Appendix 5.1H
Modeling Protocol and Related Correspondence

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May 27, 2011

Mr. Eldon Heaston
Executive Director
Mojave Desert Air Quality Management District
14306 Park Avenue
Victorville, CA 92392

Subject: Modeling Protocol for BrightSource Energy's Proposed Rio Mesa Solar Electric Generating Facility in Riverside County

Dear Mr. Heaston:

On behalf of BrightSource Energy, we are pleased to submit the enclosed air quality modeling protocol for BrightSource Energy's proposed Rio Mesa Solar Electric Generating Facility solar thermal power plant project to be located in Riverside County. BrightSource will be applying to the California Energy Commission for certification, and to the Mojave Desert Air Quality Management District for a Determination of Compliance. Attached for your review and approval is a description of the analytical approach that will be used to comply with the District's modeling requirements for the project. We intend to file an Application for a Determination of Compliance and Authority to Construct with the District during the 4th quarter of this year.

We would be pleased to meet with you to discuss this protocol if such a meeting would be useful. We look forward to working with you and your staff on this project. If you have any questions regarding this protocol, please do not hesitate to call Tom Andrews or me. Thank you for your attention in this matter.

Sincerely,

(FOR GSR)

Gary Rubenstein
Senior Partner

Attachment

cc: Todd Stewart, BrightSource Energy, Inc.
Andrea Grenier, Grenier & Associates, Inc.
Chris Ellison, Ellison Schneider & Harris

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May 27, 2011

Matt Layton
Siting Division
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Subject: Modeling Protocol for BrightSource Energy's Proposed Rio Mesa Solar Electric Generating Facility in Riverside County

Dear Matt:

On behalf of BrightSource Energy, we are pleased to submit the enclosed air quality modeling protocol for BrightSource Energy's proposed Rio Mesa Solar Electric Generating Facility solar thermal power plant project to be located in Riverside County. BrightSource will be applying to the California Energy Commission for certification, and to the Mojave Desert Air Quality Management District for a Determination of Compliance. Attached for your review and concurrence is a description of the analytical approach that we propose to use to comply with the CEC's modeling requirements for the project. We intend to file an Application for Certification with the CEC during the 4th quarter of this year.

We would like to meet with you and your staff to discuss the air quality-related aspects of the project, and will contact you in the near future to set up the meeting. We look forward to working with you and your staff on this project. If you have any questions regarding this protocol, please do not hesitate to call Tom Andrews or me. Thank you for your attention in this matter.

Sincerely,

Gary Rubenstein (FOR GSR)
Senior Partner

Attachment

cc: Todd Stewart, BrightSource Energy, Inc.
Andrea Grenier, Grenier & Associates, Inc.
Chris Ellison, Ellison Schneider & Harris

Air Dispersion Modeling and Health Risk Assessment Protocol Rio Mesa Solar Electric Generating Facility Riverside County, California

Submitted to:

Mojave Desert Air Quality Management District
California Energy Commission

prepared for:

BrightSource Energy, Inc.

May 2011

prepared by:

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Air Dispersion Modeling and Health Risk Assessment Protocol
Rio Mesa Solar Electric Generating Facility
Riverside County, California

May 2011

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Air Dispersion Modeling and Health Risk Assessment Protocol
Rio Mesa Solar Electric Generating Facility

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1. INTRODUCTION

BrightSource Energy (BSE) intends to submit an Application for Certification (AFC) to the California Energy Commission (CEC) and an Application for a Determination of Compliance to the Mojave Desert Air Quality Management District (District) for a new solar thermal power project in southeastern Riverside County.[1] The proposed Rio Mesa Solar Energy Generating Facility project will consist of three solar concentrating thermal power plants, based on distributed power tower and heliostat mirror technology, in which heliostat (mirror) fields focus solar energy on power tower receivers near the center of the heliostat array. The project will have a total output of 750 MW (nominal net, at site design conditions). Air emitting sources at the plants will include large and small natural gas-fired auxiliary boilers, Diesel emergency generators, Diesel fire pump engines, air-cooled condensers, and partial dry cooling systems that include evaporative coolers.

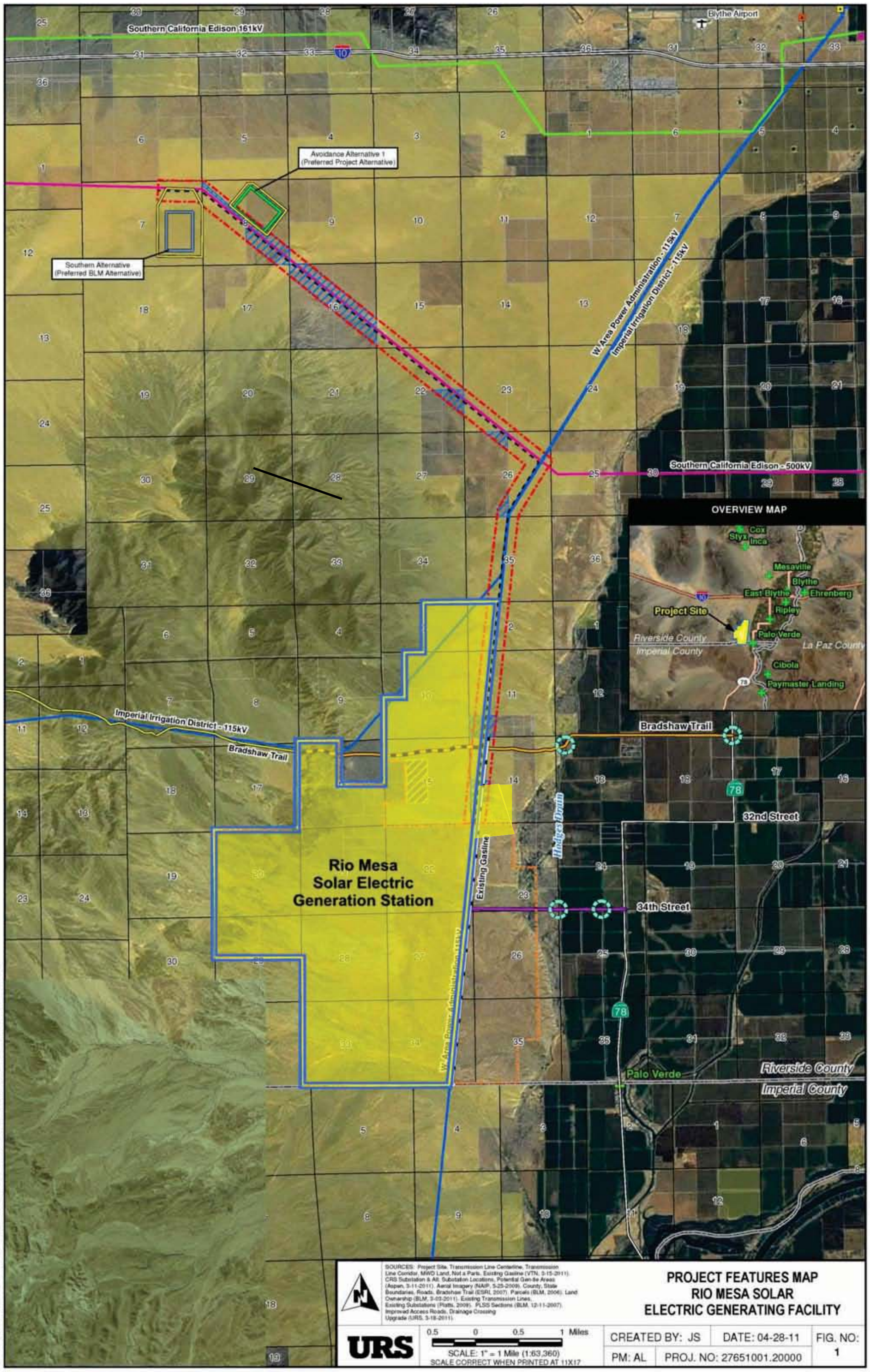
The location of the proposed project is shown in Figure 1.

Certification by the CEC will be required because the project is a thermal power plant that will generate more than 50 MW of electric power. The project will be required to provide an assessment of impacts on air quality as part of the CEC review process. In addition, while the project is not expected to trigger the ambient air quality impact analysis requirements under District Rule 1302(C)(2)(b) (for new or modified major sources), the District may require such an analysis in order to prepare a comprehensive New Source Review regulatory evaluation of the project. Furthermore, the project will be required to provide an analysis of toxic air pollutant impacts per District Rule 1320.

The project is not expected to be subject to federal PSD requirements (40 CFR 52.21) because potential emissions of each attainment pollutant will be below the 100 ton per year major source threshold that is applicable to facilities of this type.[2] Greenhouse gas (GHG) emissions will be limited to below the 100,000 ton per year major source threshold for GHG. PSD applicability will be addressed in the application documents. The applications that will be submitted to the District and the CEC (and, potentially, the USEPA) will include air quality impact analyses. Air dispersion modeling for these analyses will address criteria and toxic air pollutants as required by the District New Source Review Regulations (Regulation XIII); CEC requirements[3] for evaluation of

[1] The proposed project is not expected to require a PSD permit. If a PSD permit is required, a separate modeling protocol will be prepared for submittal to the U.S. Environmental Protection Agency (USEPA).
[2] Because the project will include several large (>250 MMBtu/hr heat input) natural gas-fired auxiliary boilers, it will be subject to the 100 tpy major stationary source threshold in 40 CFR 52.21(b)(1)(i)(a).
[3] Summarized in CEC Data Adequacy Worksheets, revised March 28, 2007, and available at *http://www.energy.ca.gov/sitingcases/documents/index.html.*

Figure 1
Location of the Proposed Rio Mesa Solar Electric Generating Facility



project air quality and public health impacts. The purpose of this document is to present the procedures for meeting District and CEC air quality modeling requirements for the proposed project.

This protocol describes the modeling procedures that will be used, which follow modeling guidance provided by the USEPA in its "*Guideline on Air Quality Models*" (USEPA 2005, including supplements), 40 CFR part 51, Appendix W, and the San Joaquin Valley Air Pollution Control District's *Guidance for Air Dispersion Modeling* (SJVAPCD, 2007).[4]

Impacts from operation of the facility will be compared to the criteria shown in Table 1.

Table 1
Air Quality Impact Analysis

Air Quality Criteria	NO_2	PM_{10}	$PM_{2.5}$	CO	SO_2
PSD Significant Impact Levels [a]	√	√	√	√	√
Ambient Air Quality Standards (AAQS)	√	√	√	√	√
Impacts to Soils and Vegetation [b]	√	√	√	NA[c]	√

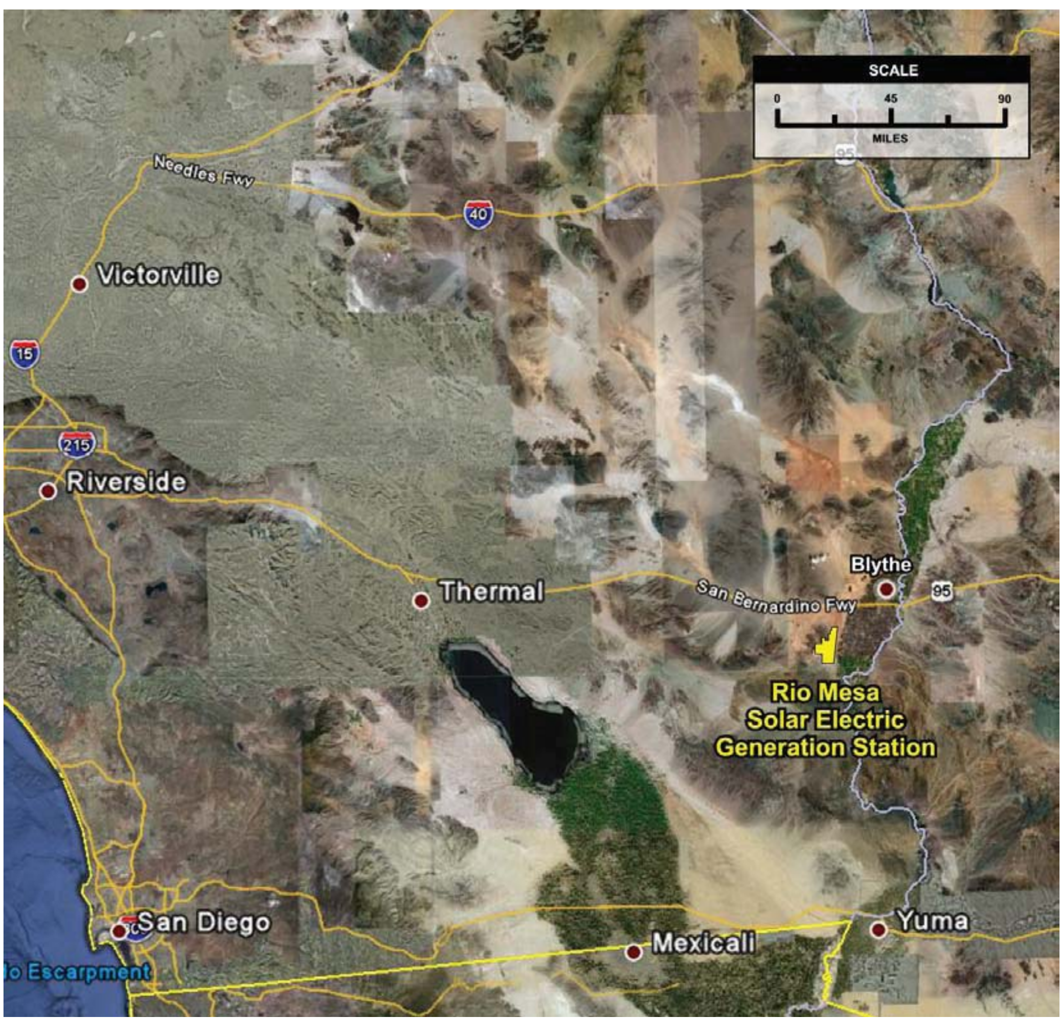
Notes:
a. Used as an objective standard to determine whether modeled air quality impacts are significant.
b. Used in assessing impacts to biological resources.
c. NA: Not applicable.

[4] While the project is not located in the San Joaquin Valley, the SJVAPCD has developed detailed guidance for implementing the 1-hour NO_2 national ambient air quality standard in non-PSD permits that is useful in laying out a tiered approach to modeling compliance with the 1-hour standard.

2. FACILITY DESCRIPTION AND SOURCE INFORMATION

The Rio Mesa Solar Electric Generating Facility will be located on approximately 6,858 acres about 6 miles south of Interstate 10 and to the southwest of the Blythe airport in Riverside County. Figure 2 shows the project site and its immediate surroundings. The nominal site elevation is approximately 350 feet above mean sea level.

Figure 2
Aerial View of the Immediate Vicinity
Around the Proposed Rio Mesa Solar Electric Generating Facility



The project will include three 250-MW (nominal, net) solar concentrating thermal power plants, based on distributed power tower and heliostat mirror technology, in which heliostat (mirror) fields focus solar energy on power tower receivers near the center of the heliostat array. The three power plants will be constructed on adjacent property and will share a natural gas supply source from TransCanada's North Baja gas transmission pipeline, an electric transmission generator tie-line infrastructure to a Southern California Edison (SCE) owned substation, and a common control area, so are considered a single facility under District Rule 1301.Y.

In each power plant, one Rankine-cycle reheat steam turbine receives steam from a solar boiler located at the top of the power tower adjacent to the turbine. The solar field and power generation equipment are started up each morning, and shut down in the evening. To optimize the power output of the plants and extend generating capability into the late afternoon/early evening shoulder period when solar insolation alone is not sufficient to generate adequate steam for the steam turbine, each plant will utilize three 500-MMBtu natural gas-fired auxiliary boilers, to be operated as required each day on summer weekdays. In addition, a small natural gas-fired start-up and night-time preservation boiler are provided to assist with and quicken startup of the solar boilers each morning, and to regulate and maintain minimum system temperatures at night. Annual heat input to the auxiliary boilers will be limited to be less than 15% of annual solar energy capture. The boilers will utilize advanced combustion design to limit emissions of nitrogen oxides (NOx), carbon monoxide (CO), and volatile organic compounds (VOC). Emissions of particulate matter with nominal aerodynamic diameter less than or equal to 10 and 2.5 microns (PM_{10} and $PM_{2.5}$), and sulfur oxides (SOx) will be kept to a minimum through the exclusive use of natural gas as the fuel.

In addition, each plant will have emergency standby Diesel fuel-fired internal combustion engine driven generators (to provide power to operate boiler feed and recirculation pumps if power is otherwise unavailable). Finally, each plant will be equipped with a Diesel fuel-fired emergency firewater pump engine. Air-cooled condensers will be used for cooling and condensing process steam. Partial dry cooling systems will be used to cool auxiliary equipment, including generators, lube oil, and pumps. The wet surface air coolers that are part of the partial dry cooling systems will be used to provide auxiliary cooling only during the hottest periods of the year and are required for equipment protection and reliability. For the purposes of the AQIA, all combustion particulate matter and particulate emissions from the wet surface air coolers will be treated as $PM_{2.5}$.

3. DISPERSION MODEL PROCEDURES

3.1 AERMOD Modeling

The following USEPA air dispersion models are proposed for use to quantify pollutant impacts on the surrounding environment based on the emission sources' operating parameters and their locations:

- American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) model, also known as AERMOD (Version 11059);
- Building Profile Input Program – Plume Rise Model Enhancements (BPIP-PRIME, Version 04274); and
- SCREEN3 (Version 96043).

The main air dispersion modeling will be conducted with the latest version (Version 11059) of AERMOD, USEPA's preferred/recommended dispersion model for new source review and PSD air quality impact assessments. The air quality modeling analysis will follow the March 2009 USEPA AERMOD Implementation Guide, USEPA's "Guideline on Air Quality Models," and the SJVAPCD's "Guidance for Air Dispersion Modeling."[5] USEPA default options will be used.

AERMOD can account for building downwash effects on dispersing plumes. Stack locations and heights and building locations and dimensions will be input to BPIP-PRIME. The first part of BPIP-PRIME determines and reports on whether a stack is being subjected to wake effects from a structure or structures. The second part calculates direction-specific building dimensions for each structure, which are used by AERMOD to evaluate wake effects. The BPIP-PRIME output is formatted for use in AERMOD input files.

Simple, Complex, and Intermediate Terrain Impacts – The AERMOD air dispersion model to be used for simple, complex, and intermediate terrain is a steady-state, multiple-

[5] As discussed above, the project will not be located in the SJVAPCD. However, the SJVAPCD has developed detailed modeling guidance that incorporates procedures for implementing the 1-hour federal NO_2 standard for non-PSD projects and we are proposing to follow that guidance in the absence of other state or local guidance.

source, Gaussian dispersion model designed for use with stack emission sources situated in terrain where ground elevations can exceed the stack heights of the emission sources (i.e., complex terrain). The AERMOD model requires hourly meteorological data consisting of wind direction and speed (with reference height), temperature (with reference height), Monin-Obukhov length, surface roughness length, heights of the mechanically and convectively generated boundary layers, surface friction velocity, convective velocity scale, and vertical potential temperature gradient in the 500-meter layer above the planetary boundary layer. AERMOD is considered a steady-state model because it assumes that there is no variability in meteorological parameters over a one-hour time period.

Standard AERMOD control parameters will be used, including stack tip downwash, non-screening mode, non-flat terrain, and sequential meteorological data check. The stack-tip downwash algorithm will be used to adjust the effective stack height downward following the methods of Briggs (1972) for cases where the stack exit velocity is less than 1.5 times the wind speed at stack top. The rural default option will be used by not invoking the URBANOPT option.[6] The use of the rural default in modeling for this project is consistent with the project's remote location.

Background ambient air quality data for the project area from the monitoring site most representative of the conditions that exist at the proposed project site will be used to represent regional background concentrations. Table 2 shows the monitoring stations we propose to use as they provide the most representative ambient air quality background data. The locations of these stations relative to the project site are shown in Figure 3.

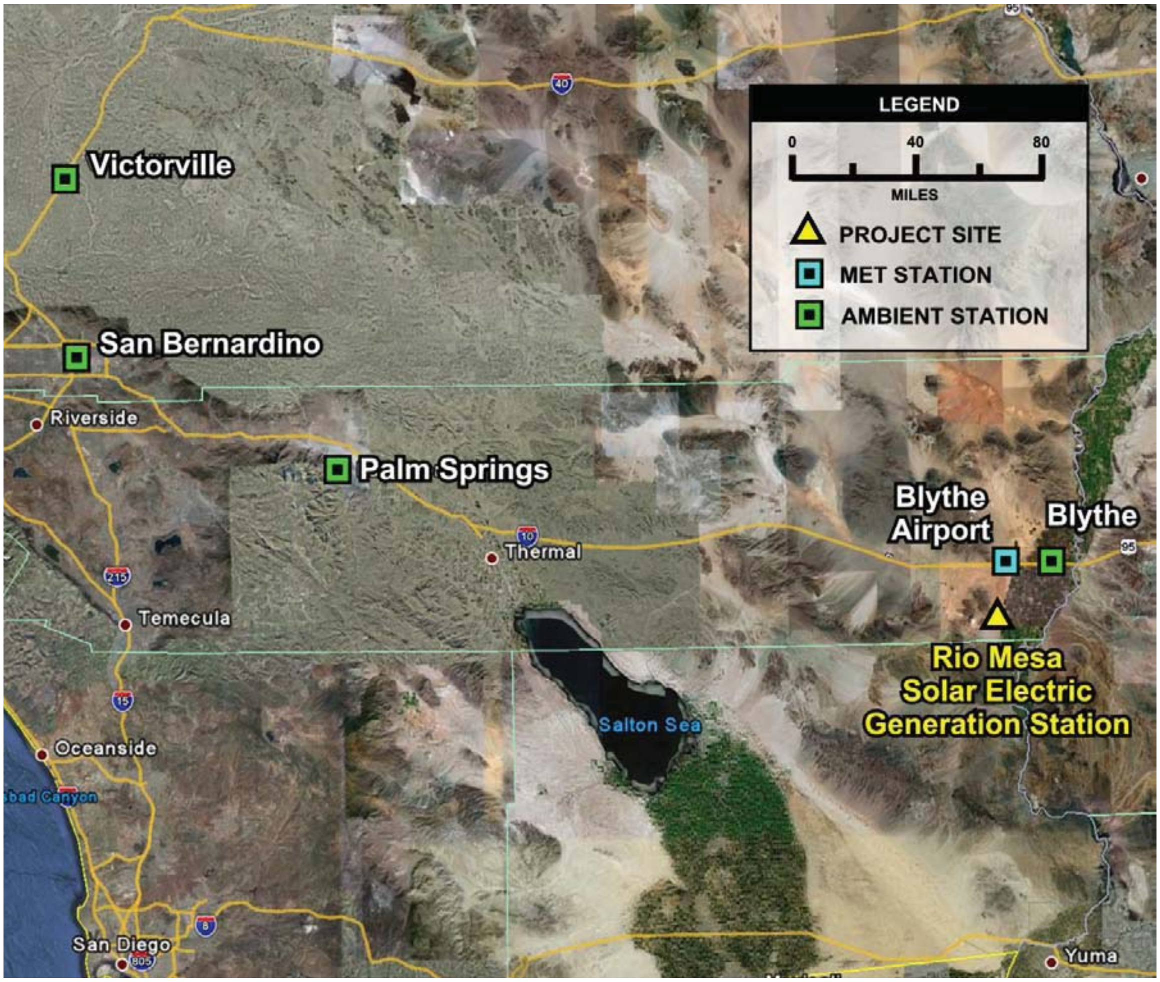
The 3-year period 2007-2009 is the most recent 3-year period for which complete background ambient data sets are available for the project area. Modeled concentrations for the project will be added to these representative background concentrations to determine compliance with the CAAQS and NAAQS (see Section 3.6).

Table 2
Representative Background Ambient Air Quality Monitoring Stations

Pollutant(s)	Monitoring Station	Distance to Project Site
Ozone	Blythe, CA (Riverside County)	6 miles
PM_{10}, $PM_{2.5}$, NO_2, CO	Palm Springs, CA (Riverside County)	107 miles
SO_2	Victorville, CA (San Bernardino County)	163 miles
Lead	San Bernardino, CA (San Bernardino County)	151 miles

[6] The rural vs. urban option in AERMOD is primarily designed to set the fraction of incident heat flux that is transferred into the atmosphere. This fraction becomes important in urban areas having an appreciable "urban heat island" effect due to a large presence of land covered by concrete, asphalt, and buildings. This situation does not exist for the proposed project site.

Figure 3
Relative Locations of the Project and Monitoring Stations



If more detailed evaluation of impacts at receptors in terrain above stack-top height is required, the screening version of the USEPA guideline Complex Terrain Dispersion Model PLUS (CTDMPLUS), Complex Terrain Screening Model (CTSCREEN), would be used. The CTSCREEN model is discussed in more detail in Appendix A. However, because there is no terrain above stack-top height within approximately 2 miles of the plant site, it is unlikely that this more refined analysis will be needed.

3.1.1 Ambient Ratio Method and Ozone Limiting Method

Annual NO_2 concentrations will be calculated using the Ambient Ratio Method (ARM), adopted in Supplement C to the Guideline on Air Quality Models (USEPA, 1995). The Guideline allows a nationwide default of 75% for the conversion of nitric oxide (NO) to NO_2 on an annual basis and the calculation of NO_2/NOx ratios.

If NO_2 concentrations need to be examined in more detail, the Ozone Limiting Method (OLM) (Cole and Summerhays, 1979), implemented through the "OLMGROUP ALL" option in AERMOD (USEPA, 2011a), will be used. AERMOD OLM will be used to calculate the NO_2 concentration based on the OLM method and hourly ozone data. Contemporaneous hourly ozone data collected at the Blythe monitoring station will be used in conjunction with OLM to calculate hourly NO_2 concentrations from modeled hourly NOx concentrations.

The Ozone Limiting Method assumes that 10% of the NOx in the exhaust is converted to NO_2 during and immediately after combustion. The remaining percentage of the NOx emissions is assumed to be nitric oxide (NO). As the exhaust leaves the stack and mixes with the ambient air, the NO reacts with ambient ozone (O_3) to form NO_2 and molecular oxygen (O_2). The OLM assumes that at any given receptor location, the amount of NO that is converted to NO_2 by this oxidation reaction is proportional to the ambient O_3 concentration. If the O_3 concentration is less than the NO concentration, the amount of NO_2 formed by this reaction is limited. However, if the O_3 concentration is greater than or equal to the NO concentration, all of the NO is assumed to be converted to NO_2.

A detailed discussion of how OLM modeling results and monitored background NO_2 will be combined is provided in Section 3.6.1.2.

3.1.2 $PM_{2.5}$

$PM_{2.5}$ impacts will be modeled in accordance with USEPA guidance (USEPA, 2010a). A detailed discussion of how modeled $PM_{2.5}$ impacts will be evaluated is provided in Section 3.6.1.

3.2 Fumigation Modeling

The SCREEN3 model will be used to evaluate inversion breakup fumigation impacts for short-term averaging periods (24 hours or less), as appropriate. The methodology in *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised* (USEPA, 1992b) will be followed for these analyses. Combined impacts for all sources under fumigation conditions will be evaluated, based on USEPA modeling guidelines.

3.3 Health Risk Modeling

A health risk assessment (HRA) will be performed according to the Office of Environmental Health Hazard Analysis "Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments" (August 2003). For the CEC AFC, a complete HRA will be performed. The HRA modeling will be prepared using the California Air Resources Board's (CARB's) Hotspots Analysis and Reporting Program (HARP) computer program (Version 1.4d) and AERMOD with the CARB "on-ramp."[7] HARP will be used to assess cancer risk as well as non-cancer chronic and acute health

[7] HARP has not yet been revised to utilize AERMOD, but CARB has developed "on-ramp" software that allows HARP to incorporate AERMOD output files. Therefore, HARP is now compatible with AERMOD.

hazards. Because the TACs emitted by the project include polycyclic aromatic hydrocarbons (PAHs), the HRA will address not only the inhalation pathway, but also the following three pathways: dermal absorption, soil, and mother's milk ingestion. Consistent with the following OEHHA (2003) guidance, because of the remote desert location of the proposed project, the produce and fish pathways will not be evaluated:

> *The other exposure pathways (e.g., the ingestion of homegrown produce or fish) are evaluated on a site-by-site basis. If the resident can be exposed through an impacted exposure pathway, then it must be included in the HRA.* ***However, if there were no vegetable gardens or fruit trees within the zone of impact for a facility, for example, then the produce pathways would not be evaluated.***[8] [emphasis added]

3.4 Meteorological Data

Hourly surface meteorological data (e.g., hourly wind speed and direction and temperature) have been obtained from Blythe, CA for calendar years 2001 through 2009 and will be processed for use in AERMOD using AERMET. Barring any problems regarding met data completeness, the final five years (2005-2009) will be used for modeling purposes. Cloud cover data from the McCarran International Airport at Las Vegas will be used, as no cloud cover data are collected at the Blythe station. Upper air data will be used from Tucson, AZ. These datasets will be processed using AERMET to generate AERMOD-compatible meteorological data for air dispersion modeling. The locations of these meteorological monitoring stations relative to the project site are shown in Figure 3. The multi-year composite wind roses for the Blythe site are included as Appendix B.

EPA defines the term "on-site data" to mean data that would be representative of atmospheric dispersion conditions at the source and at locations where the source may have a significant impact on air quality. The meteorological data requirement originates in the Clean Air Act at Section 165(e)(1), which requires an analysis "of the ambient air quality at the proposed site and in areas which may be affected by emissions from such facility for each pollutant subject to regulation under [the Act] which will be emitted from such facility."

This requirement and USEPA's guidance on the use of on-site monitoring data are also outlined in the On-Site Meteorological Program Guidance for Regulatory Modeling Applications (USEPA, 1987c). The representativeness of the data depends on (a) the proximity of the meteorological monitoring site to the area under consideration, (b) the complexity of the topography of the area, (c) the exposure of the meteorological sensors, and (d) the period of time during which the data are collected. The Blythe, CA, monitoring station is 6 miles from the project site, and is located at a similar elevation on the same Lower Colorado River Valley slope. Therefore, the met data station meets criteria (a), (b), and (c) above. In addition, we proposed to use five years of

[8] OEHHA (2003) p. 5-3.

meteorological data to ensure adequate representation of temporal variation. Based on these considerations, the applicant believes that the proposed meteorological data are representative of conditions at the project site.

Representativeness has also been defined in the *Workshop on the Representativeness of Meteorological Observations* (Nappo et. al., 1982) as "the extent to which a set of measurements taken in a space-time domain reflects the actual conditions in the same or different space-time domain taken on a scale appropriate for a specific application." Representativeness is best evaluated when sites are climatologically similar, as are the project site and the Blythe meteorological monitoring station. Representativeness has additionally been defined in the PSD Monitoring Guideline (USEPA, 1987a) as data that characterize the air quality for the general area in which the proposed project would be constructed and operated. As can be seen in Figure 3, the Blythe meteorological monitoring station is in close proximity to the proposed project site (distance between the two locations is approximately six miles, with no significant intervening terrain features), and the same large-scale topographic features located to the east and south that influence the meteorological data monitoring station influence the proposed project site in the same manner.

The surface characteristics input to AERMET should be based on the topographic conditions in the vicinity of the meteorological tower used to provide meteorological data.[9] The values for the surface characteristics of albedo, Bowen Ratio and surface roughness appropriate to the area around the Blythe meteorological monitoring station will be obtained, if possible, from AERSURFACE, a program designed to aid in obtaining realistic and reproducible surface characteristic values for AERMET, following USEPA guidance (USEPA, 2008). If Blythe's proximity to the Arizona border makes it impossible to obtain AERSURFACE data for the site, however, default USEPA tabulated land-use values for "desert scrubland" will be used.

Upper air meteorological data will be taken from soundings obtained at Tucson, AZ, located approximately 240 miles ESE of the project.

The closest upper air station to the project site is located about 150 miles WSW, at Miramar Naval Air Station, California. Miramar is a coastal site, however, and the marine-influenced surface boundary layer affects Miramar soundings in ways that would not occur in the Lower Colorado River Valley. Therefore, the meteorological data are climatologically dissimilar to the project site.

The next closest upper air station to the project site is located about 224 miles NNW, at Desert Rock, NV. For the period 2005 through 2009, however, the upper air data from Desert Rock are incomplete—approximately 15% missing data, which exceeds the 10% USEPA data completeness threshold.

The third-closest upper air station to Blythe is located at Tucson. Despite its distance, Tucson is the most climatologically similar upper-air station to the project site, mostly

[9] Based on guidance in USEPA (2005), §8.3.c, and USEPA (2009).

due to its latitude. In the late summer, particularly in August, the tropical easterlies migrate so far north that they cross the U.S. Mexican border. Late in the afternoon and into the night, these easterlies sometimes bear big mesoscale convective complexes (MCCs), with all their rain. Because Blythe and Tucson are roughly the same latitude, they see these easterlies; Desert Rock does not because it is farther north. Apart from elevation differences, this difference in summertime wind direction (and precipitation) is the main distinction between the deserts of the lower Colorado River Valley, and the Mojave Desert farther north. So, despite being a bit farther away from Blythe than Desert Rock, Tucson is more suitable than Desert Rock for upper air data because Tucson and Blythe have more similar latitudes.

3.4.1 Missing Data Protocol

Using the OLM method to model project-generated 1-hour NO_2 concentrations requires the use of ambient monitored O_3 concentrations. Because the OLM method uses the ambient ozone concentration for a particular hour to limit the conversion of NO to NO_2, it is important to have ozone concentrations for every hour. It is also important that any missing hourly ozone concentration be filled in with a value that does not underestimate the ozone concentration for that hour, to avoid underestimating the resulting NO_2 concentration. In addition, computation of total hourly NO_2 concentrations requires use of the ambient monitored hourly NO_2 concentrations from the nearest monitoring station. As for the hourly ozone data, it is important to have a background NO_2 value for every hour that does not underestimate actual background.

As discussed above, background ambient O_3 and NO_2 concentrations for the project area during 2007-2009 will be obtained from the monitoring stations at Blythe and Palm Springs, respectively. While these datasets exceed USEPA's 90% completeness criterion (that is, more than 90% of the data values are present for each month), there are still occasional missing values that must be filled in. We propose to use linear interpolation, as described in "San Joaquin Valley Air Pollution Control District's EPA Background Files" (SJVAPCD, 2011) to fill in the missing values. The SJVAPCD guidance follows USEPA guidance (USEPA, 2011a) for a single missing hour, but uses a somewhat different approach for filling in multi-hour data gaps. As discussed earlier, although the proposed project is not in the SJVAPCD, the SJVAPCD has prepared detailed guidance for evaluating one-hour NO_2 impacts from non-PSD projects that is not available from the state or other local districts. As we propose to follow this guidance for evaluating one-hour NO_2 impacts, we also propose to use this guidance to prepare the underlying datasets.

The procedure to be used for filling in multi-hour data gaps is as follows:

- If three or fewer consecutive hours of O_3 or NO_2 ambient concentrations are missing, linear interpolation will be used to fill in the missing concentrations based on the previous and subsequent hour concentrations from the same day as follows:
  - If only A_n is missing, then A_n = arithmetic mean of A_{n-1} and A_{n+1}, where A_{n-1} is the previous concentration and A_{n+1} is the subsequent concentration.

- If A_n and A_{n+1} are missing, then $A_n = A_{n-1}*0.67+A_{n+2}*0.33$ and $A_{n+1} = A_{n-1}*0.33+A_{n+2}*0.67$.

- If A_{n-1}, A_n and A_{n+1} are missing, then $A_{n-1}= A_{n-2}*0.75+ A_{n+2}*0.25$, $A_n= A_{n-2}*0.5+ A_{n+2}*0.5$, $A_{n+1} = A_{n-2}*0.25+ A_{n+2}*0.75$.

- If four or more consecutive hours of O_3 or NO_2 ambient concentrations are missing, then substitution for each missing concentration will be by the arithmetic mean of the concentrations from the same hour of the most recent previous day and soonest subsequent day.

3.5 Receptor Grids

Receptor and source base elevations will be determined from USGS National Elevation Dataset (NED) data in the GeoTIFF format at a horizontal resolution of 1 arc-second (approximately 30 meters). All coordinates will be referenced to UTM North American Datum 1983 (NAD83), Zone 11. The AERMOD receptor elevations will be interpolated among the DEM nodes according to standard AERMAP procedure. For determining concentrations in elevated terrain, the AERMAP terrain preprocessor receptor-output (ROU) file option will be chosen. Hills will not be imported into AERMOD for CTDM-like processing.

Cartesian coordinate receptor grids will be used to provide adequate spatial coverage surrounding the project area for assessing ground-level pollution concentrations, to identify the extent of significant impacts, and to identify maximum impact locations. A 250-meter resolution coarse receptor grid will be developed and will extend outwards at least 10 km (or more if necessary to calculate the significant impact area).

For the full impact analyses, a nested grid will be developed to fully represent the maximum impact area(s). This grid will have 25-meter resolution along the facility fence-line in a single tier of receptors composed of four segments extending out to 100 meters from the fenceline, 100-meter resolution from 100 meters to 1,000 meters from the fenceline, and 250-meter spacing out to at least 10 km from the most distant source modeled, not to exceed 50 km from the project site. Additional refined receptor grids with 25-meter resolution will be placed around the maximum first-high or maximum second-high coarse grid impacts and extended out 1,000 meters in all directions. Concentrations within the facility fenceline will not be calculated.

The Regions to be imported in Geographical Coordinates for the USGS National Elevation Dataset (NED) data are bounded as follows:

- South West corner: UTM Zone 11 (NAD 83) 690000.0 m, 3700000.0 m; and
- North East corner: UTM Zone 11 (NAD 83) 730000.0 m, 3740000.0 m.

3.6 Ambient Air Quality Impact Analyses (AQIA)

The majority of the pollutant emissions to the atmosphere from the proposed project will occur from combustion of natural gas in the boilers and Diesel fuel in the emergency engines, with a small amount of additional particulate matter from cooling tower drift. The expected emission rates from all sources will be based on vendor data and additional conservative assumptions of equipment performance.

Exhaust and fugitive dust emissions impacts from trucks involved in washing the heliostat mirrors will also be quantified and assessed under CEQA. Impacts from these sources will be modeled in accordance with the procedures described for construction sources in Section 3.9 below.

3.6.1 Combustion Sources and Evaporative Coolers

The purpose of the ambient air quality impact analysis is to demonstrate compliance with applicable ambient air quality standards. Both USEPA and the District have regulations that prohibit construction of a project that will cause or contribute to violations of applicable standards.

If, for a given pollutant and averaging time, the project's impact is below the significance thresholds shown in Table 3, the project's impact is deemed to be *de minimis*, and no further analysis is required. If the project's impact is above the significance threshold, the project has the potential to cause or contribute to a violation of the ambient air quality standard at the times and locations where the threshold is exceeded. In that case, the analysis must consider the contribution of other sources to the ambient concentration. If the analysis indicates that there will be a violation of an ambient air quality standard, and the project's impact *at the time and place of the violation* is significant, then the project may not be approved unless the project's impact is reduced.

Table 3
Significance Levels for Air Quality Impacts in Class II Areas (µg/m³)

Pollutant	Averaging Period				
	Annual	24-hour	8-hour	3-hour	1-hour
NO_2	1	--	--	--	7.5[10]
SO_2	1	5	--	25	7.8[10]
CO	--	--	500	--	2000
PM_{10}	1	5	--	--	--
$PM_{2.5}$	0.3	1.2	--	--	--

[10] EPA has not yet defined significance levels (SILs) for one-hour NO_2 and SO_2 impacts. However, EPA has suggested that, until SILs have been promulgated, interim values of 4 ppb (7.5 µg/m³) for NO_2 and 3 ppb (7.8 µg/m³) for SO_2 may be used (USEPA (2010c); USEPA (2010d)). These values will be used in this analysis as interim SILs.

An air quality impact analysis is required for certification by the CEC and for issuance of a Determination of Compliance by the District. Each agency has its own criteria for preparation of the air quality impact analysis; however, the criteria used by the CEC and the District are similar enough that the same analysis will satisfy both.

3.6.1.1 Step 1: Project Impact

The first step in the compliance demonstration is to determine, for each pollutant and averaging period, whether the proposed new equipment for the project has the potential to cause a significant ambient impact at any location, under any operating or meteorological conditions. As indicated in the NSR Workshop Manual,[11] "[i]f the significant net emissions increase from a proposed source would not result in a significant ambient impact anywhere, the application is usually not required to go beyond a preliminary analysis in order to make the necessary showing of compliance for a particular pollutant." The significance levels for air quality impacts are shown in the following table. If the maximum modeled impact for any pollutant and averaging period is below the appropriate significance level, no further analysis is necessary.

Based on the following USEPA (2010e) guidance, no further analysis is necessary for any location where the modeled impacts from the project alone are below the significance thresholds shown in the table above.

> *The primary purpose of the SILs is to identify a level of ambient impact that is sufficiently low relative to the NAAQS or increments that such impact can be considered trivial or de minimis. Hence, the EPA considers a source whose individual impact falls below a SIL to have a de minimis impact on air quality concentrations that already exist. Accordingly, a source that demonstrates that the projected ambient impact of its proposed emissions increase does not exceed the SIL for that pollutant at a location where a NAAQS or increment violation occurs is not considered to cause or contribute to that violation. In the same way, a source with a proposed emissions increase of a particular pollutant that will have a significant impact at some locations is not required to model at distances beyond the point where the impact of its proposed emissions is below the SILs for that pollutant. When a proposed source's impact by itself is not considered to be "significant," EPA has long maintained that any further effort on the part of the applicant to complete a cumulative source impact analysis involving other source impacts would only yield information of trivial or no value with respect to the required evaluation of the proposed source or modification.*[12]

[11] USEPA (1990), p. C.51.
[12] USEPA (2010e), p. 64891.

For $PM_{2.5}$, the highest average of the maximum annual averages and of the 24-hour averages modeled over the five years of meteorological data will be compared with the SILs in Table 3 to determine whether the modeled $PM_{2.5}$ project impacts are significant.[13] For NO_2, the highest modeled concentrations will be compared with the SILs.

For pollutants with modeled project impacts below the significance thresholds, a summary table will show the maximum modeled project impacts plus background concentrations. Although this information is not required by federal modeling guidance, it will be provided as part of the CEQA analysis.

3.6.1.2 Step 2: Project Plus Background

Pollutants/averaging periods that are not screened out in Step 1 are required to undergo a full air quality impact analysis. In this step, the ambient impacts of the project are modeled and added to background concentrations. The results are compared to the relevant state and federal ambient standards.

The second step of the compliance demonstration is required to show that the proposed new project, in conjunction with existing sources, will not cause or contribute to a violation of any ambient air quality standard. As discussed in more detail below, the impacts of existing sources are represented by the existing ambient air quality data collected at the monitoring stations shown in Table 2. In accordance with Section 8.2.1 of Appendix W to 40 CFR Part 51,

> *Background concentrations are an essential part of the total air quality concentration to be considered in determining source impacts. Background air quality includes pollutant concentrations due to: (1) Natural sources; (2) nearby sources other than the one(s) currently under consideration; and (3) unidentified sources. Typically, air quality data should be used to establish background concentrations in the vicinity of the source(s) under consideration.*

The impact of natural sources and unidentified sources will be represented by ambient air quality monitoring data collected at the nearby monitoring stations. In this protocol, these impacts are characterized as part of the "regional background."

Nearby sources are those non-project sources that have the potential to create a significant concentration gradient in the project's impact area. Because of the remote location of the proposed project, we do not believe that there are any nearby, non-project sources that are not represented in the regional background monitoring data.

If a Step 2 analysis is required, the modeled impacts from all project sources will be added to the representative background concentration for a comparison with the NAAQS. In accordance with USEPA guidelines,[14] the highest second-highest modeled

[13] USEPA (2010a), p. 6.
[14] USEPA (2005), 11.2.3.2 and 11.2.3.3

concentrations will be used to demonstrate compliance with the short-term federal standards (except for the statistically based federal 1-hour NO_2 and SO_2, and 24-hour $PM_{2.5}$, standards) and the highest modeled concentration will be used to demonstrate compliance with the federal annual and all state standards. If the predicted total ground-level concentration is below the state or federal ambient air quality standard for each pollutant and averaging period, no further analysis is required for that pollutant and averaging period.

For the 1-hour average federal NO_2 standard for the District and CEC analyses, the comparison of impacts with the new federal 1-hour standard will be done in accordance with the four-tier process developed by the San Joaquin Valley Air Pollution Control District (SJVAPCD, 2010b).[15] The tiered screening approach was developed to allow demonstration of compliance using the lowest amount of resources necessary. Each tier is a progressively more sophisticated and comprehensive analysis that reduces the level of conservatism without reducing the level of assurance of compliance.

- Tier 1 Analysis – In Tier 1, the maximum predicted 1-hour NO_2 concentration from all sources in the five-year modeling period is added to the representative background concentration for a comparison with the 1-hour NAAQS. If compliance is demonstrated using Tier 1 values, no further analysis is required.

- Tier 2 Analysis – Tier 2 is the same as Tier 1, except that the 8^{th} highest maximum predicted 1-hour NO_2 concentration (in the five-year modeling period) is used.

- Tier 3 Analysis – Tier 3 is the same as Tier 1, except that the highest 98^{th} percentile predicted 1-hour concentration at any receptor during the five-year modeling period is used. The 98^{th} percentile 1-hour predicted concentration will be determined as implemented in the current version of AERMOD.

- Tier 4 Analysis – The 98^{th} percentile predicted 1-hour concentrations developed under Tier 3 are paired in time with monitored NO_2 concentrations.

The one-hour SO_2 analysis will follow the same steps, except that Tier 2 will use the 4^{th} highest maximum predicted concentrations, while Tiers 3 and 4 will utilize the 99^{th} percentile predicted one-hour average SO_2 concentrations.

For the 24-hour average federal $PM_{2.5}$ standard for the District and CEC analyses, the comparison of impacts with the federal 24-hour average standard will be done in accordance with USEPA March 23, 2010 guidance (USEPA, 2010a). This guidance calls

[15] "This modeling protocol is meant to define the stepwise approach necessary to satisfy the requirements in General Guidance for Implementing the 1-Hour NO_2 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim NO_2 Significant Impact Level and the Applicability of Appendix W Modeling Guidance for 1-Hour NO_2 National Ambient Air Quality Standard. Nothing in this protocol should be taken as overriding guidance contained in those two memoranda, or Appendix W of Part 51 of Title 40 of the Code of Federal Regulations (40 CFR 51, Appendix W)." (SJVAPCD, 2010b)

for basing the initial determination of compliance with the standard on the 5-year average of the highest modeled annual and 24-hour averages, combined with background concentrations based on the form of the standards (the 3-year average of the annual $PM_{2.5}$ concentrations and the 3-year average of the 98th percentile 24-hour averages).[16] If a more detailed assessment of $PM_{2.5}$ impacts is required, a second tier analysis may be necessary. USEPA's March 23, 2010 memo provides minimal guidance regarding this type of more detailed analysis, saying only "a Second Tier modeling analysis may be considered that would involve combining the monitored and modeled $PM_{2.5}$ concentrations on a seasonal or quarterly basis, and re-sorting the total impacts across the year to determine the cumulative design value."[17] As no additional guidance has been provided, such an analysis would be discussed with the District prior to implementation.

3.7 Ambient Air Quality Data

The closest District-, state-, or federal-operated stations are used to provide representative background ambient levels for the project site during 2007–2009. These representative background levels are shown in Table 4. The monitoring station locations were shown previously in Figure 3.

Table 4
Background Concentrations, 2007-2009 (µg/m³)

Pollutant	Averaging Time	2007	2008	2009
Palm Springs (Riverside County)				
PM_{10}	24 hours	**83**	75	140
	Annual (Nat'l)	**30**	17.7	20.4
$PM_{2.5}$	24 hours (3-yr avg, 98th Percentile)[a]	**19.8**	17.8	17.4
	Nat'l 3-Year Avg AAM [b]	**8.2**	7.8	7.4
NO_2	1 hour (1st high)	**118.4**	92.1	90.2
	1 hour (98th percentile)[a]	**95.9**	84.6	73.3
	Annual	**18.8**	16.9	15.0
CO	1 hour	**920**	575	805
	8 hours (CA. 1st high)	**909**	621	771
Victorville, (San Bernardino County)				
SO_2	1 hour	**23.4**	15.6	72.8
	3 hours	**15.6**	13.0	72.8
	24 hours	**13.0**	5.2	13.0
	Annual	**2.6**	2.6	1.8

Notes:
PM_{10}, $PM_{2.5}$, NO_2, and CO statistics calculated from CARB's Air Quality Data Statistics (ADAM) and USEPA's AirExplorer data: *http://www.arb.ca.gov/adam/index.html*, *http://www.epa.gov/mxplorer /index.htm.* SO_2 calculated from CARB's ADAM site and hourly monitoring data.
[a] See Table 5. Annual arithmetic mean
[b] Annual arithmetic mean

[16] USEPA (2010a), p. 9.
[17] USEPA (2010a), p. 8.

For NO_2, SO_2, PM_{10} and CO, the highest values monitored during the most recent available three-year period (shown in bold in Table 4) will be used to represent ambient background concentrations in the project area (except for the Tier 3 and 4 NO_2 analyses as described above). For CEQA analyses of 24-hour and annual $PM_{2.5}$ impacts, the three-year average of the 98th percentile 24-hour monitored levels for the period between 2005 and 2009 will be used to represent project background because these values correspond to the method used for determining compliance with the federal $PM_{2.5}$ standards and are consistent with the guidance cited above. Table 5 shows the individual 98th percentile 24-hour averages used to calculate the 3-year averages shown in Table 4.

Table 5
98th Percentile 24-hour Average $PM_{2.5}$ Concentrations from Palm Springs

Period	2005	2006	2007	2008	2009
Individual 98th Pctl Monitored Concentrations	23.1[b]	15.8[b]	20.5[a]	17.1[a]	14.6[a]
3-year Averages			19.8	17.8	17.4

Notes:
[a] From *http://www.arb.ca.gov/adam/*
[b] Calculated from *http://www.epa.gov/air/data/index.html*, Monitoring Values Report.

3.8 Health Risk Assessment

A health risk assessment will be performed according to the Office of Environmental Health Hazard Analysis "Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments" (OEHHA, 2003). The HRA modeling will be prepared using CARB's Hotspots Analysis and Reporting Program (HARP) computer program (Version 1.4d, January 2011). The HARP model will be used to assess cancer risk as well as non-cancer chronic and acute health hazards. Because the TACs emitted by the project include PAHs, the HRA will address not only the inhalation pathway, but also the following three pathways: dermal absorption, soil ingestion, and mother's milk ingestion.[18]

The HARP model incorporates the ISCST3 model previously approved by USEPA. CARB offers a software program that allows AERMOD data to be imported into the HARP model, called HARP On-Ramp. The on-ramp will be used with most recent versions of AERMOD and HARP for the screening risk assessment.

[18] As discussed in Section 3.3, produce pathways are not included, per OEHHA guidance (2003).

3.9 Construction Air Quality Impact Analysis

The potential ambient impacts from air pollutant emissions during the construction of the project will be evaluated by air quality modeling that will account for the construction site location and the surrounding topography; the sources of emissions during construction, including vehicle and equipment exhaust emissions; and fugitive dust.[19]

Types of Emission Sources − Construction of the project can be viewed as three main sequential phases: site preparation; construction of foundations; and installation and assembly of power towers, boilers, steam turbines, and associated equipment. The construction impacts analysis will include a schedule for construction operation activities. Site preparation includes site excavation, excavation of footings and foundations, and backfilling operations.

Fugitive dust emissions from the construction of the project result from the following activities:

- Excavation and grading at the construction site;
- Onsite travel on paved and unpaved roads and across the unpaved construction site;
- Aggregate and soil loading and unloading operations;
- Raw material transfer to and from material stockpiles; and
- Wind erosion of areas disturbed during construction activities.

Engine exhaust will be emitted from the following sources:

- Heavy equipment used for excavation, grading, and construction of onsite structures;
- Water trucks used to control construction dust emissions;
- Diesel- and gasoline-fueled welding machines, generators, air compressors, and water pumps;
- Gasoline-fueled pickup trucks and Diesel-fueled flatbed trucks used onsite to transport workers and materials around the construction site;
- Transport of mechanical and electrical equipment to the project site;
- Transport of rubble and debris from the site to an appropriate landfill; and
- Transport of raw materials to and from stockpiles.

Emissions from a peak activity day will be modeled. Annual average emissions over the construction period will also be calculated and modeled for comparison with annual standards.

[19] As discussed above, the procedures described in this section will also be used to evaluate the impacts of mirror washing activities under CEQA.

Existing Ambient Levels – The background data discussed earlier will be used to represent existing ambient levels for the construction analysis as well as the analysis of the impacts of project operations.

Model Options – The AERMOD "OLMGROUP ALL" option will be used to estimate ambient impacts from construction emissions. The modeling options and meteorological data described above will be used for the modeling analysis.

The construction site will be represented as both a set of volume sources and a separate set of area sources in the modeling analysis. Emissions will be divided into three categories: exhaust emissions, mechanically generated fugitive dust emissions, and wind-blown fugitive dust emissions. Exhaust emissions and mechanically generated fugitive dust emissions (e.g., dust from wheels of a scraper) will be modeled as volume sources with a height of 6 meters. Wind-blown fugitive dust emissions, sources at or near the ground that are at ambient temperature and have negligible vertical velocity, will be modeled as area sources with a release height of 0.5 meters.

Combustion Diesel PM_{10} emission impacts from construction equipment will be evaluated to demonstrate that the cancer risk from construction activities will be below ten in one million at all receptors.

For the construction modeling analysis, the receptor grid will begin at the property boundary and will extend approximately one kilometer in all directions. Receptor spacing will be 60 meters, except for one tier of receptors along the project boundary composed of four segments with 25-meter spacing that extends out 100 meters.

3.10 Cumulative Air Quality Impact Analysis

To address CEC requirements, a cumulative air quality modeling impacts analysis of the project's typical operating mode will be performed in combination with other stationary source emissions sources within a six-mile radius that have received construction permits since January 1, 2010, or are in the permitting process. For each criteria pollutant, facilities having an emission increase of less than five tons per year are generally considered to be *de minimis*, and these facilities may be excluded from the cumulative impacts analysis after consultation with the CEC staff. Information on any recently constructed/permitted sources that might be appropriate for a cumulative air quality impact analysis (as defined above) will be requested from the Mojave Desert AQMD.

Upon receipt of sufficient information from the local air agencies to allow air dispersion modeling of the recently constructed/permitted non-project sources to be included in the cumulative air quality impact analysis, AERMOD will be used in a procedure similar to that described earlier in this protocol.

4. REPORTING

The results of the criteria pollutant and TAC modeling will be integrated into the application documents, and will include the information listed below.

- Project Description – Site map and site plan along with descriptions of the emitting equipment and air pollution control systems.

- Model Options and Input – Model options, screening and refined source parameters, criteria pollutant and TAC emission rates, meteorological data, and receptor grids used for the modeling analyses.

- Air Dispersion Modeling – Dispersion modeling results will include the following:

  - Plot plan showing emission points, nearby buildings (including dimensions), cross-section lines, property lines, fence lines, roads, and UTM coordinates;
  - A table showing building heights used in the modeling analysis;
  - Summaries of maximum modeled impacts; and
  - Model input and output files, including BPIP-PRIME and meteorological files as well as hourly ozone and NO_2 files used in demonstrating compliance with the 1-hour NO_2 standard, in electronic format on a compact disc, together with a description (README file) of all filenames.

- HRA – The HRA will include the following:

  - Descriptions of the methodology and inputs to the construction and operation AERMOD runs;
  - Tables of TAC emission rates and health impacts;
  - Figures showing sensitive receptor locations; and
  - Model input and output files in electronic format on a compact disc, together with a description (README file) of all filenames.

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Appendix A

Information on CTSCREEN Model

The CTDMPLUS and CTSCREEN Models

Complex terrain impacts may need to be modeled with more accuracy than that provided by AERMOD. The use of more refined modeling techniques is specifically addressed in USEPA's Appendix W[20] modeling guidance, as follows:

> *Since AERMOD treats dispersion in complex terrain, we have merged sections 4 and 5 of appendix W, as proposed in the April 2000 NPR [Notice of Proposed Rulemaking]. And while AERMOD produces acceptable regulatory design concentrations in complex terrain, it does not replace CTDMPLUS for detailed or receptor-oriented complex terrain analysis, as we have made clear in Guideline section 4.2.2. CTDMPLUS remains available for use in complex terrain. [p. 68225]*
>
> *4.2.2 Refined Analytical Techniques*
> *d. If the modeling application involves a well defined hill or ridge and a detailed dispersion analysis of the spatial pattern of plume impacts is of interest, CTDMPLUS, listed in Appendix A, is available. CTDMPLUS provides greater resolution of concentrations about the contour of the hill feature than does AERMOD through a different plume-terrain interaction algorithm. [p. 68233]*

CTSCREEN is the same basic model as CTDMPLUS, except that meteorological data are handled internally in a simplified manner. As discussed in the CTSCREEN users guide,[21]

> *Since [CTDMPLUS] accounts for the three-dimensional nature of plume and terrain interaction, it requires detailed terrain and meteorological data that are representative of the modeling domain. Although the terrain data may be readily obtained from topographic maps and digitized for use in the CTDMPLUS, the required meteorological data may not be as readily available.*
>
> *Since the meteorological input requirements of the CTDMPLUS can limit its application, the EPA's Complex-Terrain-Modeling, Technology-Transfer Workgroup developed a methodology to use the advanced*

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[20] 40 CFR 51 Subpart W, as amended November 9, 2005 at 70 FR 68218, "Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions."

[21] USEPA, EPA-600/8-90-087, "User's Guide to CTDMPLUS: Volume 2. The Screening Mode (CTSCREEN)," October 1990.

techniques of CTDMPLUS in situations where on-site meteorological measurements are limited or unavailable. This approach uses CTDMPLUS in a "screening" mode--actual source and terrain characteristics are modeled with an extensive array of predetermined meteorological conditions.

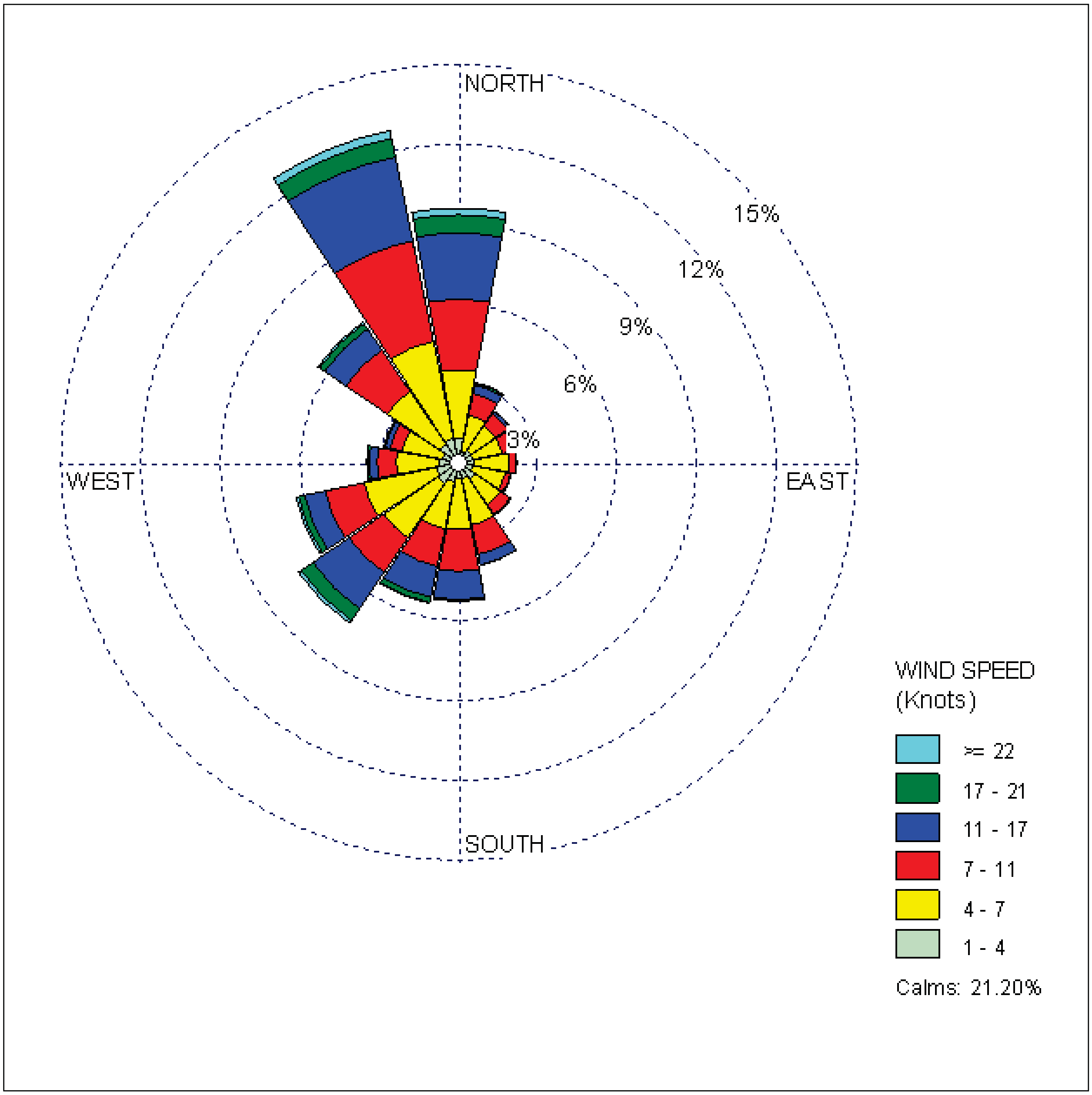
This CTDMPLUS screening mode (CTSCREEN) serves several purposes in regulatory applications. When meteorological data are unavailable, CTSCREEN can be used to obtain conservative (safely above those of refined models), yet realistic, impact estimates for particular sources.

Therefore, the use of the CTSCREEN version of CTDMPLUS is consistent with USEPA guidance.

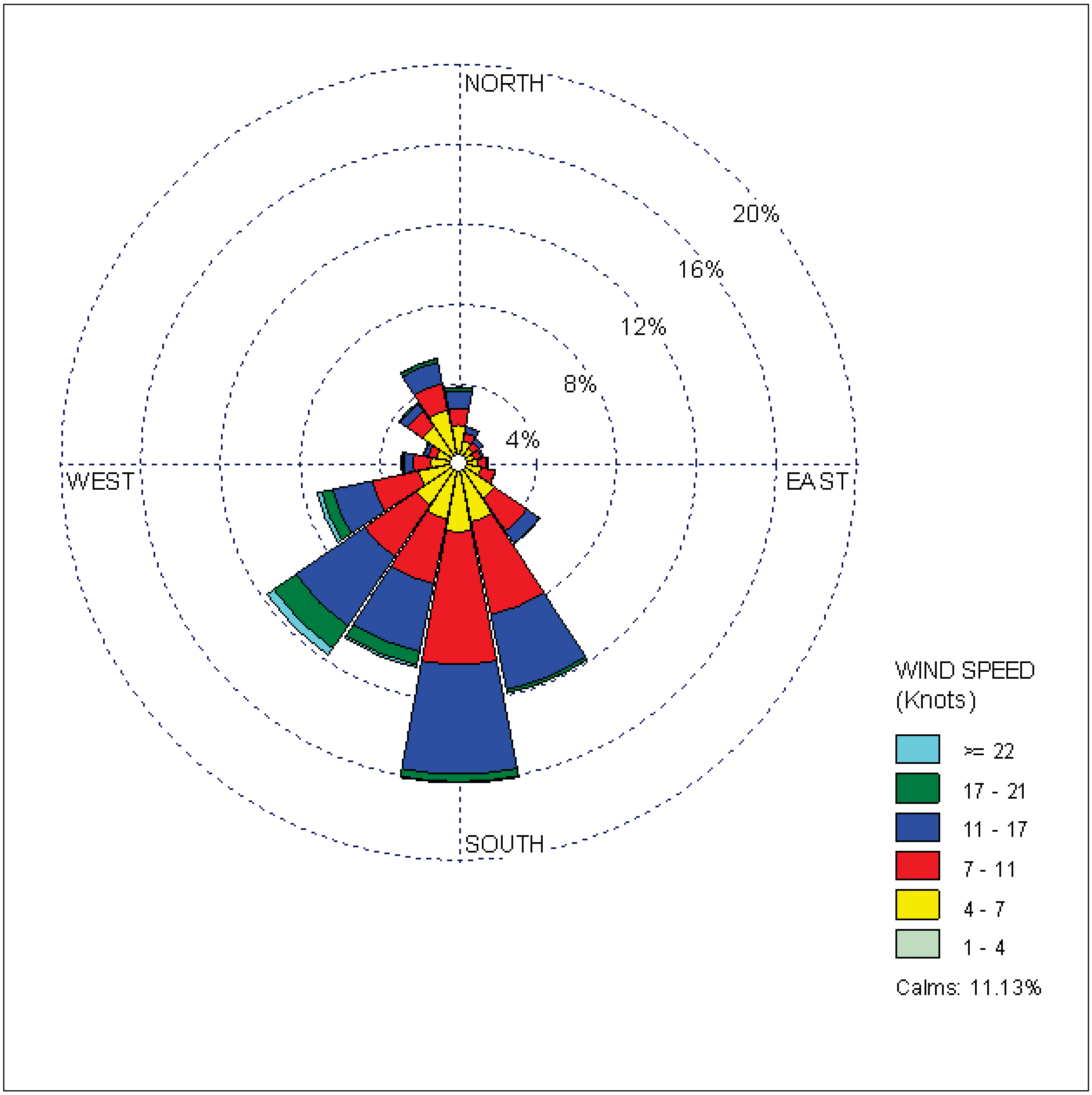
Appendix B

Composite Quarterly and Annual Wind Roses for Blythe, CA 2001 – 2009

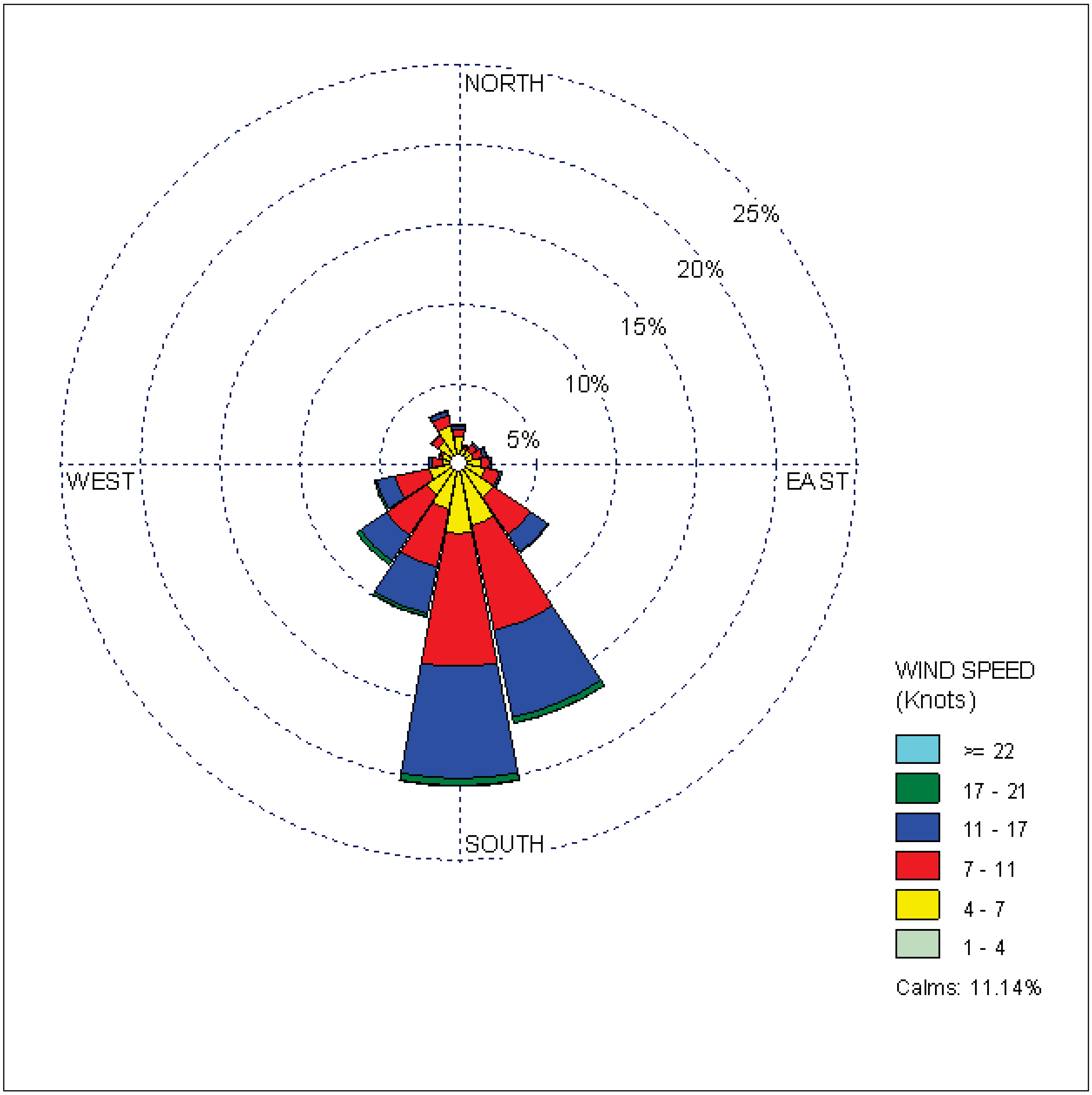
First Quarter, 2001 – 2009



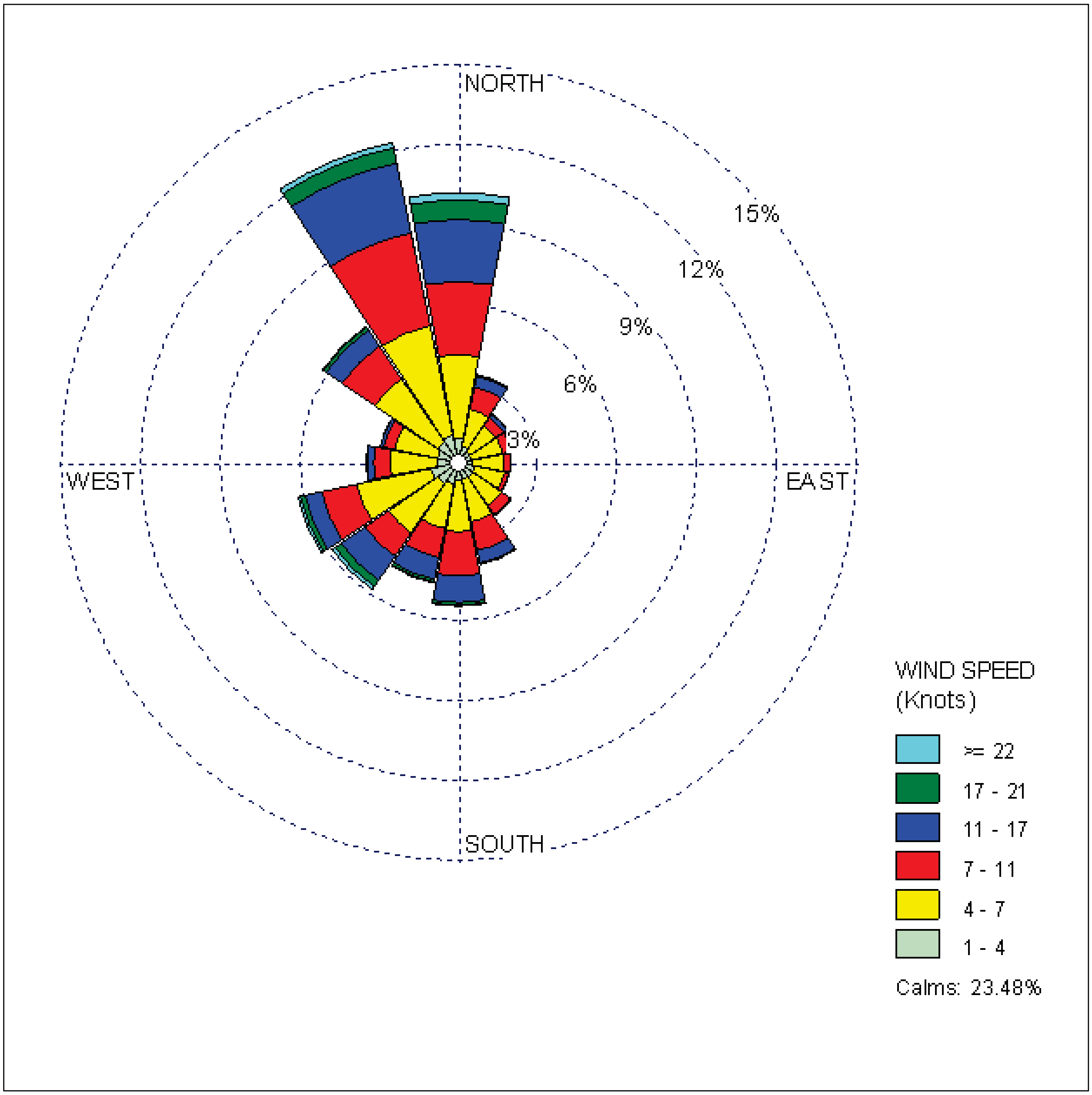
Second Quarter, 2001 – 2009



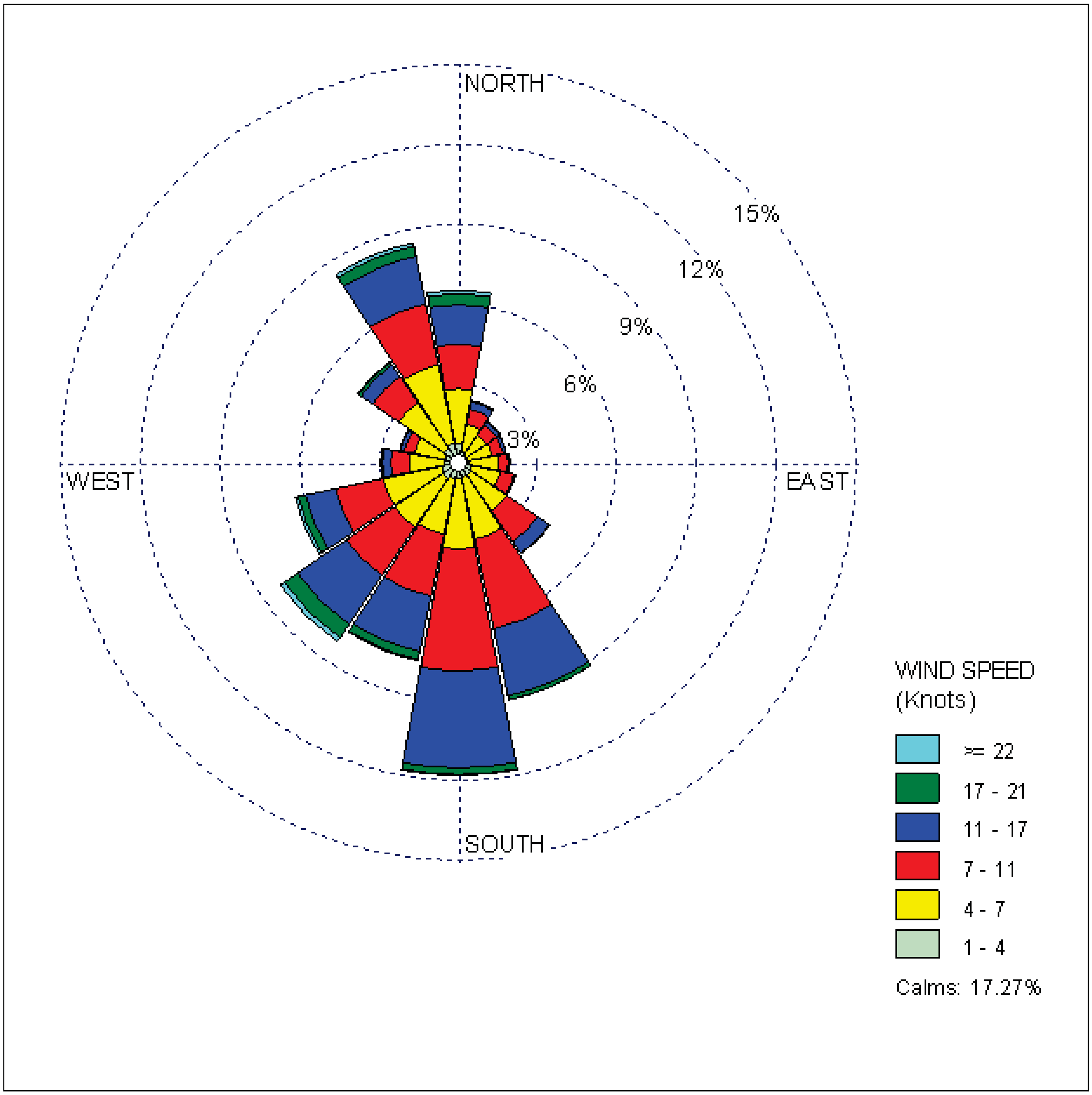
Third Quarter, 2001 – 2009



Fourth Quarter, 2001 – 2009



Annual, 2001 – 2009



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July 28, 2011

Memo to: Chris Anderson
MDAQMD

Gerry Bemis
CEC Siting Division

From: Tom Andrews

Subject: BrightSource Energy Rio Mesa Solar Electric Generating Facility
Responses to Comments on Modeling Protocol

Thank you for taking the time to review the May 27, 2011 air quality modeling protocol for the proposed Rio Mesa Solar Electric Generating Facility in Riverside County. The purpose of this memo is to explain how we plan to address your comments in the Application for Certification that is expected to be filed later this year.

1. Would the ambient data collected at the Twentynine Palms monitoring station be more representative of background ambient levels for the project site compared to the ambient monitoring stations proposed in the modeling protocol?

As discussed in the May 27, 2011 modeling protocol, we propose using ambient data collected over the three-year period from 2007-2009 for the monitoring stations shown in Table 1. This three-year period represents the most recent three-year period for which complete background ambient data sets are available for the project area.

Table 1
Background Ambient Air Quality Monitoring Stations

Pollutant(s)	Monitoring Station	Distance to Project Site
Ozone	Blythe, CA (Riverside County)	6 miles
PM_{10}, $PM_{2.5}$, NO_2, CO	Palm Springs, CA (Riverside County)	107 miles
SO_2	Victorville, CA (San Bernardino County)	163 miles

With regard to the background ambient data collected at a monitoring station located in Twentynine Palms, CA, based on our review of ambient data shown on the CARB and

EPA ambient air quality data websites, ambient PM_{10} data collection at the Twentynine Palms station stopped at the end of 2005. Therefore, the data collected at Twentynine Palms are not as current as the proposed data set. Neither the CARB nor EPA website showed $PM_{2.5}$, NO_2, CO, or SO_2 ambient data collected at this monitoring station. In addition, at a distance of approximately 85 miles from the project site, the Twentynine Palms monitoring station is not located significantly closer to the project site compared to the proposed Palm Springs monitoring station. Therefore, for the above reasons, we believe that PM_{10} data collected at the Palm Springs monitoring station should be used for the ambient air quality impact analysis that will be included as part of the application for certification and permit application for the RMS Project.

2. Please explain how the background ambient monitoring stations proposed in the modeling protocol are representative for the project site.

Table 1 lists the ambient monitoring stations proposed for the air quality modeling analysis for this project. While our preference would be to use ambient data collected at monitoring stations located closer to the project site, the only nearby ambient monitoring station is the Blythe ozone monitor. Because the proposed monitoring stations are all located in arid areas in Southern California, they are generally representative of the regional background levels for the project site. In addition to being representative, we believe it is equally important that background ambient data be conservative in terms of not underestimating background levels for a project site.

One of the more critical background ambient pollutants listed in the above table is ozone. This is because hourly background ozone levels will be used directly in the AERMOD air dispersion model to determine ambient NO_2 impacts due to the use of ozone limiting methods. For ozone, the ambient data are based on a monitoring station located only approximately 6 miles from the project site. For background NO_2, CO, PM_{10}, and $PM_{2.5}$ levels, we are proposing to use ambient data collected at the Palm Springs monitoring station. Because the Palm Springs station is located closer to large urbanized areas than the project site, it is likely that the background ambient levels measured at the Palm Springs monitoring station are higher than the levels at the project site[1]. Therefore, the use of these data is conservative and will not underestimate background levels for the project site. The same is true with the SO_2 ambient data collected at the Victorville monitoring station, which is also located closer to large urbanized areas than compared to the project site.

In addition to the above factors, it is important to remember that data collected from the ambient monitoring stations listed in Table 1 were also used for the air quality analyses performed for the following three recently approved solar power projects located near the RMS Project site:

[1] For example, 2003 to 2005 24-hr average PM_{10} levels at the Twentynine Palms monitoring station show maximum levels of 64, 40, and 53 $\mu g/m^3$, respectively, compared to 106, 78, and 64 $\mu g/m^3$ at the Palm Springs monitoring station. In addition, the number of days above the state 24-hr PM_{10} standard during 2003 to 2005 at the Twentynine Palms station were 3, 0, and 2, respectively, compared to 4, 2, and 2 at the Palm Springs station.

- Blythe Solar Power Project (09-AFC-6), CEC approval on 9/15/2010;
- Genesis Solar Energy Project (09-AFC-8), CEC approval on 9/29/2010; and
- Palen Solar Power Project (09-AFC-7), CEC approval on 12/15/2010.

Therefore, the use of the ambient background data collected at the monitoring stations listed above in Table 1 is consistent with other similar projects recently permitted by the CEC in this area.

For the above reasons, we believe the ambient data collected at the monitoring stations listed in Table 1 are appropriate for the air quality impact analysis that will be performed for the RMS Project.

3. It may not be appropriate to use the default assumption that 10% of the NOx in the exhaust of all project emission sources is emitted as NO_2.

Since we are attempting to use San Joaquin Valley APCD assumptions whenever possible in the modeling analysis for this Project, we propose the use of the equipment-specific NO_2 fractions provided in the San Joaquin Valley APCD's NO_2 modeling guidance.[2] The fractions to be used are summarized in Table 2.

Table 2
In-Stack NO_2/NOx Ratios

SJVAPCD Equipment Category	RMS Project Equipment	Ratio (%)
NG Boilers (all)	All boilers	10%
Diesel IC engines	Diesel emergency generators	20%
Diesel IC engine: 322 bhp water pump	Diesel fire pump engines	15.64%

4. The procedures used for filling in missing values in the NO_2 and ozone datasets may not be adequately conservative.

In the protocol, we proposed using the missing data filling procedures provided by the SJVAPCD on its website. After submitting the protocol, we discovered that the staffs of several air pollution control districts are working, through CAPCOA, to develop a CAPCOA-recommended procedure for filling in missing data. We consulted with the SJVAPCD staff on the status of the CAPCOA work, and Glenn Reed of the SJVAPCD provided draft guidance that is being submitted by a subcommittee for approval by CAPCOA. The SDAPCD, SJVAPCD, and other district staffs are collaborating on this draft guidance.

[2] SJVAPCD, "Assessment of Non-Regulatory Option in AERMOD," Appendix C, March 2011. Accessed at *http://www.valleyair.org/busind/pto/Tox_Resources/AssessmentofNon-RegulatoryOptioninAERMODAppendixC32111.xls*.

A copy of the draft guidance is attached. Our proposal to use linear interpolation for filling in single missing hours (p. 13 of the protocol) is consistent with the attached guidance (Section 1.1.1: "For a single hour, it is widely accepted that the best method of gap filling is the use of a liner interpolation of the hour before and after the missing hour."), so we are not proposing to make any changes to the missing data procedure for single hours. For multiple hours, the attached draft guidance provides the SDAPCD-developed procedure as one of the options (Section 1.1.2.2, Option 2). We propose using this procedure for multi-hour gaps.

5. The air quality ambient impact analysis should be performed using the most current version of the AERMOD model.

On April 13, 2011 EPA announced the replacement of AERMOD version 11059 with version 11103. Therefore, for the air quality impact analysis for the RMS Project, we will use AERMOD version 11103.

6. How will nearby existing stationary emission sources be accounted for in the modeling analysis?

As discussed in the modeling protocol (p.16 of the protocol), existing nearby stationary sources that will be examined as part of the RMS Project ambient impact analysis are non-project sources that have the potential to create a significant concentration gradient within the Proposed Project's modeled significant impact area. The Proposed Project's significant impact area is the area surrounding the project site where modeled impacts are above the corresponding EPA significant impact levels (SILs). For the RMS Project site, the only nearby existing stationary source that we are aware of that could potentially cause a significant concentration gradient within the modeled significant impact area for the RMS Project is the Blythe I Power Plant. As part of the air quality impact analysis for the RMS Project, we will examine the modeling results for the Blythe I Power Plant to see if there is an overlap between significant impact areas of the two projects (Blythe I and the RMS Project). If there is an overlap in these significant impacts, the Blythe I Power Plant impacts will be included in the RMS Project modeling analysis.

Thank you again for your comments on the modeling protocol. If you have any questions regarding these responses, please do not hesitate to contact us.

Attachment

cc: Todd Stewart, BrightSource Energy, Inc.
Andrea Grenier, Grenier & Associates, Inc.
Chris Ellison, Ellison Schneider & Harris

1 Gap Filling For Ozone and NO_2 Datasets

There are several reasons why missing data may exist in a dataset. They may be missing because of equipment malfunction, human error, or maintenance of the monitoring equipment. Nevertheless data gaps should be addressed to ensure that underestimation of NO_2 impacts are minimized. The following section provides several options that may be used to fill-in data gaps. **Please note:** The reviewing agency should be consulted to determine the appropriate method to be used.

This section only describes the method by which missing data can be filled and does not describe in any detail the procedure used to create/update ozone or NO_2 files used in ISCST3 or AERMOD.

1.1 Missing Data Procedures

Several approaches may be taken when addressing missing data, but each has its own issues from being too conservative or not conservative enough. Therefore, the reviewing agency will need to determine which method is appropriate for its regulatory needs.

1.1.1 Single Hour

For a single hour, it is widely accepted that the best method of gap filling is the use of a liner interpolation of the hour before and after the missing hour. This method is also known as the mean-before-after.

- Sum of the concentrations for the hour before and after
- Divide the sum by 2

1.1.2 Multiple Hours

For data gaps spanning more than a single hour no single acceptable method has been developed to date. Therefore the following section will describe several methods that may be used to fill-in gaps when more than a single hour is missing. **Please note:** The methods presented here are not an exhaustive list of procedures that may be acceptable to the reviewing agency. Therefore, the reviewing agency should be consulted before processing any dataset.

Note: The following methods are only intended to be used for multiple consecutive missing hours, unless otherwise noted. If only a single hour is missing it is recommended that the method described in Section 1.1.1 be used.

1.1.2.1 Simple Fill Methods

These methods are considered to be simple fill methods because they require a minimum amount of resources to be implemented and are more conservative in nature.

Gap filling Methods for Multi-hour Gaps:

1. Maximum Annual Hourly Concentration Over the Model Period (5yrs)
   - Determine maximum hourly concentration for each year
   - Select the highest hourly concentration over the modeled period
   - Use this value to fill-in all remaining missing hours
2. Maximum Annual Hourly Concentration – For each year modeled
   - Determine maximum hourly concentration for each year
   - Use this value to fill-in all remaining missing hours
3. Maximum Annual Average Hourly Concentration – Over the modeling period (5yrs)
   - Determine maximum hourly concentration for each year
   - Take the average of the maximum hourly concentration over the modeled period
   - Use this concentration to fill-in all remaining missing hours
4. Quarterly Maximum Concentration – For each year
   - Determine maximum hourly concentration for each quarter (1st Qtr = Jan - March, 2nd Qtr = April – June, 3rd Qtr = July – Sept, 4th Qtr = Oct – Dec)
   - Use each quarter's maximum concentration to substituted for any missing data within that quarter until all missing data is filled
5. Monthly Maximum Concentration
   - Determine maximum hourly concentration for each month
   - Use each month's maximum concentration to fill gaps for any missing data within that month until all missing data is filled.

1.1.2.2 Complex Fill Methods

The method described in this section are considered complex in nature since they are resource intensive and may require some programming or expertise in meteorology and using spreadsheets. Additionally, this method provides a more realistic interpolation of the actual missing data because it accounts for the diurnal and seasonal change in ozone and NO_2 concentration.

Gap Filling Methods:

1. Monthly Hourly Concentration - Option 1 (For each year)
   - For each month determine the maximum concentration for each hour (1, 2, 3, …) of the day. For each month you should have 24 values.

- For each missing hour within a month use the corresponding maximum hourly concentration.
- Perform the above steps until all hours are filled.
- Any missing hour will be filled in manually

2. Monthly Hourly Concentration - Option 2 (For each year)
    a. Fill any single missing hour with the maximum of the:
        i. Preceding hour
        ii. Succeeding hour
        iii. Same hour of day on previous day
        iv. Same hour of day on succeeding day

       If there is missing data for either iii and/or iv, use only the maximum of the available data to fill the missing hour (both a and b are guaranteed to be present since only single missing hours are filled in this step). Note that the most likely scenario for both c and d to be missing is for years when the monitor is calibrated at the same hour each day. In this case, the 30-day rolling average (see step b) for that hour will also not be available.

    b. For hours that are not filled by step a (all periods with more than one hour missing), fill the missing hour with the maximum for that hour of day for a 30-day rolling period centered on the hour (i.e., for the 15 preceding days and the 15 succeeding days). Note that 30-day rolling period will extend into the preceding and succeeding year at the start or end, respectively, of the modeling period.
    c. For hours not filled by step b, fill the missing data with the maximum of the 30-day rolling period for the preceding or succeeding hour.
    d. Any hours not filled by steps a–c, are likely periods with more than a month of missing data for all hours. These will be filled on a case-by-case basis.
    e. **For NO_2 File Only** - Check all filled hours for which the filled concentration is higher than the maximum monitored concentration recorded for that day (for a complete day of missing data, the maximum monitored concentration is considered zero for purposes of this comparison). If the filled concentration is higher than the appropriate nth highest daily maximum monitored concentration for the calendar year for determining compliance with federal 1-hour standard (e.g., for 351 or more days of valid data, the 8^{th} highest daily maximum is the appropriate value), then replace filled concentration with the appropriate nth highest daily

maximum to fill that hour. Note: This prevents the filling procedure from changing the nth highest daily maximum for the year.

Tom W. Andrews

From: Tom W. Andrews
Sent: Wednesday, August 24, 2011 11:24 AM
To: canderson@mdaqmd.ca.gov
Cc: Tom W. Andrews
Subject: Rio Mesa SEGF air quality modeling

Chris:

Per our telecon today, we understand that it is OK to go forward with the air quality impact modeling for the proposed Rio Mesa Solar Electric Generating Facility based on the May 2011 modeling protocol submitted to the District with the changes/corrections discussed in the July 28, 2011 letter to the District. These changes are:

- Rather than a default NO2/NOx ratio of 10%, we will perform the modeling using the NO2/NOx ratios in the San Joaquin Valley APCD modeling guidelines (see July 28, 2011 letter, response to question number 3).
- We will perform the modeling using the 1-hr NO2 and ozone missing data substitution method per CAPCOA guidelines (see July 28, 2011 letter, response to question number 4).
- We will perform the modeling using the current version of the AERMOD model - version 11103 (see July 28, 2011 letter, response to question number 5).
- We will examine the modeling results for the Blythe I Power Plant to see if there is an overlap in the significant impacts areas for the two projects (Blythe I vs. Rio Mesa SEGF). If there is such an overlap, the Blythe I Power Plant modeled ambient impacts will be included in the Rio Mesa SEGF modeling results (see July 28, 2011 letter, response to question number 6).

In addition to the above changes, 2010 ambient background monitoring data is now available for the monitoring stations identified in the May 2011 modeling protocol. Therefore, rather than using background ambient monitoring data for the period from 2005 to 2009 (as discussed in the May 2011 modeling protocol), we will perform the modeling using ambient monitoring data for the period from 2006 to 2010. With this change to the five-year period for background ambient data, we will perform the modeling using met. data for the period from 2006 - 2010 (to match the background monitoring data) rather than the period of 2005 – 2009 discussed in the May 2011 modeling protocol. If you have any questions, please let us know.

Tom W. Andrews

From: Gerry Bemis <Gbemis@energy.state.ca.us>
Sent: Tuesday, August 16, 2011 12:00 PM
To: Tom W. Andrews
Cc: Joseph Hughes
Subject: Re: Rio Mesa Solar Electric Generating Facility - Air QualityModeling

Thanks, Tom...... this looks good.

If construction activities include portable generators, you need to include them in the construction modeling. These were omitted in some of the earlier AQ modeling for other solar projects. Having such large areas of construction, it is reasonable that not all construction-related electricity would come from SCE, or whom ever serves the area.

-- Gerry

Gerald R. Bemis
Air Resources Supervisor I
Air Quality/Public Health/T-line
Safety & Nuisance Unit
California Energy Commission
1516 Ninth Street, MS 40 Sacramento, CA 95814
(916) 654-4960

>>> "Tom W. Andrews" <TAndrews@sierraresearch.com> 8/16/2011 11:49 AM >>>
Gerry:

We are very close to beginning the air quality impact modeling for the proposed Rio Mesa Solar Electric Generating Facility. We would like to perform this modeling based on the enclosed May 2011 modeling protocol with the changes/corrections discussed in the enclosed July 28, 2011 letter. These changes are:

- Rather than a default NO2/NOx ratio of 10%, we will perform the modeling using the NO2/NOx ratios in the San Joaquin Valley APCD modeling guidelines (see response to question number 3).
- We will perform the modeling using the 1-hr NO2 and ozone missing data substitution method per CAPCOA guidelines (see response to question number 4).
- We will perform the modeling using the current version of the AERMOD model - version 11103 (see response to question number 5).
- We will examine the modeling results for the Blythe I Power Plant to see if there is an overlap in the significant impacts areas for the two projects (Blythe I vs. Rio Mesa SEGF). If there is such an overlap, the Blythe I Power Plant modeled ambient impacts will be included in the Rio Mesa SEGF modeling results (see response to question number 6).

In addition to the above changes, 2010 ambient background monitoring data is now available for the monitoring stations identified in the modeling protocol. Therefore, rather than using background ambient monitoring data for the period from 2005 to 2009 (as discussed in the May 2011 modeling protocol), we will perform the modeling using ambient monitoring data for the period from 2006 to 2010. With this change to the five-year period for background ambient data, we will perform the modeling using met. data for the period from 2006 - 2010 (to match the background monitoring data) rather than the period of 2005 – 2009 discussed in the May 2011 modeling protocol. Please let us know if with the above changes it is OK to begin the modeling for this proposed project. If you have any questions, please let us know.