Modeling Report for SO_2 NAAQS Designation for Tucson Electric Power Co. (TEP)-Springerville Generating Station

Submitted To:

Environmental Protection Agency

Region 9

Prepared By:

Arizona Department of Environmental Quality
Air Quality Department

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1.0 Introduction

On August 21, 2015, U.S. Environmental Protection Agency (EPA) finalized and promulgated the sulfur dioxide (SO_2) Data Requirements Rule (DRR) (80 FR 51052), which requires the characterization of ambient SO_2 air quality around SO_2 emission sources emitting 2,000 or more tons per year of SO_2. The Arizona Department of Environmental Quality (ADEQ) identified five sources that needed to be addressed for the SO_2 DRR. Those sources include two copper smelters and three coal-fired power plants. EPA has designated the two copper smelters areas (Hayden and Miami) as nonattainment areas in the first round of designations. The three coal-fired power plants include the Tucson Electric Power Springerville Generating Station (TEP-Springerville), the Arizona Public Service Cholla Generating Station (APS-Cholla), and Arizona Electric Power Cooperatives Apache Generating Station (AEPCO-Apache). As required, ADEQ must characterize air quality in the areas impacted by the three power plants and EPA expects to use this data to designate the areas as meeting or not meeting the 2010 SO_2 standard.

This SO_2 DRR provides air agencies the flexibility to characterize air quality using either modeling of actual source emissions or using appropriately sited ambient air quality monitors. ADEQ decided to evaluate air quality using air dispersion modeling for the three coal-fired power plants. Specifically, ADEQ characterized ambient air quality in areas proximate to the three sources by using actual hourly emissions and meteorology for the most recent 3 years (2012, 2013 and 2014). As required by DRR, for source areas that an air agency decides to evaluate through air quality modeling, the air agency must provide a modeling protocol and a modeling analysis to the EPA Regional Administrator by July 1, 2016 and January 13, 2017, respectively. ADEQ submitted a modeling protocol to EPA Region 9 for review on July 1, 2016 and the protocol was approved by email on December 05, 2016. This modeling report presents the results of the modeling conducted in accordance with the approved modeling protocol for areas around the TEP-Springerville facility. For the other two sources, please see separate modeling report.

As described in the approved protocol, the modeling work performed in accordance with the Draft EPA's SO_2 NAAQS Designations Modeling Technical Assistance Document (hereafter, "EPA Designation Modeling TAD" (U.S. EPA, 2016a). This report is organized as follows:

- Section 2 provides general description of TEP-Springerville power plant including processes, topography and climate;
- Section 3 provides a discussion on the determination of the modeling domain, sources to explicitly model and the receptor grids;
- Section 4 provides a discussion on the model selection;

- Section 5 provides detailed source inputs, including source configuration, source emissions, source release parameters, and urban/rural determination;
- Section 6 provides a discussion on the selection and processing of meteorological data;
- Section 7 provides a discussion on the determination of background concentrations; and
- Section 8 provides a summary of model results.

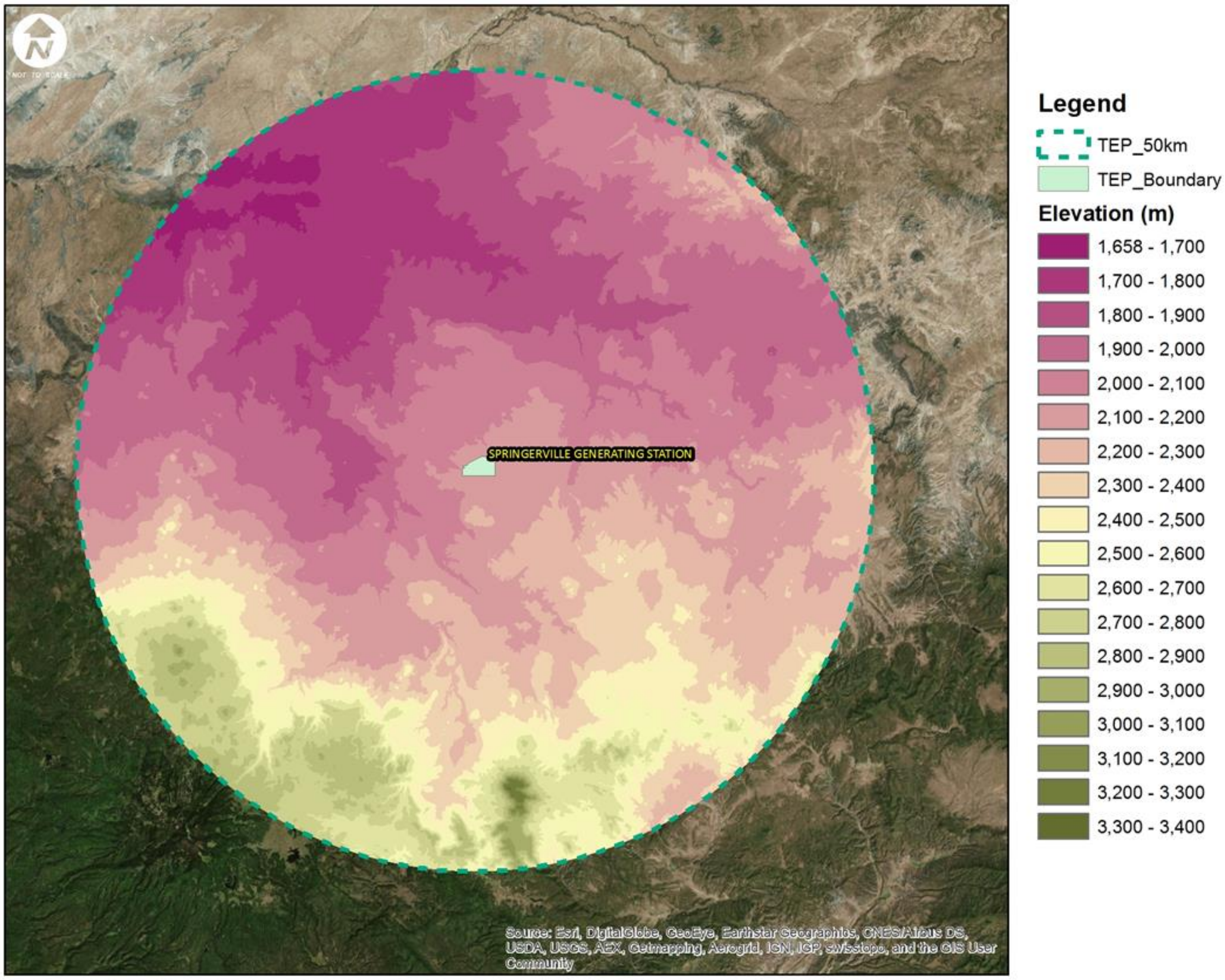
2.0 General Description of Sources

Tucson Electric Power Company (TEP)-Springerville Generating Station, is located in Apache County, approximately 15 miles north of Springerville, Arizona. TEP-Springerville is a steam electric generating station. The Standard Industrial Classification (SIC) is 4911. The station consists of four coal-fired generating units designated as Unit 1, Unit 2, Unit 3 and Unit 4. All four units burn coal during normal operations except the period of start-up and flame stabilization for which fuel oil including bio-diesel is fired. Under normal full load operating conditions, the net megawatts (MW) ratings at the units are 387 MW, 390 MW, 417 MW, and 415 MW, respectively. TEP-Springerville supplies electric power for sale to customers. Unit 1 and Unit 2 boilers are tangentially-fired units and burn coal. Unit 3 and Unit 4 boilers are dry bottom wall-fired units and are primarily fired with coal.

The climate is hot during summer and very cold and dry during winter. The warmest month of the year is July with an average maximum temperature of 82.40 degrees Fahrenheit, while the coldest month of the year is December with an average minimum temperature of 15.40 degrees Fahrenheit. The annual average precipitation in the area is 11.99 inches. The wettest month of the year is August with an average rainfall of 3.11 inches.

The terrain features within 50 km from the facility are mostly flat. Escudilla Mountains are located about 40 km south of the facility. Escudilla Peak is Arizona's third highest mountain, at 10,912 feet (3326 m) above sea level. The topography of the local area is depicted in Figure 2-1.

Figure 2-1 Topography of the Area Surrounding TEP-Springerville



3.0 Modeling Domain

Selection of the modeling domain is dependent on the number of sources to explicitly model and size of the receptor network in order to account for the areas of impact (U.S. EPA, 2016a). The modeling domain should at a minimum include the sources that are most likely to cause or contribute to NAAQS violations in the area. In the modeling exercise, all modeled receptors should exhibit modeled attainment of the NAAQS.

In this modeling analysis, the modeling domain is centered at the TEP-Springerville power plant and extended for 50 kilometers (km) from the facility fence line.

3.1 Determining Sources to Model

Per EPA's SO_2 NAAQS Designations Modeling TAD (U.S. EPA, 2016a), the determination of modeling domains and number of sources to consider for modeling should begin with analyzing the spatial distributions of sources that meet or exceed the emissions threshold established in the data requirements rule. The modeling domains should be centered over these sources.

ADEQ has identified SO_2 sources within the 50-km modeling domain for the TEP-Springerville power plant. Figure 3-1 is a geographical representation of these sources. Table 3-1 is an inventory of the individual sources within the 50-km modeling domain for TEP-Springerville. As shown in Table 3-1, Salt River Project Coronado Generating Station (SRP-CGS) is the only major source near TEP-Springerville. SRP-CGS consists of two pulverized coal-fired, electric utility steam boilers (Units 1 and 2). Units 1 and 2 are dry-bottom turbo-fired boilers with a net rated output of 380 MW and 382 MW, respectively, primarily firing low-sulfur western coals.

As discussed in the EPA's Designations Modeling TAD (U.S. EPA, 2016a), the determination of specific sources (those sources that are below the emissions threshold) to explicitly model should consider emissions, source parameters, and proximity to the target source are items for consideration. SRP-CGS, consisting of two tall stacks of 122 m, is located around 18 miles northwest of TEP-Springerville (Figure 3-1). Although ADEQ does not expect that SRP-CGS will cause significant concentration gradients in the vicinity of TEP-Sringerville, it is not clear whether the cumulative impacts from SRP-CGS and TEP-Springerville would cause a NAAQS violation in some areas between the two sources. Moreover, the background concentration as proposed in Section 7 may not sufficiently reflect the impacts from major SO_2 sources such as SRP-CGS. Therefore, to be safe, ADEQ incorporated SRP-CGS into the TEP-Springerville designation modeling. The modeling parameters for SRP-CGS will be discussed later in Section 5.

Figure 3-1 Point Sources within 50-km Modeling Domain of TEP-Springerville

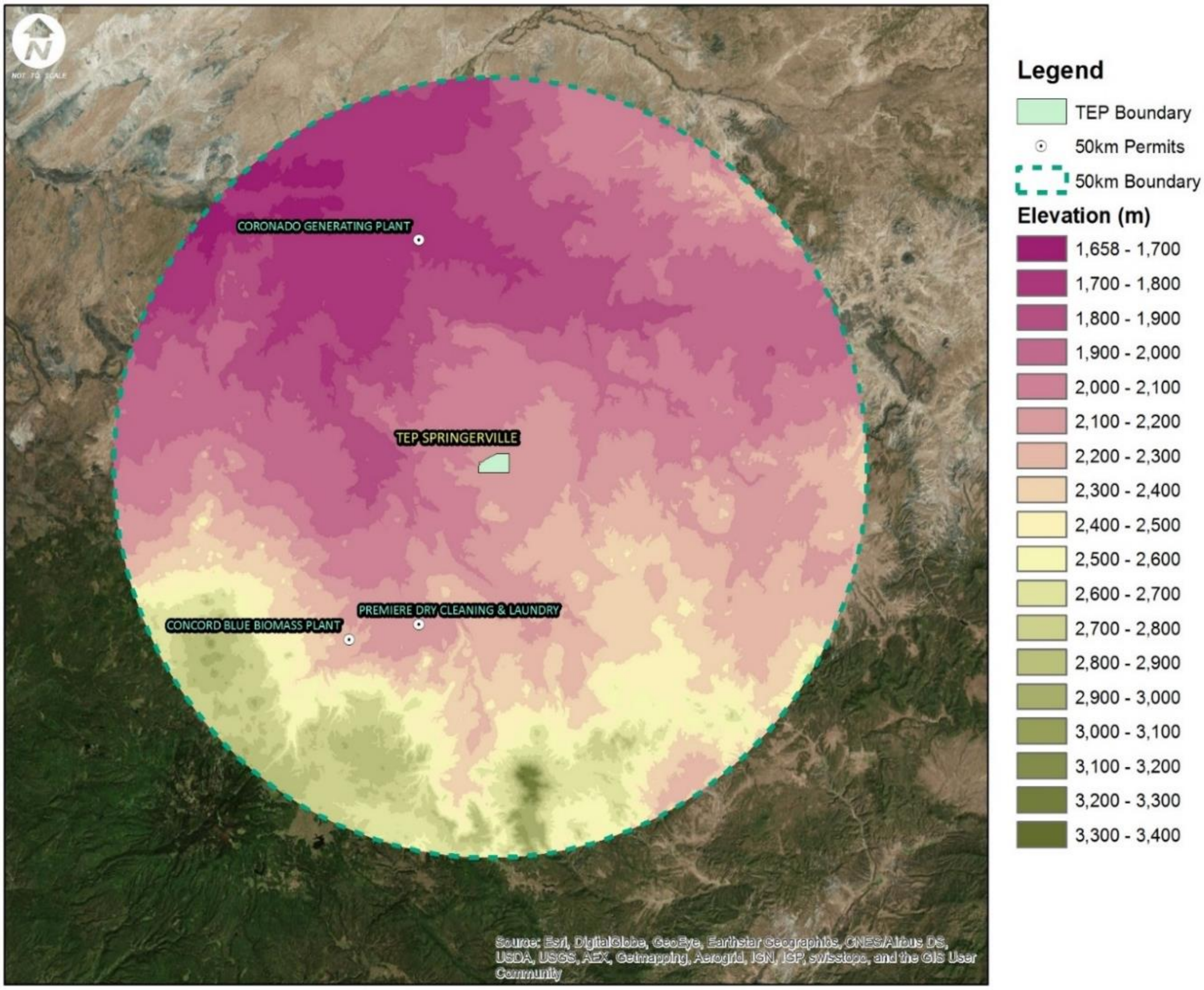


Table 3-1 Point Sources within 50 km Modeling Domain of TEP-Springerville (Permitted Sources)

County	Site Name	Facility Type	Latitude	Longitude	2012 SO_2 (TPY)	2013 SO_2 (TPY)	2014 SO_2 (TPY)
Apache	Springerville Generating Station	Power Plant	34.312	-109.172	6160.36	7944.67	6221.04
Apache	Coronado Generating Station	Power Plant	34.576	-109.275	1219.31	843.43	908.12
Apache	Premier Dry Cleaning & Laundry	Dry Cleaning and Laundry	34.132	-109.275	0	0	0
Apache	Concord Blue Biomass Plant	Electrical Energy Production from Biomass	34.115	-109.375	0	0	0

3.2 Receptor Grid

ADEQ chose a modeling domain centered on TEP-Springerville facility and extended that to 50 km from facility fence line to make sure that the high model concentrations are captured. In this case, a total of 27,700 receptors are placed in the approximately 108 km by 106 km modeling domain for TEP-Springville power plant facility.

ADEQ used the following receptor spacing:

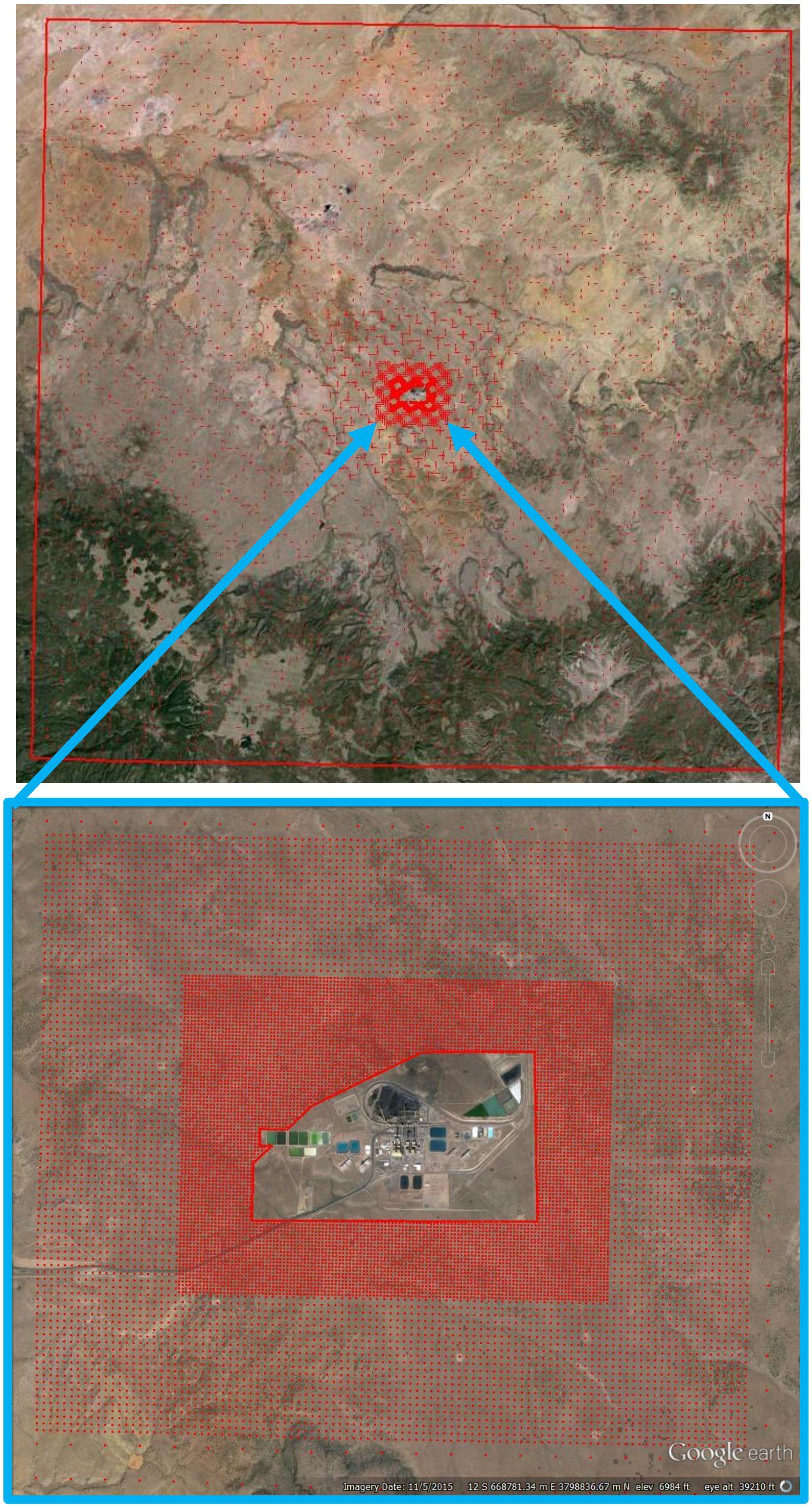
- Receptors along ambient air boundary (AAB) at a spacing of 25 m;
- Receptors from AAB to 1 km at a spacing of 100 m;
- Receptors from 1 km to 5 km away from AAB at a spacing of 200-500 m;
- Receptors from 5 km to 20 km away from AAB at a spacing of 500-1,000 m;
- Receptors from 20 km to 50 km away from AAB at a spacing of 1,000-2,500 m.

ADEQ used EPA's AERMAP software tool (version 11103; U.S. EPA, 2011) to estimate receptor elevations and hill heights. AERMAP is a terrain preprocessor for AERMOD and uses the following procedure to assign elevations to each receptor:

- For each receptor, the program searches through the U.S. Geological Survey (USGS) input files to determine the two profiles (longitude or easting) that straddle this receptor;
- For each of these two profiles, the program then searches through the nodes in the USGS input files to determine which two rows (latitudes or northings) straddle the receptor;
- The program then calculates the coordinates of these four points and reads the elevations for these four points;
- A 2-dimensional distance-weighted interpolation is used to determine the elevation at the receptor location based on the elevations at the four nodes determined above.

ADEQ used 10 meter USGS National Elevation Dataset (NED) data as inputs to AERMAP. The NED data are produced from digitized map contours or from manual or automated scanning of aerial photographs. A 1/3 arc-second NED data file consists of a regular array of elevations referenced horizontally in the UTM (Universal Transverse Mercator) coordinate system, with a uniform horizontal spacing of approximately 10 meters. The NED data used for this analysis are based on the 1983 North American Datum (NAD83). The modeled receptors for TEP-Springerville are depicted in Figure 3-2.

Figure 3-2 Modeled Receptors for TEP-Springerville in 50km



4.0 Model Selection

In 2005, the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) was promulgated as the EPA's preferred near-field dispersion modeling for a wide range of regulatory applications in all types of terrain based on extensive developmental and performance evaluation(40 CFR 51, Appendix W) (U.S. EPA, 2005). AERMOD is EPA's preferred model for area designations under the 1-hour SO_2 primary NAAQS.

ADEQ used AERMOD (version 15181; U.S. EPA, 2014a) to predict ambient concentrations in simple, complex and intermediate terrain. ADEQ is aware that EPA just released AERMOD and AERMET Models Version 16216 on December 20, 2016 (U.S. EPA, 2016b). However, it is unlikely that the changes made in the new version will affect the TEP-Springerville designation modeling.

There are two input data processors that are regulatory components of the AERMOD modeling system: AERMET (version 15181; U.S. EPA, 2014b), a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and AERMAP (version 11103; U.S. EPA, 2011), a terrain data preprocessor that incorporates complex terrain using USGS Digital Elevation Data. Other non-regulatory components of this system include: AERSURFACE (Version 13016; U.S. EPA, 2013a), a surface characteristics preprocessor, and BPIPPRIM, a multi-building dimensions program incorporating the Good Engineering Practice technical procedures for PRIME applications (U.S. EPA, 2004).

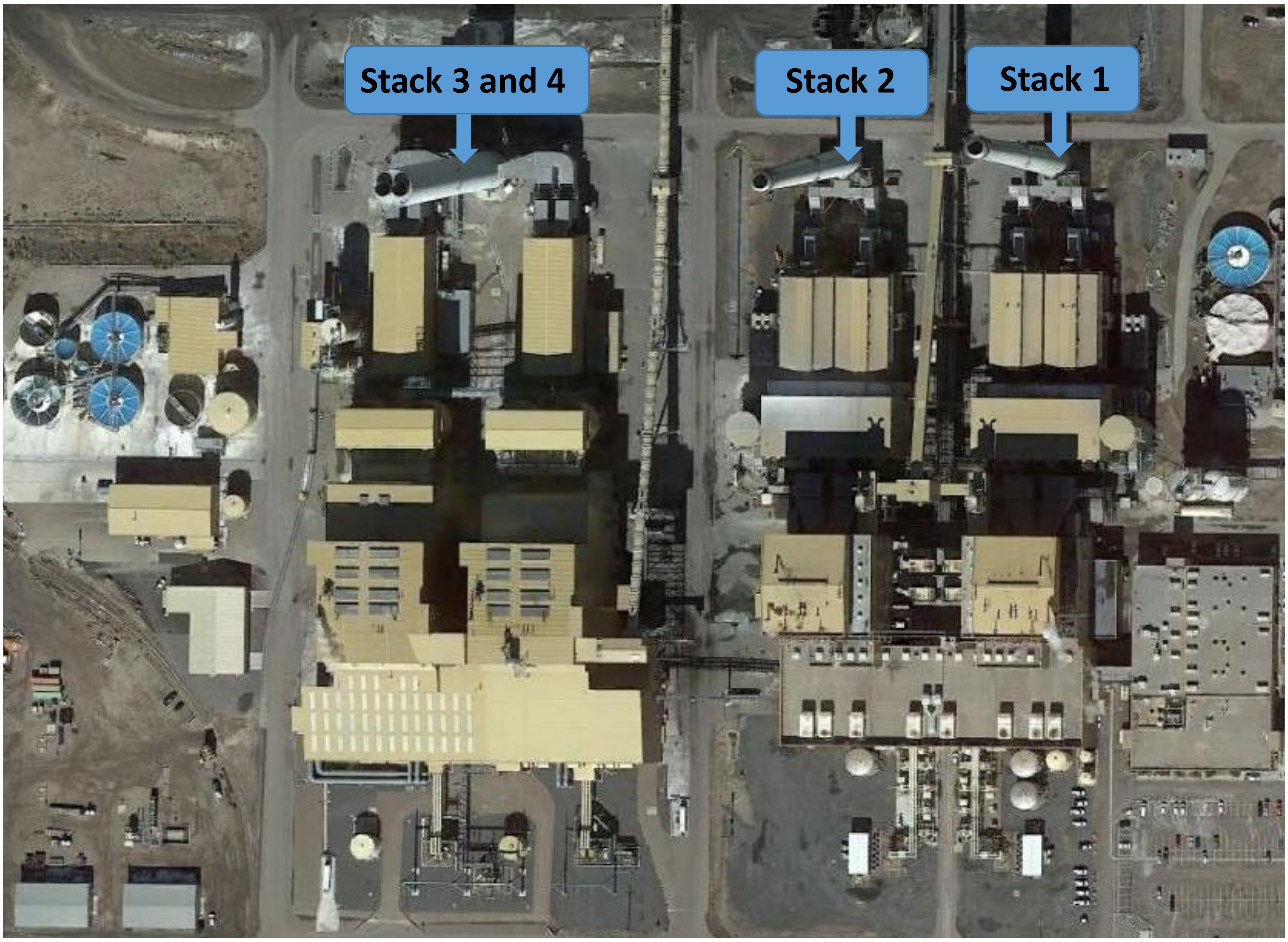
ADEQ used the regulatory default option. This option commands AERMOD to:

- Use the elevated terrain algorithms requiring input of terrain height data for receptors and emission sources;
- Use stack tip downwash (building downwash automatically overrides);
- Use the calms processing routines;
- Use buoyancy-induced dispersion;
- Use the missing meteorological data processing routines.

5.0 Source Inputs

This section discusses source characterization to develop appropriate source inputs for dispersion modeling with AERMOD modeling system. SO_2 emissions are released to the atmosphere from four stacks at TEP power plant as shown in Figure 5-1.

Figure 5-1 Modeled Emission Sources in TEP-Springerville Power Plant



5.1 Source Inputs for TEP-Springerville

5.1.1 Emission Data

In SO_2 designation modeling with AERMOD, the real-time 2012-2014 SO_2 emissions and stack parameter data measured by continuous emission monitoring system (CEMS) are applied to obtain accurate modeling results. The hourly SO_2 emissions data being modeled are consistent with those reported from EPA Air Market database (https://ampd.epa.gov/ampd/). As discussed in EPA Designation Modeling TAD (U.S. EPA, 2016a), hourly SO_2 emissions data are input into AERMOD using the HOUREMIS keyword in the source pathway of the AERMOD control file (AERMOD.INP).

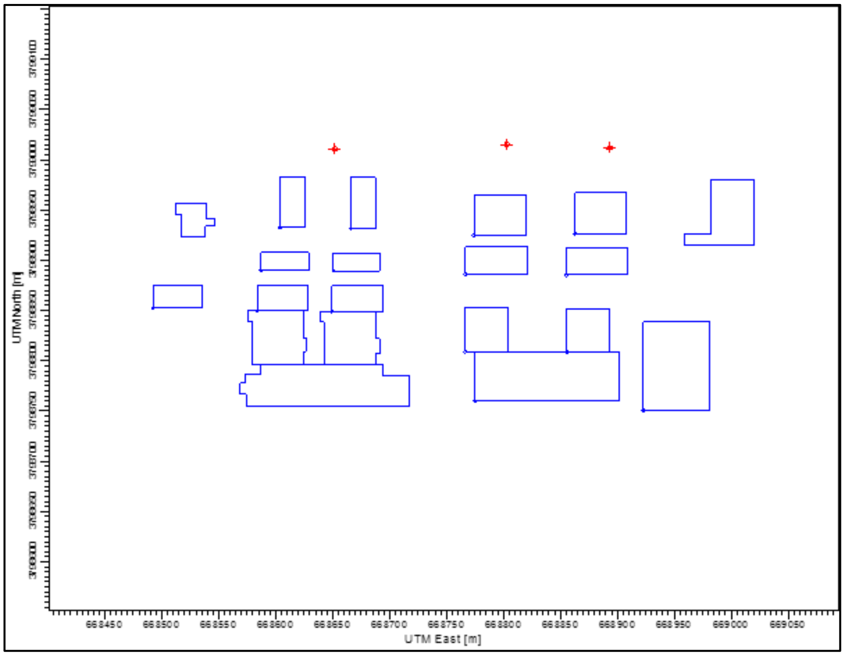
ADEQ obtained the CEMS data from TEP. After carefully reviewing the data, ADEQ did not identify any missing hours and therefore no data substitution is necessary in the TEP modeling inputs.

5.1.2 Emission Release Parameters

For the purposes of modeling with actual emissions to characterize air quality, ADEQ followed the EPA's recommendation and used actual stack heights, instead of calculating Good Engineering Practice (GEP) stack height. In addition, hourly emissions parameters measured by CEMS (including exhaust temperature, exit velocity and exit flow rate) were used as source inputs, which is most closely represent the facility actual emission conditions.

Downwash effects were considered for TEP-Springerville modeling by using BPIPPRM. BPIPPRM requires a digitized footprint of the facility's buildings and stacks. The source must evaluate the position and height of buildings relative to the stack position in the building wake effects analysis. ADEQ obtained the information of actual heights of existing structures from TEP. The simplified layout used in modeling for TEP-Springerville is shown in Figures 5-2.

Figure 5-2 Simplified Facility Layout for TEP-Springerville



ADEQ identified coordinates for the stacks by mapping the site buildings to rectified aerial photographs of the site and projected UTM coordinates of each stack to UTM Zone 12. These coordinates are based on the NAD83.

In summary, Table 5-1 presents the parameters modeled for the four stacks at TEP-Springerville.

Table 5-1 Modeling Parameters for TEP Stacks

Stack	UTM Easting (m)	UTM Northing (m)	Base Elevation (m)	Stack Height (m)	Exit Diameter (m)	Exit Velocity (m/s)	Exhaust Temp. (ºK)	Exit Flow Rate
Stack 1	668893.00	3799012.00	2127.35	152.4	6.096	CEMS	CEMS	CEMS
Stack 2	668803.06	3799015.28	2127.52	152.4	6.096	CEMS	CEMS	CEMS
Stack 3	668651.60	3799010.72	2125.71	152.4	6.096	CEMS	CEMS	CEMS
Stack 4	668651.60	3799010.72	2125.71	152.4	6.096	CEMS	CEMS	CEMS

5.2 Source Inputs for SRP-CGS

ADEQ adopted conservative modeling approaches to evaluate the maximum impacts of CGS emissions in the vicinity of TEP-Springville site. The emission parameters of CGS were set to “fixed” values as shown in Table 5-2.

Those modeled emission parameters were determined based on enforceable emission limits that were established through best available retrofit technology (BART) under Arizona's regional haze State Implementation Plan (SIP).

Table 5-2 Modeling Parameters for CGS Impact Evaluation

Stack	UTM Easting (m)	UTM Northing (m)	Base Elevation (m)	Stack Height (m)	Exit Diameter (m)	Emission Rate (g/s)	Gas Exit Temp. (ºK)	Gas Exit Flow Rate (m^3/s)	Gas Exit Velocity (m/s)
Unit 1	658427.44	3827741.06	1765.89	121.9	7.388	47.262	329.261	772.3026	18.014
Unit 2	658437.80	3827408.07	1767.50	121.9	7.401	44.792	329.261	774.8535	18.014

5.3 Urban/Rural Determination

Dispersion coefficients for air quality modeling were selected based on the land use classification technique suggested by Auer (Auer, 1978), which is EPA's preferred method. The classification determination involved assessing land use by Auer's categories within a 3-km radius of the proposed site. A source selected urban dispersion coefficients if greater than 50 percent of the area consists of urban land use types; otherwise, rural coefficients apply.

Following the 2016 EPA Designation Modeling TAD (U.S. EPA, 2016a), ADEQ classified the land use of the area using the land-use procedure set forth in EPA's "Guideline on Air Quality Models" (GAQM) (U.S. EPA, 2005). This approach requires determining the amount of specific types of land use categories within a 3-km radius circle centered on the source; if the total land use (as defined by Auer) is classified as 50% or more "urban" then the area is designated as urban; otherwise it is designated as rural.

Land use (taken from the U.S. Geological Survey (USGS) National Land Cover Data (NLCD) 1992 archives) was examined for the 3-km radius circle, and total of each land use category were calculated. These land use categories were then correlated to the categories as established by Auer (Auer, 1978), and the amount of urban and rural land use within 3 km of TEP-Springerville were calculated. The area near TEP-Springerville that was examined is depicted in Figure 5-3, while the detailed results of the analysis are presented in Table 5-2.

Figure 5-3 Land Use near TEP-Springerville

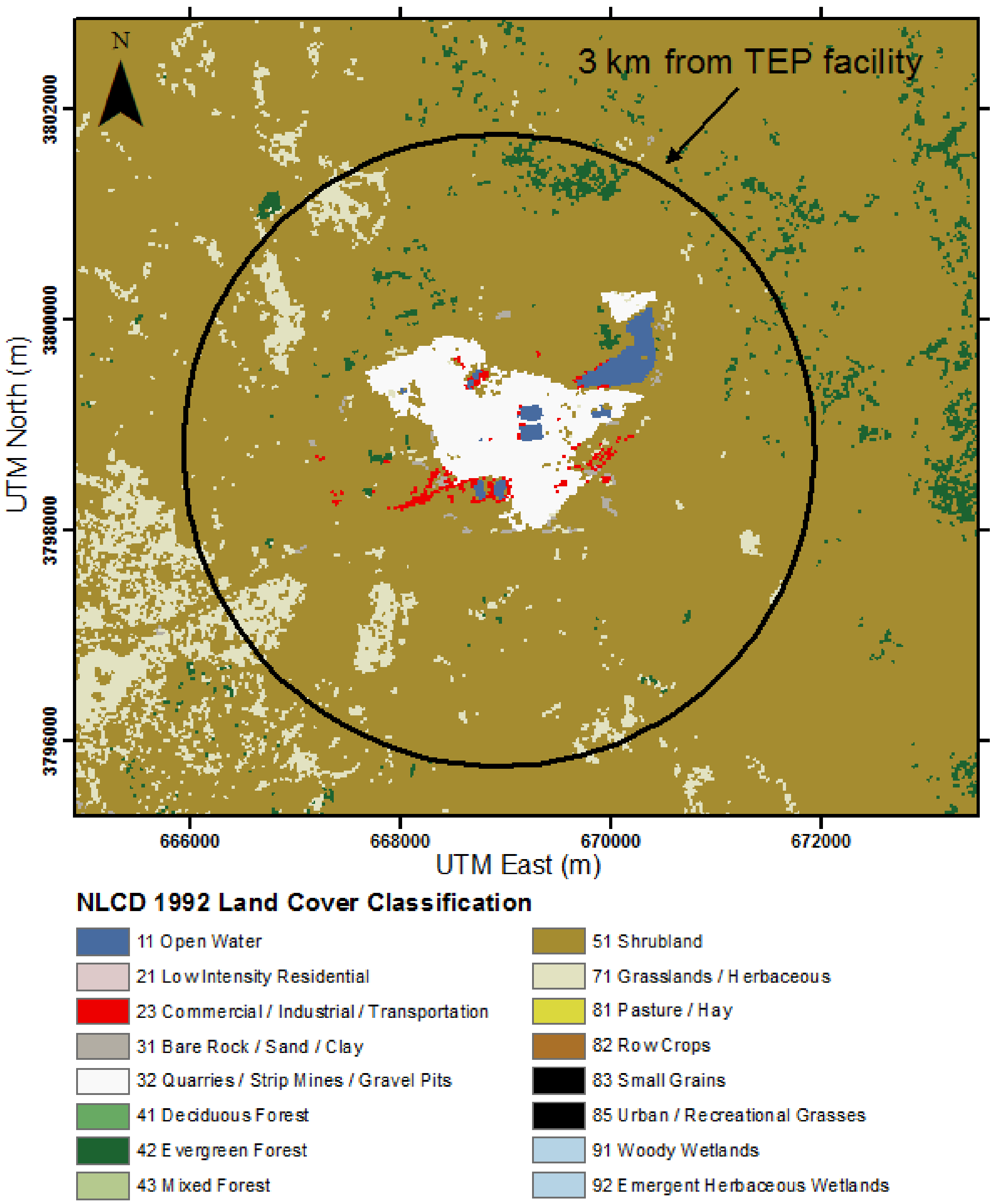


Table 5-3 Land Use Analysis within 3 km of TEP-Springerville Facility

1992 NLCD Land Use Category		% of Total Land Use within 3 km of Asarco	Auer Land Use Category		
Code	Description		Code	Description	Rural/Urban
11	Open Water	1.3	A5	Water Surfaces	Rural
12	Perennial Ice/Snow	0	A5	Water Surfaces	Rural
21	Low Intensity Residential	0	R1 / R4	Common/Estate Residential	Rural
22	High Intensity Residential	0	R2 / R3	Compact Residential	Urban
23	Commercial / Industrial / Transportation	0.7	C1 / I1 / I2	Commercial/Heavy Industrial/Light-Moderate Industrial	Urban
31	Bare Rock / Sand / Clay	0.3	A	N/A	Rural
32	Quarries / Strip Mines / Gravel Pits	7.2	A	N/A	Rural
33	Transitional	0	A	N/A	Rural
41	Deciduous Forest	0	A4	Undeveloped Rural	Rural
42	Evergreen Forest	1.7	A4	Undeveloped Rural	Rural
43	Mixed Forest	0	A4	Undeveloped Rural	Rural
51	Shrubland	83.9	A3	Undeveloped	Rural
61	Orchards / Vineyards / Other	0	A2 / A3 / A4	Agricultural Rural / Undeveloped / Undeveloped Rural	Rural
71	Grasslands / Herbaceous	4.9	A3	Undeveloped	Rural
81	Pasture / Hay	0	A2	Agricultural Rural	Rural
82	Row Crops	0	A2	Agricultural Rural	Rural
83	Small Grains	0	A2	Agricultural Rural	Rural
84	Fallow	0	A2	Agricultural Rural	Rural
85	Urban / Recreational Grasses	0	A1	Metropolitan Natural	Rural
91	Woody Wetlands	0	A3 / A4 / A5	Undeveloped / Undeveloped Rural / Water Surfaces	Rural
92	Emergent Herbaceous Wetlands	0	A3 / A5	Undeveloped / Water Surfaces	Rural

Over 80% of the land use within 3 km of TEP-Springerville is “shrubland” according to the NLCD92 classification scheme. Under the Auer’s scheme, the sum of the percentage of land use categories classified as urban (R2, R3, C1, I1, and I2) is only 0.7%. Accordingly, the sum of the rural categories is 99.3%. Therefore, the area around TEP-Springerville is defined as “rural” and identified as such in the AERMOD input.

6.0 Meteorological Data

The AERMOD model used AERMET to process the meteorological data and create the data files for AERMOD.

6.1 Meteorological Data Selection

As stated in SO_2 designation modeling TAD (U.S. EPA, 2016a), for the purposes of modeling to characterize air quality for use in SO_2 designations, EPA recommends using the most recent 3 years of meteorological data to allow the modeling to simulate what a monitor would observe.

The TEP-Springerville power plant provided 2012-2014 site-specific meteorological data collected from a 10-m meteorological tower. However, these data have not gone through quality assurance. ADEQ also found an older site-specific meteorological dataset obtained from a 60-m meteorological tower which was previously used for a Prevention of Significant Deterioration (PSD) modeling analysis for TEP-Springerville generating station. Although the EPA Designation Modeling TAD indicates that older site-specific meteorological data may be used under some circumstances (U.S. EPA, 2016a), the use of this one-year meteorological dataset is encountering some limitations. If this dataset is used, it must be duplicated twice to model three-year emissions, which appears to be inappropriate. Moreover, the meteorological data were collected as early as in 1993, more than 20-years ago. The EPA Designation Modeling TAD cautions the use of older meteorological data with recent emissions, "especially for those emissions that are meteorological dependent, such as demand in hot or cold weather for EGUs."

Due to the limitations associated with the use of site-specific meteorological data, ADEQ used the 2012-2014 National Weather Service (NWS) data collected from St. Johns Industrial Air Park, St. Johns, Arizona. The following section discusses why the St. Johns NWS data are representative of transport and dispersion conditions within the modeling domain.

Criteria for Representativeness

The section 8.3 of 40 CFR 51 Appendix W (U.S. EPA, 2005) stipulates that the representativeness of meteorological data is dependent upon four criteria:

- Spatial proximity of the meteorological monitoring site to the facility;
- Complexity of the topography of the area;
- Exposure of the meteorological sensors; and

- Period of time during which the data are collected.

As discussed in Appendix W section 8.3, the spatial representativeness of the data can be adversely affected by large distances between the source and receptors of interest and the complex topographic characteristics of the area. Significant cautions must be taken to select a meteorological station if the meteorological conditions vary drastically in the modeling domain and/or the areas of concern have complex terrain.

Spatial representativeness for off-site data were also assessed by comparing the surface characteristics (albedo, Bowen ratio, and surface roughness) of the meteorological monitoring site and the analysis area.

Evaluation of Representativeness of St. Johns Airport Data

As shown in Figure 6.1 and Table 1, St. Johns Industrial Air Park is located around 18 miles away from TEP-Springerville and 7 miles from SRP-CGS (the other source being included in this modeling analysis as we mentioned in Section 3.1). Because of their proximity, the three sites share the same climatic characteristics. The climate is cold semi-arid with cold, dry winters and hot summers with relatively greater precipitation via erratic thunderstorms.

Table 6-1 Information of Meteorological Site Location

Meteorological Data Sources	Sampling Period	Latitude	Longtitude
St. Johns Industrial Air Park	2012-2014	34.518 N	109.379 W
10-m meteorological tower	2012-2014	34.308 N	109.146 W
60-m meteorological tower	1993	34.320 N	109.160 W

Figure 6-1 Meteorological Stations near TEP-Springerville Facility

The St. Johns Industrial Air Park site and the TEP-Springerville site have similar surrounding topography. Terrain between St. Johns Airport and TEP-Springerville is simple with gently rolling features. There are no specific terrain features that would cause directional steering of locally generated winds or would influence the predominant meteorology in the modeling domain. The wind roses at the project site (both 10-m and 60-m meteorological tower) show the similar wind patterns to the St. Johns Industrial Air Park site, indicating the winds from west, southwest and south prevail in the modeling domain (Figure 6.2 to 6.4).

Figure 6-2 2012-2014 St. Johns Airport Meteorological Data

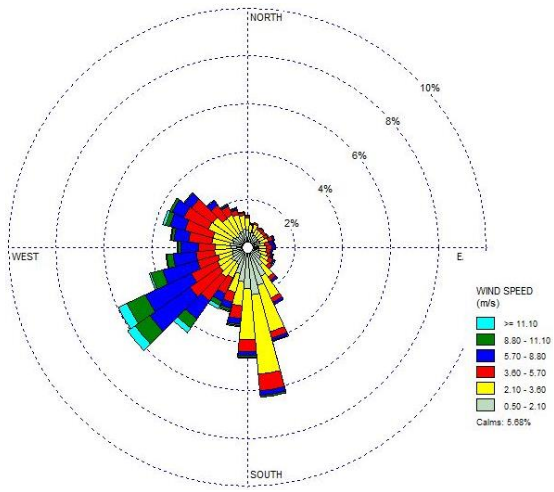


Figure 6-3 2012-2014 On-site Meteorological Data Collected at 10-m Tower

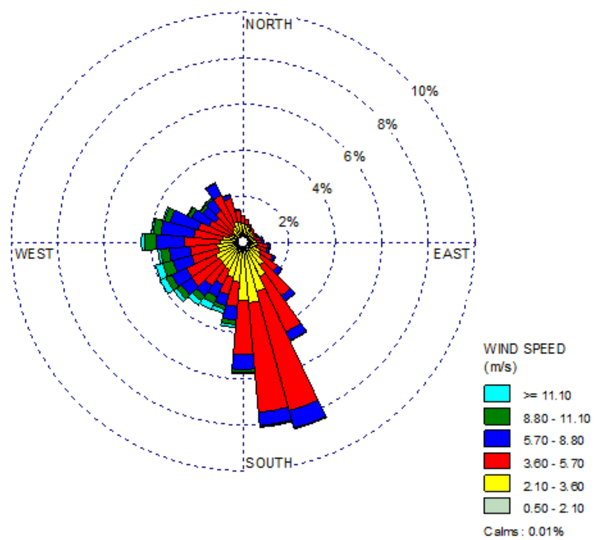
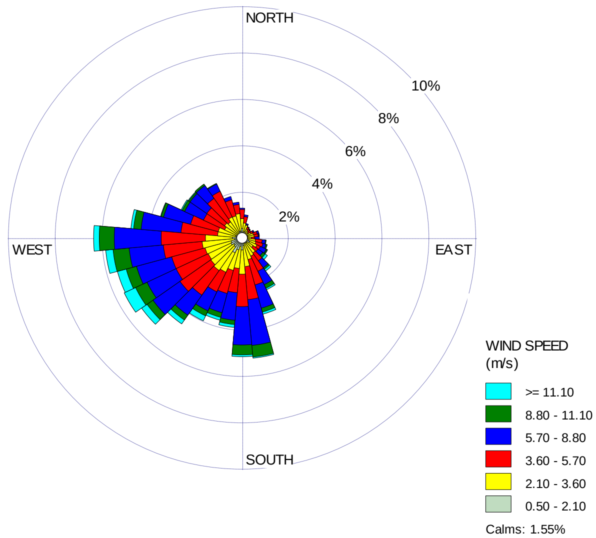


Figure 6-4 1993 On-site Meteorological Data Collected at 60-m Tower



Meteorological data from St. Johns were obtained through the Automated Surface Observing System (ASOS) network. The siting requirements of an ASOS station (including exposure conditions of the meteorological sensors) are consistent with those necessary for use in an air dispersion modeling analysis. Moreover, for the years 2012, 2013 and 2014, the surface data collected from the St. Johns Industrial Air Park meet the data completeness requirements of Section 5.3.2 of “Meteorological Monitoring Guidance for Regulatory Modeling Applications” (U.S. EPA, 2000). Especially, the ASOS station can utilize AERMINUTE to significantly reduce calm or missing hours, which is critical for modeling 1-hour standards (U.S. EPA, 2013a).

ADEQ also used AERSURFACE to compare the surface characteristics within 1 km/10 km of the St. Johns Industrial Air Park site and the project site, specifically the albedo, Bowen ratio, and the surface roughness length (Table 6-2 and Table 6-3). As shown in Table 6-2 and Table 6-3, the albedo and the surface roughness length of the two sites are nearly identical. The Bowen ratio between the two sites show some differences, mainly due to the Pasture/Hay and Low Intensity Residential land use near the St. Johns Industrial Air Park site. In general, AERMOD is not sensitive to changes in Bowen ratio. Overall, shrubland dominates the land cover near both sites. Therefore, the surface characteristics of the two sites are very similar.

As discussed above, the St Johns NWS data meet all representativeness criteria listed in section 8.3 of 40 CFR 51 Appendix W. Therefore, used St Johns NWS data were used in this modeling analysis by ADEQ.

Table 6-2 St. Johns Industrial Air Park AERSURFACE Inputs/Outputs for Use in AERMET

Month	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Albedo	0.23	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23
Bowen Ratio	3.66	1.82	1.82	1.82	1.82	1.82	2.49	2.49	2.49	2.49	3.66	3.66
Surface Roughness	0.146	0.145	0.145	0.145	0.145	0.145	0.146	0.146	0.146	0.146	0.146	0.146

Table 6-3 TEP-Springerville AERSURFACE Inputs/Outputs for Use in AERMET

Month	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Albedo	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Bowen Ratio	5.07	5.07	5.07	5.07	2.6	2.6	3.37	3.37	3.37	3.37	5.07	5.07
Surface Roughness	0.14	0.14	0.14	0.14	0.146	0.146	0.148	0.148	0.148	0.148	0.148	0.148

6.2 Meteorological Data Processing with AERMET

ADEQ used the EPA's AERMET tool (version 15181; U.S. EPA, 2014b) to process meteorological data for using with AERMOD. AERMET merges NWS surface observations with NWS upper air observation and performs calculation of boundary layer parameters required by AERMOD. In addition to the meteorological observations, AERMET further requires the inclusion of the characteristics of land use surfaces (routinely calculated using EPA's AERSURFACE tool). Although EPA has proposed to designate some beta options as the default regulatory formulation in AERMET (U.S. EPA, 2015) and recently finalized the ADJ_U* option as the default option (U.S. EPA, 2016b), ADEQ did not use the ADJ_U* option and all previous default options in AERMET were used for this case.

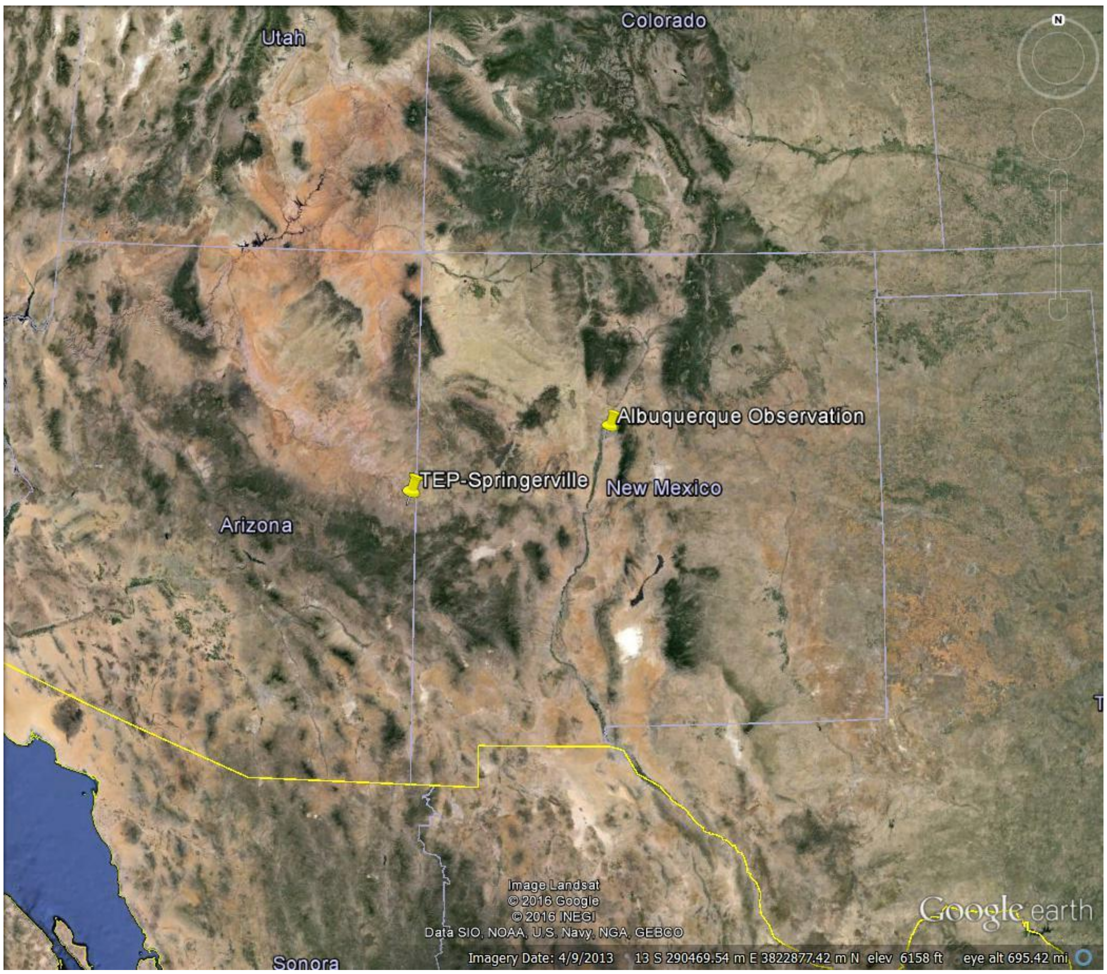
6.2.1 Surface Observation

As discussed in Section 6.1, ADEQ used the 2012-2014 NWS data collected at St. Johns Industrial Air Park site for this project. To reduce the number of calms and missing winds associated with the NWS meteorological data, ADEQused AERMINUTE to supplement the standard ASOS data with hourly-averaged wind speed and direction to support AERMOD dispersion modeling (U.S. EPA, 2013b). ADEQ also used a minimum wind speed threshold of 0.5 m/s to the hourly averaged wind speeds provided by AERMINUTE.

6.2.2 Upper Air Observation

Given the proximity of location, topography and climate at the TEP-Springerville power plant, ADEQ used the upper air data obtained from Albuquerque, NM (Station ID:23050,Latitude/Longitude: 35.05 N/106.62 W),which is 240 km northeast away from TEP-Springerville.

Figure 6-5 Location of Upper Air Station and TEP-Springerville Power Plant



6.2.3 AERSURFACE

ADEQ used EPA's AERSURFACE tool to calculate the surface characteristic parameters (surface roughness length, albedo and Bowen ratio) based on the 1992 USGS National Land Cover Data (NLCD). EPA developed AERSURFACE to identify these parameters within a defined radius from a specified point. In this case, ADEQ inputted the UTM coordinates of the NWS meteorological station to AERSURFACE along with a default 1-km radius. ADEQ calculated the parameters for twelve compass sectors of 30° each, and by month. Considering the climate characteristics in the St. Johns area, ADEQ assigned the seasonal categories for TEP-Springerville as follows:

- Late autumn after frost and harvest, or winter with no snow: none;
- Transitional spring (partial green coverage, short annuals): February, March, April, May, June;
- Midsummer with lush vegetation: July, August, September, October;
- Autumn with unharvested cropland: January, November, December.

The surface moisture condition were determined by comparing precipitation for the period of data to be processed to the 30-year climatological record, selecting “wet” conditions if precipitation is in the upper 30th-percentile, “dry” conditions if precipitation is in the lower 30th-percentile, and “average” conditions if precipitation is in the middle 40th-percentile. “Average” condition was set for TEP-Springerville case.

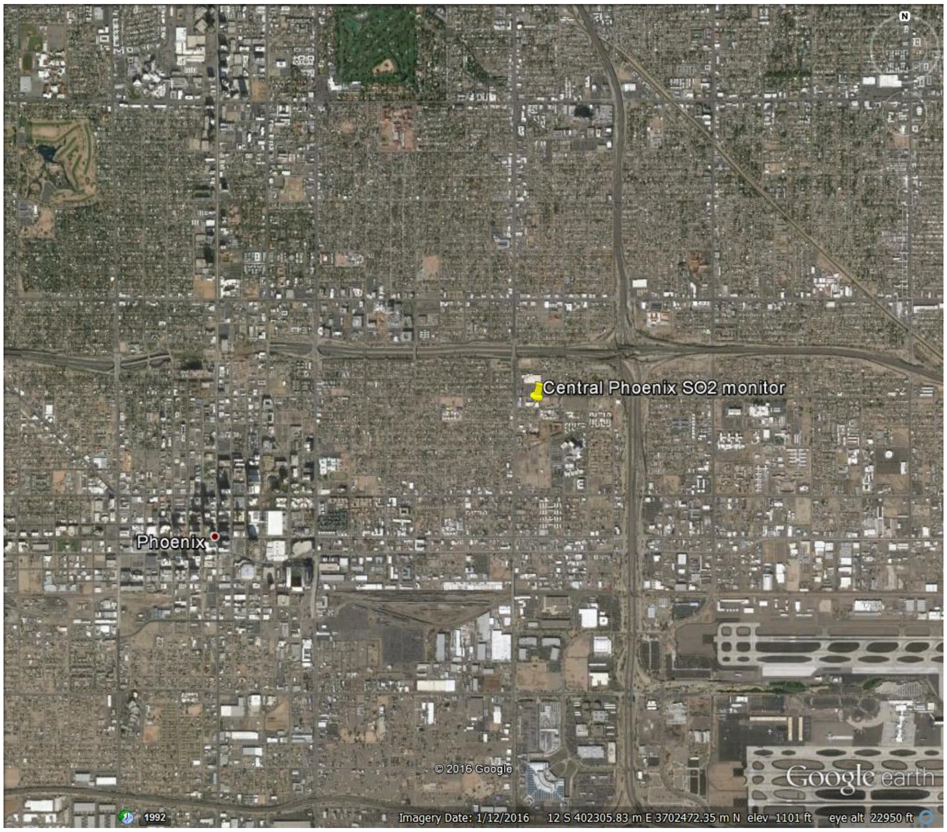
7.0 Background Air Quality

EPA requires background air quality estimates be added to modeling results for comparison to the NAAQS.

There are limited SO_2 monitoring sites in Arizona and the monitoring sites are located in the Phoenix/Tucson metropolitan area or close to copper smelters. ADEQ used the ambient monitoring data collected from Central Phoenix (1645 E Roosevelt St, ID: 40133002, Figure 7-1) as 1-hour SO_2 background concentration. This site is located in an urban area and surrounded by various anthropogenic sources. The TEP-Springerville power plant is located in a rural area without significant human activities. Since the source contribution from SRP-CGS had been taken into account in the modeled concentration, the monitoring concentration at central Phoenix is expected to be higher than the background concentration in the TEP-Spingerville modeling domain. Thus this method is considered as conservative.

The 99th percentile SO_2 1-hour concentrations at the Central Phoenix Monitoring Site was calculated for each year in the 2010-2014 dataset which were retrieved from EPA's Air Quality System (https://www3.epa.gov/airdata/). The 3 year (2012-2014) design values were 8ppb, 8ppb and 7ppb, respectively. Following EPA Designation Modeling TAD, the SO_2 background concentration for the TEP-Springerville power plant was determined to be 7.7 ppb (20.18 $\mu g/m^3$) as the average of 3-year 99^{th} percentile SO_2 1-hour concentrations.

Figure 7-1 Location of Central Phoenix SO_2 Monitor



8.0 Modeling Results and Discussions

Demonstration of protection of the NAAQS was accomplished by comparison of the modeled design value to the applicable standard. The modeled design value for 1-hour SO_2 is defined as the sum of the 4th highest modeled hourly concentration and the 99th percentile background concentration. The results for TEP-Springerville are discussed in this section.

The predicted highest 4th high 1-hour SO_2 concentrations using the St Johns NWS meteorological data was 87.51 µg/m^3.This predicted concentration added to the 1-hour SO_2 background concentration of 20.18 µg/m^3 yields the ambient concentration of 107.69µg/m^3. This concentration is less than the applicable 1-hour SO_2 NAAQS of 196 µg/m^3. In conclusion, the SO_2 concentrations around the TEP-Springerville power plant complies with 1-hour SO_2 NAAQS. Table 8-1 summarizes the modeling results.

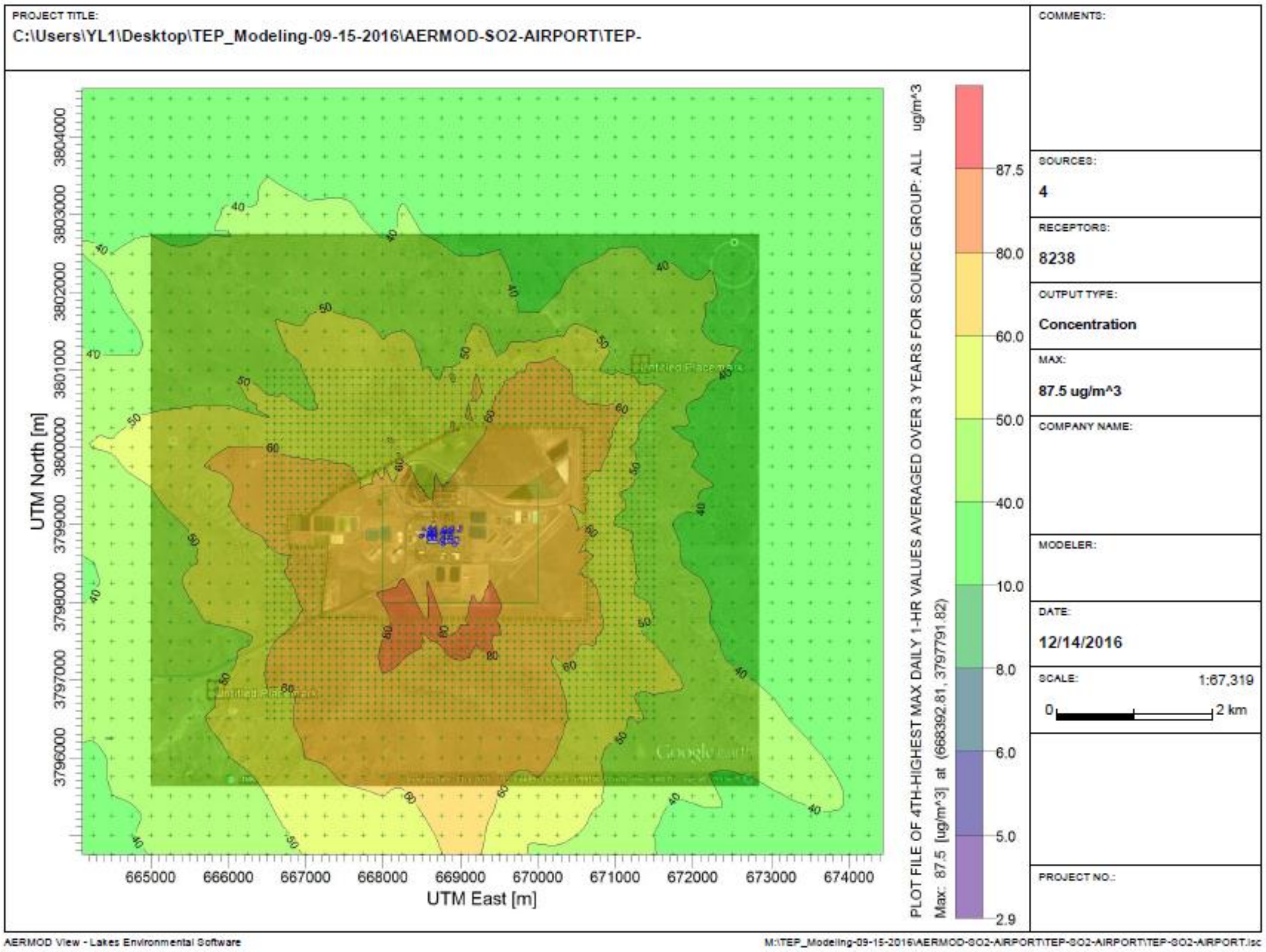
Table 8-1 Results of TEP-Sprinerville Designation Modeling

Model Predicted Impact(Highest 4th High) µg/m^3	Background Concentration(99th Percentile) µg/m^3	Total Concentration µg/m^3	NAAQS µg/m^3
87.51	20.18	107.69	196
4th highest maximum daily 1-hour SO_2 concentration predicted to occur at 668392.81 mN and 3797791.82 mE			

Based on the spatial concentration of contour plot (Figure 8-1), the highest concentrations of 1-hour SO_2 around TEP-Springerville Power Plant were located to the south of the facility. The modeling analysis also revealed that the inclusion of SRP-CGS emissions did not affect the design concentration of the TEP-Springerville designation modeling (Please check TEP-CGS folder in SO_2 Technical Assistance Document for more details).

ADEQ is submitting all applicable electronic modeling files including model input files, model output files, building downwash files, terrain files, and meteorological data files along with this modeling report.

Figure 8-1 Spatial distributions of SO_2 concentration modeled by AERMOD near TEP-Springerville



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