Modeling Report for SO_2 NAAQS Designation for Arizona Public Service (APS)-Cholla Generating Station

Submitted To:

Environmental Protection Agency

Region 9

Prepared By:

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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. 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 has 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 have submitted a modeling protocol on July 1, 2016 and the protocol was approved by email on December 05, 2016. This modeling report presents the methodology that ADEQ followed to complete the ambient air quality analysis in areas around the APS-Cholla facility followed by modeling results and discussion. For the other two sources, please see separate modeling reports.

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

- Section 2 provides general description of APS-Cholla 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 grid;
- 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 the modeling results and discussion.

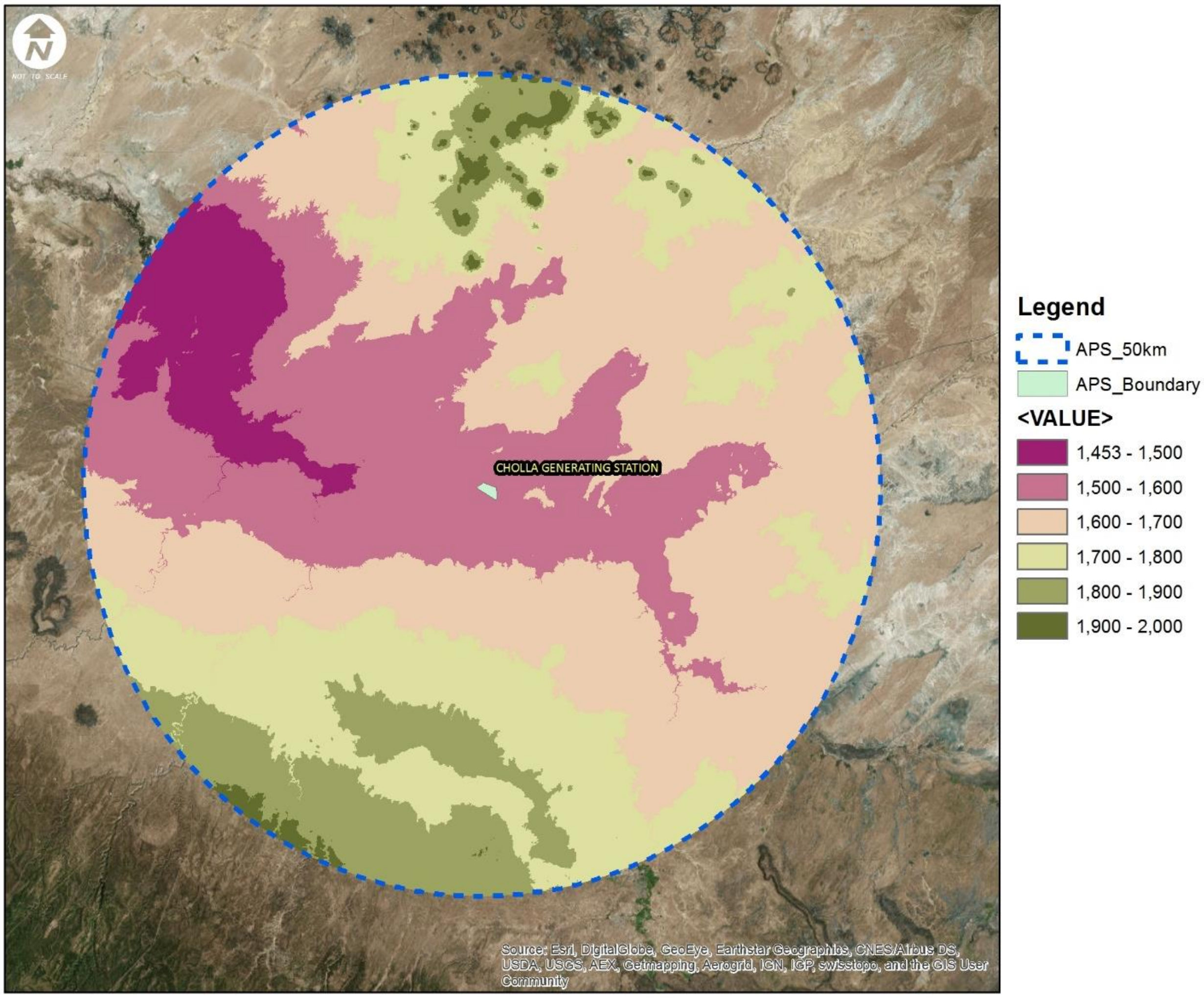
2.0 General Description of APS-Cholla Power Plant

The Arizona Public Service Cholla Generating Station (APS-Cholla) is located approximately two miles east of Joseph City along Interstate 40 in Navajo County, Arizona. Cholla consists of four primarily coal-fired EGUs with a total plant-wide generating capacity of 1,180 gross megawatts (MW). Unit 1 is a 126 gross MW tangentially-fired, dry-bottom boiler. Units 2, 3, and 4 have capacities of 272, 272, and 410 gross MW, respectively, and are tangentially-fired, dry-bottom boilers. Units 1, 2, and 3 are owned and operated by APS, and Unit 4 is owned by PacifiCorp and operated by APS. Unit 1 was completed in 1962, Units 2 and 3 were completed in 1978 and 1980, and Unit 4 was placed in commercial operation in 1981.

The area has a semi-arid climate with cold to cool winters and hot summers. The warmest month of the year is July with an average maximum temperature of 92.2 degrees Fahrenheit, while the coldest months of the year are January and December with an average minimum temperature of 20.9 degrees Fahrenheit. Although the mean snowfall is 6.30 inches, the median is zero, so the majority of winters do not have measurable snow. The wettest month of the year is August with an average rainfall of 1.51 inches.

The Cholla facility is located in a flat area. There are no elevated or complex terrain features within 20-25 km distance from the facility. The topography of the local area is depicted in Figure 2-1.

Figure 2-1: Topography of the Area Surrounding APS-Cholla



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, 2016). 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 facility and extended for 50 kilometers from the facility fence line.

3.1 Determining Sources to Model

Per EPA's SO_2 NAAQS Designations Modeling TAD, 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 could be centered over these sources.

ADEQ has identified SO_2 sources within the 50-km modeling domain for the Cholla power plant. Figures 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 Cholla.

As table 3-1 shows, the SO_2 emissions from APS-Cholla represent more than 99.6% of actual SO_2 emissions during 2012-2014. Excluding this source, there are no sources that emitted more than 29.5 tons per year of SO_2 in the Cholla modeling domain during 2012-2014. Due to their insignificant emissions, it is very unlikely that these minor sources could cause or contribute to a NAAQS violation in the area. Therefore, ADEQ only modeled Cholla for this designation modeling.

Figure 3-1: Point Sources within 50-km Modeling Domain of APS-Cholla

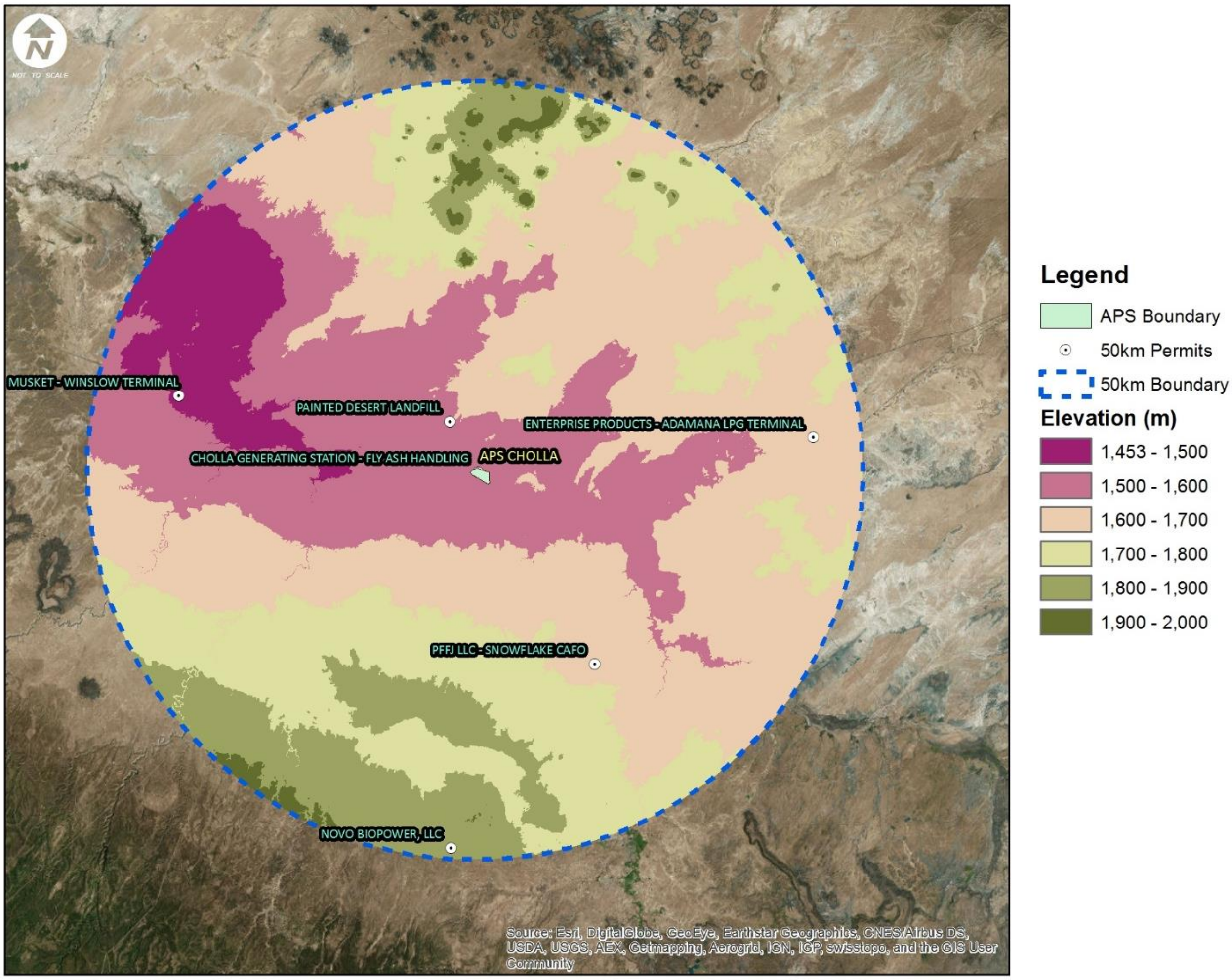


Table 3-1: Point Sources within 50-km Modeling Domain of APS-Cholla (Permitted Sources)

County	Site Name	Facility Type	Latitude	Longitude	2012 SO_2 (TPY)	2013 SO_2 (TPY)	2014 SO_2 (TPY)
Navajo	Cholla Generating Station	Power Plant	34.941	-110.301	6174.1	5065.3	3806.6
Navajo	Painted Desert Landfill	Landfill	34.998	-110.337	0.0671	0.0671	0.0521
Navajo	Cholla Generating Station- Fly Ash Handling	Fly Ash Handling	34.940	-110.296	0	0	0
Navajo	Musket- Winslow Terminal	Petroleum Distribution Terminals	35.028	-110.719	0	0	0
Navajo	Novo Bio-power, LLC	Biomass Power Generation Utilizing Wood Waste	34.504	-110.335	29.494	8.768	20.358
Navajo	PFFJ LLC- Snowflake CAFO	Farm Operations	34.718	-110.132	0	0	0
Apache	Enterprise Products- Adamana LPG Terminal	LPG Storage and Terminal	34.980	-109.824	0	0	0

3.2 Receptor Grid

ADEQ defined a modeling domain centered on the Cholla power plant and extended that to 50 kilometers from the facility fence line to make sure that the high model concentrations are captured. A total of 12483 receptors were placed in approximately 101km by 103km modeling domain.

- ADEQ used the following receptor spacing to determine areas of maximum predicted concentrations:
- 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 the EPA's AERMAP software tool (version 11103; U.S. EPA, 2011) to estimate receptor elevations and hill heights. AERMAP is the terrain preprocessor for AERMOD (discussed in Section 4) and uses the following procedure to assign elevations to a 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 ten (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 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 APS-Cholla are depicted in Figure 3-2.

Figure 3-2: Modeled Receptors, APS-Cholla

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 APS-Cholla designation modeling.

There are two input data processors that are regulatory components of the AERMOD modeling system: AERMET (version 15181; U.S. EPA, 2015), 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, 2013), 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 the Cholla power plant as shown in Figure 5-1.

Figure 5-1 Modeled Emission Sources in APS-Cholla Power Plant

5.1 Source Inputs for APS-Cholla

5.1.1 Emission Data

For AERMOD SO_2 modeling 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, 2016), hourly SO_2 emissions data are input into AERMOD using the HOUREMIS keyword in the source pathway of the AERMOD control file (AERMOD.INP).

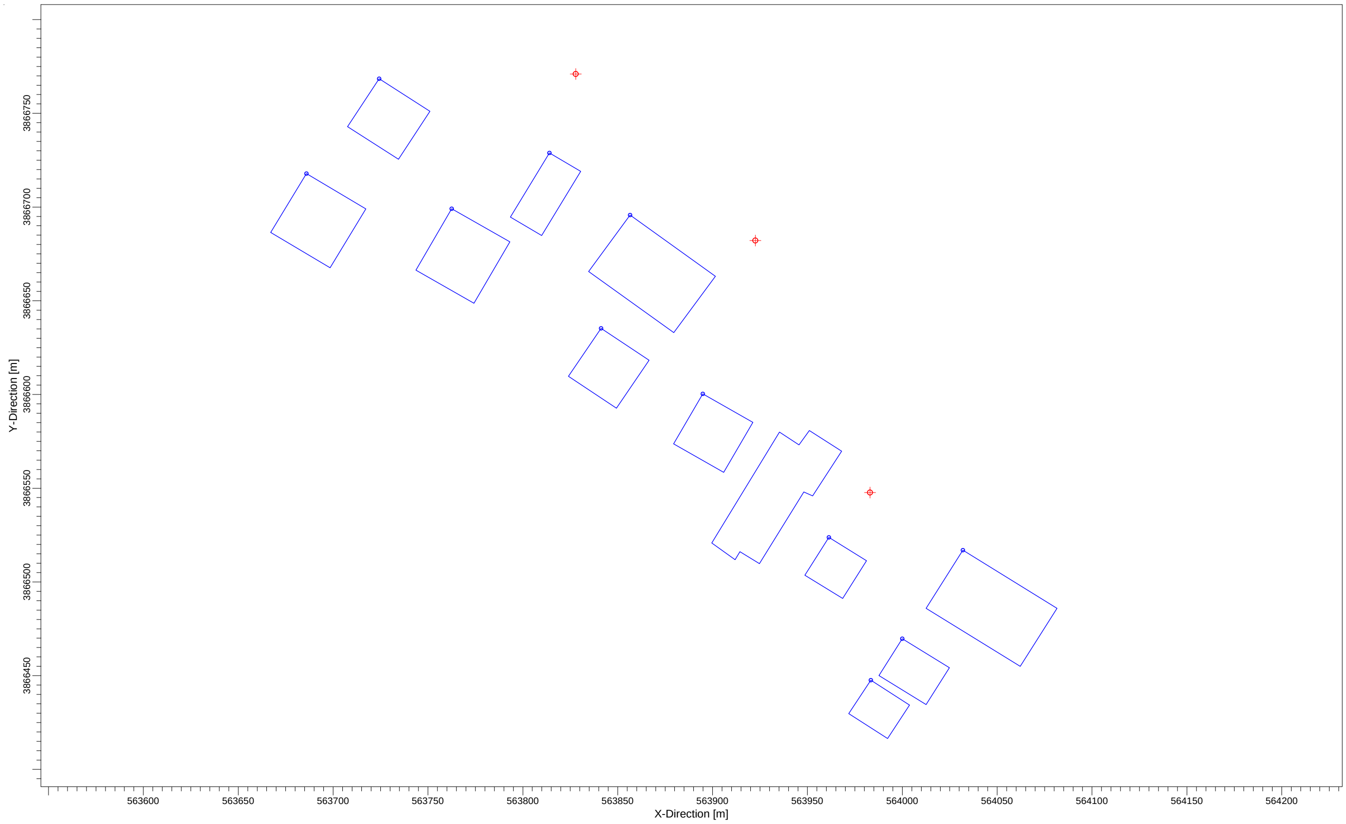
ADEQ obtained the CEMS data from Cholla facility. After carefully reviewing the data, ADEQ did not identify any case of missing hours and therefore no data substitution was done for missing hours in the modeling input.

5.1.2 Emission Release Parameters

For the purposes of modeling with actual emissions to characterize air quality, ADEQ followed the EPA 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 will most closely represent the facility actual emission conditions.

Downwash effects were considered for APS-Cholla 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. The information of actual heights of existing structures were provided by the Cholla facility. The simplified layout used in modeling for APS-Cholla is shown in Figures 5-2.

Figure 5-2: Simplified Facility Layout for APS-Cholla



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.

Table 5-1 presents the modeling parameters for the stacks.

Table 5-1: Modeling Parameters for APS-Cholla 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	563983.04	3866547.68	1531.48	76.2	3.43	Variable	Variable	Variable
Stack 2&3	563922.60	3866682.10	1531.52	167.6	6.88	Variable	Variable	Variable
Stack 4	563827.93	3866771.00	1531.48	167.6	5.85	Variable	Variable	Variable

Please note that unit 2 and 3 flue exhaust into a common stack, which is called Stack 2&3 in this document. The equivalent stack diameter for Stack 2&3 was obtained from the facility and the equivalent stack temperature and exit velocity were calculated for the 2012-2014 hourly emissions based on CEMS data, which were used in the model.

5.2 Urban/Rural Determination

Dispersion coefficients for air quality modeling are selected based on the land use classification technique suggested by Auer (Auer, 1978), which is EPA's preferred method. The classification determination involves assessing land use by Auer's categories within a 3-kilometer radius of the proposed site. A source should select 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). 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 Auer6) 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 the totals of each land use category were calculated. These land use categories were then correlated to the categories as established by Auer, and the amount of urban and rural land use within 3 km of each facility was calculated.

The area near APS-Cholla that was examined is depicted in Figure 5-3, while the results of the analysis are presented in Table 5-2.

Figure 5-3: Land Use near APS-Cholla

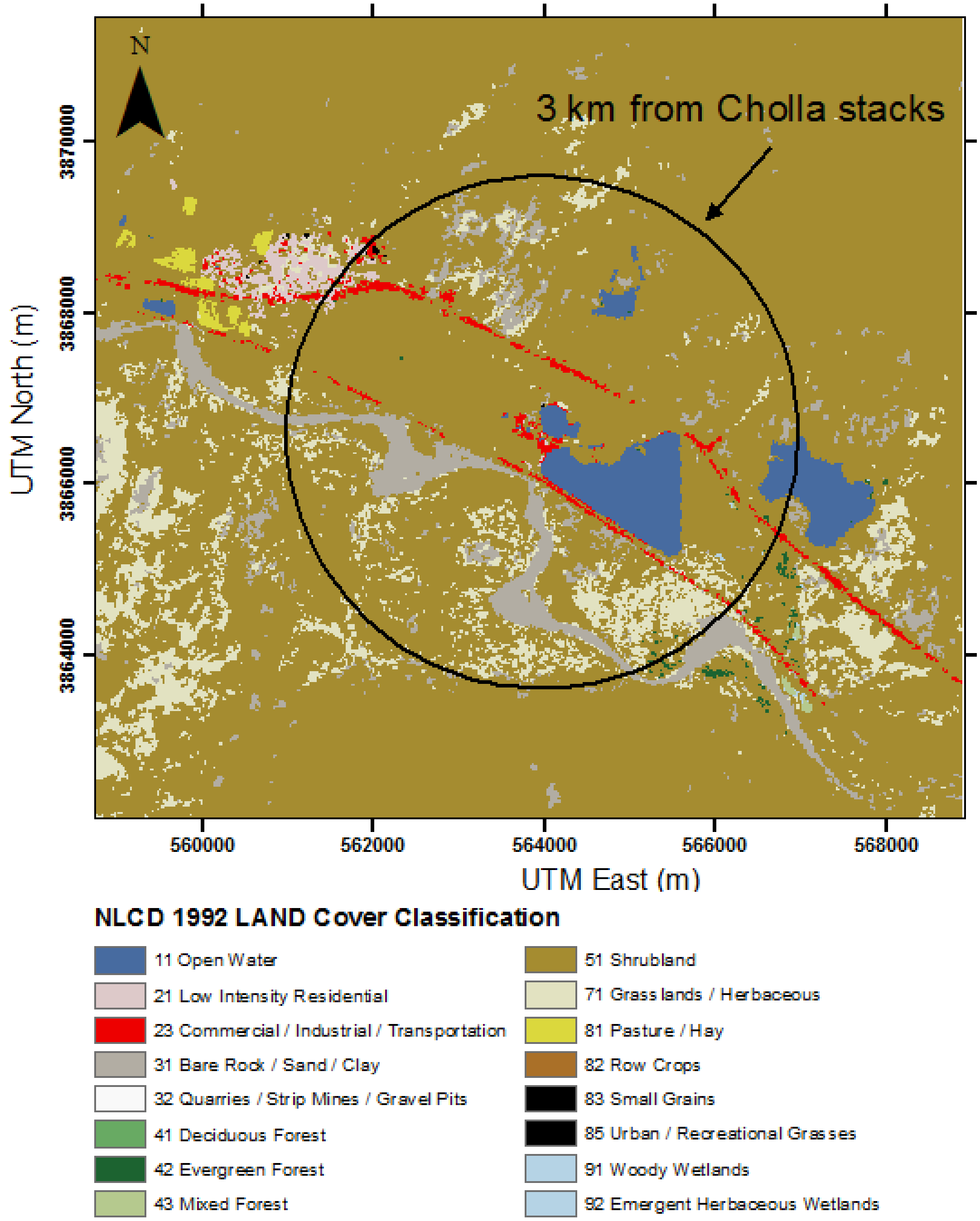


Table 5-2: Land Use Analysis within 3 km of APS-Cholla Facility

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	8.3	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	1.7	C1 / I1 / I2	Commercial/Heavy Industrial/Light-Moderate Industrial	Urban
31	Bare Rock / Sand / Clay	9.4	A	N/A	Rural
32	Quarries / Strip Mines / Gravel Pits	0	A	N/A	Rural
33	Transitional	0	A	N/A	Rural
41	Deciduous Forest	0	A4	Undeveloped Rural	Rural
42	Evergreen Forest	0.4	A4	Undeveloped Rural	Rural
43	Mixed Forest	0	A4	Undeveloped Rural	Rural
51	Shrubland	71.9	A3	Undeveloped	Rural
61	Orchards / Vineyards / Other	0	A2 / A3 / A4	Agricultural Rural / Undeveloped / Undeveloped Rural	Rural
71	Grasslands / Herbaceous	8.3	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

About 72% of the land use within 3 km of APS-Cholla is "shrubland" according to the NLCD92 classification scheme. Under the Auer scheme the sum of the percentage of land use categories classified as urban (R2, R3, C1, I1, and I2) is only 1.7%. Accordingly, the sum of the rural categories is 98.3%. Therefore, the area around APS-Cholla is defined as "rural" and identified as such in the AERMOD input.

6.0 Meteorological Data

AERMOD requires the use of 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, 2016), for the purposes of modeling to characterize air quality for use in SO_2 designations, the EPA recommends using the most recent 3 years of meteorological data to allow the modeling to simulate what a monitor would observe.

The APS-Cholla power plant provided the 2012-2014 site-specific meteorological data collected from a 10-m meteorological tower. However, the data for 2012-2014 from the tower has not gone through quality assurance. ADEQ also found an older site-specific meteorological dataset (2005-2006) obtained from a meteorological tower at different heights from 10 m to 400 m, which were used for previous regulatory applications. Although the EPA Designation Modeling TAD indicates that older meteorological data may be used under some circumstances (U.S. EPA, 2016), the use of this one-year meteorological dataset has some limitations. If this dataset is used, it must be duplicated twice to model three-year emissions, which would be inappropriate. In addition, the meteorological data was collected more than 10-years ago. The EPA Designation Modeling TSD 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 Winslow-Lindbergh ASOS station in Winslow, Arizona. The following section discusses why the Winslow NWS data are representative of transport and dispersion conditions within the modeling domain.

Criteria for Representativeness

For a better evaluation of using Winslow airport data for Cholla, ADEQ referred to Section 8.3 of 40 CFR 51 Appendix W, which states that the representativeness of meteorological data is dependent upon (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.

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 should also be assessed by comparing the surface characteristics (albedo, Bowen ratio, and surface roughness) of the meteorological monitoring site and the analysis area.

Winslow airport MET data are examined below for these criteria.

Evaluation of Representativeness of Winslow Airport Data

As shown in Figure 6.1 and Table 6.1, Winslow airport is located about 24 miles from the Cholla power plant. Because of their proximity, both sites share the same climate characteristics. The area has a semi-arid climate with cold to cool winters and hot summers.

Table 6-1: Information of Meteorological Site Location

Meteorological Data Sources	Sampling Period	Latitude	Longitude
Winslow-Lindbergh Regional Airport	2012-2014	35.022	-110.723
10-m on-site meteorological tower	2012-2014	34.9086	-110.2838

Figure 6-1: Meteorological Stations near APS-Cholla Facility

Both locations are at approximately the same elevation (1526 m versus 1490 m) and have similar topography surrounding each location. Also, the Winslow airport and APS-Cholla are located roughly about the same distance and in the same orientation to the significant terrain features in the region that influence wind flow patterns. These terrain features are part of the same large scale terrain features in the area that are oriented in a northeast-southwest direction. There are no specific terrain features in the Cholla area or in Winslow that would cause directional steering of locally generated winds or would influence the predominant meteorology in the area. Therefore, the same mesoscale and localized geographic and topographic features that influence wind flow patterns at the airport site also influence the wind flow patterns at the Cholla site

The wind roses at the site (both 10-m and multi-height measurement towers) show the similar wind patterns to the Winslow airport site, indicating the winds from west, south west and south east prevail in the modeling domain (Figures 6.2 to 6.6).

Figure 6-2: 2012-2014 Winslow Airport Meteorological Data

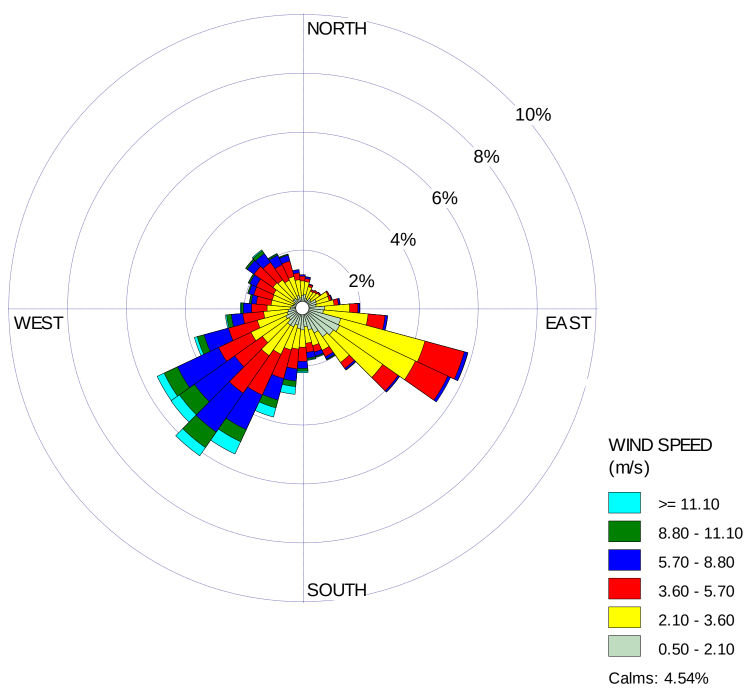


Figure 6-3: 2012-2014 On-site Meteorological Data Collected at 10-m Tower

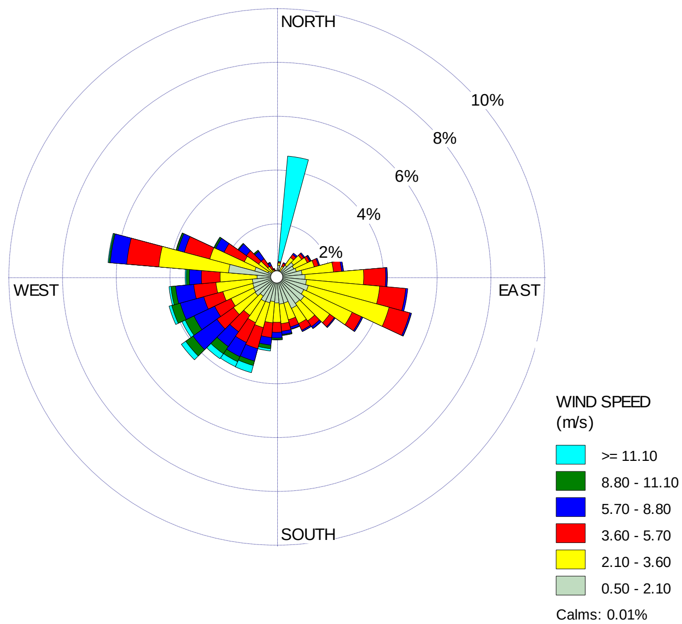


Figure 6-4: 2005-2006 On-site Meteorological Data Collected at 10-m

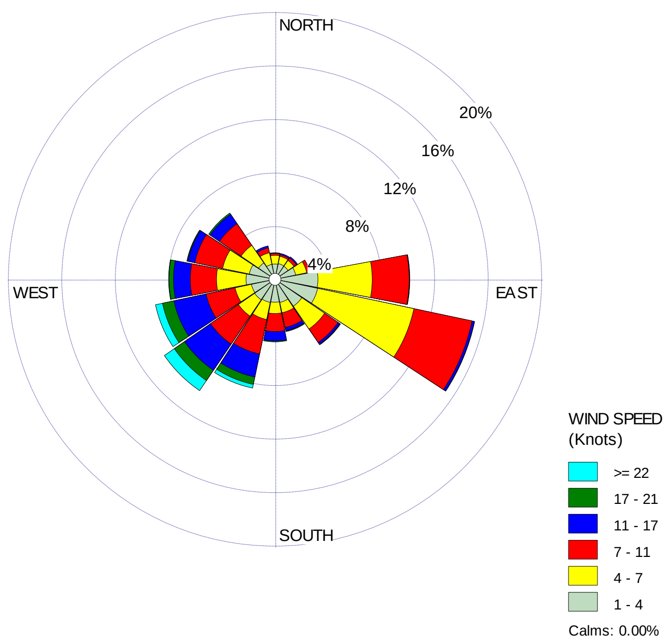


Figure 6-5: 2005-2006 On-site Meteorological Data Collected at 50-m

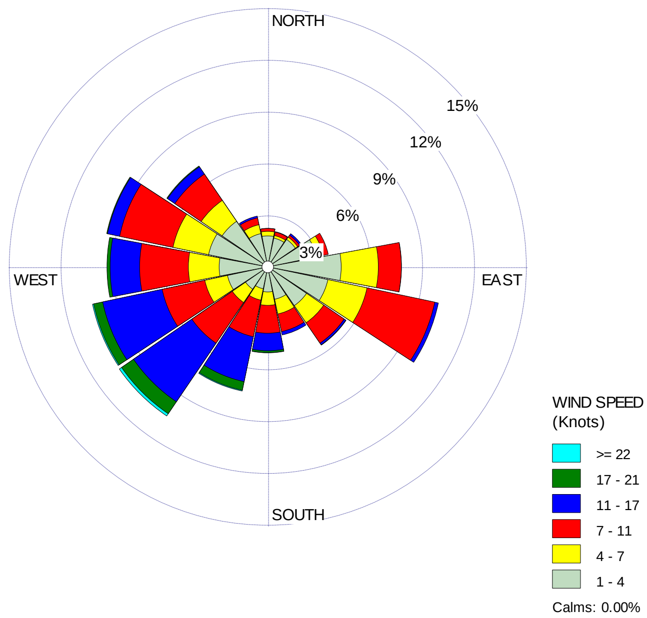
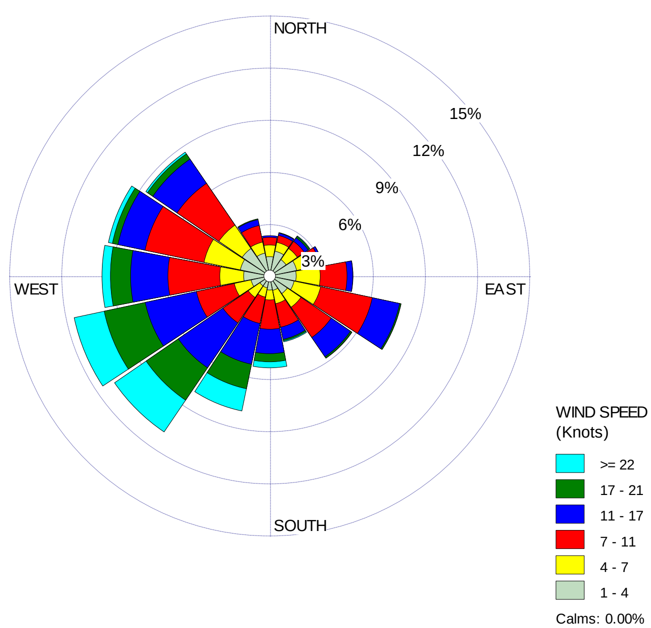


Figure 6-6: 2005-2006 On-site Meteorological Data Collected at 150-m



Meteorological data from Winslow station was 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. For the years 2012, 2013 and 2014, the surface data collected from the Winslow airport meets the data completeness requirements of Section 5.3.2 of "Meteorological Monitoring Guidance for Regulatory Modeling Applications" (U.S. EPA, 2000). Additionally, the ASOS station can utilize AERMINUTE to significantly reduce calm or missing hours, which is critical for modeling 1-hour standards (U.S. EPA, 2013).

Additionally, monthly surface characteristics were determined with AERSURFACE using Land Use/Land Cover (LULC) data in accordance with EPA guidance documents ("AERMOD Implementation Guide" and "AERSURFACE User's Guide") as described below. AERSURFACE uses U.S. Geological Survey (USGS) National Land Cover Data 1992 archives (NLCD92) to determine the midday albedo, daytime Bowen ratio, and surface roughness length representative of the surface meteorological station and project site.

Running AERSURFACE at both the meteorological monitoring and proposed site locations produced similar results for Bowen ratio, albedo and roughness lengths. Also, based on the Auer land use classifications, which was described in section 5.3, both locations are classified as rural, and there is good correlation of the rural characteristic land types between the two locations. Table 6-1 and 6-2 present the AERSURFACE input/outputs assigned to the processing of the AERMET data.

For the reasons discussed above, the Winslow NWS data meets all representativeness criteria listed in section 8.3 of 40 CFR 51 Appendix W. Therefore ADEQ believes that the Winslow NWS data is appropriate for use in this modeling analysis.

Table 6-2: Winslow AERSURFACE Inputs/Outputs for Use in AERMET

Month	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Seasonal Assumptions for Surface Roughness (meters) and Albedo												
Season	Winter	Winter	Winter	Spring	Spring	Spring	Summer	Summer	Autumn	Autumn	Winter	Winter
Surface Roughness, meters	0.073	0.073	0.073	0.091	0.091	0.091	0.101	0.101	0.099	0.099	0.073	0.073
Albedo	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.24
Bowen Ratio	4.29	4.29	4.29	2.22	2.22	2.22	2.99	2.99	4.29	4.29	4.29	4.29

Table 6-3: On-site AERSURFACE Inputs/Outputs for Use in AERMET

Month	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Seasonal Assumptions for Surface Roughness (meters) and Albedo												
Season	Winter	Winter	Winter	Spring	Spring	Spring	Summer	Summer	Autumn	Autumn	Winter	Winter
Surface Roughness, meters	0.069	0.069	0.069	0.070	0.070	0.070	0.071	0.071	0.071	0.071	0.069	0.069
Albedo	0.024	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Bowen Ratio	4.66	4.66	4.66	2.36	2.36	2.36	3.18	3.18	4.66	4.66	4.66	4.66

6.2 Meteorological Data Processing with AERMET

ADEQ used EPA's AERMET tool (version 15181; U.S. EPA, 2014b) to process meteorological data for use 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.

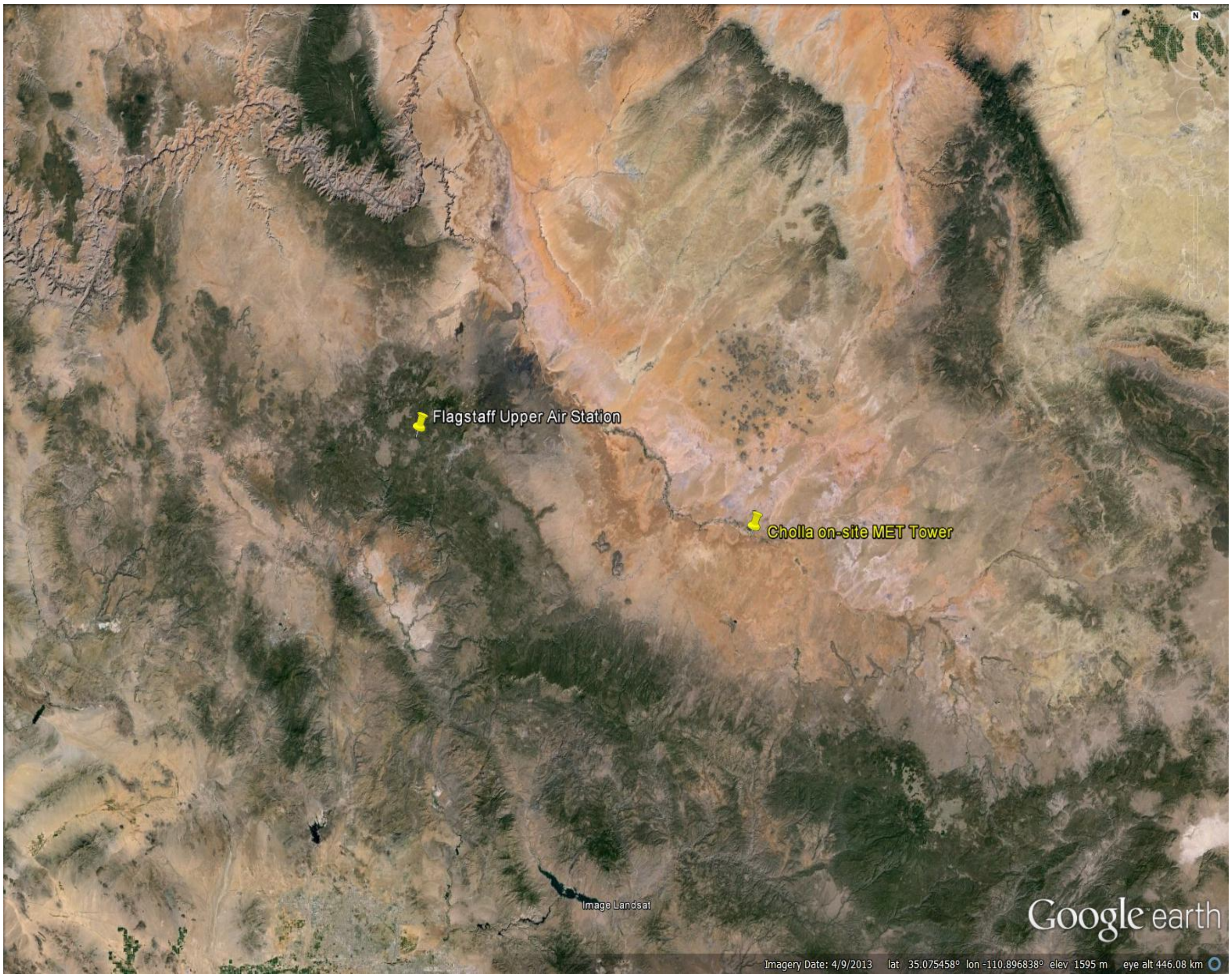
6.2.1 Surface Observation

As discussed in Section 6.1, ADEQ used the 2012-2014 NWS data collected at Winslow airport for this project. To reduce the number of calms and missing winds associated with the NWS meteorological data, ADEQ used 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 APS-Cholla power plant, ADEQ used the upper air data obtained from Flagstaff, AZ (Station ID:53103,Latitude/Longitude: 35.23 N/111.82 W),which is 144 km northwest away from APS-Cholla.

Figure 6-7: Location of Upper Air Station and APS-Cholla Power Plant



6.2.3 AERSURFACE

ADEQ used EPA's AERSURFACE tool to calculate the surface roughness length, albedo and Bowen ratio inputs required by AERMET. EPA developed AERSURFACE to identify these parameters within a defined radius from a specified point. In this case, ADEQ input the UTM coordinates of the NWS meteorological station to AERSURFACE along with a 1-kilometer radius per EPA guidance. ADEQ used 1992 USGS National Land Cover Data (NLCD) for the state of Arizona as inputs to AERSURFACE. ADEQ calculated the parameters for twelve compass sectors of 30° each, and by month. Considering the climate characteristics in the Winslow area, ADEQ assigned the seasonal categories for APS-Cholla as follows:

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

The surface moisture condition can be 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.

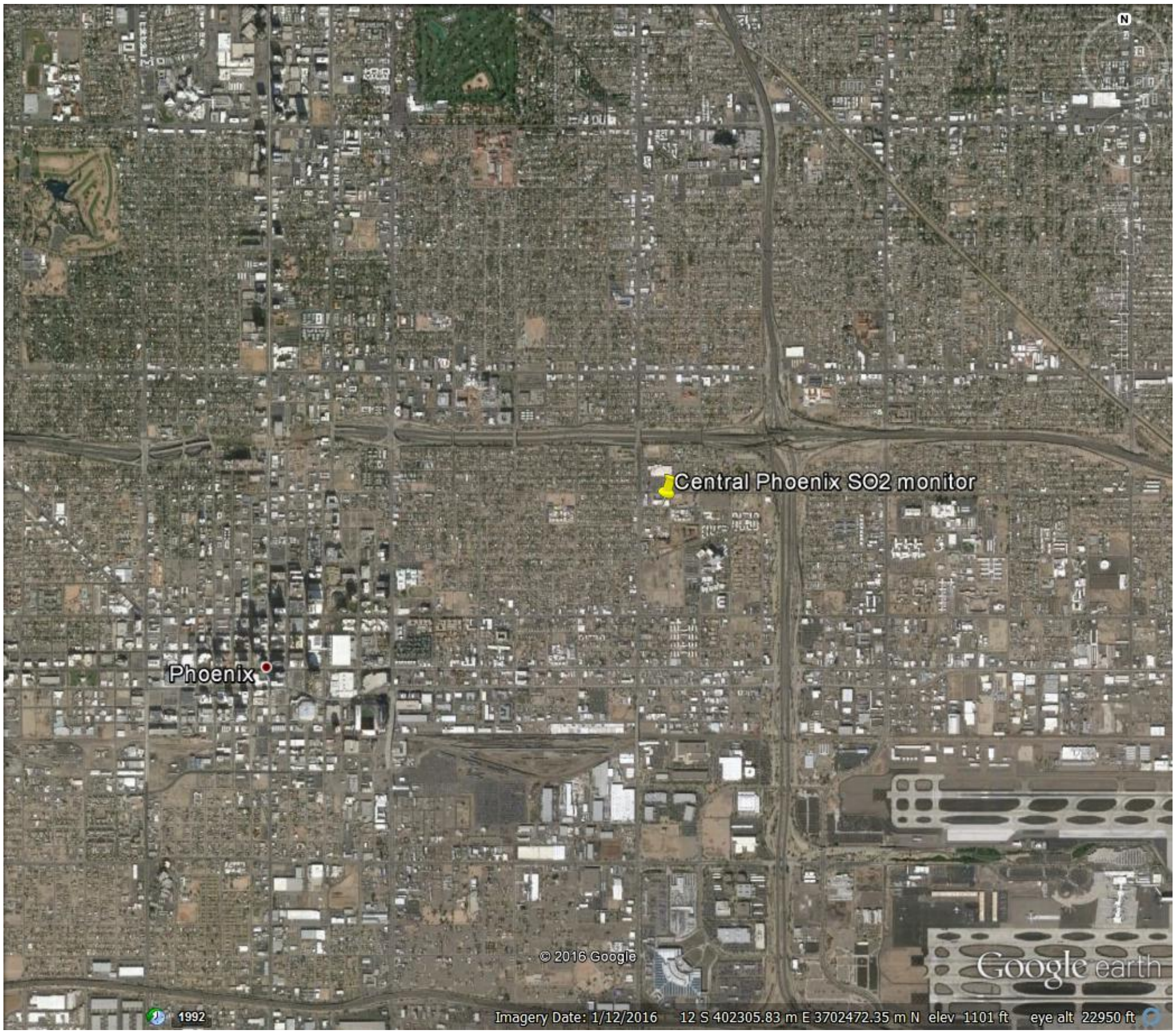
7.0 Background Air Quality

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 anthropological sources. The APS-Cholla power plant is located in a rural area without significant human activities. Therefore, the monitoring concentration at central Phoenix is expected to be higher than the background concentration in the APS-Cholla modeling domain. Thus this method is considered a conservative approach to calculate the background concentration.

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 U.S. EPA's Air Quality System (https://www3.epa.gov/airdata). The 3 year (2012-2014) design values were 8ppb, 8ppb and 7ppb, respectively. Following the EPA Designation Modeling TAD, the SO_2 background concentration for the Cholla power plant was determined to be 7.7 ppb (20.18 µg/m3) as the average of 3-year 99th percentile SO_2 1-hour concentrations.

Figure 7-1: The 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 maximum modeled SO_2 design value to the NAAQS. The maximum design value for 1-hour SO_2 is defined as the sum of the 4th highest modeled hourly concentrations and the background concentration. The results for APS-Cholla are discussed in this section.

The predicted 4th highest maximum daily 1-hour SO_2 concentrations using the Winslow NWS metrological data was 136.65 µg/m³. Adding a background concentration of 20.18 µg/m³ to the modeled concentration, resulted in an ambient concentration of 156.83 µg/m³. This concentration is less than the applicable 1-hour SO_2 NAAQS of 196 µg/m³. In conclusion, the SO_2 concentrations around the APS-Cholla power plant complies with 1-hour SO_2 NAAQS. Table 8-1 summarizes the modeling results.

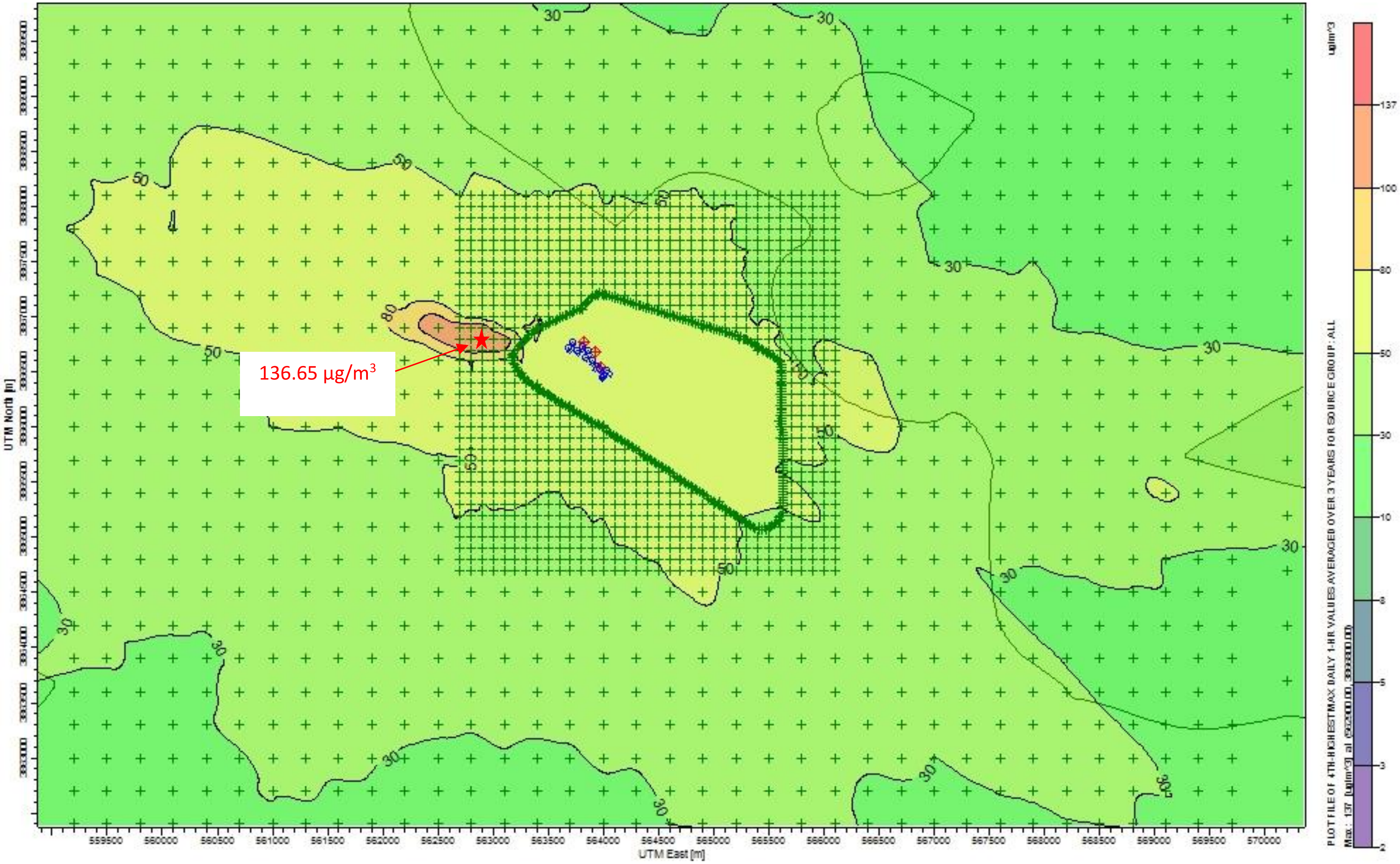
Table 8-1 APS-Cholla 1-Hour SO_2 Modeling Results

Model Predicted Impact (Highest 4th High) Concentration µg/m³	Background Concentration (99th Percentile) µg/m³	Total Concentration µg/m³	NAAQS µg/m³
136.65	20.18	156.83	196
4th highest maximum daily 1-hour SO_2 concentration predicted to occur at 562900 mN and 3866800 mE			

As Figure 8-1 shows, the highest concentrations of 1-hour SO_2 around APS-Cholla power plant were located in the west of the facility near the facility fence line.

ADEQ will submit 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: Isopleths of Predicted Design Value SO_2 Concentrations



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