Air Quality Analysis Checklist

I. Introduction

The purpose of the Air Quality Analysis Checklist is assist the regulatory reviewer in assuring that important aspects of the NSR/PSD compliance demonstrations for NAAQS and PSD increments are accounted for and appropriately examined. Additionally, this checklist is useful for those conducting these regulatory demonstrations by identifying the necessary pieces of information required to assure an appropriate air quality assessment. The information below is comprehensive; however, each assessment is unique and individual demonstrations may require more or less information depending on the complexity of the circumstances.

This checklist does not constitute new EPA policy and does not offer new guidance recommendations. Rather, it highlights important aspects of an air quality analysis with appropriate references to existing EPA policy and guidance to assist in the development and review of the compliance demonstration modeling as part of the overall air quality assessment.

II. Process of Engagement

A pre-application meeting (sometimes referred to as a modeling protocol meeting) between the appropriate reviewing authority and the applicant is an important part of the regulatory modeling process. These meetings help ensure consensus on critical aspects of a modeling application, such as appropriate databases and modeling methods consistent with the *Guideline on Air Quality Models* (Appendix W to 40 CFR Part 51; hereafter, *Guideline*), current modeling guidance, and any other state/local regulatory requirements. The primary goal of the pre-application meeting is to develop a modeling protocol upon which all parties can agree and an identification of circumstances where the modeling protocol might deviate from the Appendix W or current modeling guidance and require additional justification and approval by the EPA.

A pre-application meeting should include (but is not limited to) discussion of the following information:

___ Surrounding topographic features (terrain, lakes, river valleys, coastlines, etc…)

___ Plant layout on the topographic map

___ Existing ambient monitoring network and monitor(s) locations

___ Representativeness of site-specific or nearby NWS meteorological observations (surface and upper air) or prognostic meteorological model data

___ If using prognostic meteorological model data, discuss on meteorological model setup and performance

___ Proposed new/modified facility emission source characterization

___ Emissions inventory development

___ Other major existing sources / potential nearby sources

___ Other proposed PSD applications

___ Proposed method for developing background concentrations

___ Buildings/structures that influence building downwash (onsite and offsite)

___ Areas not considered ambient air

___ Major roadways and areas of traffic congestion

___ Urban areas in the vicinity

___ Location of PSD Class I areas

___ Nearby nonattainment areas

___ Proposed methodology for demonstrating compliance with the NAAQS and PSD increments (screening or refined model or modeling technique, including any potential alternative techniques)

III. Preconstruction Ambient Air Monitoring

For PSD applications, there are requirements, 40 CFR 52.21 (m)(1) and 40 CFR 51.166(m)(1), to establish existing air quality in the area around the proposed/modified source if certain criteria are met. This can be accomplished by appropriately siting new ambient monitors for the necessary pollutants and collecting at least 1 year of data. A monitoring protocol must be submitted for approval by the appropriate reviewing authority. Alternatively, the existing air quality can be characterized using monitors already deployed in other locations which are reasonably representative of the air quality in the location of the new proposed source.

Considerations for whether existing data are adequately representative include:

___ Surrounding terrain

___ Surrounding land use (*e.g.*, urban versus rural)

___ Similar sources potentially impacting the monitor

___ Time period and length of data record available

___ Completeness requirements

___ Does data collection and processing follow the recommendations of the *Ambient Monitoring Guidelines for Prevention of Significant Deterioration* (EPA-450/4-80-012)?

___ Quality assurance and quality control requirements consistent with the EPA's *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II – Ambient Air Quality Monitoring Program* (EPA-454/B-13-003)

IV. Modeling Protocol

As discussed in Section II (Process of Engagement) above, an important aspect of the regulatory modeling process involves the establishment of a modeling protocol upon which all parties can agree. While the pre-application meeting is the initial engagement for the applicant and appropriate reviewing authority to discuss the various underlying pieces of a modeling protocol, a written modeling protocol should be agreed upon by the reviewing authority prior to the commencement of any considerable air quality modeling.

Project Description

The modeling protocol should begin with a narrative that provides an overview of the project and any special considerations that will be included in the compliance demonstration modeling. It is important at the beginning of the modeling protocol to establish an understanding of the new or modifying source(s) and the pollutant(s) of concern that will be assessed.

Source Characterization

Please reference the *Guideline*, Section 8.2 for specific requirements used in the determination of source data, including many source characteristics and operating conditions.

Items of considerations for inclusion in the modeling protocol to assist in the development and justification of adequate source data include:

___ Project type, fuel type, size, number of units, location of source(s)

___ Consideration of auxiliary equipment (*e.g.*, emergency generators, fire pumps, etc...)

___ Startup and shutdown emissions are appropriately addressed, if applicable

___ Consideration of fugitive emissions

___ Stack Parameters for varying loads/scenarios:

Point Sources – location (UTM's with zone and datum identified), stack height, inside stack diameter, exit velocity, exit temperature, base elevation. Note if stacks are obstructed with rain caps or feature a downward/horizontal release.

Area Sources – size and location of area, release height

Volume Sources – size and location of volume, release height, sigma values

___ Building dimensions and location included for downwash consideration

___ Table of short-term and annual emission rates for criteria and toxic pollutants to be modeled (in grams/second)

___ Urban/Rural determination consistent with the *Guideline*, Section 7.2.1.1(b)

___ Source location maps identifying topographic features, Class I areas, nonattainment areas, other major sources, monitoring locations, met sites, etc…

Note: The emission rate, temperature, and exit velocity for each load is specified. The load with the worst case impact is identified. This could be done with screening modeling since it is the relative difference that matters. The worst case load is carried through to refined modeling and the cumulative impact analysis, if applicable, consistent with Tables 8-1 and 8-2 of the *Guideline*.

Meteorological Input Data

Please reference the *Guideline*, Section 8.4 for specific requirements and recommendations used in the establishment of the meteorological input data.

Items to consider for inclusion in the modeling protocol to assist in the development and justification of adequate meteorological input data include:

Screening Meteorology

___ Was MAKEMET used to generate the screening meteorology? If not, what was used?

___ Is the screening meteorology representative of meteorological conditions routinely experienced at the application site?

Site-Specific Meteorology

___ At least 1 year of site-specific data and concurrent representative upper air data?

___ Concurrent representative National Weather Service (NWS) surface data used for data substitution, if needed?

___ Options used for on-site data processing – Bulk Richardson Method, missing data substituted with nearby NWS surface site, number of obs/hour, instrument thresholds, options to fill missing NWS temperature and cloud cover (SUB_CC, SUB_TT).

___ What variables are included in the data? Does the data contain the minimum variables that are recommended in the *Guideline*, Section 8.4.4.2(a)?

___ Does the data consist of a single vertical level of data or does it contain multiple levels of data?

___ Does data processing and QA follow the recommendations of the *Meteorological Monitoring Guidance for Regulatory Modeling Applications* (EPA-454/R-99-005)?

___ Was the adjusted surface friction velocity (u*) option used? If so, was it used appropriately, *i.e.*, no turbulence parameters passed to AERMOD if adjusted u* is used?

NWS Meteorology

___ Five years of representative NWS surface data and concurrent representative upper air data?

___ Options used for filling missing NWS temperature and cloud cover (SUB_CC, SUB_TT).

___ Was a wind speed threshold used for the surface data?

___ Was the adjusted surface friction velocity (u*) option used? If so, what is it used appropriately?

Prognostic Meteorology

___ At least three years of representative prognostic meteorological data used?

___ What was the grid resolution of the underlying prognostic meteorological data?

___ Was MMIF used to generate the dispersion model ready meteorological data? If not what was used?

___ If for a regulatory application (permit, PSD, SIP, etc…), was the prognostic data processed to be input into AERMET, consistent with the *Guideline*, Section 8.4?

___ Was a model performance evaluation performed on the prognostic meteorological data, consistent with the MMIF guidance document (EPA-454/B-16-003)?

___ If MMIF was used to process the prognostic data for input into AERMET or AERMOD, did the MMIF options follow recommendations in the MMIF guidance document (EPA-454/B-16-003)?

___ Was the adjusted surface friction velocity (u*) option used? If so, is it used appropriately?

Representativeness and surface characteristics

___ Is there a discussion of meteorological site representativeness based on recommendations in the *Guideline*, Section 8.4.2(b)? This applies to all types of data (site-specific, NWS, or prognostic).

___ AERSURFACE used to calculate surface characteristics for screening, site-specific or NWS data?

___ Secondary surface characteristics (albedo, Bowen ratio, surface roughness) from the secondary site, e.g. NWS station, required when using site-specific data and

NWS data? The secondary site is the site used to substitute for missing values when data is missing in the primary dataset, i.e. site-specific data.

___ Assumptions used to for snow cover characterization?

___ Number and spatial distributions of sectors used for surface roughness calculation?

___ Assumptions used for climate variables (arid, non-arid, wet, dry, average)?

___ Season definitions (month-to-season assignments)?

___ Land use used? 1992 NLCD, 2001 NLCD, something else? Resolution? Format? Projection?

___ Representativeness of land use data for time period modeled?

___ Map of land use/sectors surrounding met site and facility

General Considerations

___ QA/QC of data – wind rose, # of calm hours, # of missing hours - Has data been filled? Were 1-minute ASOS data processed in AERMINUTE for either site-specific data with NWS substitution and when using NWS data only?

___ Confirm meteorological data tower location, site-specific or NWS, to the nearest meter if in UTM's and to the 4th or 5th decimal place if in Lat/Long decimal degrees are used.

___ Check that AERMET time-zone adjustment is correct – if NWS surface data is ISHD (Integrated Surface Hourly Data) format, data is reported in GMT. Use a non-zero number consistent with time zone (5 for EST, 6 for CST, etc…) to convert to local time. Other formats, including prognostic data, should be in local time and adjustment should be 0. Upper air data is reported in GMT, so should also have time adjust be non-zero (5 for EST, 6 for CST, etc…) for both observed and prognostic data.

___ AERSURFACE and AERMET Input/Output files verified?

___ Confirm PROFBASE in AERMOD.INP equals the base elevation of the met tower or the prognostic meteorological data grid cell.

___ Confirm anemometer height and location for site-specific and NWS data.

Air Quality Model Selection

The selection of the appropriate air quality screening or refined model for the compliance demonstration modeling must be consistent with the requirements of the *Guideline*, Section 4 for carbon monoxide, lead, sulfur dioxide, nitrogen dioxide and primary particulate matter and should reasonably conform with the recommendations of the *Guideline*, Section 5 for ozone and secondarily formed particulate matter. Any deviation from an EPA preferred air quality model or development of an alternative modeling technique is subject to the alternative model requirements of the *Guideline*, Section 3.2. If an alternative model or modeling technique is desired by the applicant or reviewing authority, early contact with the EPA Regional Office is highly encouraged. Appropriate justification for the proposed alternative model or modeling technique must be provided to the EPA Regional Office for consideration and approval with concurrence of the EPA's Model Clearinghouse.

Items to consider for inclusion in the modeling protocol to assist in the selection and justification of the appropriate air quality model for the compliance demonstration include:

___ Identify the air quality model(s), including version number, to be used in the compliance demonstration modeling based on pollutant(s) of concern.

___ For carbon monoxide, lead, sulfur dioxide, nitrogen dioxide and primary particulate matter, ensure that the appropriate modeling requirements as listed in the pollutant specific section of the *Guideline*, Section 4.2 are followed.

___ For nitrogen dioxide, a multi-tiered screening approach is required to obtain short and long-term average estimates. Since these methods are considered screening techniques, their usage shall occur in agreement with the appropriate reviewing authority.

___ The modeling of negative nitrogen dioxide emissions rates should only be done after consultation with the EPA Regional Office to ensure that decreases in concentrations would not be overestimated.

___ For ozone and secondarily formed particulate matter, ensure reasonable conformity with the recommendations as listed in the pollutant specific sections of the *Guideline*, Section 5.3 and Section 5.4 are followed.

___ For ozone and secondarily formed particulate matter, a two-tiered approach is recommended to obtain short and long-term estimates, as appropriate. The tier selected should be appropriately discussed and justified with the appropriate reviewing authority.

___ If a Tier 1 ozone or secondarily formed particulate matter assessment is necessary, the use of technically credible and appropriate relationships between emissions and impacts developed from previous air quality modeling is recommended. If Modeled Emissions Rates for Precursor (MERPs) are to be considered, are the recommendations from the *Guidance on the Development of Modeled Emission Rates*

for Precursors as a Tier l Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program (EPA-454/R-16-006) followed in consultation with the appropriate reviewing authority?

___ If a Tier 2 ozone or secondarily formed particulate matter assessment is necessary, a more sophisticated or refined case-specific air quality modeling analysis is recommended. Are the recommendations from the *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-454/R-16-005) followed in consultation with the appropriate reviewing authority?

___ For situations where a source emits both primary and secondarily formed particulate matter, the contribution from both should be combined for use in determining the source's ambient impacts.

___ In the case of dry deposition, if an algorithm to account for gravitational settling of particulates is be used, document your disposition modeling assumptions (*e.g.*, surface roughness") and approach.

Additional specific downwash considerations in the EPA's preferred near-field dispersion model, AERMOD, for inclusion in the modeling protocol include:

___ Facility Plot Plan with terrain, emission points and buildings labeled, and a scale and coordinate system identified

___ Building/tier heights and dimensions/coordinates of building corners

___ Base elevation for stacks and buildings – source of elevations (GPS, facility survey/plot plan, AERMAP?)

___ Results of BPIP-Prime – are stacks above 65 meters GEP?

___ BPIP-Prime Input/Output files verified?

___ Are there unusual building dimensions such as hyperbolic cooling towers or lattice structures?

___ Offsite buildings within 5L of a stack that should be included?

___ Building parameters should still be input to the model and let the model determine if downwash affects the impacts. Downwash may be implemented even if stack is at or greater than GEP stack height.

___ Background sources in cumulative modeling analysis modeled with downwash?

Modeling Domain and Receptors

Please reference the *Guideline*, Section 8.1 for specific requirements used in the establishment of the modeling domain and receptor grid for the compliance demonstration modeling.

Items of considerations for inclusion in the modeling protocol to assist in the development and justification of an adequate modeling domain and receptor grid include:

___ Scaled maps of nearby terrain showing areas of complex terrain.

___ Plot of receptor grid(s) with corresponding coordinates.

___ Ensure receptors are appropriately included for all publically accessible locations (ambient air).

___ Receptor coordinate system consistent with source coordinate system?

___ Fence line receptors with appropriately representative spacing (*e.g.*, no greater than 25m)

___ Discrete receptors placed in sensitive areas and/or above ground (flagpole) used?

___ Terrain data to be used – DEM, NED, source specific XYZ data, and resolution?

___ Is stack base elevation greater than receptor heights?

___ Modeling domain includes all locations where the emissions from the new or modifying source(s) may cause a significant ambient impact?

Background Concentration

Please reference the *Guideline*, Section 8.3 for various recommendations used in the determination of background concentrations in isolated single and multi-source areas. The background concentrations are essential in constructing the design concentration, or total air quality concentration, as a part of a cumulative impact analysis, if required, for NAAQS and PSD increments. Background air quality should not include the ambient impacts of the project source under consideration.

Items to consider for inclusion in the modeling protocol to assist in the development and justification of background concentrations include:

___ Discussion of monitored value(s) used for background, including location(s) and time period.

___ Representativeness of monitored values used.

___ Nearby source list determined using Significant Concentration Gradient with professional judgement criteria?

___ Any nearby source concentration impacts based on emissions consistent with tables 8-1 and 8-2 in the *Guideline*?

___ Method used to generate background value(s).

___ Concentrations by pollutant.

___ Averaging time (*e.g.*, short-term and long-term).

For PSD increment assessments, all impacts after the appropriate baseline dates (*i.e.*, trigger date, major source baseline date, and minor source baseline date) from all increment-consuming and increment-expanding sources should be considered in the design concentration.

Analysis of Class I Area Impacts

The applicant is required to provide an air quality analysis for any Class I area that may be affected by the emissions from the proposed new source or modification. There are two components for this analysis the NAAQS and Class I increments analysis, and the air quality related values (AQRV) analysis.

___ Reference 40 CFR 52.21(p) and 51.166(p)

___ Has the appropriate FLM been notified based on source characteristics and proximity to Class I area?

___ Are there potentially significant impacts to Class I area?

___ Is major source within 10 km from a Class I area, and has an impact of 1 ug/m3 on a 24-hour basis? If so, then PSD affected for that pollutant.

Additional Impact Analysis

As required by 40 CFR 52.21(o) of the PSD regulations, the applicant must provide an analysis of the proposed facility's impact on soils, vegetation, and visibility (even to Class II areas) and the expected general commercial, residential, and industrial growth associated with the new or modified source. If no impacts are anticipated, then the analysis can generally be qualitative in nature and designed to provide the basis for this determination. The proposed analyses to address these items should be included in the modeling protocol.

___ Reference 40 CFR 52.21(o)

___ Are there potentially significant impact to soils, vegetation, and visibility?

General Considerations

Endangered Species Act

___ Have the requirements of the Endangered Species Act been addressed in the local area?

Other Federal Requirements

___ Are all other requirements for federal permits met which are summarized in EPA's October 15, 2012 memorandum (https://www.epa.gov/sites/production/files/2015-07/documents/timely.pdf)?

V. Compliance Demonstration and Results

Single-Source Impact Analysis

The single-source impact analysis, or first stage of an air quality analysis, should begin by determining the potential of a proposed new or modifying source to cause or contribute to a NAAQS or PSD increment violation, as described in the *Guideline*, Section 9.2.3.

___ Reference the *Guideline*, Section 9.2.3(c).

___ If a screening model or technique is used to estimate a new or modifying source's impact, do worst-case ambient impacts from the source indicate that the proposed new or modifying source will not cause or contribute to any potential violation of a NAAQS or PSD increment?

___ If a refined model is used to estimate a new or modifying sources' impact, does the ambient concentration increase predicted with refined modeling indicate that the source will not cause or contribute to any potential violation of a NAAQS or PSD increment?

___ A refined modeling analysis should use a model or technique consistent with the *Guideline* (either a preferred model or technique or an alternative model or technique) and follow the requirements and recommendations for model inputs outlined in the *Guideline*, Section 8.

To determine if a compliance demonstration for NAAQS and/or PSD increments may be necessary beyond 50 km (*i.e.*, long-range transport assessment), a screening approach shall be used to determine if a significant ambient impact will occur with particular focus on Class I areas and/or the applicable receptors that may be threatened at such distances.

___ Reference the *Guideline*, Section 4.2.

___ Based on application in the near-field of the appropriate screening and/or preferred model, are there significant ambient impacts at or about 50 km from the new or modifying source?

___ If a near-field assessment is not available or this initial analysis indicates there may be significant ambient impacts at that distance, then further assessment is necessary. There is not a preferred model or screening approach for distances beyond 50 km. Thus, the appropriate reviewing authority and the EPA Regional Office shall be consulted in determining the appropriate and agreed upon screening technique to conduct the second level assessment.

Cumulative Impact Analysis

The cumulative impact analysis, or the second stage of an air quality analysis, should be conducted with the same refined model or technique to characterize the project source and then include the appropriate background concentrations (*Guideline*, Section 8.3).

___ Reference the *Guideline*, Section 9.2.3(d).

___ Receptors that indicated the location of significant ambient impacts from the source impact analysis (above) should be used to define the modeling domain for use in the cumulative impact analysis (*Guideline*, Section 8.2.2).

___ The resulting design concentrations should be used to determine whether the source will cause or contribute to a NAAQS or PSD increment violation. This determination should be based on:

(1) The appropriate design concentration for each applicable NAAQS (and averaging period); and

(2) whether the source's emissions cause or contribute to a violation at the time and location of any modeled violation (i.e., when and where the predicted design concentration is greater than the NAAQS).

___ For PSD increments, the cumulative impact analysis should also consider the amount of the air quality increment that has already been consumed by other sources, or, conversely, whether increment has expanded relative to the baseline concentration.

In those situations where a cumulative impact analysis for NAAQS and/or PSD increments analysis beyond 50 km is necessary, the selection and use of an alternative model shall occur in agreement with the appropriate reviewing authority and approval by the EPA Regional Office based on the requirements of the *Guideline*, Section 3.2.2(e).

Results

A comprehensive set of statistics, tables, plots, and other modeling results should be provided to support the compliance demonstration for each applicable NAAQS and PSD increment.

___ All applicable NAAQS and PSD increments should be represented in these results (*e.g.*, tables with maximum and/or significant impacts, associated receptor location, meteorological data, and modeling scenario) based on the corresponding form of each NAAQS (*i.e.*, averaging times) or the PSD increment.

___ Concentration plots of maximum and/or significant impacts overlaid on previous discussed source location maps identifying topographic features, Class I areas, nonattainment areas, other major sources, monitoring locations, met sites, etc…

___ Modeled concentrations should not be rounded before comparing the resulting design concentration to the NAAQS or PSD increments.