Attachment C:

1-Hour SO_2 Data Requirement Rule
Air Quality Modeling for the
Oklaunion Power Station
Vernon, TX

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Air Quality Modeling
for the
Oklaunion Power Station
Vernon, TX

Prepared for
Public Service Company of Oklahoma

For Submittal
to
The Texas Commission on Environmental Quality

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INTRODUCTION

American Electric Power Service Corporation (AEPSC) on behalf of the American Electric Power subsidiary Public Service Company of Oklahoma, has performed modeling under the USEPA 1-Hour SO_2 Data Requirements Rule (DRR) found at 40 CFR 51.1200 for the Oklaunion Power Station (Oklaunion) located in Vernon, Texas. This modeling is being submitted to the Texas Commission on Environmental Quality (TCEQ) to demonstrate compliance with the 1-Hour SO_2 Standard by Oklaunion Power Station under the USEPA 1-Hour SO_2 Data Requirements Rule.

The results of this modeling using actual operating data from the period 2013 to 2015 along with the corresponding meteorological data from Wichita Falls Municipal airport paired with Fort Worth Upper Air Data resulted in a maximum modeled design value of 41.96 ug/m^3. This value is less than 50% of the 1-Hour SO_2 limit of 196.6 ug/m^3 that allows future monitoring of emissions from Oklaunion Power Station to follow the provisions of 40 CFR 51.1205(b)(1) going forward and with the approval of USEPA will allow the implementation of 40 CFR 51.1205(b)(2) that dismisses the source from further reporting requirements under the DRR.

DESCRIPTION OF FACILITY AND AREA

The Oklaunion Power Station consists of one electric generating unit rated at 720 MW gross. The unit is equipped with an electrostatic precipitator, wet flue gas desulfurization (FGD), and activated carbon injection (ACI). The plant is located near the Oklahoma border, approximately 12 kilometers southeast of Vernon, Texas. The elevation of the plant site averages 372 m MSL. There are no significant terrain or elevation changes surrounding the Oklaunion Power Station. The area around the plant is classified as rural for purposes of air quality modeling as there are no towns or areas with significant population in the vicinity of the plant.

Figure 1. Oklaunion Power Station and the Surrounding Area Showing Property Holdings

Figure 2. Detail of the Oklaunion Power Station Site

Since this modeling study used the actual operating conditions for the period 2013 to 2015, the Data Requirements Rule allows the use of the actual stack height for purposes of demonstrating compliance with the 1-Hour SO_2 NAAQS[1] regardless of the GEP stack height for the facility.

DEVIATIONS FROM THE PROTOCOL

There were no deviations from the Modeling Protocol submitted to TCEQ dated May 27, 2016 and revised June 16, 2016[2].

SOURCES TO BE MODELED

Based on previous discussion with TCEQ, there are no other significant sources of SO_2 in the area surrounding Oklaunion Plant that need to be included in the DRR modeling demonstration. Oklaunion Plant itself contains the main coal fired boiler, an emergency generator, and a diesel fire pump. The emergency generator is used in the event of a loss of power event and is classified as an emergency engine under the RICE MACT. The fire pump is only operated for testing purposes and in the event of an emergency. It is also classified as an emergency engine under the RICE rules and is not reported on the Annual Emissions Inventory due to its small size and low annual operating levels. The emergency generator and fire pump are limited to 100 hours of non-emergency operation a year in order to retain their classification as emergency engines. Table 1 summarizes these additional sources and shows the emissions reported in the

Annual Emissions Inventory filed with the TCEQ for the years 2013 to 2015 along with the annual hours of operation for each year.

Table 1. Minor Sources at Oklaunion and their Reported SO_2 Emissions in Tons and Hours of Operation

	2013		2014		2015	
Equipment	**Annual Emissions (tpy)**	**Hours of Operation**	**Annual Emissions (tpy)**	**Hours of Operation**	**Annual Emissions (tpy)**	**Hours of Operation**
Emergency Generator	0.0002	3.1	0.0004	6.4	0.0003	5.3
Diesel Fire Pump	Not Reported	6.4	Not Reported	7.3	Not Reported	22.8

Due to the limited emissions and operation of all minor SO_2 emitting sources at Oklaunion Plant, the main boiler is the only source that was included in this modeling analysis.

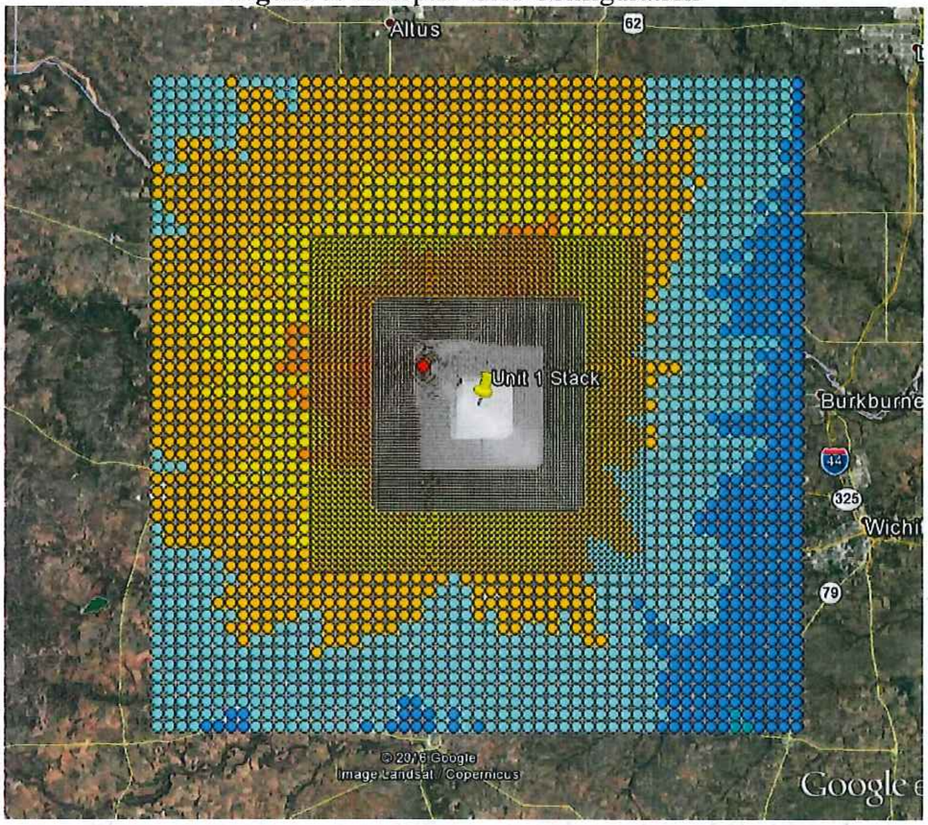
MODEL PLATFORM SELECTION

Version 15181 of AERMOD and AERMET are the current versions of the Appendix A Gaussian Model listed in 40 CFR 51 Appendix W, AERMOD at the time this work was performed and is the appropriate model for use in in regulatory activities such as this study. No Beta Options present in AERMOD or AERMET were used as part of the study. The receptor grid was developed using Version 11103 of AERMAP, the current version of the receptor preprocessor software for the AERMOD Model. In addition, a BPIP analysis of Oklaunion Plant was completed using Version 04274 of BPIPPRM, the current version listed on the USEPA TTN Web Site as applicable for studies of this nature.

RECEPTOR GRID

The receptor grid for the study used DEM data sourced from the MRLC System at a 1/3 arc second resolution in geo tiff format and processed through AERMAP Version 11103. The receptor grid consists of a series of nested receptor grids starting at the Unit 1 stack (483787 E, 3771325 N, Zone 14, NAD 83) and extending out roughly 50 kilometers from that starting point. The inner nest around the plant has a resolution of 100 meters and extends out 4 kilometers from the stack location in all directions. The next nest has a resolution of 250 meters covering the next 5 kilometers out from the stack. The third nest has a resolution of 500 meters covering the next 7 kilometers. The fourth nest has a resolution of 1000 meters and extends out an additional 10 kilometers. The final receptor field has a resolution of 2000 meters and extends out from 26 kilometers to 52 kilometers from the stack. No receptors were removed from plant property. Figure 3 shows the receptor grid configuration on a Google Earth map. In the process of performing the modeling, no critical values occurred outside the 100 meter grid. Therefore, no additional receptors were added to the grid.

Figure 3. Receptor Grid Configuration



METEOROLOGICAL DATA

The meteorological data set used for this study was the 2013 – 2015 Wichita Falls Municipal Airport surface data, paired with Fort Worth Upper Air Data. One minute and five minute surface data from Wichita Falls Municipal Airport for 2013 to 2015 was processed through AERMINUTE Version 15272 to augment the hourly surface data in an effort to reduce the number of missing and calm hours in the final meteorological data files for use in AERMOD version 15181. No Beta Options were used in the processing of the data and no changes were made to the dataset prepared for and described in the Modeling Protocol submitted to TCEQ on May 27, 2016 and revised June 16, 2016[2].

Surface conditions based on the Oklaunion Plant site were developed by AERSURFACE in accordance with USEPA guidance using a 1 km distance from the grid center point. Monthly precipitation data for use in determining the surface moisture levels for the 2013 to 2015 period based on the 30 year historic average for the Wichita Falls Municipal Airport was sourced from the National Climatic Data Center[3]. Table 2 shows the monthly precipitation data and classification for the Wichita Falls Municipal Airport for the period from 2013 to 2015. The classifications were based on average being classified as precipitation being between +/- 20% of the 30 year average precipitation value and the dry and wet classifications being outside of the +/- 20% of the 30 year average range.

Table 2. Precipitation Data for Wichita Falls Regional Airport for 2013 to 2015

		Precipitation				Classification		
Month	**30 Year AVG**	**2013**	**2014**	**2015**		**2013**	**2014**	**2015**
January	1.14	0.6	0.0	2.2		DRY	DRY	WET
February	1.75	2.0	0.4	0.4		AVG	DRY	DRY
March	2.20	0.5	2.2	1.8		DRY	AVG	AVG
April	2.60	2.4	1.5	3.7		AVG	DRY	WET
May	3.79	1.6	1.1	17.0		DRY	DRY	WET
June	4.15	2.9	3.1	4.2		DRY	DRY	AVG
July	1.59	3.9	5.5	2.8		WET	WET	WET
August	2.50	1.5	2.0	1.5		DRY	AVG	DRY
September	2.81	2.0	1.5	4.6		DRY	DRY	WET
October	3.11	2.0	1.3	4.4		DRY	DRY	WET
November	1.65	0.7	4.2	5.2		DRY	WET	WET
December	1.62	1.3	1.0	2.6		DRY	DRY	WET

BACKGROUND VALUE

The nearest SO_2 monitors to the Oklaunion Power Station are located southeast of the plant in Dallas (48-113-0069) and Midlothian (48-139-0016), northwest of the plant Amarillo (48-375-1025), and northeast in Oklahoma City (40-107-1037). Tables 3 and 4 contain various high level metrics for the potential background ambient monitors that are useful in screening various monitors from consideration as a source of background data. Table 3 shows the percentage of data captured, by year for the period 2013 to 2015 at each monitor. Based on this metric, the monitor in Amarillo was dropped from further consideration as data capture at this monitor was very limited in 2013.

Table 3. Annual Hourly Data Capture Rate for the Monitors Examined

Monitor	2013		2014		2015		Acceptable Capture
	Hrs	Capture	Hrs	Capture	Hrs	Capture	
48-113-0069	8281	95%	8413	96%	8560	98%	YES
48-139-0016	8239	94%	8556	98%	8474	97%	YES
48-375-1025	1808	21%	8467	97%	7052	81%	NO
40-109-1037	8681	99%	8692	99%	8381	96%	YES

Table 4 then considers the high level 1-hour and annual data from the Dallas, Midlothian, and Oklahoma City monitors shown in the USEPA Air Data system to give an indication of the nature of the monitor values in the data set.

Table 4. Air Data 1-Hour and Annual SO_2 Metrics by Year for Potential Background Monitors in ppb

Monitor	2013				2014				2015			
	1 hr Max	1 hr 2nd Max	99th pctle	Annual Avg	1 hr Max	1 hr 2nd Max	99th pctle	Annual Avg	1 hr Max	1 hr 2nd Max	99th Pctle	Annual Avg
48-113-0069	7.4	7.3	5	0.17	6.3	5.3	5	0.27	5.6	4.8	4	0.25
48-139-0016	23.8	18.4	16	0.54	19.8	11.1	8	0.17	12.7	8.6	5	0.17
40-109-1037	5	3	3	0.22	7	4	3	0.08	4	4	3	0.5

In examining the data in Table 4, the Midlothian monitor (48-139-0016), Oklahoma City monitor (40-109-1037), and Dallas monitor (48-113-0069) all show relative stability in the high level values and do not exhibit a sharp gradient as these values are worked through, indicating that they do not appear to be impacted by local sources. Based on the monitored values and the apparent lack of SO_2 sources in both the area around Oklaunion Plant and the Oklahoma City SO_2 monitor located on the campus of Oklahoma Christian University, this monitor was used to develop a background value. Since the data at this monitor is stable, a three year average of the 99^{th} percentile values was used for all hours in this study resulting in a background value of 3.0 ppb (7.9 ug/m^3).

PLANT OPERATING DATA

Under the Data Requirements Rule, actual hourly emissions and operating data is preferred for use in an SO_2 modeling analysis. The exhaust flue at Oklaunion Power Station has Continuous Emissions Monitor Systems (CEMS) installed and operated under 40 CFR 75 that measure SO_2, Flow, Temperature, and other parameters specified in 40 CFR 75. This data is then processed and reported to USEPA Clean Air Markets Division (CAMD) in units of ppm SO_2, lb/hr SO_2, and wscfh for flow. Temperature is used in the derivation of the reported flow, but is not reported to CAMD as the CAMD reporting protocols do not allow for the explicit reporting of the temperature data. Certain hours may also be impacted by data substitution requirements and other data management requirements found in 40 CFR 75. These hours were manually edited to ensure the data was truly representative of the actual operating conditions present.

Table 5 shows the input data for the modeling study, with the hourly data elements being used shown as "Variable" to denote the use of actual hourly conditions based on CEMS and other operating data sources. The data selected covers the period 2013 to 2015 to match the meteorological data being used. The QA/QC requirements in 40 CFR Part 75 were met by the CEMS during this time.

Table 5. Modeling Inputs for the Oklaunion Power Station Simulation

Unit	Flue Easting (m)	Flue Northing (m)	Stack Base (m)	Emission Rate (g/sec)	Stack Height (m)	Exit Temp (K)	Exit Velocity (m/sec)	Exit Diameter (m)
Unit 1	**483787**	**3771326**	**370.3**	**Variable**	**137.9**	**Variable**	**Variable**	**7.01**

The emissions, temperature, and exit velocity data for the period 2013 to 2015 have been prepared into an HOUREMIS file as described in the AERMOD User's Guide and processed in accordance with the June 16, 2016 Modeling Protocol for this project. Table 6 compares the average SO2 emission rate values in the original 40 CFR Part 75 dataset to the processed HOUREMIS file on an annual basis. The insignificant difference seen between the two datasets indicates the processed dataset is suitable for modeling. The HOUREMIS file used for this study is included with this report.

Table 6. Comparison of Original vs Processed Hourly Emission Data

	Original CEMS Average SO2 Rate (lb/hr)	**Processed Average SO2 Rate (lb/hr)**	**% difference**
2013	870.2	869.1	0.13
2014	801.0	799.5	0.19
2015	338.2	337.4	0.24

MODELING RESULTS

Table 7 shows the design value results generated by the modeling simulation and includes the background of 7.9 μg/m^3. The results are shown in the three year average form (true design value in the form of the 1-hour SO_2 standard) and the individual annual fourth high daily high values that make up the three year average.

Table 7. Results Including Background by Three Year Average and by Year

Receptor Easting (m)	**Receptor Northing (m)**	**Receptor Elevation (m)**	**Three Year Average (μg/m^3)**	**2013 value (μg/m^3)**	**2014 value (μg/m^3)**	**2015 value (μg/m^3)**
480387	**3771926**	**380.86**	**41.96**	**51.66**	**49.87**	**24.33**

In addition to the design value presented in Table 7, Figures 4, 5 and 6 show the spatial distribution of the modeled design values.

Figure 4. Full Domain Receptor Representation

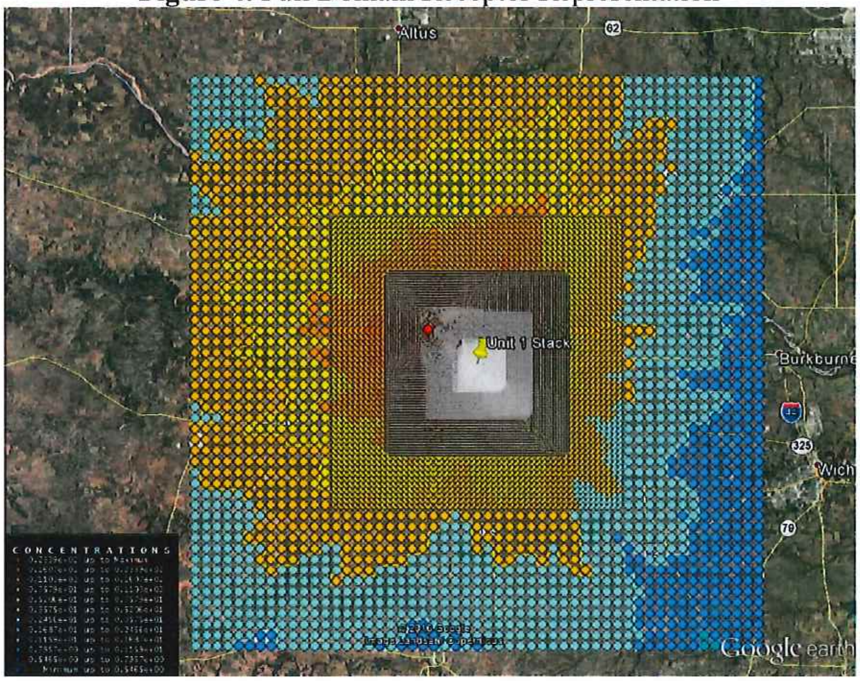


Figure 5. Detail of the 100 Meter Grid

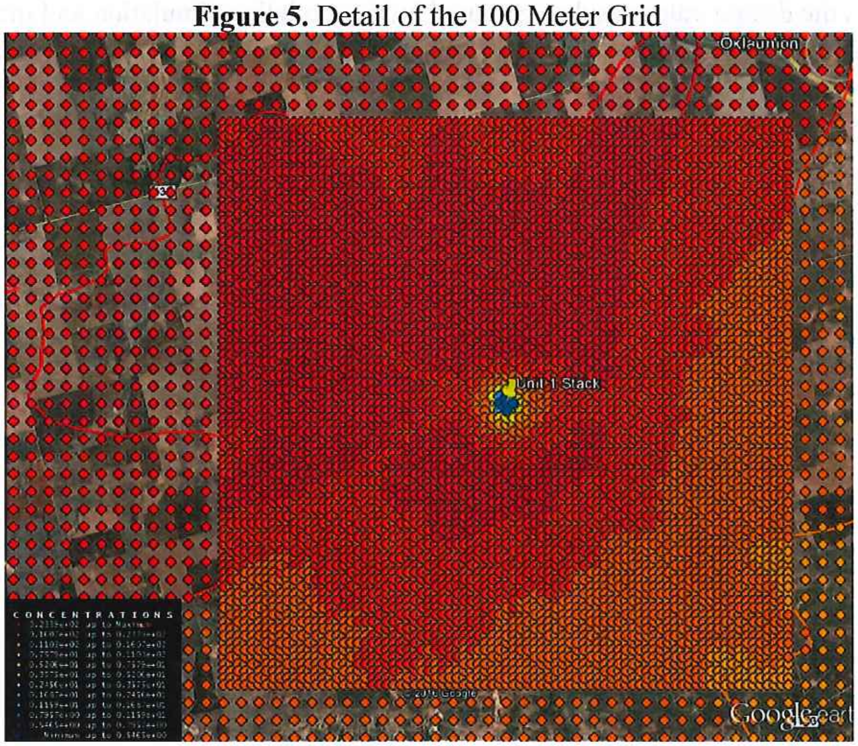
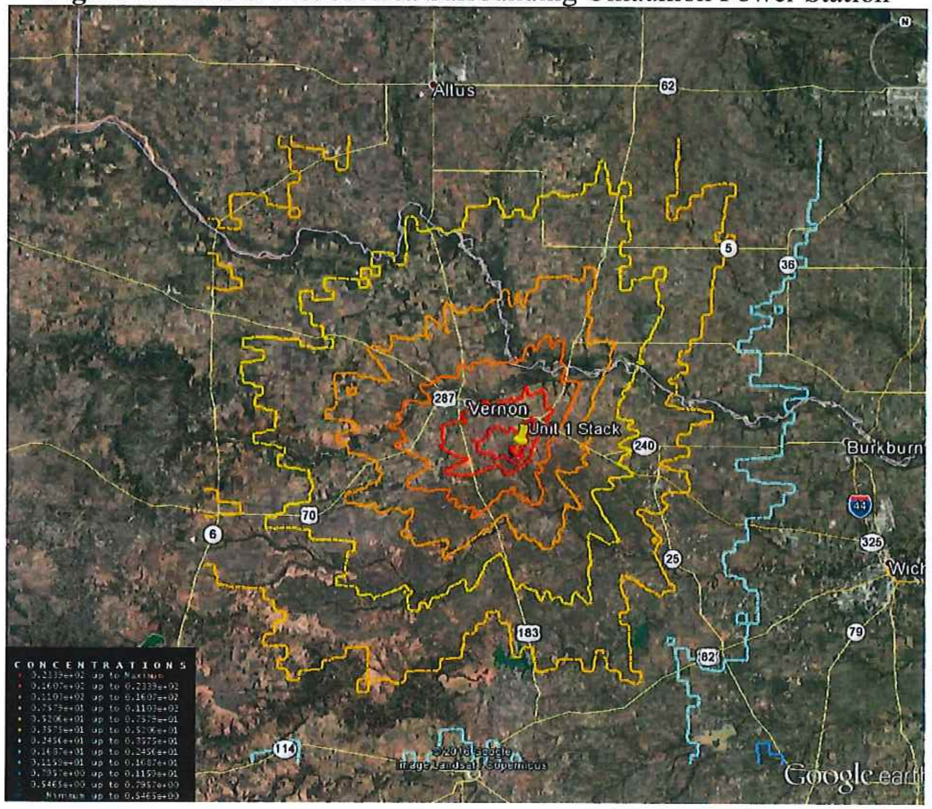


Figure 6. Contour Plot of Area Surrounding Oklaunion Power Station



CONCLUSION

Based on these results, Oklaunion Power Station demonstrates that it meets the 1-Hour SO_2 Standard based on the use of actual operating data. Further, based on the provisions of 40 CFR 1205(b)(2) in the DRR, USEPA may exempt Oklaunion Power Station from further reporting under the DRR since the modeled actual emissions with background were below 50% of the 1-Hour SO_2 Standard. This modeling study provides the required technical basis for the granting of such an exemption.

REFERENCES

1. US EPA, Office of Air Quality Planning and Standards, *Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide (SO_2) National Ambient Air Quality Standard* (NAAQS), Federal Register, Vol 80 No 162, August 21, 2015, page 51078.
2. Long, David J, and Ullstrom, Ashley, *1-Hour SO_2 Data Requirement Rule Air Quality Modeling Protocol for the Oklaunion Power Station Vernon, TX,* May 27, 2016, Revised June 16, 2016.
3. National Climatic Data Center, http://www.ncdc.noaa.gov, last checked May 17, 2016