1-Hour SO_2 Data Requirement Rule
Air Quality Modeling
for the
Flint Creek Power Plant
Gentry, AR

Prepared for
Southwestern Electric Power Company

For Submittal
to
The Arkansas Department of Environmental Quality

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INTRODUCTION

American Electric Power Service Corporation (AEPSC) on behalf of the American Electric Power subsidiary Southwestern Electric Power Company, has performed modeling under the USEPA 1-Hour SO_2 Data Requirements Rule (DRR) found at 40 CFR 51.1200 for Flint Creek Power Plant (Flint Creek) located in Gentry, Arkansas. This modeling is being submitted to the Arkansas Department of Environmental Quality (ADEQ) to demonstrate compliance with the 1-Hour SO_2 Standard by Flint Creek Power Plant under the USEPA 1-Hour SO_2 Data Requirements Rule.

The results of this modeling using the maximum allowable emissions along with the 2013-2015 Northwest Arkansas Regional Airport surface data and Springfield, Missouri Upper Air Data resulted in a maximum modeled design value of 63.75 ug/m^3 which includes a background of 30.6 ug/m^3. This result allows Flint Creek to be removed from further examination under the DRR based on the requirements found in 40 CFR 51.1205(c).

DESCRIPTION OF FACILITY AND AREA

The Flint Creek Power Plant consists of one electric generating unit rated at 558 MW gross. The unit is equipped with dry flue gas desulfurization (DFGD) with a pulse jet fabric filter (PJFF) and activated carbon injection (ACI). The plant is located in Northwest Arkansas, approximately 40 kilometers northwest of Fayetteville, Arkansas. The elevation of the plant site averages 352 m MSL. The area around the plant is classified as rural for purposes of air quality modeling as the only significant population area is the town of Gentry, AR.

Figure 1. Flint Creek Power Plant and the Surrounding Area Showing Property Holdings

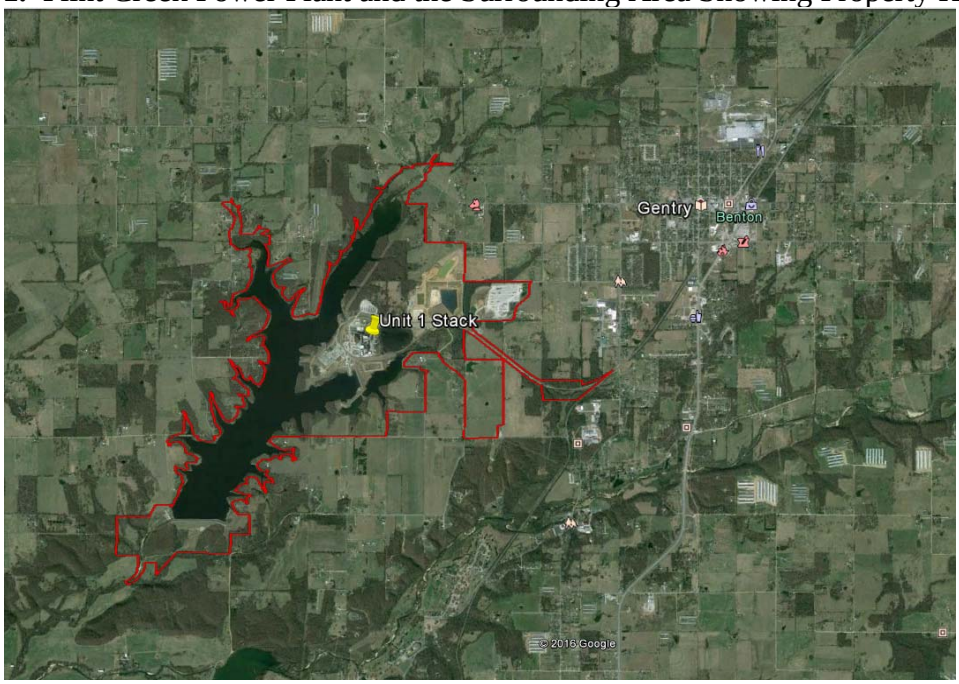


Figure 2. Detail of the Flint Creek Power Plant Site

DEVIATIONS FROM THE PROTOCOL

There were no deviations from the Modeling Protocol submitted to ADEQ dated June 13, 2016 and revised June 29, 2016[1].

SOURCES MODELED

There are no other significant sources of SO_2 in the area surrounding Flint Creek Power Plant that need to be included in the DRR modeling demonstration. Flint Creek itself contains the main coal fired boiler, an emergency generator, and a fire pump. The emergency generator and fire pump are only used for maintenance and testing and in the event of an emergency or loss of power condition. Both engines are classified as emergency engines under the RICE rules. Table 1 summarizes these additional sources and shows the emissions reported in the Annual Emissions Inventory filed with the Arkansas Department of Environmental Quality (ADEQ) for the years 2013 to 2015.

Table 1. Minor Sources at Flint Creek and Their Reported 2013 to 2015 Annual SO_2 Emissions in Tons

Equipment	2013	2014	2015
Emergency Generator	0.004	0.010	0.024
Diesel Fire Pump	0.009	0.009	0.014

Due to the limited emissions and operation of the emergency generator and fire pump at Flint Creek Power Plant, the main boiler was the only source included in this modeling and 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 Flint Creek Power 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

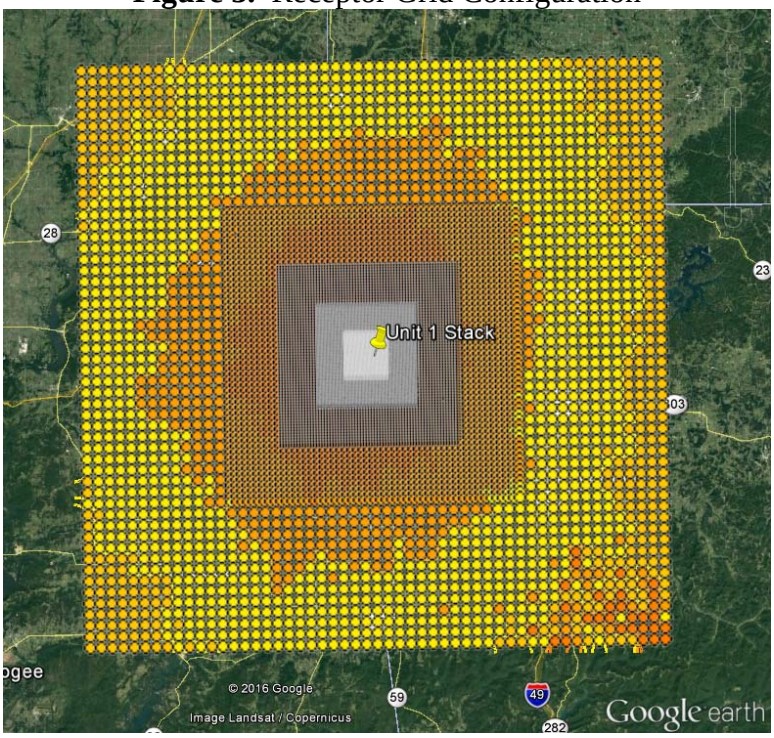
The receptor grid for the study used DEM data sourced from the MRLC System at a 1/3 arc second resolution in geo tiff format and processed through AERMAP Version 11103. The receptor grid consists of a series of nested receptor grids starting at the center of the new stack (363080 E, 4013440 N, Zone 15, 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 to represent the plant property. Figure 3 shows the receptor grid configuration on a Google Earth map.

In preparing this grid, the following receptors were classified by AERMAP as being in locations with insufficient data in the geo tiff files to process the receptors:

250 meter grid	1000 meter grid
358830 E, 4005440 N	339080 E, 4035440 N
359080 E, 4005440 N	

In the process of performing the modeling, no critical values occurred near these gaps or outside of the 100 meter grid. Therefore, no additional receptors were removed from the grid and no 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 Northwest Arkansas Regional Airport surface data, paired with Springfield, Missouri Upper Air Data. One minute and five minute surface data from Northwest Arkansas Regional Airport in Fayetteville 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.

Surface conditions based on the Northwest Arkansas Regional Airport 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 location was sourced from the National Climatic Data Center[2]. Table 2 shows the monthly precipitation data and classification for the Northwest Arkansas Regional 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 Northwest Arkansas Regional Airport for 2013 Through 2015

		Precipitation				Classification		
Month	**30 Year AVG**	**2013**	**2014**	**2015**		**2013**	**2014**	**2015**
January	2.54	3.20	1.35	0.91		WET	DRY	DRY
February	2.61	2.24	0.48	1.70		AVG	DRY	DRY
March	4.10	4.13	2.85	4.20		AVG	DRY	AVG
April	4.44	5.75	1.98	2.44		WET	DRY	DRY
May	5.82	10.01	1.85	12.26		WET	DRY	WET
June	5.11	2.24	6.61	5.33		DRY	WET	AVG
July	3.42	4.65	1.70	5.71		WET	DRY	WET
August	3.45	6.63	1.70	5.05		WET	DRY	WET
September	4.78	3.25	4.42	1.44		DRY	AVG	DRY
October	4.14	5.4	7.89	3.10		WET	WET	DRY
November	4.25	1.65	2.56	7.52		DRY	DRY	WET
December	3.24	2.85	2.65	12.63		AVG	AVG	WET

BACKGROUND VALUE

The nearest SO_2 monitors to the Flint Creek Power Plant are located southwest of the plant in Stilwell (40-001-9009), Muskogee (40-101-0167), and Oklahoma City (40-109-1037), west of the plant in Tulsa (40-143-0175, 40-143-0179, 40-143-0235, 40-143-1127) and Ponca City (40-071-0604), and southeast of the plant in North Little Rock (41-190-007). Upon further investigation, many of these monitors are located near major SO_2 sources including coal fired power plants or refineries and therefore do not accurately represent background ambient air conditions around Flint Creek Power Plant. These monitors were removed from consideration (40-071-0604, 40-101-0167, 40-143-0175, 40-143-0179, 40-143-0235). Tables 3 and 4 contain various high level metrics for the potential background ambient monitors that were useful in screening the various remaining 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.

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

Monitor	2013		2014		2015		Acceptable Capture
	Hrs	Capture	Hrs	Capture	Hrs	Capture	
40-001-9009	7520	86%	7345	84%	7978	91%	YES
40-109-1037	8681	99%	8692	99%	8381	96%	YES
40-143-1127	8593	98%	8100	92%	8578	98%	YES
51-190-007	8720	100%	8731	100%	8724	100%	YES

Table 4 then considers the high level 1-hour and annual data from the Stilwell, Oklahoma City, Tulsa, and Little Rock 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

	2013				2014				2015			
Monitor	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
40-001-9009	5.7	4.8	5	0.44	43.2	35.4	35	0.63	34.8	8.7	6	0.54
40-109-1037	5	3	3	0.22	7	4	3	0.08	4	4	3	0.50
40-143-1127	36.3	22.7	20	0.49	9.3	9	6	0.31	13.7	10	9	0.82
51-190-007	8.8	8.5	7	1.54	11.1	10.6	10	1.34	29.3	28.4	23	1.12

In examining the data in Table 4, the Stilwell monitor (40-001-9009) does not show stability throughout the three years examined, indicating it is likely affected by a nearby source that is unlikely to affect the area around Flint Creek. Therefore it is not an accurate representation of background near the Flint Creek Power Plant. The next closest monitor is the Tulsa monitor (40-143-1127). This monitor is fairly consistent and does not appear to be largely impacted by nearby sources, making it suitable for use to determine the recommended background value. Since the data at this monitor is stable, the three year average of the 99th percentile values was used for all hours in this study, resulting in a background value of 11.7 ppb (30.6 ug/m3).

PLANT OPERATING DATA

Under the Data Requirements Rule, sources have the option to model actual or allowable emissions. Flint Creek Power Plant recently completed a retrofit project to install Dry Flue Gas Desulfurization, a Pulse Jet Fabric Filter, and Activated Carbon Injection in May 2016 resulting in reduced allowable emissions which was used in this modeling analysis. Since allowable emissions are being modeled, the Good Engineering Practice (GEP) stack height must be used in this study. The GEP stack height for Flint Creek Power Plant is 163.85 meters, 0.75 meters less than the actual stack height of 164.6 meters.

The emission rate used in this modeling analysis was derived from the current permitted allowable emission rate of 948.6 lb/hr on a three hour rolling average. This limit was divided by a factor of 0.9 in order to estimate the equivalent 1-hour limit[3] resulting in an emission rate of 1,054 lb/hr or 132.8 g/s. Table 5 summarizes the input data for the modeling study.

Table 5. Modeling Inputs for the Flint Creek Power Plant 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	**363080**	**4013440**	**341**	**132.8**	**163.85**	**352.6**	**30.4**	**6.1**

MODELING RESULTS

Table 6 shows the design value results generated by the modeling simulation and includes the background of 30.6 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 6. 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)
360780	**4012140**	**352.07**	**63.75**	**69.36**	**60.63**	**61.26**

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

Figure 4. Full Domain Receptor Representation

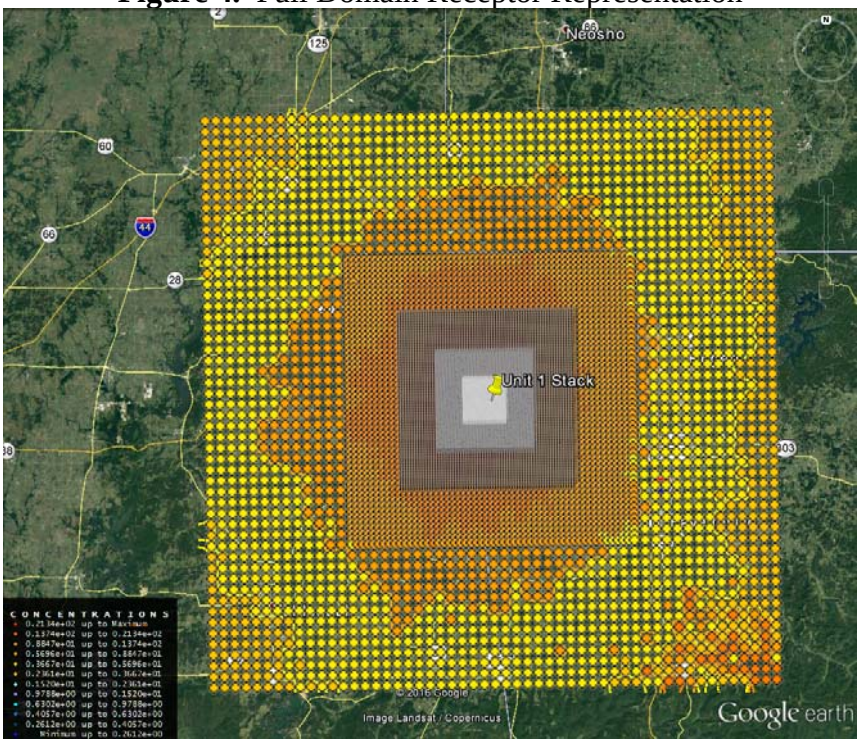


Figure 5. Detail of the 100 Meter Grid

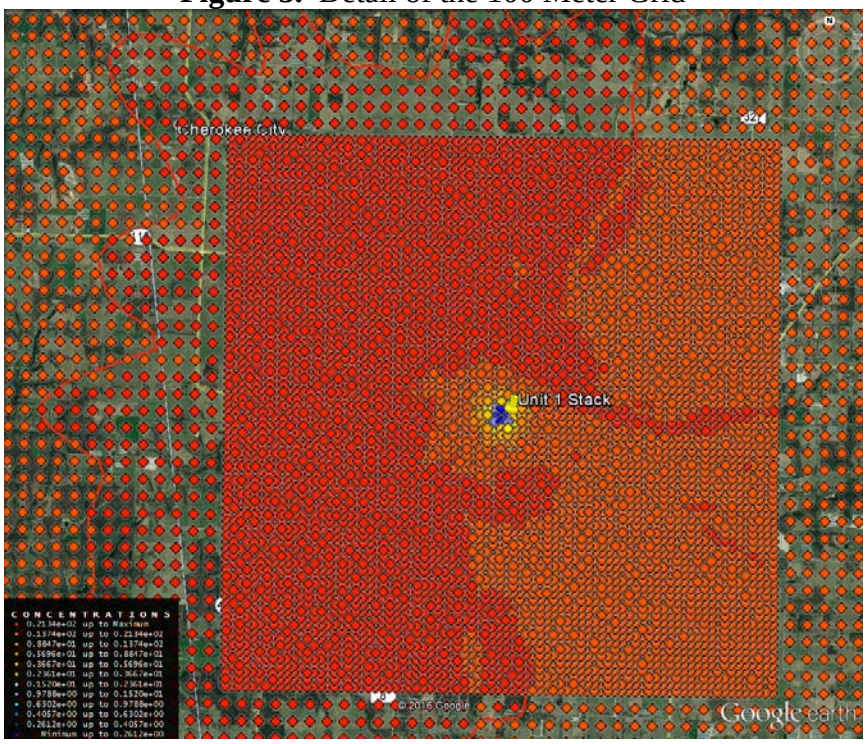
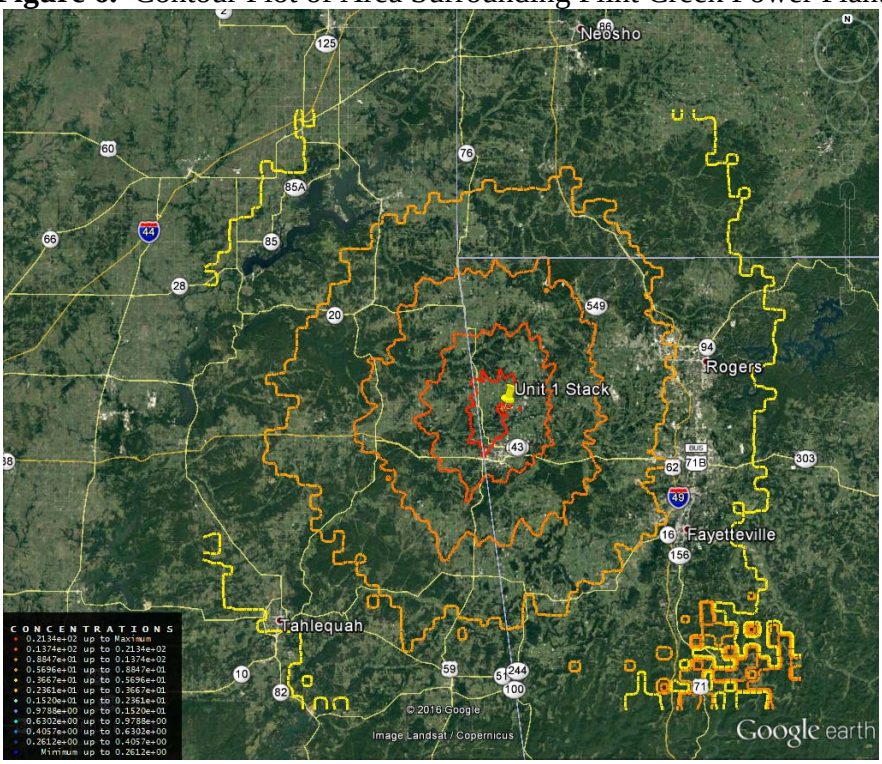


Figure 6. Contour Plot of Area Surrounding Flint Creek Power Plant



CONCLUSION

Based on these results, Flint Creek Power Plant demonstrates that it meets the 1-Hour SO_2 Standard based on the use of maximum allowable emissions combined with meteorological data from the past 3 years. Further, based on the provisions of 40 CFR 51.1205(c) in the DRR, USEPA may exempt Flint Creek Power Plant from further reporting under the DRR since this evaluation shows the area meets the 2010 SO_2 NAAQS using allowable emissions.

REFERENCES

1. Long, David J, and Ullstrom, Ashley, *1-Hour SO_2 Data Requirement Rule Air Quality Modeling Protocol for the Flint Creek Power Plant Gentry, AR,* June 13, 2016, Revised June 29, 2016.
2. National Climatic Data Center, http://www.ncdc.noaa.gov, last checked May 25, 2016
3. US EPA, Office of Air Quality Planning and Standards, *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised*, October 1992, page 4-16.

APPENDIX
Modeling Input and Output Files