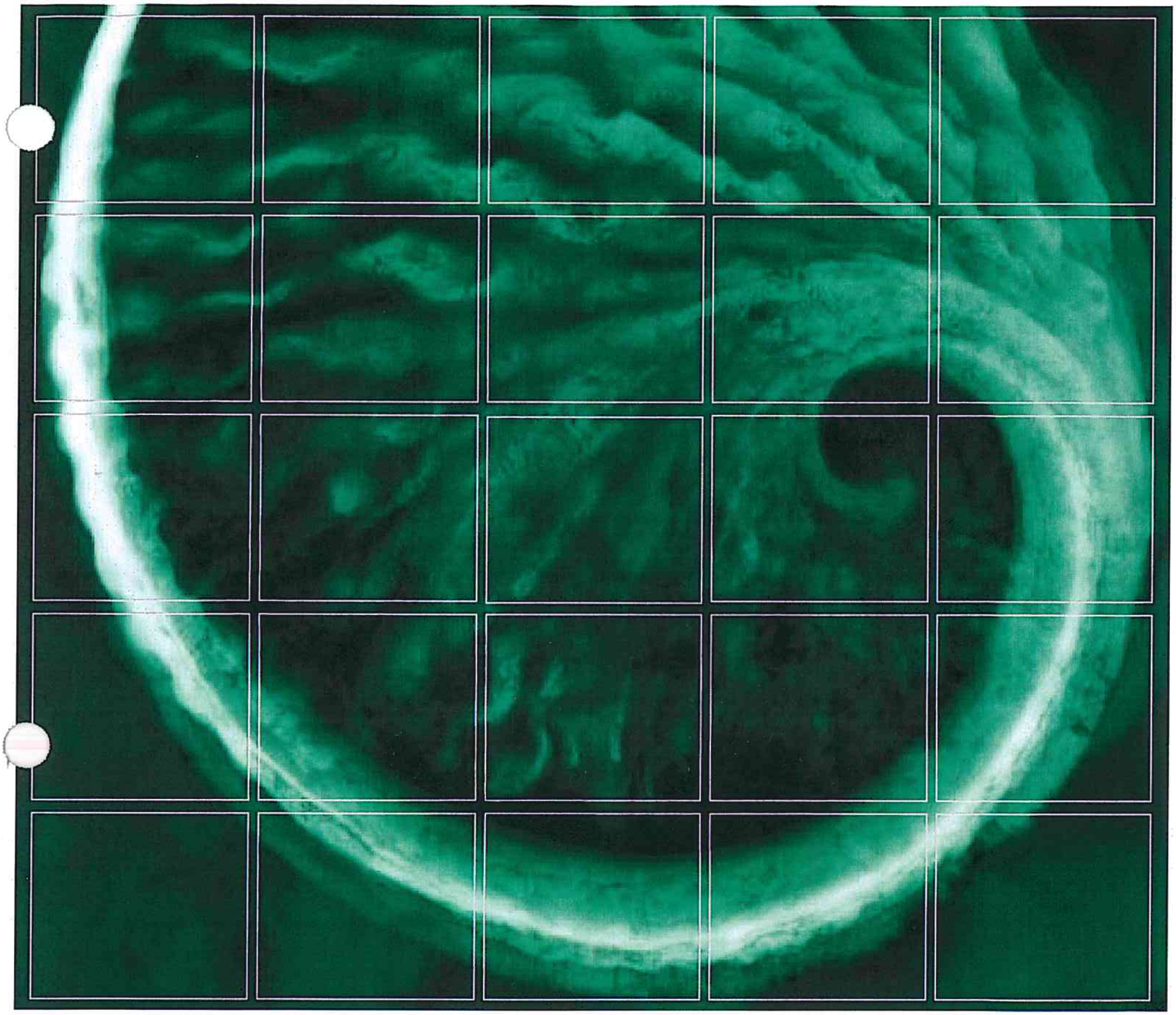

SO_2 Air Dispersion Modeling Report for Big Cajun II Power Plant

Louisiana Generating, LLC

January 9, 2017

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SO_2 Air Dispersion Modeling Report for Big Cajun II Power Plant

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1.0 INTRODUCTION

Environmental Resources Management (ERM) presents this air dispersion modeling report on behalf of Louisiana Generating LLC for their Big Cajun II (BCII) Power Plant. Dispersion modeling was completed in response to the Environmental Protection Agency's (EPA) Data Requirements Rule (DRR) to assess the compliance status of the area surrounding BCII with respect to the 1-hour Sulfur Dioxide (SO_2) National Ambient Air Quality Standard (NAAQS).

This report describes the modeling methodology that was used to evaluate the impacts of SO_2 emissions from BCII on ambient air quality as well as the results of the cumulative assessment of emissions from BCII along with nearby sources of SO_2 and ambient monitoring data.

1.1 PROJECT OVERVIEW

Unlike previous NAAQS attainment demonstrations, in the 1-hour SO_2 DRR EPA has proposed to make 1-hour SO_2 NAAQS attainment determinations using ambient air monitoring data and/or air dispersion modeling. In situations where air modeling is used to make this determination, the recommended approach is described in EPA's proposed "Modeling Technical Assistance Document" (TAD)[1], which sets forth a significantly different technical approach compared to conventional regulatory modeling prescribed by 40 CFR Part 51, Appendix W (EPA's *Guideline on Air Quality Models*).

EPA distinguishes the approaches described in the SO_2 Modeling TAD from those used for other regulatory purposes as being designed to "reflect a view that designations are intended to address current actual air quality (i.e., modeling simulates a monitor), and thus are unlike attainment plan modeling, which must provide assurances that attainment will occur." EPA's proposed methodology utilizes several distinctive technical approaches, including but not limited to the following:

- Simulating actual emissions and exhaust conditions (e.g., temperature and flowrate) on an hourly basis reflecting actual operations for a specified historical time period;
- Representing actual stack heights, irrespective of the GEP limitations;
- Limiting modeled ambient air receptors to locations where monitoring could actually take place and locations that would conventionally be considered "ambient air" for regulatory and permitting purposes, by excluding waterways, roadways, railways, restricted access property, and other locations not accessible to the general public or where a monitor could not reasonably be sited; and

[1] http://epa.gov/oaqps001/sulfurdioxide/pdfs/SO2ModelingTAD.pdf

- Simulating a three-year period of meteorological and background monitoring data, concurrent with the actual operating conditions and emissions, to meet EPA's objective that "modeling simulates monitoring" in this context.

ERM performed a modeling analysis to evaluate the impact of SO_2 emissions from BCII on ambient air quality in the vicinity. In addition, although the approach for considering cumulative ambient impacts with other SO_2 sources in the region is not specifically covered in the proposed DRR, ERM considered other sources in the vicinity of BCII for inclusion in the modeling.

ERM's approach to the modeling analysis used the methods directly addressed in the DRR, such as using actual hourly emissions, actual stack heights and variable (seasonal diurnal) ambient background concentrations.

The first section of this report describes the modeling methodology that was followed. Section 2 provides a description of the facility and the emissions that were included in the modeling. Model selection and the methodology used in the modeling are described in Section 3. Section 4 presents the results of the modeling and compares the results with the 1-hour SO_2 NAAQS.

1.2 OVERVIEW OF METHODOLOGY

ERM's assessments were conducted in a manner consistent with EPA and Louisiana Department of Environmental Quality (LDEQ) air quality regulations and modeling guidelines, including the following EPA documents:

- *Guideline on Air Quality Models* – 40 CFR Part 51, Appendix W, Revised November 9, 2005.
- AERMOD Implementation Guide, Revised March 19, 2009;
- "SO_2 NAAQS Designations Modeling Technical Assistance Document (Draft)," August 2016;
- "SO_2 NAAQS Designations Monitoring Technical Assistance Document (Draft)," August 2016;
- "Data Requirements Rule for the 1-Hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS)," Final rule, August 11th, 2015 (published in the Federal Register on August 21st, 2015 80FR No. 162);
- Sierra Club and Natural Resources Defense Council vs. Gina McCarthy Consent Decree, Case No. 3:13-cv-3953-SI, United States District Court for the Northern District of California, March 2nd, 2015; and
- "Guidance for 1-hour SO_2 Nonattainment Area SIP Submissions," April 23, 2014.

The steps that were undertaken by ERM for conducting the air dispersion modeling analyses are summarized below:

- Compile information on the parameters and characteristics for sources of SO_2 emissions at BCII including the 3 primary Electrical Generating Units (EGUs).
- Develop a comprehensive receptor grid to capture the maximum off-site impacts from BCII sources using AERMAP (v.11103).
- Review regional ambient background monitors to determine the most appropriate ambient background concentration data for SO_2 to represent sources not explicitly included in the modeling runs.
- Develop 3 years (2013-2015) of meteorological data using surface observations from Baton Rouge Regional Airport with upper air data from Lake Charles, LA using the most recent version (v.15181) of AERMET, the meteorological data processor for AERMOD, and its two preprocessors: AERSURFACE (v.13016) and AERMINUTE (v.15272).
- Review all major sources of SO_2 in the vicinity of BCII for possible inclusion in the cumulative modeling analysis using the 2011 National Emission Inventory Database[2] and the Louisiana Emissions Reporting and Inventory Center (ERIC)[3], based on guidance included in the SO_2 Modeling TAD.
- Conduct an air dispersion modeling analysis using the most recent version of EPA's regulatory dispersion model, AERMOD (v.15181) and 3 years (2013-2015) of actual operating data from BCII sources, consistent with the methodology described in the SO_2 DRR and SO_2 Modeling TAD.
- Complete a cumulative air dispersion modeling analysis including BCII EGUs, selected background sources and ambient monitoring data.
- Summarize the results and compare them with the 1-hour SO_2 NAAQS to determine a recommended attainment designation for the vicinity of BCII.

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[2] http://www.epa.gov/ttnchie1/net/2011inventory.html
[3] http://www.deq.louisiana.gov/portal/tabid/109/Default.aspx

2.0 *FACILITY DESCRIPTION AND REGULATORY SETTING*

2.1 *FACILITY LOCATION*

The Big Cajun II Power Plant is located in New Roads, LA. The station is located about 23 miles northwest of downtown Baton Rouge, LA. The site is accessed by state road 10 off state highway 964. Approximate site coordinates are 30.73° North Latitude, 91.37° West Longitude. The Universal Transverse Mercator ("UTM") coordinates of the facility are 656,100 Easting and 3,400,621 Northing (using North American Datum of 1983 - NAD83) in UTM Zone 15. The base elevation of the facility is 39.4' (12.0 m) above sea level. A full scale site plan of BCII is shown in Figure 2-1, and Figure 2-2 shows the site location marked on a United States Geological Survey ("USGS") topographic map.

2.2 *SO_2 ATTAINMENT STATUS*

In July 2013, EPA issued a rule designating 29 counties or partial counties as non-attainment for 1-hour SO_2. However, the vast majority of the country was not designated by EPA at that time. None of the parishes surrounding Big Cajun II, including Pointe Coupee, the parish in which BCII is located, have been designated as attainment or non-attainment for the 1-hour SO_2 NAAQS as of this time.

FIGURE 2-1: Big Cajun II Site Plan

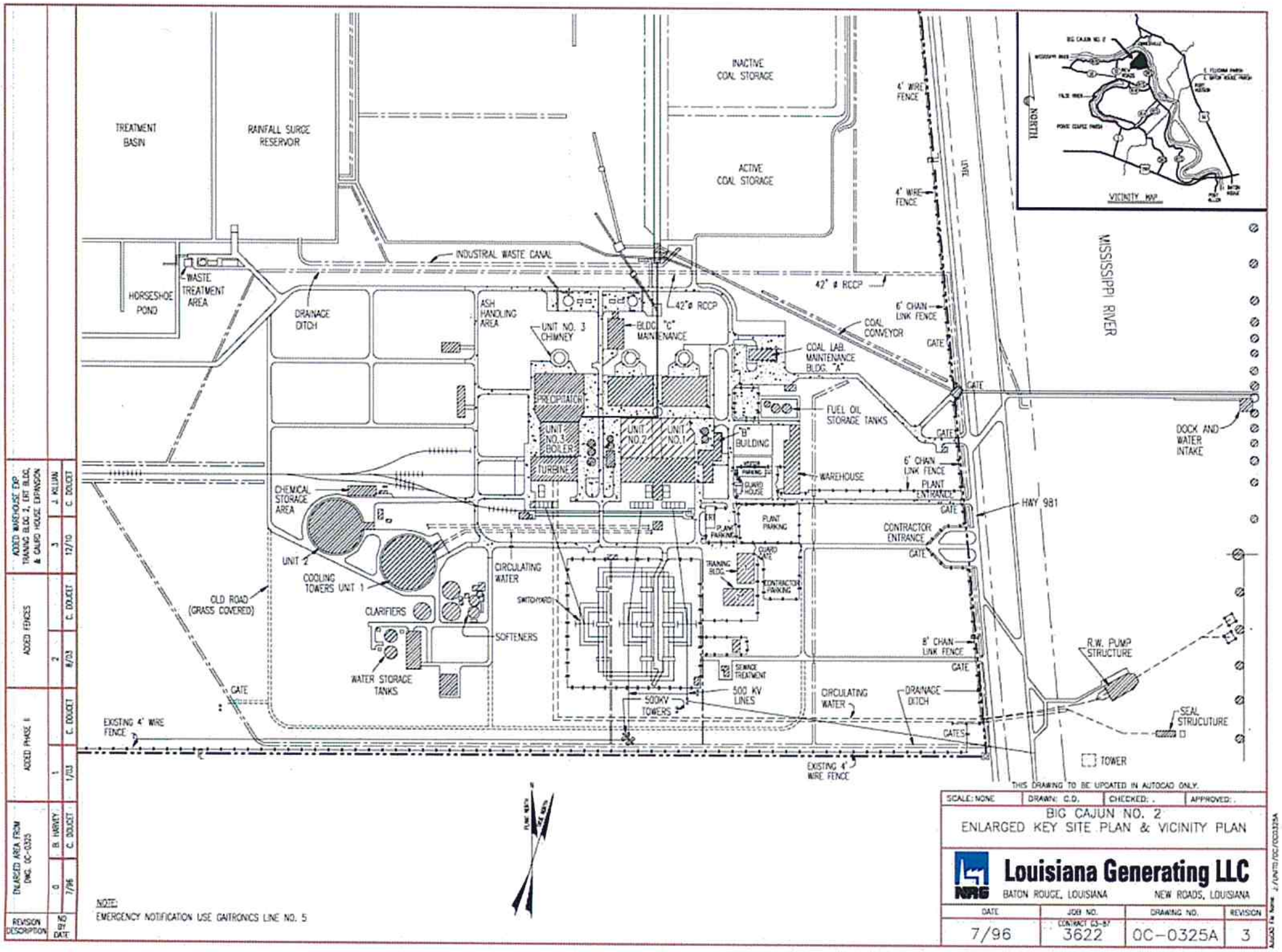
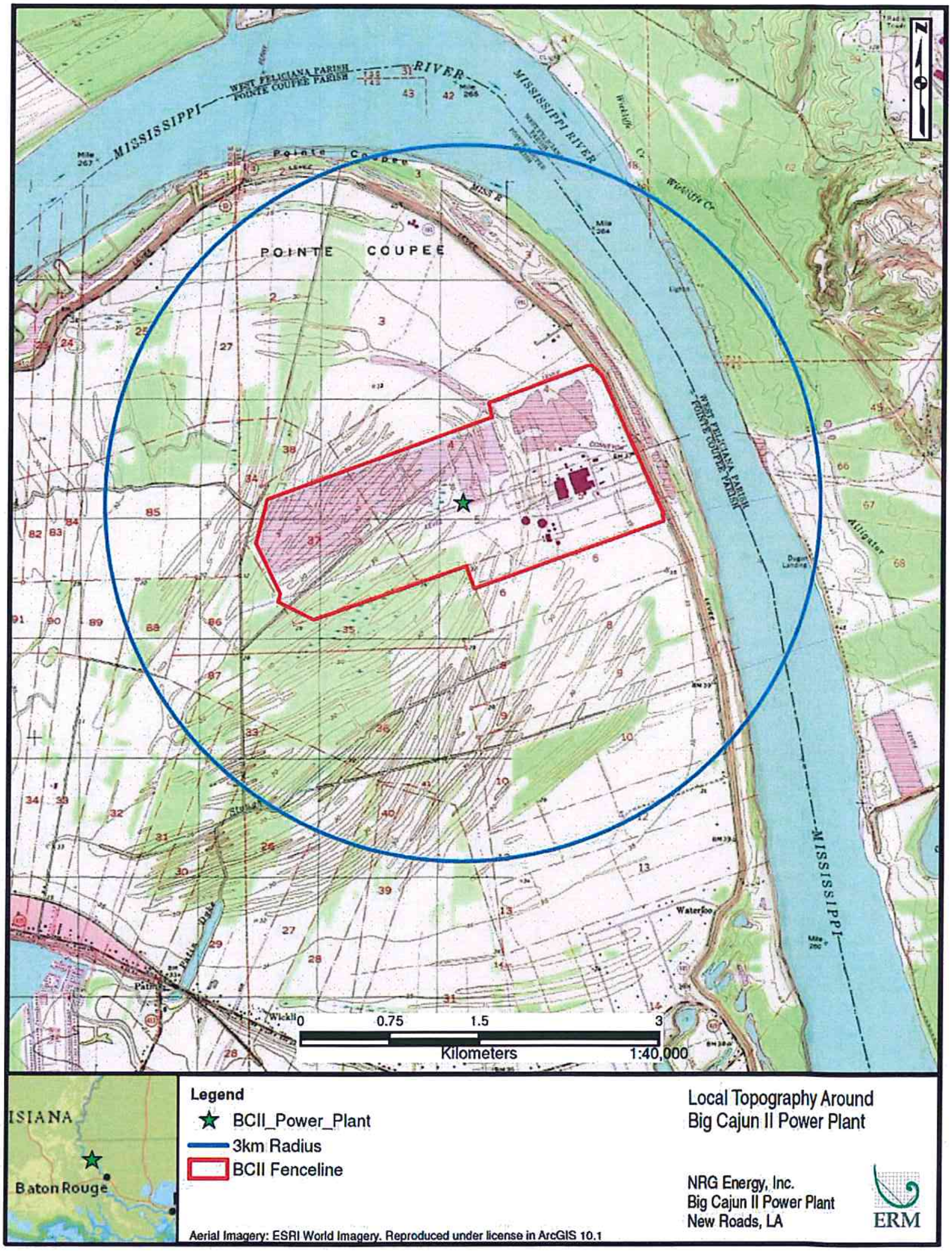


FIGURE 2-2: Big Cajun II Local Topography



2.3 *SOURCE PARAMETERS AND EMISSION RATES*

For this 1-hour SO_2 NAAQS modeling demonstration, all major sources of SO_2 at the facility were included in the modeling. Per the 1-hour SO_2 DRR and SO_2 Modeling TAD, the most recent 3 years of actual operating data, along with the actual stack heights of all sources, were used whenever available in the modeling. The following provides a description of all BCII SO_2 emission sources represented in the model. Table 2-1 summarizes the characteristics of the emissions sources located at BCII that were included in the modeling.

TABLE 2-1: Big Cajun II Point Sources - Stack Parameters

Description	Model Source	Stack Height		Exit Temperature		Exit Velocity		Stack Diameter	
		(ft)	(m)	(F)	(K)	(ft/sec)	(m/s)	(ft.)	(m)
Unit 1 Boiler[1]	UNIT1	600	183	---	---	---	---	26.5	8.1
Unit 2 Boiler[1]	UNIT2	600	183	305.0	424.8	18.3	60.0	26.5	8.1
Unit 3 Boiler[1]	UNIT3	600	183	---	---	---	---	26.5	8.1

1. For Units 1 and 3, exit temperature and exit velocity varied on an hourly basis based on CEMS data. Unit 2 was modeled with a constant exit temperature and exit velocity based on parameters related to gas-fired operations that began in June, 2015.

Since the past actual emissions do not reflect the current emission limitations imposed in the 2012 USA and LDEQ vs. Louisiana Generating LLC Consent Decree (United States District Court - Middle District of Louisiana, Civil Action No. 09-100-JJB-DLD), hourly emissions were developed that conform to the following current Big Cajun II Title V permit requirements:

1. Unit 2 may fire only natural gas; and
2. A dry sorbent injection (DSI) system must be operated on Unit 1; the unit must meet a 30-day rolling average SO_2 emissions limit of 0.38 lbs/MMBtu.

Unit 2 converted to gas in June 2015 and the DSI system was installed on Unit 1 in April 2015. Actual emissions for input to AERMOD on an hourly basis were developed as follows based on these currently federally enforceable limits:

1. Unit 2 emissions were assumed to be constant and equal to the maximum hourly SO_2 emission rate from the CEMs data since the unit started burning gas only,
2. Unit 3 emissions were modeled at the actual hourly rate for 2013-2015 as recorded by CEMs, and
3. Unit 1 emissions were adjusted to reflect the new limit of 0.38 lb/MMBtu. Since the limit assumes a rolling 30 day average, it was multiplied by 1.2 before being combined with the actual hourly heat input to simulate hourly emissions that comply with the current permit limit.

3.0 *AIR DISPERSION MODELING ANALYSIS*

ERM conducted the modeling analysis for BCII to assess ambient impacts of SO_2 against the 1-hour SO_2 NAAQS following the approach described in the SO_2 Modeling TAD.

3.1 *MODEL SELECTION AND APPLICATION*

The latest version of USEPA's AERMOD model (v.15181) was used for predicting ambient impacts for 1-hour SO_2. Regulatory default options were used in the analysis. Model predicted impacts of emissions from BCII and nearby background sources were combined with the appropriate ambient background concentrations and compared to the 1-hour SO_2 NAAQS to determine the recommended attainment status of the area in the vicinity of the facility.

3.2 *THE 1-HOUR SO_2 NAAQS*

This study estimated 1-hour SO_2 concentrations in the vicinity of the BCII Power Plant and compared them to the 1-hour SO_2 NAAQS. The new standard came into effect in August, 2010. The form of the standard is the 99^{th} percentile of the 3-year average 1-hour daily maximum concentration, and the standard was set to 75 ppb (196.5 $\mu g/m^3$).

3.3 *METEOROLOGICAL DATA*

Guidance for regulatory air quality modeling recommends the use of one year of on-site meteorological data or five years of representative off-site meteorological data. The SO_2 Modeling TAD however, specifies that 3 years of meteorological data concurrent with the actual emissions data being input into the model be used.

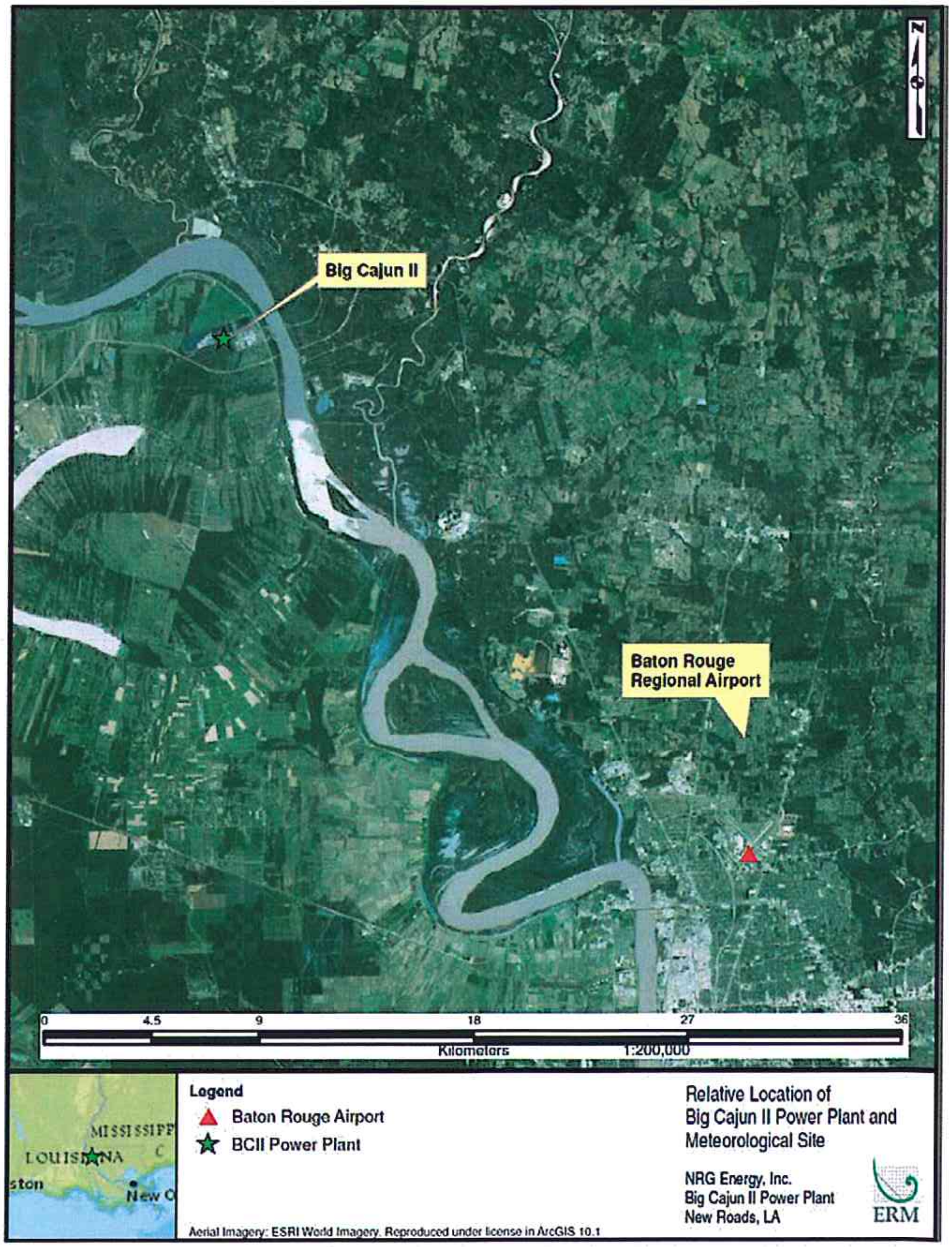
Three years (2013-2015) of surface observations from the National Weather Service (NWS) tower at Baton Rouge Regional Airport in Baton Rouge, LA (WBAN No. 13970) and concurrent upper air data from Lake Charles, LA (WBAN No. 03937) were processed as described in Section 3.3.1. The meteorological data was generated with the most recent version of AERMET (v.15181), the meteorological preprocessor for AERMOD, along with the two pre-processors to AERMET: AERSURFACE (v.13016) and AERMINUTE (v.15272). AERMET was applied to create the two meteorological data files required for input to AERMOD.

The data characteristics of Baton Rouge Regional Airport are shown in Table 3-1. Figure 3-1 shows the relative location of the airport and BCII Power Plant.

TABLE 3-1: Characteristics of the Baton Rouge Regional Airport Meteorological Data

Distance from Big Cajun II Station	18.5 miles
Average Wind Speed	2.93 m/s
Percent Calm Hours	1.24%
Data Completeness	99.71%

FIGURE 3-1: Relative Location of Facility and Meteorological Site



3.3.1 *Surface Characteristics*

EPA and LDEQ guidelines recommend that meteorological data from a representative measurement station be used in modeling analyses to address ambient impacts. This section describes how the surface and upper air data were processed to generate AERMOD-ready input files.

AERMET is the recommended processor for developing inputs to AERMOD. AERMET requires, at a minimum, hourly surface data and once-daily (morning) upper air sounding profiles. The processing program produces two files for input to AERMOD: a surface file containing calculated micrometeorological variables (heat flux, stability, and turbulence parameters) that represent the dispersive potential of the atmosphere, and a profile file that provides vertical profiles of wind speed, wind direction, and temperature. In the case of meteorological data files developed from NWS data, the profiles contain only one level (the surface level) and a meteorological interface within AERMOD generates vertical profiles of wind, temperature, and turbulence from the input data files.

AERMET requires specification of site characteristics including surface roughness (z_o), albedo (r), and Bowen ratio (B_o). These parameters were developed according to the guidance provided by EPA in the AERMOD Implementation Guide (AIG)[4]. The AIG provides the following recommendations for determining the site characteristics:

1. The determination of the surface roughness length should be based on an inverse distance weighted geometric mean for a default upwind distance of one km relative to the measurement site. Surface roughness length may be varied by sector to account for variations in land cover near the measurement site; however, the sector widths should be no smaller than 30 degrees. As discussed further below, twelve sectors were used in this application.
2. The determination of the Bowen ratio was based on a simple un-weighted geometric mean (no direction or distance dependency) for a representative domain, with a default domain defined by a 10-km by 10-km region centered on the measurement site.
3. The determination of the albedo should be based on a simple un-weighted arithmetic mean (i.e., no direction or distance dependency) for the same representative domain as defined for Bowen ratio, with a default domain defined by a 10-km by 10-km region centered on the measurement site.

[4] EPA 2009. AERMOD Implementation Guide (AIG). Office of Air Quality Planning and Standards, Research Triangle Park, NC. March.

The AIG recommends that the surface characteristics be determined based on digitized land cover data. EPA has developed the AERSURFACE tool that was used to determine the site characteristics based on digitized land cover data in accordance with the recommendations from the AIG discussed above. AERSURFACE incorporates look-up tables of representative surface characteristic values by land cover category and seasonal category. AERSURFACE was applied with the instructions provided in the *AERSURFACE User's Guide*[5] to determine the land-use characteristics around the airport.

The current version of AERSURFACE (Version 13016) supports the use of land cover data from the USGS National Land Cover Data 1992 archives (NLCD92)[6]. The NLCD92 archive provides data at a spatial resolution of 30 meters based on a 21-category classification scheme applied over the continental U.S.

The 1-km radius circular area centered at the meteorological station site was divided into twelve 30-degree sectors for this analysis. Figure 3-2 shows the land use within 1 km (the extent for the surface roughness analysis) of the anemometer for the meteorological site using the NLCD92 data.

In AERSURFACE, the various land cover categories are linked to a set of seasonal surface characteristics. As such, AERSURFACE requires specification of the seasonal category for each month of the year. The following five seasonal categories are supported by AERSURFACE, with the applicable months of the year specified for this site.

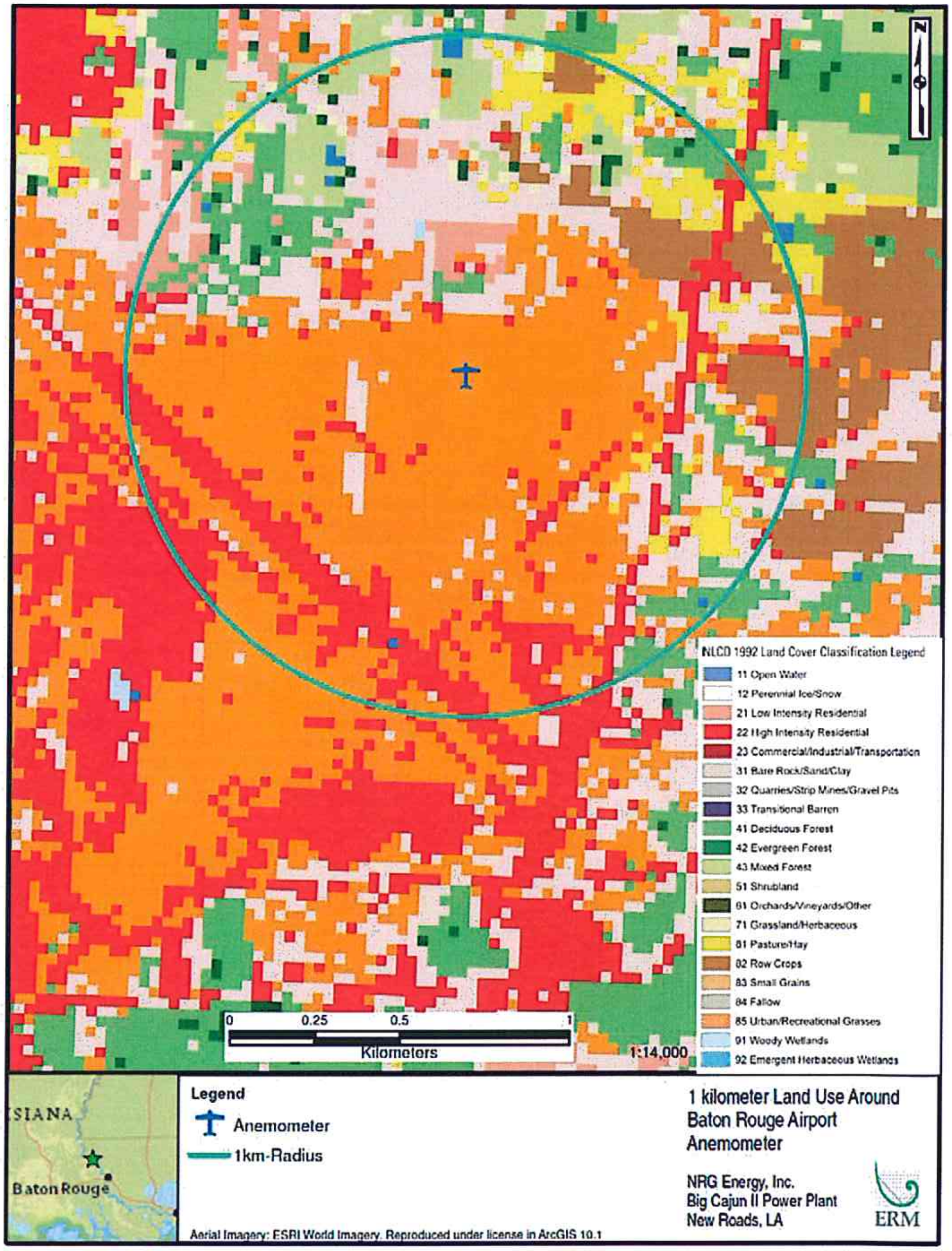
1. Midsummer with lush vegetation (June-September).
2. Autumn with un-harvested cropland (October and November).
3. Late autumn after frost and harvest, or winter with no snow (December, January, and February)
4. Transitional spring with partial green coverage or short annuals (March, April, and May).

In addition, for the Bowen ratio, the land use values are linked to three categories of surface moisture corresponding to average, wet, and dry conditions. The surface moisture condition for the site may vary depending on the meteorological data period for which the surface characteristics were applied. AERSURFACE applies the surface moisture condition for the entire data period. Therefore, if the surface moisture condition varies significantly across the data period, then AERSURFACE can be applied multiple times to account for those variations.

[5] EPA 2008. AERSURFACE User's Guide (EPA 454/B-08-001). Office of Air Quality Planning and Standards. January 2008.

[6] http://edcftp.cr.usgs.gov/pub/data/landcover/states/

FIGURE 3-2: Land-use around 1km of the Baton Rouge Regional Airport Anemometer



As recommended in the AERSURFACE User's Guide, the surface moisture condition for each month was determined by comparing precipitation for the period of data to be processed to the 30-year climatological record from the Baton Rouge Regional Airport, selecting "wet" conditions if precipitation was in the upper 30th-percentile, "dry" conditions if precipitation was in the lower 30th-percentile, and "average" conditions if precipitation was in the middle 40th-percentile. The monthly designations of surface moisture that were input to AERSURFACE are summarized in Table 3-2.

TABLE 3-2: AERSURFACE Bowen Ratio Designations for Baton Rouge, LA

Month	Bowen Ratio Category		
	2013	2014	2015
January	Wet	Dry	Average
February	Wet	Wet	Average
March	Dry	Average	Average
April	Wet	Average	Wet
May	Wet	Wet	Wet
June	Wet	Wet	Average
July	Average	Wet	Average
August	Dry	Average	Average
September	Wet	Average	Dry
October	Average	Average	Wet
November	Average	Average	Wet
December	Average	Average	Average

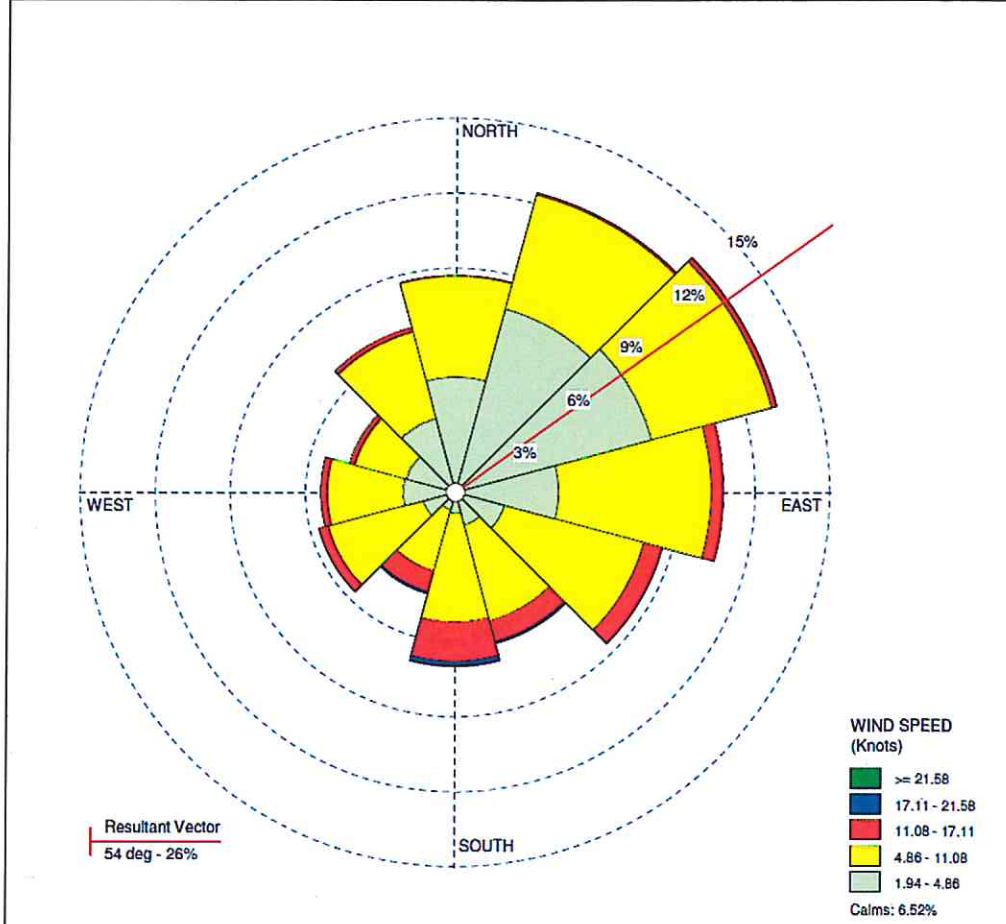
AERMINUTE was processed using one-minute wind speed and direction data from Baton Rouge Regional Airport, LA, to compute hourly averaged wind speed and direction data for input into AERMET in accordance with EPA guidance[7]. A wind rose of the Baton Rouge Regional Airport wind data is provided in Figure 3-3. As shown by the wind rose, winds are predominantly from the north, northeast, and east. Consistent with EPA guidance[8] issued on March 8, 2013, the starting threshold wind speed for AERMET processing was set to 0.5 m/s.

[7] EPA, 2010b: Addendum – User's Guide for the AERMOD Meteorological Preprocessor (AERMET). EPA-454/B-03-002. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711

[8] http://www.epa.gov/ttn/scram/guidance/clarification/20130308_Met_Data_Clarification.pdf.

FIGURE 3-3: Three-year Wind Rose (2013-2015): Baton Rouge Regional Airport

WIND ROSE PLOT:	DISPLAY:
3-year Wind Rose, Baton Rouge Regional Airport **2013-2015**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:		
	Start Date: 1/1/2013 - 00:00 **End Date: 12/31/2015 - 23:59**		ERM
	CALM WINDS: **6.52%**	TOTAL COUNT: **26231 hrs.**	
	AVG. WIND SPEED: **5.72 Knots**	DATE: **12/5/2016**	PROJECT NO.: **0332758**

3.4 *RECEPTOR GRID*

A comprehensive Cartesian receptor grid extending out to approximately 20 kilometers (km) from Big Cajun II was used in the AERMOD modeling analysis to assess maximum ground-level 1-hour SO_2 concentrations. The Modeling TAD states that the receptor grid must be sufficient to determine ambient air quality in the vicinity of the source being studied.

Specifically, the Cartesian receptor grid consisted of the following receptor spacing:

- 50-meter spacing along the facility fence line;
- 100-meter spacing extending from the fence line to 3 kilometers;
- 200-meter spacing extending from 3 to 5 kilometers;
- 500-meter spacing extending from 5 to 10 kilometers; and
- 1,000-meter spacing extending from 10 to 20 kilometers.

Receptor locations were reviewed and, in accordance with the 1-hour SO_2 Modeling TAD, receptors located over areas where monitors could not reasonably be sited were excluded from the modeling, specifically two receptor locations within the Georgia Pacific fence line were omitted from the cumulative modeling. To assure that non-Georgia Pacific sources were not contributing to NAAQS violations on Georgia Pacific property, an additional run that included these receptors, but did not include emissions from Georgia Pacific operations was also completed.

Terrain elevations from National Elevation Data ("NED") from USGS were processed using the most recent version of AERMAP (v.11103) to develop the receptor terrain elevations required by AERMOD. NED data files contain profiles of terrain elevations, which in conjunction with receptor locations are used to generate receptor height scales. The height scale is the terrain elevation in the vicinity of a receptor that has the greatest influence on dispersion at that location and is used for model computations in complex terrain areas. The near-field (within 5 kilometers) and far-field (full grid) receptor grids are shown in Figures 3-4 and 3-5, respectively.

FIGURE 3-4: Near-Field Model Receptors

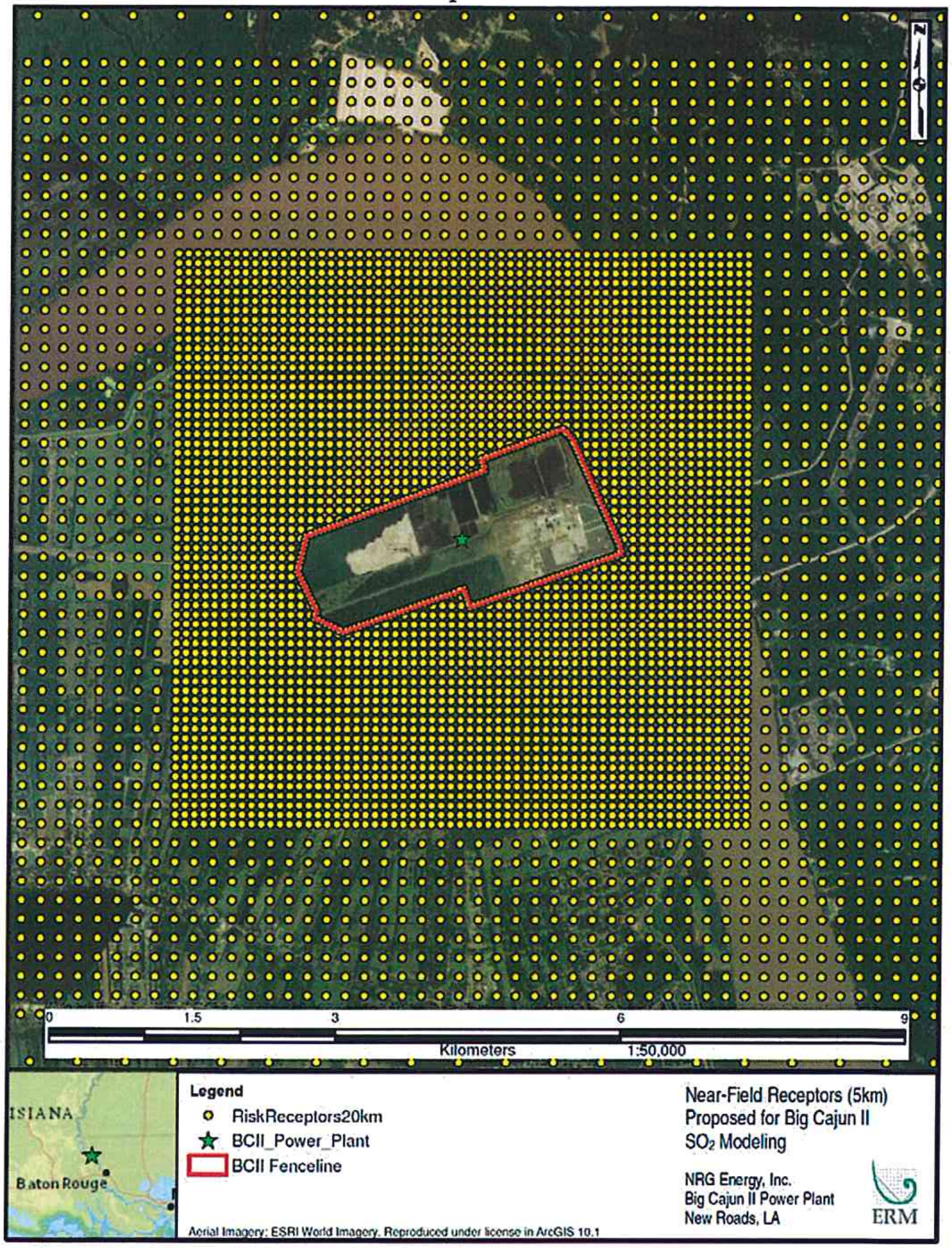
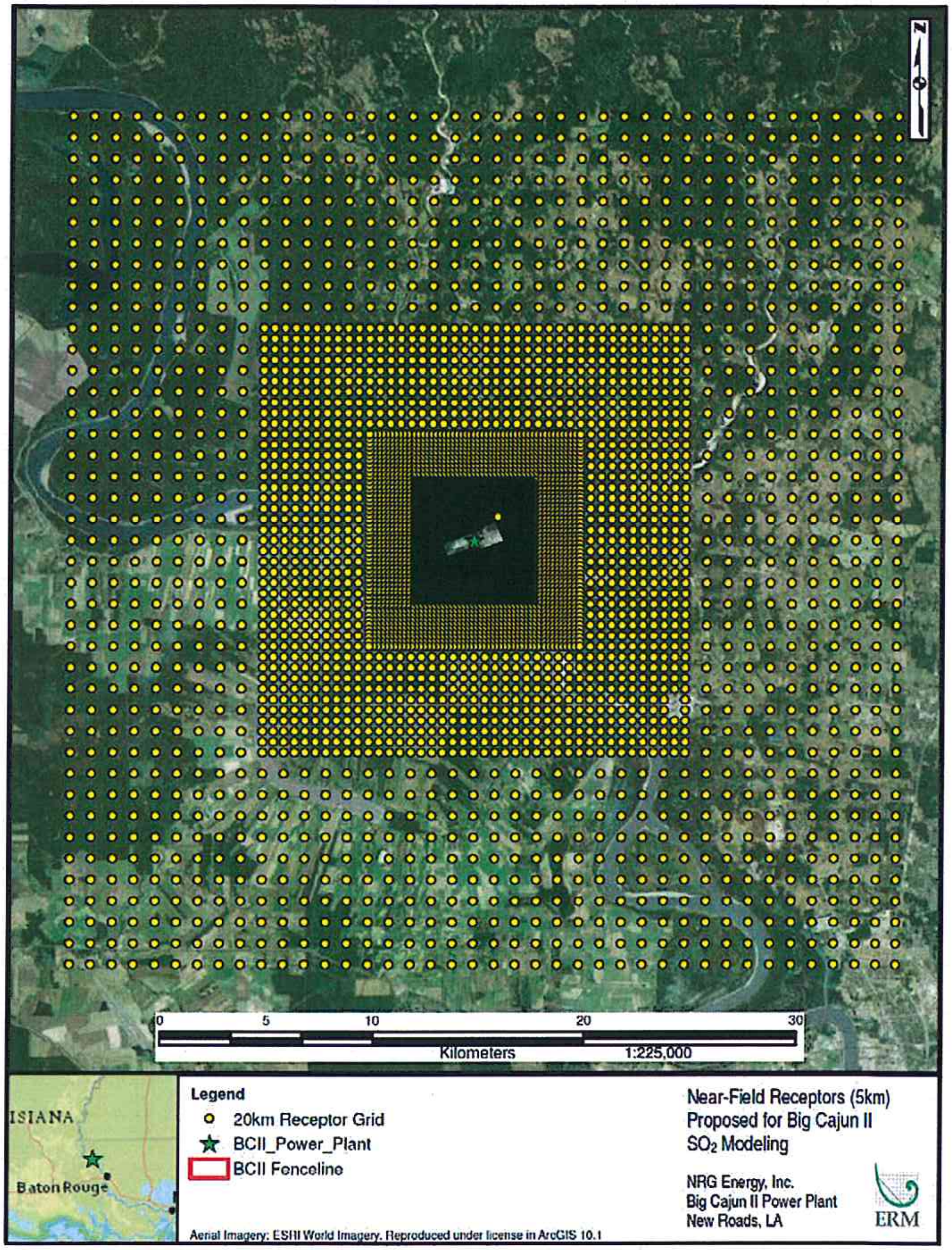


FIGURE 3-5: Far-Field Model Receptors



3.5 GOOD ENGINEERING PRACTICE STACK HEIGHT ANALYSIS

Good engineering practice ("GEP") stack height is defined as the stack height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash, wakes, or eddy effects created by the source, nearby structures, or terrain features.

A GEP stack height analysis has been performed for all stacks using the Building Profile Input Program (BPIP) in accordance with USEPA's guidelines (USEPA 1985). Per the guidelines, the physical GEP height, (H_{GEP}), is determined from the dimensions of all buildings which are within the region of influence using the following equations, depending on the construction data of the stack:

(1) For stacks in existence on January 12, 1979 and for which the owner or operator had obtained all applicable permits or approvals required,

$$H_{GEP} = 2.5H,$$

provided the owner or operator produces evidence that this equation was actually relied on in establishing an emission limitation;

(2) For all other stacks:

$$H_{GEP} = H + 1.5L$$

where:

H = height of the structure within 5L of the stack which maximizes H_{GEP}; and
L = lesser dimension (height or projected width) of the structure.

For a squat structure, i.e., height less than projected width, the formula reduces to:

$$H_{GEP} = 2.5H$$

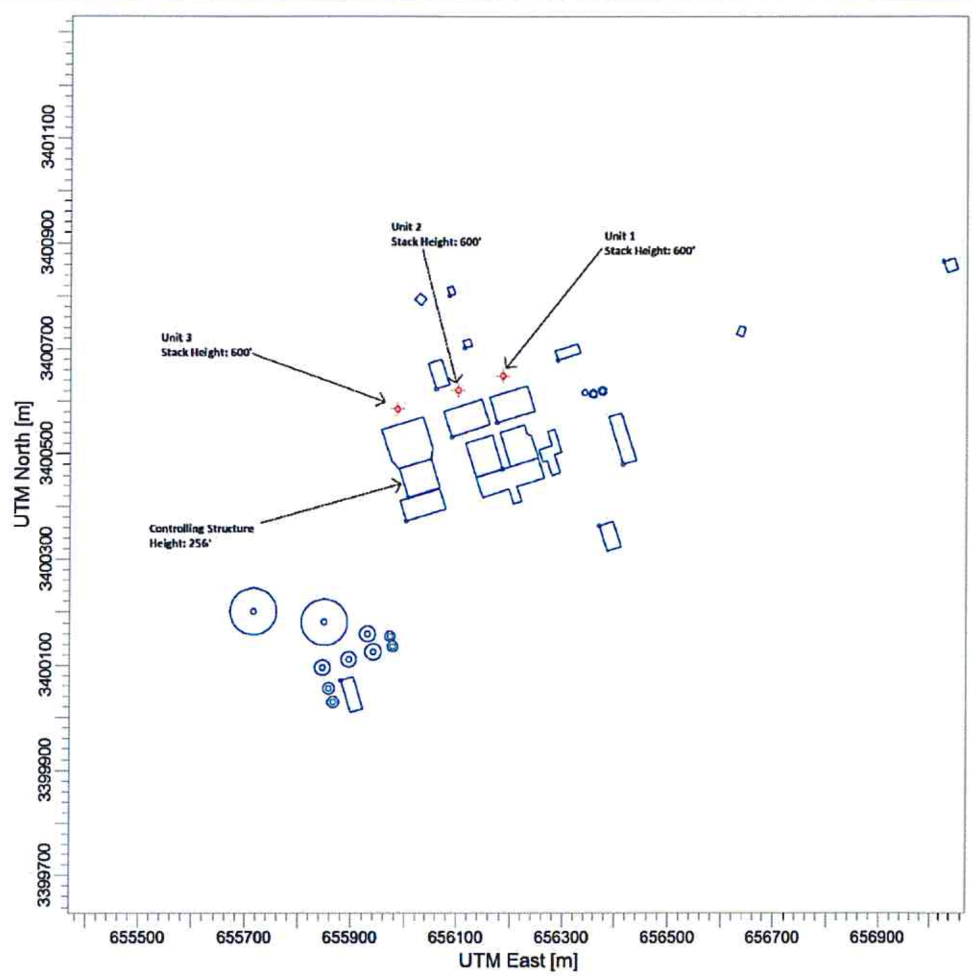
In the absence of influencing structures, a "default" GEP stack height is creditable up to 65 meters (213 feet).

A summary of the GEP stack height analyses is presented in Table 3-3. As described in the SO_2 Modeling TAD, modeling to determine the attainment status of the facility when compared to the 1-hour SO_2 NAAQS, the full height of all stacks is allowed in the modeling regardless of their GEP Formula Heights. The Unit 1 and 2 stacks at BCII are below their respective GEP heights; the actual stack height for Unit 3 is just above GEP height. As provided in the SO_2 Modeling TAD the actual stack heights were used in the modeling for each of the stacks. The locations of all structures and sources included in the GEP analysis are shown in Figure 3-6. The output from BPIP was input into AERMOD to allow consideration of aerodynamic downwash caused by structures around the stacks.

FIGURE 3-6: Structures Included in the Big Cajun II GEP Analysis

PROJECT TITLE:

Buildings Included in the Big Cajun II GEP Analysis



COMMENTS:	SOURCES:	COMPANY NAME:	
	21	ERM	
	RECEPTORS: 7409		ERM
	OUTPUT TYPE: Concentration	SCALE: 1:10,701 (0 – 0.4 km)	
	MAX: 270 ug/m^3	DATE: 4/6/2016	PROJECT NO.:

TABLE 3-3: Summary of Big Cajun II Power Plant GEP Analysis

Emission Source	*Stack Height (m)*	*Controlling Buildings/ Structures*	*Building Height (m)*	*Projected Width (m)*	*GEP Formula Height (m)*[1]
UNIT 1	182.9	Unit 3 Boiler Bldg.	78.0	78.4	183.1
UNIT 2	182.9	Unit 3 Boiler Bldg.	78.0	82.4	183.1
UNIT 3	182.9	Unit 3 Boiler Bldg.	78.0	77.0	181.5

1. In the absence of influencing structures, a "default" GEP stack height is creditable up to 65 meters (213 feet).

3.6 *AMBIENT SO_2 BACKGROUND DATA FOR CUMULATIVE MODELING*

In addition to assessing impacts from Big Cajun II sources, the impacts from other sources of SO_2 in the region were considered in order to assess the air quality in the region compared with the 1-hour SO_2 NAAQS. There are two sources of SO_2 in the vicinity of BCII that warrant inclusion in the modeling as discussed in Section 3.7. In order to account for other minor sources of SO_2 in the area, an ambient background concentration was added to model-predicted impacts from BCII and other modeled sources of SO_2 for comparison to the NAAQS.

Data from the nearest SO_2 monitoring station, Port Allen (AIRS No. 22-121-0001), was selected to represent the contribution of sources that were not explicitly modeled.

EPA guidance allows for the simulation of background values that vary by season and hour of day in lieu of the single design value. The modeling was performed with a set of seasonal diurnal values developed using the methodology described in the USEPA March 1st, 2011 Clarification Memorandum for 1-hour NO_2 Modeling[9]. Though this memorandum primarily addresses NO_2 modeling, page 20 describes the process for developing seasonal diurnal background values for SO_2 as well. The seasonal diurnal values used are shown in Table 3-4.

TABLE 3-4: 2013 – 2015 Seasonal Diurnal Ambient SO_2 Concentrations for the Port Allen Monitor ($\mu g/m^3$)

Hour[1]	*Winter*	*Spring*	*Summer*	*Fall*
1	26.35	15.71	8.38	18.15
2	28.36	27.22	9.95	26.09
3	21.99	31.85	13.79	20.77
4	22.95	26.79	10.21	20.94
5	23.91	27.05	9.86	21.12

[9] https://www3.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf

Hour[1]	Winter	Spring	Summer	Fall
6	20.50	31.06	10.03	19.63
7	22.08	27.22	9.95	30.71
8	32.46	26.26	11.17	31.15
9	29.93	23.03	13.00	21.99
10	30.89	18.41	8.55	17.54
11	31.59	23.12	8.99	27.57
12	36.73	20.24	9.77	17.97
13	42.32	18.85	9.25	22.08
14	34.73	16.32	8.64	19.02
15	45.37	17.01	8.29	18.85
16	34.38	15.09	11.17	19.63
17	30.02	18.58	10.91	16.49
18	26.61	14.75	8.73	23.03
19	28.79	16.49	8.64	16.84
20	19.54	14.57	8.20	16.84
21	21.99	11.95	10.21	14.48
22	22.86	18.15	8.73	18.85
23	22.69	16.23	11.69	16.75
24	26.00	16.05	8.29	18.50

[1] Hours in AERMOD are defined as hour-ending. i.e., Hour 1 is the period from midnight through 1 AM, etc.

3.7 *INVENTORY SOURCES FOR CUMULATIVE MODELING*

Two SO_2 monitors in the Baton Rouge area, Port Allen (AIRS No. 22-121-0001) and Capitol (AIRS No. 22-033-0009), are located approximately 30 km to the southeast of BCII. These two monitors have recorded design values for 2013-2015 that are less than half the 1-hour SO_2 NAAQS. Based on a review of the 2011 NEI and the LDEQ ERIC system, there are several sources of SO_2 within approximately 5 kilometers of these monitors, and a large source of SO_2 approximately 15 kilometers to the south of these monitors (and approximately 45 kilometers from BCII). Since these monitors are positioned to record concentrations due to these sources, there is no need to include sources that have an influence on these monitors in the modeling inventory for BCII.

Other sources within approximately 20 km of BCII were investigated. The two largest sources of SO_2 are Georgia Pacific and Oxbow Calcining. These two facilities were included in the modeling as background sources. Modeling these emissions explicitly, and adding a background concentration as described in the previous section to account for the impact from smaller sources, ensures that the results conservatively reflect the cumulative effect of BCII and other sources on the existing 1-hour SO_2 ambient concentration.

Emissions and stack parameters from the LDEQ inventory for Georgia Pacific and Oxbow Calcining were incorporated into the final modeling to assess attainment with the NAAQS. Hourly data files for both Georgia Pacific and Oxbow for the 2012 – 2014 period were provided by LDEQ. These files were used to characterize hourly emissions, stack temperatures, and exit velocities for Oxbow and Georgia Pacific sources.

To develop the hourly background emissions inventory for 2013-2015 for both Oxbow and Georgia Pacific, a proxy data set was developed based on the following conservative methodology:

- From the provided 2012-2014 hourly actuals data, use 2013 and 2014 as-is for both inventory sources,
- For 2015, on an hour-by-hour basis, use the provided 2012-2014 hourly actuals data:
    - Fill with the maximum emission rate of the available data.
    - Fill stack temperature and flow (exit velocity) with the minimum value across all years. This yields the worst-case stack parameters for conservatism.

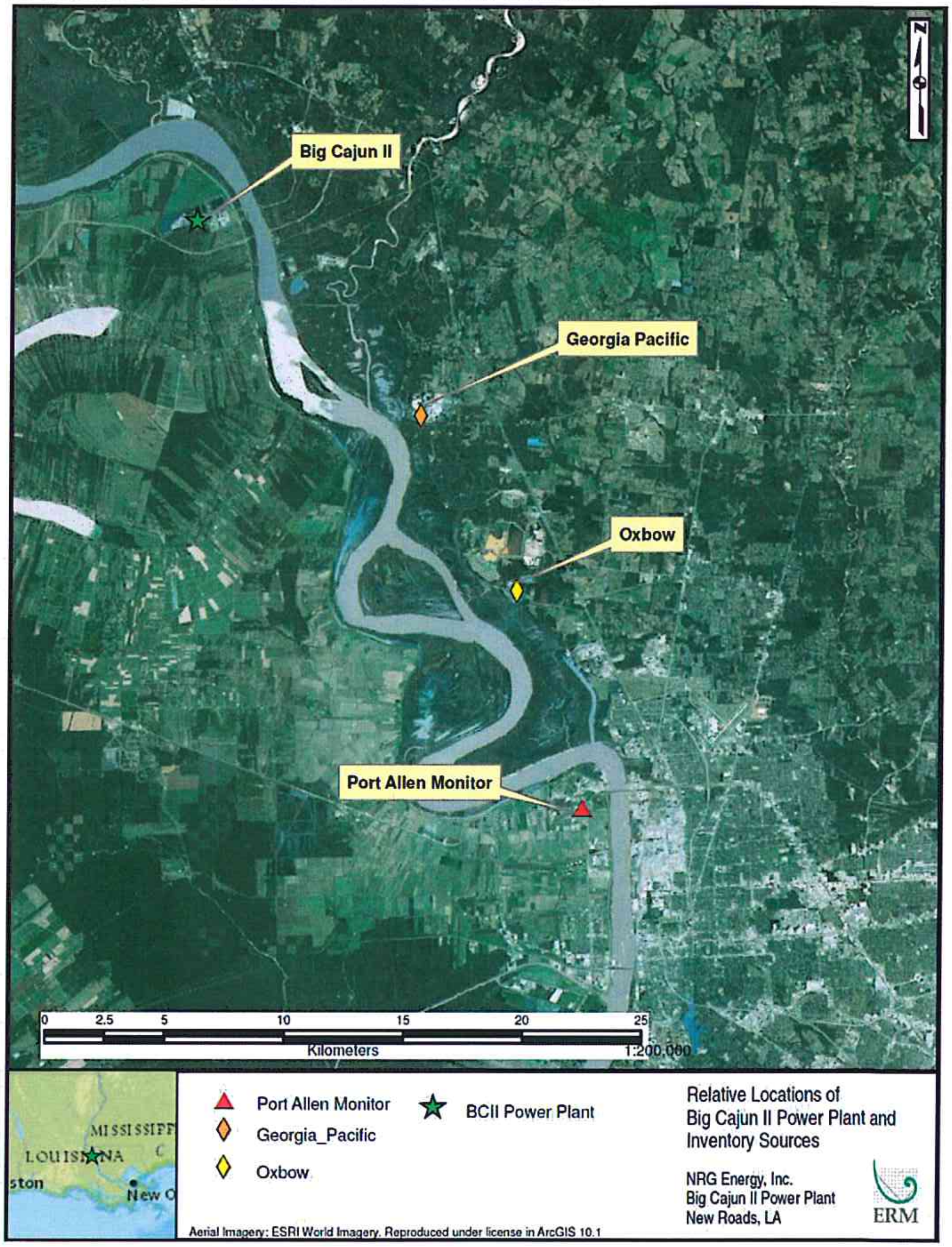
A comparison of 2015 emissions with previous years indicates that using the maximum of 2012 through 2014 for each hour will be a conservative representation of emissions in 2015.

TABLE 3-5: 2012 – 2015 Total SO_2 Emissions (TPY)

Year	Oxbow	Georgia Pacific
2012	7,071	655
2013	6,697	613
2014	12,300	558
2015	11,453	497

Figure 3-7 shows the location of the ambient monitor that collected the data that was used as background for the Big Cajun II modeling, as well as the location of all relevant SO_2 sources that were explicitly included in the modeling.

FIGURE 3-7: SO_2 Sources and Port Allen Monitor



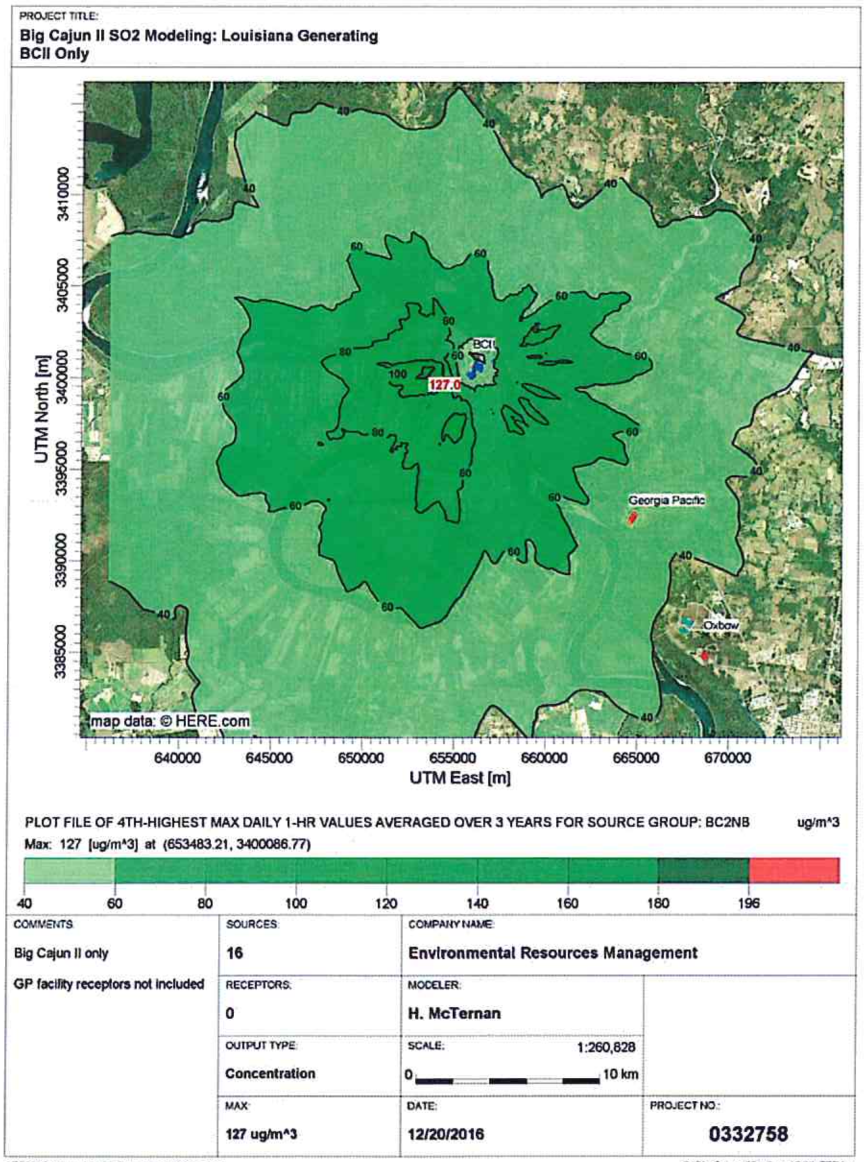
4.0 *RESULTS*

This section presents the results of modeling that was completed to assess the attainment status of the area in the vicinity of the BCII Power Plant. As discussed below, the results demonstrate that the area in the vicinity of the BCII Power Plant is currently in attainment with the 1-hour SO_2 NAAQS.

4.1 *BCII MODELING RESULTS*

Figure 4-1 presents contours of the predicted design value of hourly SO_2 concentrations associated with emissions from the BCII EGUs. As shown in the figure, the maximum design value occurs approximately 2 km west of the BCII Power Plant. The design values fall off to less than a third of the standard within 9 km in every direction.

FIGURE 4-1: Big Cajün II Only 2013-2015 1-Hour SO_2 Design Values

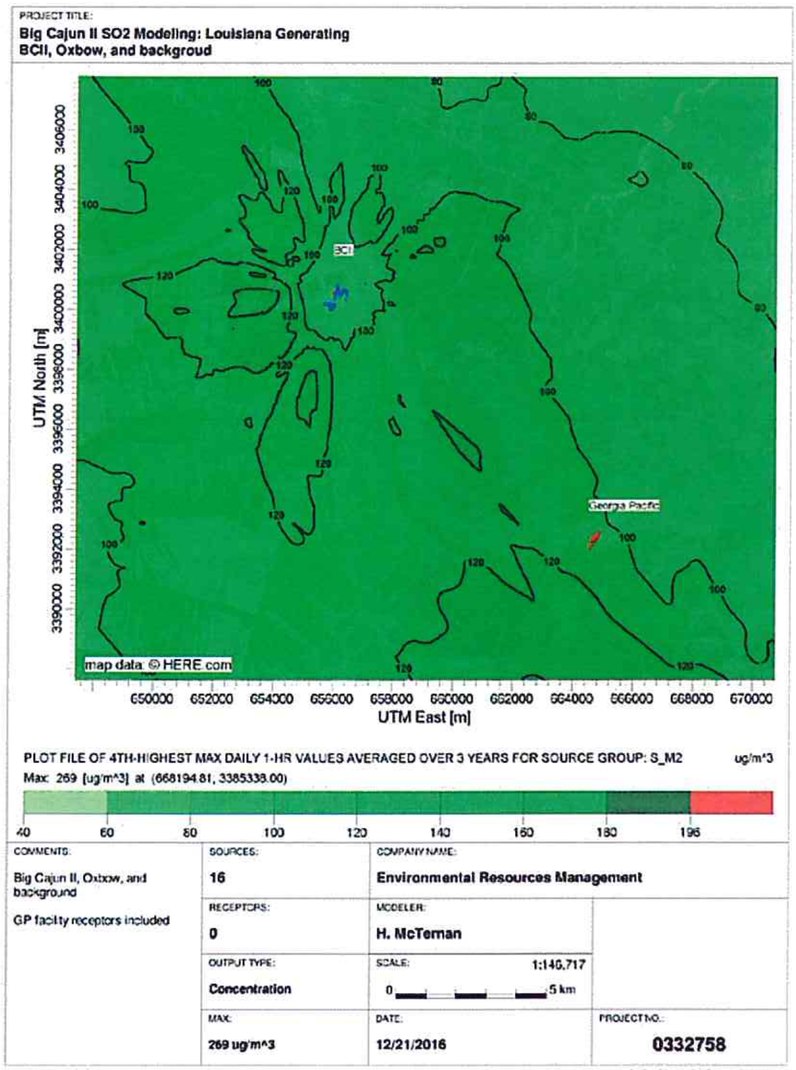


4.2 *GEORGIA PACIFIC RECEPTORS*

As noted earlier, two receptors were removed from the grid because they were on Georgia Pacific property. To assess the impact of non-Georgia Pacific sources on Georgia Pacific property, a model run using a grid that included the two receptors but not the Georgia Pacific emission sources was completed. The input to the run included emissions from BCII and Oxbow as well as seasonal diurnal background concentrations from the Port Allen monitoring location.

Figure 4-2 presents contours of the predicted design value of the 1-hour SO_2 concentrations on the receptor grid that includes the two locations on Georgia Pacific property.

FIGURE 4-2: 2013-2015 1-Hour SO_2 Design Values Including Georgia Pacific Receptors, Without Georgia Pacific Emissions



As shown in the figure, design values in excess of the NAAQS were not predicted on the Georgia Pacific property.

4.3 *CUMULATIVE MODELING RESULTS*

The MAXDCONT post processor was used to identify all of the predicted concentrations that exceeded the value of the standard and the contribution that BCII sources had to each of those concentrations. Concentrations that were identified as being the first, second or third highest ranked values for that receptor were disregarded because they would not be considered in the determination of the design value. Table 4-1 presents all of the remaining concentrations, their rank, and the BCII contribution to the predicted concentration.

TABLE 4-1: ***1-hour SO_2 Modeled Concentrations Greater than 196 μg/m³***

Receptor Location		Design Concentration (μg/m³)	Rank	BCII Contribution (μg/m³)
X (m)	Y (m)			
668194.8	3385338.0	269.2	4TH	0.06
669194.8	3384338.0	256.3	4TH	4.86
668194.8	3384338.0	251.4	4TH	0.12
669194.8	3385338.0	234.6	4TH	0.08
666194.8	3384338.0	216.5	4TH	1.06
665194.8	3384338.0	197.5	4TH	0.58
667194.8	3384338.0	196.6	4TH	0.61
668194.8	3385338.0	252.2	5TH	0.10
669194.8	3384338.0	251.3	5TH	2.66
668194.8	3384338.0	244.3	5TH	0.09
669194.8	3385338.0	225.4	5TH	0.12
668194.8	3385338.0	248.8	6TH	0.07
669194.8	3384338.0	245.1	6TH	7.50
668194.8	3384338.0	238.6	6TH	0.13
669194.8	3385338.0	217.0	6TH	0.16
668194.8	3385338.0	240.6	7TH	0.11
669194.8	3384338.0	232.3	7TH	3.76
668194.8	3384338.0	220.7	7TH	0.11
669194.8	3385338.0	215.2	7TH	0.08
668194.8	3385338.0	233.6	8TH	0.06
669194.8	3384338.0	220.6	8TH	3.03
668194.8	3384338.0	218.5	8TH	0.24
669194.8	3385338.0	206.0	8TH	0.23

Receptor Location		Design Concentration (µg/m³)	Rank	BCII Contribution (µg/m³)
X (m)	Y (m)			
668194.8	3385338.0	230.0	9TH	0.07
669194.8	3384338.0	216.6	9TH	5.99
668194.8	3384338.0	211.7	9TH	0.25
669194.8	3385338.0	203.1	9TH	0.19
668194.8	3385338.0	219.9	10TH	0.09
668194.8	3384338.0	207.1	10TH	0.12
669194.8	3384338.0	205.0	10TH	4.81
669194.8	3385338.0	198.1	10TH	0.53
668194.8	3385338.0	217.2	11TH	0.04
668194.8	3384338.0	203.7	11TH	0.25
669194.8	3384338.0	200.2	11TH	3.36
668194.8	3385338.0	207.9	12TH	0.10
668194.8	3384338.0	202.6	12TH	0.32
669194.8	3384338.0	196.2	12TH	7.76
668194.8	3385338.0	207.1	13TH	0.05
668194.8	3384338.0	199.9	13TH	0.19
668194.8	3385338.0	199.1	14TH	0.09
668194.8	3384338.0	196.8	14TH	0.14
668194.8	3385338.0	197.7	15TH	0.08

As shown in the table, although design values in excess of the standard have been predicted, the BCII contribution is less than the significant impact level in all cases. The highlighted row shows the highest BCII contribution to a total concentration (rank 4 or higher) above the standard.

It should be noted that many of the receptors for which design values in excess of the standard have been predicted are on Oxbow property and too close to Oxbow sources for the model to provide meaningful estimates of their impact. Since the receptors within Oxbow's fenceline would not be potential monitoring locations, according to the SO_2 TAD, they can be omitted from a modeling assessment of the attainment status completed in response to the DRR. Additionally, as described in Section 3.7, a conservative set of emission parameters were assumed in the modeling presented here because actual hourly emissions were not available for Georgia Pacific and Oxbow for 2015.

A more refined analysis of the impact of the emissions from Oxbow is not warranted for this attainment demonstration because Oxbow is completing its own demonstration in response to the DRR.

A summary of the results of the modeling when the background sources and monitored background concentrations are added to the contributions from the BCII EGUs is presented in Table 4-2.

TABLE 4-2: 2013-2015 SO_2 Design Value including Seasonal-Diurnal Background

SO_2 Modeling Input	Maximum All Sources (µg/m³)	BCII Contribution to Maximum (µg/m³)	Maximum BCII Contribution to a NAAQS Exceedance (µg/m³)	Pass Cause and Contribute?
Monitor: Port Allen **Inventory**: BCII, Oxbow & GP	269.2	0.06	7.763 (at 12th rank)	YES

The modeling results present here show:

1) The gradient of impact of emissions from BCII demonstrates that the maximum contributions to ambient design values are being captured in the receptor grid that was used for the modeling,
2) Emissions from BCII, when added to other significant non-Georgia Pacific sources and monitored background data do not cause or contribute to design values in excess of the applicable NAAQS on Georgia Pacific property, and
3) BCII emissions, when modeled with emissions from Oxbow and Georgia Pacific and seasonal diurnal background monitored values, do not cause or contribute to design values in excess of the applicable NAAQS.

Based on the results of the modeling documented here, the area surrounding the BCII Power Plant is in attainment with the 1-hour SO_2 NAAQS.