that the hourly monitored background concentration is spatially uniform for the hour and representative of the background levels at each receptor. Also, care should be taken that the background concentrations and the model-calculated impacts are in same units ($\mu g/m^3$) when paired together.

4.1.6 Background Concentration for Ozone

Hourly measurements of ambient ozone concentrations over the modeled time period are required for the applications of the OLM and PVMRM options in AERMOD. Ozone concentrations can be entered into the model as a single (highest hourly) value or hourly datasets. AERMOD's default value of 40 ppb or annual average ozone concentrations should not be used. The highest hourly ozone concentrations and 1-hour ozone data sets are available at:

- EPA AirData website: http://www.epa.gov/airdata/;
- By request from the Department's IAM section;
- Department air quality reports at: https://www.dec.ny.gov/chemical/8536.html

The modeling protocol should include a discussion on the representativeness and completeness of the selected background ozone data set. If the data set is incomplete, several options are available. For a single missing hour, use linear interpolations to fill in the missing concentrations based on the previous and subsequent hour concentrations or simply use the higher one. For multiple missing hours, the following approaches are acceptable:

- Substitute the highest hourly ozone concentration over the modeled period without any additional justifications;
- Determine the maximum hourly ozone concentration for each season and use the maximum seasonal concentration to substitute for any missing data within that season;
- Determine the maximum hourly ozone concentration for each month and use the maximum monthly concentration to substitute for any missing data within that month;
- For each month, calculate the maximum ozone concentration for each hour-of-day and use these hourly maximum concentrations to fill in their corresponding missing hours;
- Fill in with missing data with corresponding (exact day and hour) data from another nearby monitoring site with similar land use characteristics.

The approaches presented above may not be an exhaustive list of acceptable procedures, but whichever method is used should be clearly described and justified in the modeling protocol and discussed in advance with the Department's IAM section.

4.1.7 Treatment of Intermittent Emission Sources

Intermittent emission sources may present challenges for demonstrating compliance with the 1-hour NO_2 or SO_2 NAAQS if their continuous operation is assumed. EPA's *NO_2 Clarification Memo* recommends that compliance demonstrations for 1-hour NO_2 NAAQS should be based on "emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations." In part, the guidance allows the reviewing agency, at their discretion, to exclude intermittent emission units from model requirements under appropriate circumstances. In New York State, emergency power generating stationary internal combustion engines meeting the definition in 6 NYCRR Section 200.1(cq) can be excluded from 1-hour NO_2 modeling. Facility owners must consult with the Department to determine whether their proposed 'intermittent' emission sources can be excluded from 1-hour NO_2 modeling. The following information should be provided: number and size of intermittent emission units, frequency and duration of operation, allowable fuels and their sulfur and nitrogen content, short-term peak emission rates vs. emission rates during steady-state operations (if applicable), operating hours concurrent with other intermittent equipment (if applicable) and the location of the intermittent source(s) with respect to the ambient air boundary of the facility. Permit conditions may be necessary to ensure the proposed source meets the requirements of intermittent operation.

4.2 Modeling $PM_{2.5}$

To address the fact that compliance with $PM_{2.5}$ NAAQS is based on a statistical form and that there are technical complications associated with estimating impacts of secondarily formed $PM_{2.5}$, EPA issued the following guidance documents:

- *Guidance for $PM_{2.5}$ Permit Modeling* (2014);
- *Guidance on the Development of Modeling Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program* (2019) (*MERPs Guidance*); and
- *Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program* (2018).

Per above guidance, any facility with primary $PM_{2.5}$ emissions above the 10 tpy

Significant Emission Rate, must model the offsite concentrations. Primary emissions are the sum of both filterable and condensable $PM_{2.5}$ emissions. In addition, impacts of $PM_{2.5}$ precursor emissions from a facility must be taken into account if the facility emits more than 40 tpy of SO_2 and/or NO_x. See Section 5.3 of this document for more on secondary $PM_{2.5}$ impacts.

5. Modeling Requirements for Facilities Subject to 6 NYCRR Part 231

6 NYCRR Part 231 implements the Clean Air Act's New Source Review (NSR) permitting program. It provides for the review of the air pollution impacts of new major stationary sources and modifications to existing major stationary sources in air pollution attainment and non-attainment areas of New York State. The NSR permitting program requires owners and operators of an emission source to undergo a pre-construction review to determine the appropriate air pollution controls. Implementation guidance and applicability flow charts can be found on the Department's website: https://www.dec.ny.gov/chemical/63377.html.

NSR consists of two components: attainment NSR (a.k.a. Prevention of Significant Deterioration (PSD)) and non-attainment NSR. The PSD regulation is targeted for individual pollutants. If any of the pollutants emitted by a facility is above the Significant Project Threshold (SPT) or Significant Net Emission Increase Threshold (SNEIT), as applicable, the facility is subject to PSD requirements for that pollutant. Pollutants that are below their SPT or SNEIT levels are not subject to PSD requirements. Major facility thresholds and SNEIT levels are defined in 6 NYCRR Subpart 231-13: 'Tables and Emission Thresholds' at: https://www.dec.ny.gov/regs/2492.html.

EPA's guidance on the NSR/PSD permitting process can be found at: https://www.epa.gov/nsr/learn-about-new-source-review.

A PSD modeling analysis follows the flowchart in Figure 2. It starts with a preliminary analysis (often referred to as a significant impact analysis), and if required, a full impact analysis. The preliminary analysis estimates ambient concentrations resulting from the proposed project for pollutants that trigger PSD requirements. As discussed earlier, the project's emission load analysis should be performed to ensure that the modeled emissions are not underestimated.

If the calculated ambient impacts from the preliminary modeling analysis exceed the PSD Significant Impact Levels (Table 1), the extent of the SIA of the proposed project must be determined. A separate SIA is determined for every relevant averaging time for each PSD-triggering pollutant and the largest SIA is used for further modeling analysis.

Section 165 (e)(2) of the Clean Air Act requires the collection of ambient air quality data prior to submitting a PSD application. However, the preliminary modeling results are also used for comparison to Significant Monitoring Concentrations (SMC). If the facility impacts exceed the SMC levels specified in 6 NYCRR Section 231-12.4, then pre-application air quality monitoring may be required. The owner or operator of a new or modified facility must meet the requirements of 40 CFR Part 58, Appendix B ("Quality Assurance Requirements for PSD Air Monitoring") and the Division of Air Resources' policy DAR-2: *Oversight of Private Air Monitoring Networks*, during the operation of monitoring stations for purposes of satisfying applicable provisions of 6 NYCRR Section 231-12.3. EPA's guidance for collecting on-site (i.e. site-specific) monitoring data can be found in: *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)*, EPA-450/4-87-007, May 1987 and *Technical Note – PSD Monitoring Quality Assurance Issues*, (2016).

Facilities may request a pre-construction monitoring waiver pursuant to 6 NYCRR Section 231-12.4. This determination will be made on a case-by-case basis in accordance with *EPA's Modeling Guidelines* and monitoring guidance documents. However, it is recommended that all permit applications contain an evaluation of ambient concentrations in the area. Existing air quality data representative of the local environment may be used to fulfill this requirement.

The full impact analysis expands the preliminary impact analysis by considering emissions from both the proposed project as well as other facilities within the SIA. The full impact analysis may also consider other facilities outside the SIA that could cause significant impacts in the SIA of the proposed facility. The results from the full impact analysis are used to demonstrate compliance with NAAQS and PSD increments (Table 1). The emissions inventory for the cumulative NAAQS analysis includes all nearby permitted facilities that have significant impacts within the proposed project's SIA, while the emissions inventory for the cumulative PSD increment analysis is limited to increment-affecting facilities (new facilities and changes to existing facilities that have occurred since the applicable increment baseline date). Note that the cumulative source analysis is a balance between sources that must be modeled and those whose impacts are captured by a monitor. For further guidance on this, see 'Identifying Nearby Sources to Include in Modeled Inventory' and 'Significant Concentration Gradient Criterion' sections of EPA's *NO_2 Clarification Memo*.

The full impact analysis is limited to receptor locations within the proposed project's SIA. The modeling results from the NAAQS cumulative impact analysis are added to representative ambient background concentrations and the total concentrations are compared to the NAAQS. Conversely, the modeled air quality impacts for all increment-consuming facilities are directly compared to the PSD increments (Table 1) to determine compliance (without consideration of ambient background concentrations).

Cumulative impact assessments based on the procedures above will generally be acceptable as the basis for permitting decisions. Facility owners must coordinate the emissions inventory development in consultation with the Department and, in the modeling protocol, provide justification and documentation for the final selection of background emissions inventory.

New or modified facilities subject to 6 NYCRR Part 231 must demonstrate compliance with the NAAQS and PSD increment with an approved modeling analysis. In the event that a modeled exceedance is predicted, the modeling analysis is carried one step further. The additional step determines whether the emissions from the proposed source will have a significant ambient impact at the point of the modeled NAAQS or increment exceedance when the exceedance is predicted to occur. If it can be demonstrated that the proposed facility's impact is not "significant" in a spatial and temporal sense, then the facility may receive a PSD permit (See EPA policy memorandum: *Air Quality Analysis for Prevention of Significant Deterioration* (PSD), July 5, 1988).

Emission offsets for ozone in a nonattainment area required by 6 NYCRR Part 231 must include a contribution analysis acceptable to the Department. Permit applicants should contact the IAM section for the most current acceptable approach to the contribution analysis. One approach is the result of a study of ozone data in the Ozone Transport Region (OTR) by Rao, et.al, *Determining Temporal and Spatial Variations in Ozone Air Quality*, Journal of Air and Waste Management Association, 1995, V45, pp 57-61. Specifically, the technical documentation included in Rao, et. al., demonstrated that the time scale of ozone transport in the Northeast is two to three days. The study identified that the spatial scale of the elliptical "ozone cloud" is at least 300 miles in the major axis orientation (SW to NE) and 250 miles in the minor axis orientation (SE to NW). In a June 3, 1996 letter EPA Region II acknowledged that the technical documentation satisfied the "contribution to a violation" test of Section 173(c)(1)(B) of the Act and, thus, any source outside the New York – Northern New Jersey – Long Island, NY-NJ-CT non-attainment area can obtain offsets from any part of the State, with a limitation on VOC offsets from the moderate area.

5.1 PSD Increment Analysis

To assist in a cumulative analysis of increment consumption, the Department maintains a database for the PSD permits. Permit applicants may contact the IAM section to obtain a list of baseline dates and increment-consuming sources. All PSD source analyses must consider the incremental SO_2, NO_2, $PM_{2.5}$ and PM_{10} impacts of existing and other proposed PSD sources. Furthermore, these sources are to be included in the air quality standards compliance analysis. In addition, PSD increments and, where applicable, Federal Land Managers' (FLM) defined Air Quality Related Values (AQRVs) must be analyzed for all Class I areas within 100 km of the source. On a case-by-case basis, a larger area for evaluating impacts may be required by the FLM, the Department or EPA Region 2 staff.

5.2 Additional Impact Analysis

Applications for facilities subject to 6 NYCRR Part 231 must include additional impact analyses for each PSD-triggering pollutant. Per EPA's *Modeling Guidance*, these analyses must assess the impacts of air, ground, and water pollution on soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the facility or modification under review, and from associated growth.

Visible emissions from the facility are typically minimized by controlling the emissions through the implementation of BACT (Best Available Control Technology) for new emission sources or modifications for existing facilities. Visibility analyses can be performed using VISCREEN or PLUVUE models. Further guidance relating to these analyses are provided in the EPA documents entitled: *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals* (1980) and *Workbook for Plume Visual Impact Screening and Analysis* (Revised) (October 1992).

In the event that a proposed or modified major facility is located within 300 km of the Class I areas in the northeast (such as Lye Brook Wilderness, Vermont or Brigantine National Wildlife Refuge, New Jersey), the applicant must complete the Federal Land Manager's Request for the Class I Area PSD Model Applicability Form, and send it to the regional FLM for the purpose of determining if a Class I area AQRV analysis is required. Consultation with Department staff is highly recommended. If an AQRV refined modeling analysis is required, the applicant, the Department, and the FLM will work together to formulate an appropriate modeling demonstration. For a general description of what is expected of an AQRV analysis, see "Resources for Permit Applicants" at: https://www.nps.gov/subjects/air/permitresources.htm#FLAG

5.3 Secondary $PM_{2.5}$ Impacts for NSR/PSD Facilities

EPA suggests a two-tiered approach to address secondary $PM_{2.5}$ impacts. Tier 1 involves scenarios where available information can be deemed representative of the facility's precursor emissions, meteorology, terrain, etc. to sufficiently evaluate the facility's secondary $PM_{2.5}$ impacts.

The Tier 2 assessment involves the use of regional scale photochemical grid models or Chemical Transport Models (CTMs). EPA guidance on the use of CTMs is available in: *Guidance on the use of models for assessing the impacts of emissions from single sources on the secondarily formed pollutants ozone and* $PM_{2.5}$ (2016).

It is anticipated that the Tier 1 approach will adequately assess the secondary impact of $PM_{2.5}$ precursors in a vast majority of compliance demonstration cases. Options for Tier 1 secondary $PM_{2.5}$ impact calculations are:

- a qualitative assessment
- a hybrid of qualitative and quantitative assessments utilizing existing technical work
- MERPs.

To support a qualitative assessment of the impact from secondary $PM_{2.5}$ formation, it is important to fully characterize the current $PM_{2.5}$ concentrations in the region where the new or modifying facility is to be located. This characterization should take into account the most current 24-hour and annual $PM_{2.5}$ design values, evaluation of the seasonality and speciated composition of the current $PM_{2.5}$ concentrations and any long-term trends that may be occurring. Examining the monitored $PM_{2.5}$ precursor concentrations (such as SO_x and NO_x) in the area and their relationship with $PM_{2.5}$ component species (sulfates, nitrates) can further that understanding and assess the $PM_{2.5}$ formation potential in the area. It may also be important to describe the typical background concentrations of certain chemical species that participate in the photochemical reactions that form secondary $PM_{2.5}$ such as ammonia, volatile organic compounds and ozone, as these can have mitigating effects on $PM_{2.5}$ formation. The qualitative assessment should include a narrative explaining how any identified significant precursor emissions and subsequent secondary $PM_{2.5}$ formation contributes to the ambient $PM_{2.5}$ concentration in the region.

A qualitative assessment should also characterize the regional meteorological conditions which are associated with periods or seasons of higher and lower ambient 24-hour $PM_{2.5}$ concentrations. Any meteorological factors that could limit or enhance the formation of secondary $PM_{2.5}$ from any significant precursor emissions should be identified.

In addition to the above qualitative characterizations, the hybrid qualitative/ quantitative approach should include an analysis of existing photochemical modeling developed for the area (regional haze, ozone, past or current SIP attainment demonstrations, published modeling studies and/or peer-reviewed literature). The existing modeling-based information would need to be appropriate and representative of the type of source, its precursor emissions and geographic location. The facility owner should describe how the existing modeling reflects the formation of $PM_{2.5}$ from that facility and in that particular area. The information that can be used to describe the comparability of two different geographic areas includes average and peak temperatures, humidity, terrain, rural or urban nature of the area, nearby regional sources of pollutants and ambient concentrations of relevant pollutants where applicable. Examples of qualitative and hybrid qualitative/ quantitative approaches are provided in Appendices of EPA's *Guidance for $PM_{2.5}$ Permit Modeling* (2014).

The facility may choose to use MERPs to estimate single-source impacts on secondarily formed pollutants under the Tier 1 approach. Section 4.1 of the EPA's *MERPs Guidance* document provides examples and illustrates how to use MERPs for each precursor pollutant and how to combine them together.

The combined contribution from both primary and secondary impacts should be compared to the $PM_{2.5}$ SIL concentration (Table 1). If the impacts are above the SIL, then a cumulative modeling analysis will be required to determine compliance with the applicable $PM_{2.5}$ NAAQS and PSD Increments. If there are exceedances of the $PM_{2.5}$ NAAQS and PSD increments, additional analysis is required to show that the subject facility does not contribute significantly to any air quality standard exceedance. Consultation with the Department modeling staff is highly recommended before undertaking additional secondary $PM_{2.5}$ assessments.

6. Presentation of Modeling Results / Modeling Report

It is highly recommended, and for facilities subject to 6 NYCRR Section 212-1.5(e)(2) and 6 NYCRR Subpart 231-12 mandatory, that the permit applicant submit a modeling protocol to the IAM section prior to commencing a refined modeling analysis. A list of typical protocol topics is provided in Section 7 of this document. In most cases, the approved modeling protocol may serve as the foundation of the modeling report. The modeling report should include a discussion of each relevant topic from the modeling protocol, as well as tables and figures which appropriately indicate facility impacts, display surrounding terrain, sensitive receptors, etc. Graphics showing facility building layouts, emission source locations, and facility property boundaries are also required in order to facilitate the modeling review. The approved modeling protocol does not necessarily limit the extent of the modeling that will be required. Additional modeling may be required as determined by Department staff on a case-by-case basis.

The modeling reports submitted to the Department must provide a table listing emission parameters for all emission points. For point sources, this includes location, stack height above grade, stack base elevation, exit diameter, exit velocity, and exit temperature. For area sources, the size and location of the area and the release height of the emission source are needed. For volume sources, the location, release height, and initial horizontal and vertical dimensions are required. It is important that emissions data is provided for all applicable averaging times and all pollutants to be considered in the modeling analysis. An organized emissions inventory provides a crucial link between the emissions used to determine a facility's regulatory applicability and the emissions used directly in the modeling analysis.

Contour plots of modeled concentrations should be prepared and overlaid on a map of the area that identifies key geographical features that may influence the dispersion patterns. The concentration contour plots also serve to visually depict the concentration gradients associated with the facility's impacts. As an aid to interpreting this information, it is desirable to include the location of the meteorological monitoring station used in the modeling analysis on the plot of source impacts, as well as a wind rose plot depicting general flow patterns.

All electronic files needed to reproduce modeling results must be included with the report. This includes AERMOD input and output files, BPIPPRM building input and output files, and meteorological data files. Any additional emission calculations files or tables in Excel format should also be included. It is preferred that the electronic files are submitted in the general text file formats described in model user's guides rather than the proprietary modeling software. When sending multiple electronic files, it is essential to include an index describing what files are included and how they are organized. Electronic files may be sent via email, Dropbox, on CD, DVD or USB electronic media.

The modeling protocol and modeling report can be sent to the IAM section staff directly, but a copy must also be sent to the Department permit review staff in the regional office where the facility is located. The regional staff is ultimately responsible for the overall review of the permit conditions and the emissions data. Depending on the applicability of regulatory requirements for the proposed project, a copy of the modeling report may need to be sent to EPA Region 2 office and any affected federal land managers.

7. Modeling Protocol Checklist

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

- Summary of applicable regulatory requirements;
- Facility/project description;
- Attainment status of the area surrounding the facility;
- Facility layout on a topographic map (include the nearest meteorological station and air monitoring location - if used);
- Facility blueprint/plot plan with clearly marked emission points;
- Proposed new or modified emissions inventory at the facility;
- Emissions inventory development;
- Good Engineering Practice (GEP) - stack height calculation/discussion;
- Buildings and structures within 5L of each stack. List the dimensions of each building;
- Property boundary and distance from stack(s) to nearest boundary;
- Signify if a physical fence/barrier exists along the property boundary;
- Proposed model(s) and non-regulatory options (if any);
- Urban/rural determination;
- Representativeness of meteorological data used;
- Proposed receptor network;
- Terrain features/surrounding land use;
- Pollutants / averaging periods / emission rates – if known;
- Preliminary impact analysis;
- NAAQS / PSD increment analysis;
- Proposed method for developing background concentrations;
- Preconstruction monitoring - if any;
- Significant impact area / offsite facility inventories (NAAQS, PSD increment);
- Additional impact analysis (growth, soils and vegetation, visibility impairment);
- Class I area impact analysis (areas evaluated, model(s), model input assumptions, class I increments, Air Quality Related Values (AQRVs));
- Potential Environmental Justice issues;
- Proposed methodology for demonstrating compliance with the NAAQS and PSD increments.

Table 1. Ambient Air Quality Standards, PSD Increments, Significant Monitoring Concentrations and Significant Impact Levels (SILs)

Pollutant	Ambient Air Quality Standards				PSD Increment Class II (µg/m^3)	Significant Monitoring Concentration (µg/m^3)	Significant Impact Level (µg/m^3)
	Averaging Period	Primary/ Secondary	National AAQS	New York AAQS			
Carbon Monoxide (CO)	1-hour (1)	Primary	40000 µg/m^3 (35 ppm)	—	—	—	2,000
	8-hour (1)	Primary	10000 µg/m^3 (9 ppm)	—	—	575	500
Lead	Rolling 3-month (2)	Primary and Secondary	0.15 µg/m^3	—	—	0.1	—
Nitrogen Dioxide (NO_2)	1-hour (3)	Primary	188 µg/m^3 (0.100 ppm)	—	—	—	7.5
	Annual (4)	Primary and Secondary	100 µg/m^3 (0.053 ppm)	—	25	14	1
Ozone (O_3)	8-hour (5)	Primary and Secondary	0.070 ppm (137 µg/m^3)	—	—	—	2.0 (1.0 ppb)
Particulate Matter ($PM_{2.5}$)	24-hour (6)	Primary and Secondary	35 µg/m^3	—	9	0	1.2
	Annual (7)	Primary	12 µg/m^3	—	4	0	0.3
		Secondary	15 µg/m^3				
Particulate Matter (PM_{10})	24-hour (8)	Primary and Secondary	150 µg/m^3	—	30	10	5
Sulfur Dioxide (SO_2)	1-hour (9)	Primary	196 µg/m^3 (0.075 ppm)	—	—	—	7.8
	3-hour (1)	Secondary	1300 µg/m^3 (0.50 ppm)	—	512	—	25
		—	—	1300 µg/m^3 (0.50 ppm)			
	24-hour (1)	—	—	365 µg/m^3 (0.14 ppm)	91	13	5
	Annual (4)	—	—	80 µg/m^3 (0.03 ppm)	20	—	1
Gaseous Fluorides (as F)	12-hour (2)	—	—	3.7 µg/m^3 (4.5 ppb)	—	—	—
	24-hour (2)	—	—	2.85 µg/m^3 (3.5 ppb)	—	0.25	—
	1-week (2)	—	—	1.65 µg/m^3 (2.0 ppb)	—	—	—
	1-month (2)	—	—	0.8 µg/m^3 (1.0 ppb)	—	—	—
Hydrogen Sulfide (H_2S)	1-hour (2)	—	—	14 µg/m^3 (0.010 ppm)	—	0.2	—

Notes:

(1) Not to be exceeded more than once per year

(2) Not to be exceeded

(3) 98th percentile of the daily maximum 1-hour concentration, averaged over 3 years

(4) Arithmetic mean; Not to be exceeded

(5) Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years

(6) 98th percentile, averaged over 3 years

(7) Arithmetic mean, averaged over 3 years

(8) Not to be exceeded more than once per year on average over 3 years

(9) 99th percentile of the daily maximum 1-hour concentration, averaged over 3 years

References and weblinks provided in this document are current at the time of publishing. For latest updates call the IAM section of NYSDEC's Division of Air Resources at 518-402-8402.

Table 2. Modeled Design Concentrations

NAAQS Pollutant	Averaging Time	Modeled Design Concentration: Modeling with 5-years of meteorological data	Modeled Design Concentration: Modeling with 1-year of onsite meteorological data	Reference
Carbon Monoxide (CO)	1-Hour	Highest of the second highest (H2H) 1-hour concentration over the entire receptor network for each year modeled	Second highest 1-hour concentration over the entire receptor network	40 CFR Part 51, App. W (9.1)(d)
	8-Hour	Highest of the second highest (H2H) 8-hour average concentration over the entire receptor network for each year modeled	Second highest 8-hour concentration over the entire receptor network	
Lead	Rolling 3-Month Average	Highest modeled 3-month average concentration over the entire receptor network	Highest modeled 3-month average concentration over the entire receptor network	40 CFR Part 51, App. W (9.1)(d)
Nitrogen Dioxide (NO_2)	1-Hour	Highest of multi-year averages of the 98th percentile (H8H) of the annual distribution of maximum daily 1-hour concentrations predicted at each receptor	Highest of the 98th percentile of the annual distribution of maximum daily 1-hour concentrations predicted at each receptor	EPA Memo: "Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" (June 28, 2010) and EPA Memo: "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS" (March 1, 2011)
	Annual	Highest modeled annual concentration predicted over the entire receptor network	Highest annual concentration over the entire receptor network	40 CFR Part 51, App. W (9.1)(d)
Particulate Matter ($PM_{2.5}$)	24-Hour	Multi-year average of the 98th percentile (H8H) of the annual distribution of 24-hour concentrations predicted each year at each receptor	Highest of the 98th percentile of the annual distribution of 24-hour concentrations predicted at each receptor	EPA Memo: "Guidance for $PM_{2.5}$ Permit Modeling" (May 20, 2014)
	Annual	Highest of the multi-year averages of annual concentrations at each receptor	Highest annual concentration over the entire receptor network	
Particulate Matter (PM_{10})	24-Hour	Highest of the sixth highest (H6H) 24-hour modeled concentration that occurred at each receptor over the 5 years	The second highest 24-hour modeled concentration that occurred at each receptor	40 CFR Part 51, App. W (9.1)(d)
Sulfur Dioxide (SO_2)	1-Hour	Highest of multi-year averages of the 99th percentile (H4H) of the annual distribution of maximum daily 1-hour concentrations predicted at each receptor	Highest of the 99th percentile of the annual distribution of maximum daily 1-hour concentrations predicted at each receptor	EPA Memo: "Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program" (August 23, 2010)
	3-hour	Highest of the second highest (H2H) 3-hour concentration over the entire receptor network for each year modeled	Second highest concentration over the entire receptor network	40 CFR Part 51, App. W (9.1)(d)
	24-hour	Highest of the second highest (H2H) 24-hour concentration over the entire receptor network for each year modeled	Second highest concentration over the entire receptor network	6 NYCRR Subpart 257-2
	Annual	Highest modeled annual concentration predicted over the entire receptor network	Highest annual concentration over the entire receptor network	

Table 3. Determination of Background Concentrations

AAQS Pollutant	Averaging Period	NAAQS or NYAAQS Level	AAQS Form	Background Form
Carbon Monoxide (CO)	1-hour	40000 µg/m^3 (35 ppm)	Not to be exceeded more than once per year	Highest of the 2nd highest concentration each year over the most recent 3 years
	8-hour	10000 µg/m^3 (9 ppm)		
Lead	Rolling 3 Month	0.15 µg/m^3	Not to be exceeded	Highest concentration over the most recent 3 years
Nitrogen Dioxide (NO_2)	1-Hour [(1)]	188 µg/m^3 (0.100 ppm)	3-year average of the 98th percentile of the annual distribution of the daily maximum 1-hour concentrations	3-year average of the 98th percentile of the annual distribution of the daily maximum 1-hour concentrations
	Annual	100 µg/m^3 (0.053 ppm)	Annual Mean	Highest annual concentration over the most recent 3 years
Ozone (O_3)	8-Hour	0.070 ppm (137 µg/m^3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years	–
Particulate Matter ($PM_{2.5}$)	24-Hour [(2)]	35 µg/m^3	98th percentile, averaged over 3 years	Average of the 98th percentile 24-hour concentrations over the most recent 3 years
	Annual (Fed. primary)	12 µg/m^3	Annual mean, averaged over 3 years	Average of the annual concentrations over the most recent 3 years
	Annual (Fed. Secondary)	15 µg/m^3	Annual mean, averaged over 3 years	Average of the annual concentrations over the most recent 3 years
Particulate Matter (PM_{10})	24-Hour [(2)]	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years	Average of the highest 24-hour concentrations over the most recent 3 years
Sulfur Dioxide (SO_2)	1-Hour [(1)]	196 µg/m^3 (0.075 ppm)	3-year average of the 99th percentile of the annual distribution of the daily maximum 1-hour concentrations	3-year average of the 99th percentile of the annual distribution of the daily maximum 1-hour concentrations
	3-hour	1300 µg/m^3 (0.50 ppm)	Not to be exceeded more than once per year	Highest 3-hour concentration each year over the most recent 3 years
	24-hour	365 µg/m^3 (0.14 ppm)	Not to be exceeded more than once per year	Highest 24-hour concentration each year over the most recent 3 years
	Annual	80 µg/m^3 (0.03 ppm)	Not to be exceeded	Highest annual concentration over the most recent 3 years

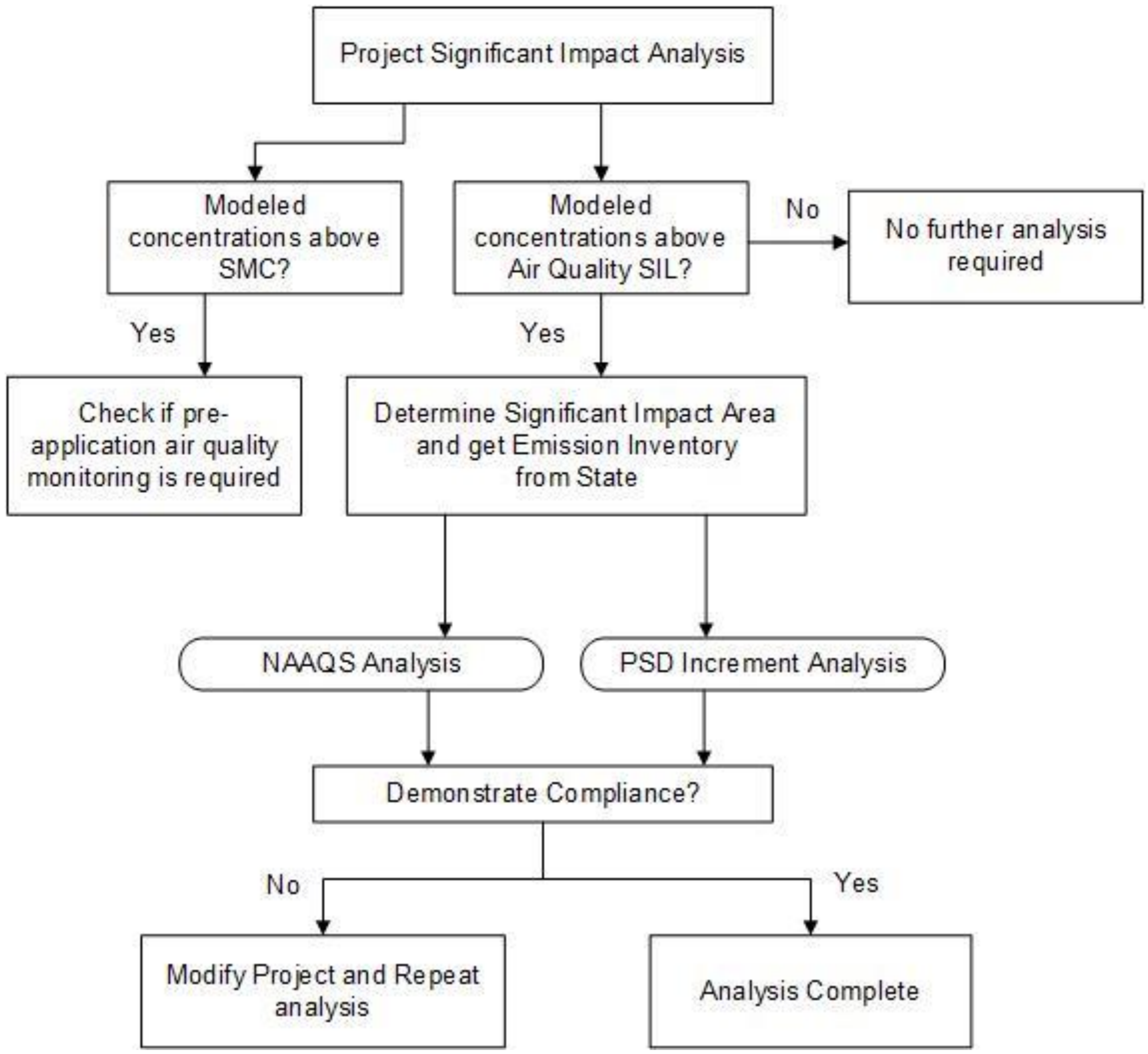
Notes:

[(1)] Monthly/Seasonal/Annual hour-of-day monitored background concentrations may be used in some refined analyses

[(2)] Seasonal background concentrations may be used in some refined analyses

Figure 1. Locations with AERMOD-ready meteorological data

Figure 2. PSD Modeling Analysis Flowchart



VI. REFERENCES

40 CFR Part 51, Appendix W (“Guideline on Air Quality Models”) (January 2017)

AERMOD Implementation Guide, EPA-454/B-16-013 (December 2018)

AERMOD User’s Guide, EPA-454/B-16-011 (December 2018)

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Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-005 (revised February 2000) https://www3.epa.gov/scram001/guidance/met/mmgrma.pdf

The Division of Air Resources policy guide DAR-2: Oversight of Private Air Monitoring Networks. http://www.dec.ny.gov/chemical/8533.html

Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard (EPA, 2010) https://www3.epa.gov/ttn/scram/guidance/clarification/ClarificationMemo_AppendixW_Hourly-NO2-NAAQS_FINAL_06-28-2010.pdf

Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard (EPA, 2014) https://www3.epa.gov/scram001/guidance/clarification/NO2_Clarification_Memo-20140930.pdf

Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard (EPA, 2010) https://www3.epa.gov/scram001/guidance/clarification/ClarificationMemo_AppendixW_Hourly-SO2-NAAQS_FINAL_08-23-2010.pdf

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Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), EPA-450/4-87-00, (May 1987) https://www.epa.gov/sites/production/files/2015-07/documents/monguide.pdf

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A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals (EPA,1980)

Workbook for Plume Visual Impact Screening and Analysis (Revised) (EPA, October 1992). https://www3.epa.gov/scram001/userg/screen/WB4PlumeVisualOCR.pdf

Guidance on the use of models for assessing the impacts of emissions from single sources on the secondarily formed pollutants ozone and $PM_{2.5}$ (EPA, 2016). https://www3.epa.gov/ttn/scram/appendix_w/2016/EPA-454_R-16-005.pdf

APPENDIX A: Legislative Authority

Federal:

42 U.S.C. §7401 et seq. (The Clean Air Act (CAA))
40 CFR Part 51, Appendix W (Guideline on Air Quality Models)
40 CFR Part 50, National Primary and Secondary Ambient Air Quality Standards

New York:

NY Public Service Law, Article 10 (Siting of Major Electric Generating Facilities)
NY Environmental Conservation Law, Article 19, Title 9 (State Acid Deposition Control Act (SADCA))

6 NYCRR Part 201 (Permits and Registrations)
6 NYCRR Part 212 (Process Operations)
6 NYCRR Part 219 (Incinerators)
6 NYCRR Part 225 (Fuel Composition and Use)
6 NYCRR Part 231 (New Source Review for New and Modified Facilities)
6 NYCRR Part 257 (Air Quality Standards)
6 NYCRR Part 617 (State Environmental Quality Review)