BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

ILLINOIS POWER HOLDINGS, LLC and AMERENENERGY MEDINA VALLEY COGEN, LLC,	)	
Petitioners,	)	
AMEREN ENERGY RESOURCES, LLC,	)	PCB 2014-010
Co-Petitioner,	)	(Variance – Air)
v.	)	
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY,	)	
Respondent.		

NOTICE OF ELECTRONIC FILING

To: Attached Service List

PLEASE TAKE NOTICE that on September 16, 2013, I electronically filed with the Clerk of the Illinois Pollution Control Board of the State of Illinois the attached Written Statement of Steven Klafka on behalf of the Sierra Club and Environmental Law and Policy Center, a copy of which is attached hereto and herewith served upon you. This Statement includes evaluations of compliance with the 1-hour sulfur dioxide national ambient air quality standard for the Edwards, Joppa, and Newton power plants.

Respectfully submitted,

Andrew Armstrong

Andrew Armstrong
Faith Bugel
Environmental Law and Policy Center
35 East Wacker Drive, Suite 1600
Chicago, IL 60601
312-795-3708
FBugel@elpc.org
AArmstrong@elpc.org

Edwards Power Station

Bartonville, Illinois

Sierra Club Evaluation of Compliance with 1-hour SO_2 NAAQS

December 10, 2012

Conducted by:

Steven Klafka, P.E., BCEE

Wingra Engineering, S.C.

Madison, Wisconsin

1. Introduction

The Sierra Club prepared an air modeling impact analysis to help USEPA, state and local air agencies identify facilities that are likely causing violations of the 1-hour sulfur dioxide (SO_2) national ambient air quality standard (NAAQS). This document describes the results and procedures for an evaluation conducted for the Edwards Power Station located in Bartonville, Illinois.

The dispersion modeling analysis predicted ambient air concentrations for comparison with the one hour SO_2 NAAQS. The modeling was performed using the most recent version of AERMOD, AERMET, and AERMINUTE, with data provided to the Sierra Club by regulatory air agencies and through other publicly-available sources as documented below. The analysis was conducted in adherence to all available USEPA guidance for evaluating source impacts on attainment of the 1-hour SO_2 NAAQS via aerial dispersion modeling, including the AERMOD Implementation Guide; USEPA's Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010; modeling guidance promulgated by USEPA in Appendix W to 40 CFR Part 51; and, USEPA's March 2011 Modeling Guidance for SO_2 NAAQS Designations, available at http://www.epa.gov/ttn/scram/SO2%20Designations%20Guidance%202011.pdf.

2. Compliance with the 1-hour SO_2 NAAQS

2.1 1-hour SO_2 NAAQS

The 1-hour SO_2 NAAQS takes the form of a three-year average of the 99th-percentile of the annual distribution of daily maximum 1-hour concentrations, which cannot exceed 75 ppb.[1] Compliance with this standard was verified using USEPA's AERMOD air dispersion model, which produces air concentrations in units of $\mu g/m^3$. The 1-hour SO_2 NAAQS of 75 ppb equals 196.2 $\mu g/m^3$, and this is the value used for determining whether modeled impacts exceed the NAAQS.[2] The 99th-percentile of the annual distribution of daily maximum 1-hour concentrations corresponds to the fourth-highest value at each receptor for a given year.

2.2 Modeling Results

Modeling results for Edwards Power Station are summarized in Table 1. It was determined that based on either currently permitted emissions or measured actual emissions, the Edwards Power Station is estimated to create downwind SO_2 concentrations which exceed the 1-hour NAAQS.

[1] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010.
[2] The ppb to $\mu g/m^3$ conversion is found in the source code to AERMOD v. 11103, subroutine Modules. The conversion calculation is 75/0.3823 = 196.2 $\mu g/m^3$.

The currently permitted emissions and measured actual emissions used for the modeling analysis are summarized in Table 2. Based on the modeling results, emission reductions from current rates considered necessary to achieve compliance with the 1-hour NAAQS were calculated and presented in Table 3.

Predicted exceedences of the 1-hour NAAQS for SO_2 extend throughout the region to a maximum distance of 50 kilometers.

Figure 1 provided at the end of this report shows the extent of NAAQS violations throughout the entire 50 kilometer modeling domain.

Figure 2 provides a close-up local view of NAAQS violations.

Air quality impacts in Illinois are based on a background concentration of 26.2 $\mu g/m^3$. This is the 2009-11 design value for LaSalle County, Illinois - the lowest measured background concentration in the state. This is the most recently available design value.

2.3 Conservative Modeling Assumptions

A dispersion modeling analysis requires the selection of numerous parameters which affect the predicted concentrations. For the enclosed analysis, several parameters were selected which under-predict facility impacts.

Assumptions used in this modeling analysis which likely under-estimate concentrations include the following:

- Allowable emissions are based on a limitation with an averaging period which is greater than the 1-hour average used for the SO_2 air quality standard. Emissions and impacts during any 1-hour period may be higher than assumed for the modeling analysis.
- No consideration of facility operation at less than 100% load. Stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts.
- No consideration of off-site sources. These other sources of SO_2 will increase the predicted impacts.

Table 1 - SO_2 Modeling Results for Edwards Power Station Modeling Analysis

Emission Rates	Averaging Period	99th Percentile 1-hour Daily Maximum (µg/m^3)				Complies with NAAQS?
		Impact	Background	Total	NAAQS	
Allowable	1-hour	1,498.3	26.2	1,524.5	196.2	No
Maximum	1-hour	244.9	26.2	271.1	196.2	No

Table 2 - Modeled SO_2 Emissions from Edwards Power Station [3,4]

Stack ID	Unit ID	Allowable Emissions 24-hour Average (lbs/hr)	Maximum Emissions 1-hour Average (lbs/hr)
S01	Unit 1	5,584.8	820
	Unit 2	12,178.1	2,189
	Stack Total	17,762.9	3,009
S02	Unit 3	16,846.2	2,656
Stack Total	All Units	34,609.1	5,665

Table 3 - Required Emission Reductions for Compliance with 1-hour SO_2 NAAQS

Acceptable Impact (NAAQS - Background) 99th Percentile 1-hour Daily Max (µg/m^3)	Required Total Facility Reduction Based on Allowable Emissions (%)	Required Total Facility Emission Rate (lbs/hr)	Required Total Facility 1-hour Average Emission Rate (lbs/mmbtu)
170.0	88.7%	3,926.8	0.42

[3] Illinois Environmental Protection Agency, Clean Air Act Permit Program Permit, Application No. 95070026, I.D. No.: 143805AAG, September 29, 2005. The allowable emissions from the three facility boilers are based on an emission limitation 3.667 lbs per million btu heat input.
[4] Maximum emissions are measured hourly rates reported for 2011 in USEPA, Clean Air Markets - Data and Maps.

3. Modeling Methodology

3.1 Air Dispersion Model

The modeling analysis used USEPA's AERMOD program, version 12060. AERMOD, as available from the Support Center for Regulatory Atmospheric Modeling (SCRAM) website, was used in conjunction with a third-party modeling software program, *AERMOD View*, sold by Lakes Environmental Software.

3.2 Control Options

The AERMOD model was run with the following control options:

- 1-hour average air concentrations
- Regulatory defaults
- Flagpole receptors

To reflect a representative inhalation level, a flagpole height of 1.5 meters was used for all modeled receptors. This parameter was added to the receptor file when running AERMAP, as described in Section 4.4.

An evaluation was conducted to determine if the modeled facility was located in a rural or urban setting using USEPA's methodology outlined in Section 7.2.3 of the Guideline on Air Quality Models.[5] For urban sources, the URBANOPT option is used in conjunction with the urban population from an appropriate nearby city and a default surface roughness of 1.0 meter. Methods described in Section 4.1 to determine whether rural or urban dispersion coefficients were used.

3.3 Output Options

The AERMOD analysis was based on five years of recent meteorological data. The modeling analyses used one run with five years of sequential meteorological data from 2007-2011. Consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations, AERMOD provided a table of fourth-high 1-hour SO_2 impacts concentrations consistent with the form of the 1-hour SO_2 NAAQS.[6]

Please refer to Table 1 for the modeling results.

---

[5] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005.
[6] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 24-26.

4. Model Inputs

4.1 Geographical Inputs

The "ground floor" of all air dispersion modeling analyses is establishing a coordinate system for identifying the geographical location of emission sources and receptors. These geographical locations are used to determine local characteristics (such as land use and elevation), and also to ascertain source to receptor distances and relationships.

The Universal Transverse Mercator (UTM) NAD83 coordinate system was used for identifying the easting (x) and northing (y) coordinates of the modeled sources and receptors. Stack locations were obtained from facility permits and prior modeling files provided by the state regulatory agency. The stack locations were then verified using aerial photographs.

The facility was evaluated to determine if it should be modeled using the rural or urban dispersion coefficient option in AERMOD. A GIS was used to determine whether rural or urban dispersion coefficients apply to a site. Land use within a three-kilometer radius circle surrounding the facility was considered. USEPA guidance states that urban dispersion coefficients are used if more than 50% of the area within 3 kilometers has urban land uses. Otherwise, rural dispersion coefficients are appropriate.[7]

USEPA's AERSURACE model Version 08009 was used to develop the meteorological data for the modeling analysis. This model was also used to evaluate surrounding land use within 3 kilometers. Based on the output from the AERSURFACE, approximately 13.4% of surrounding land use around the airport was of urban land use types including: 22 – High Intensity Residential and 23 - Commercial/Industrial/Transportation.

This is less than the 50% value considered appropriate for the use of urban dispersion coefficients. Based on the AERSURFACE analysis, it was concluded that the rural option would be used for the modeling summarized in this report. Please refer to Section 4.5.3 for a discussion of the AERSURFACE analysis.

---

[7] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005, Section 7.2.3.

4.2 Emission Rates and Source Parameters

The modeling analyses only considered SO_2 emissions from the facility. Off-site sources were not considered. Concentrations were predicted for two scenarios shown in Table 2:

1) approved or allowable emissions based on permits issued by the regulatory agency, and

2) measured actual hourly SO_2 emissions obtained from USEPA's Clean Air Markets Database. To assure realistic emission rates were used, emissions from all units at the facility were combined and the hour with the maximum total facility emissions was used to determine the actual emissions.

Stack parameters and emissions used for the modeling analysis are summarized in Table 4.

Table 4 – Facility Stack Parameters and Emissions [8]

Stack	S01	S02
Description	Units 1 and 2	Unit 3
X Coord. [m]	274755	274729.85
Y Coord. [m]	4497324	4497253.89
Base Elevation [m]	141.18	141.02
Release Height [m]	153.31	153.31
Gas Exit Temperature [°K]	379.26	388.71
Gas Exit Velocity [m/s]	7.578	8.151
Inside Diameter [m]	7.62	6.4
Allowable Emission Rate [g/s]	2238	2123
Maximum Emission Rate [g/s]	379.1	334.7

The above stack parameters and emissions were obtained from regulatory agency documents and databases identified in Section 2.3. The analysis was conducted based on 100% operating load using maximum exhaust flow rates and emission rates. Operation at less than full capacity loads was not considered. This assumption tends to under-predict impacts since stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts. Stack location, height and diameter were verified using aerial photographs, and flue gas flow rate and temperature were verified using combustion calculations.

[8] Stack parameters obtained from IEPA AERMOD modeling file, pekin0.txt, SOURCE - 143805AAG - 8611 - Ameren Energy Resources Generating Co, April 27, 2012.

4.3 Building Dimensions and GEP

No building dimensions or prior downwash evaluations were available. Therefore this modeling analysis did not address the effects of downwash which may increase predicted concentrations.

4.4 Receptors

For Edwards Power Station, three receptor grids were employed:

1. A 100-meter Cartesian receptor grid centered on Edwards Power Station and extending out 5 kilometers.
2. A 500-meter Cartesian receptor grid centered on Edwards Power Station and extending out 10 kilometers.
3. A 1,000-meter Cartesian receptor grid centered on Edwards Power Station and extending out 50 kilometers. 50 kilometers is the maximum distance accepted by USEPA for the use of the AERMOD dispersion model.[9]

A flagpole height of 1.5 meters was used for all these receptors.

Elevations from stacks and receptors were obtained from National Elevation Dataset (NED) GeoTiff data. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. These elevations were extracted from 1 arc-second (30 meter) resolution NED files. The USEPA software program AERMAP v. 11103 is used for these tasks.

4.5 Meteorological Data

To improve the accuracy of the modeling analysis, recent meteorological data for the 2007 to 2011 period were prepared using the USEPA's program AERMET which creates the model-ready surface and profile data files required by AERMOD.   Required data inputs to AERMET included surface meteorological measurements, twice-daily soundings of upper air measurements, and the micrometeorological parameters surface roughness, albedo, and Bowen ratio. One-minute ASOS data were available so USEPA methods were used to reduce calm and missing hours.[10] The USEPA software program AERMINUTE v. 11325 is used for these tasks.

---

[9] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, Section A.1.(1), November 9, 2005.

[10] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, p. 19.

This section discusses how the meteorological data was prepared for use in the 1-hour SO_2 NAAQS modeling analyses. The USEPA software program AERMET v. 11059 is used for these tasks.

4.5.1 Surface Meteorology

Surface meteorology was obtained for General Downing - Peoria International Airport located near the Edwards Power Station. Integrated Surface Hourly (ISH) data for the 2007 to 2011 period were obtained from the National Climatic Data Center (NCDC). The ISH surface data was processed through AERMET Stage 1, which performs data extraction and quality control checks.

4.5.2 Upper Air Data

Upper-air data are collected by a "weather balloon" that is released twice per day at selected locations. As the balloon is released, it rises through the atmosphere, and radios the data back to the surface. The measuring and transmitting device is known as either a radiosonde, or rawindsonde. Data collected and radioed back include: air pressure, height, temperature, dew point, wind speed, and wind direction. The upper air data were processed through AERMET Stage 1, which performs data extraction and quality control checks.

For Edwards Power Station, the concurrent 2007 through 2011 upper air data from twice-daily radiosonde measurements obtained at the most representative location were used. This location was the Lincoln, Illinois measurement station. These data are in Forecast Systems Laboratory (FSL) format and were downloaded in ASCII text format from NOAA's FSL website.[11] All reporting levels were downloaded and processed with AERMET.

4.5.3 AERSURFACE

AERSURFACE is a non-guideline program that extracts surface roughness, albedo, and daytime Bowen ratio for an area surrounding a given location. AERSURFACE uses land use and land cover (LULC) data in the U.S. Geological Survey's 1992 National Land Cover Dataset to extract the necessary micrometeorological data. LULC data was used for processing meteorological data sets used as input to AERMOD.

AERSURFACE v. 08009 was used to develop surface roughness, albedo, and daytime Bowen ratio values in a region surrounding the meteorological data collection site. AERSURFACE was used to develop surface roughness in a one kilometer radius surrounding the data collection site. Bowen ratio and albedo was developed for a 10 kilometer by 10 kilometer area centered on the meteorological data collection site. These micrometeorological data were processed for seasonal

---

[11] Available at: http://esrl.noaa.gov/raobs/

periods using 30-degree sectors. Seasonal moisture conditions were considered average with no months with continuous snow cover.

4.5.4 Data Review

Missing meteorological data were not filled as the data file met USEPA's 90% data completeness requirement.[12] The AERMOD output file shows there were 2.5% missing data.

The representativeness of airport meteorological data is a potential concern in modeling industrial source sites.[13] The surface characteristics of the airport data collection site and the modeled source location were compared. Since the General Downing - Peoria International Airport is located close to Edwards Power Station, this meteorological data set was considered appropriate for this modeling analysis.

5. Background SO_2 Concentrations

Background concentrations were determined consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations.[14] To preserve the form of the 1-hour SO_2 standard, based on the 99th percentile of the annual distribution of daily maximum 1-hour concentrations averaged across the number of years modeled, the <u>background</u> fourth-highest daily maximum 1-hour SO_2 concentration was added to the <u>modeled</u> fourth-highest daily maximum 1-hour SO_2 concentration.[15]

Background concentrations were based on the 2009-11 design value measured by the ambient monitors located in Illinois.[16]

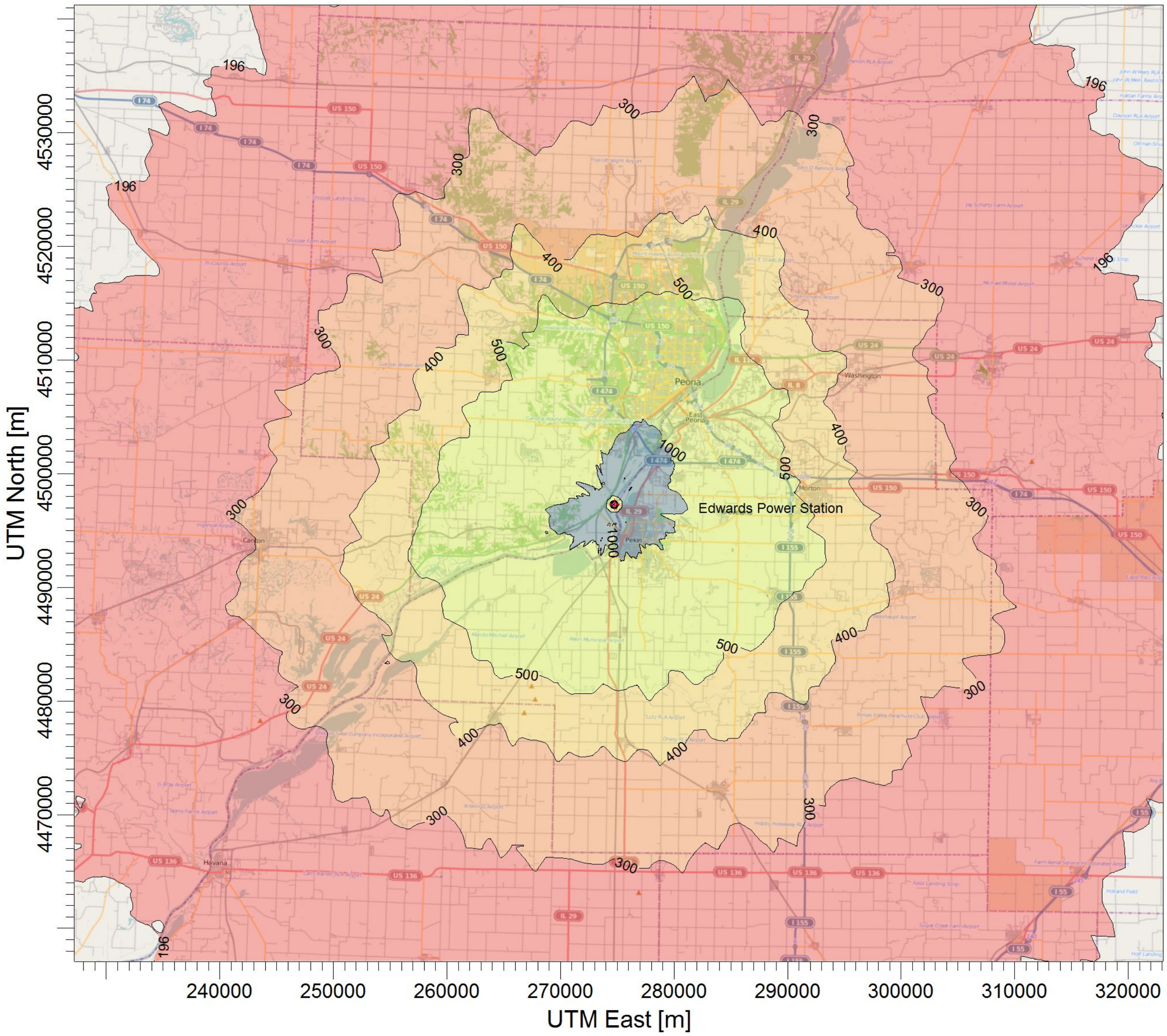
6. Reporting

All files from the programs used for this modeling analysis are available to regulatory agencies. These include analyses prepared with AERSURFACE, AERMET, AERMAP, and AERMOD.

---

[12] USEPA, Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-05, February 2000, Section 5.3.2, pp. 5-4 to 5-5.
[13] USEPA, AERMOD Implementation Guide, March 19, 2009, pp. 3-4.
[14] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 20-23.
[15] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010, p. 3.
[16] http://www.epa.gov/airtrends/values.html

Edwards Power Station - Bartonville, Illinois
Evaluation of Compliance with the 1-hour NAAQS for SO2



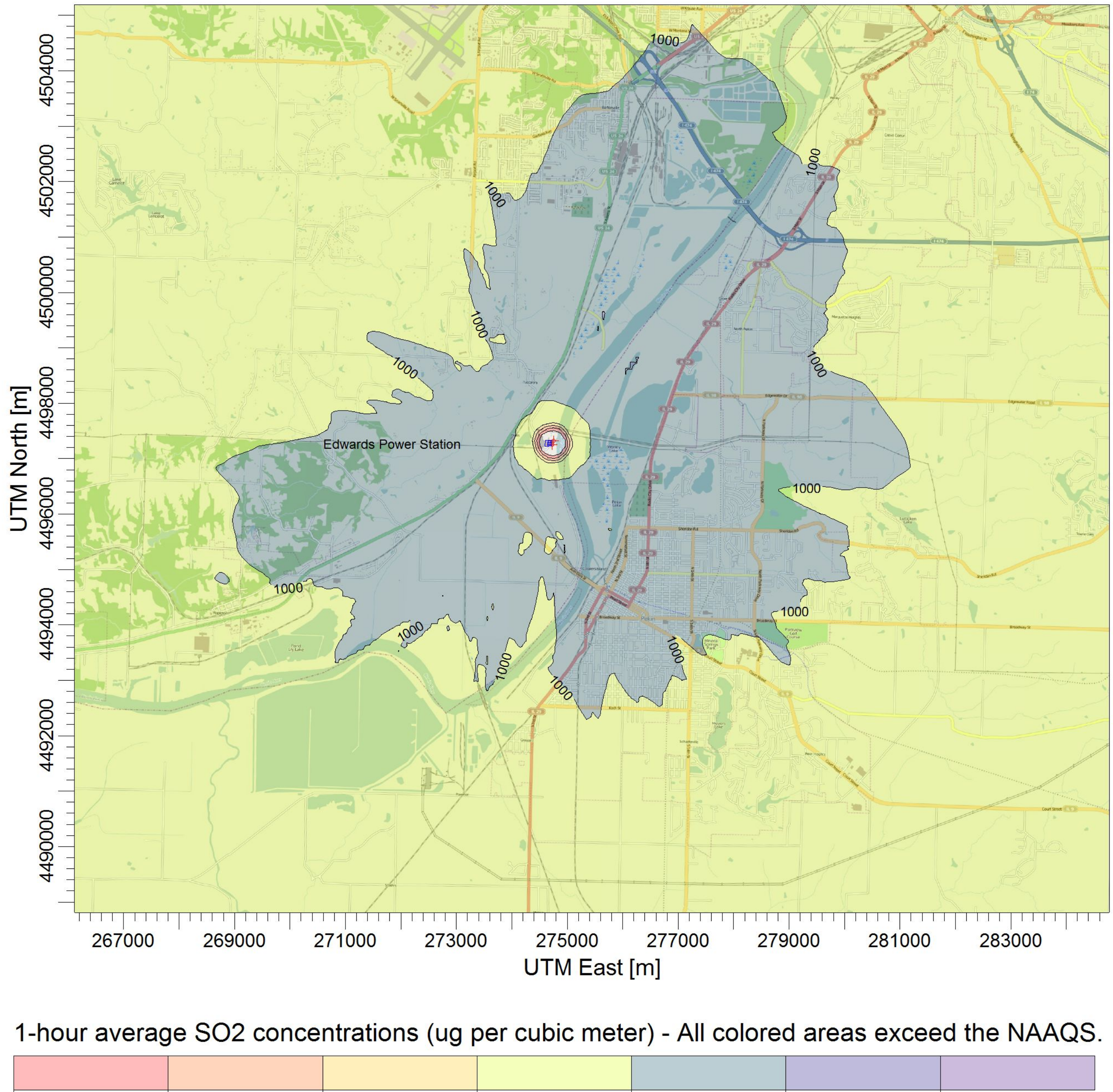
1-hour average SO2 concentrations (ug per cubic meter) - All colored areas exceed the NAAQS.

196 | 300 | 400 | 500 | 1000 | 1500 | 2000

All concentrations include a background of 26.2 ug/m3. This figure is based on allowable emissions.	Total Sources **4**	**Conducted on behalf of the Sierra Club**
	Total Receptors **21201**	**by Wingra Engineering, S.C.**
	Output Type **Concentration**	SCALE: 1:602,999 0 20 km
	Maximum **1524.49346 ug/m^3**	DATE: **12/10/2012**

AERMOD View - Lakes Environmental Software

Edwards Power Station - Bartonville, Illinois
Evaluation of Compliance with the 1-hour NAAQS for SO2



All concentrations include a background of 26.2 ug/m3. This figure is based on allowable emissions.	Total Sources **4**	**Conducted on behalf of the Sierra Club**
	Total Receptors **21201**	**by Wingra Engineering, S.C.**
	Output Type **Concentration**	SCALE: 1:117,366 0 — 4 km
	Maximum **1524.49346 ug/m^3**	DATE: **12/10/2012**

AERMOD View - Lakes Environmental Software

Joppa Steam Electric Station

Joppa, Illinois

Sierra Club Evaluation of Compliance with 1-hour SO_2 NAAQS

September 13, 2013

Conducted by:

Steven Klafka, P.E., BCEE

Wingra Engineering, S.C.

Madison, Wisconsin

1. Introduction

The Sierra Club prepared an air modeling impact analysis to help USEPA, state and local air agencies identify facilities that are likely causing violations of the 1-hour sulfur dioxide (SO_2) national ambient air quality standard (NAAQS). This document describes the results and procedures for an evaluation conducted for the Joppa Steam Electric Station located in Joppa, Illinois.

The dispersion modeling analysis predicted ambient air concentrations for comparison with the one hour SO_2 NAAQS. The modeling was performed using the most recent version of AERMOD, AERMET, and AERMINUTE, with data provided to the Sierra Club by regulatory air agencies and through other publicly-available sources as documented below. The analysis was conducted following IEPA and USEPA guidance for evaluating source impacts on attainment of the 1-hour SO_2 NAAQS via aerial dispersion modeling, including the AERMOD Implementation Guide; USEPA's Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010; modeling guidance promulgated by USEPA in Appendix W to 40 CFR Part 51; and, USEPA's March 2011 Modeling Guidance for SO_2 NAAQS Designations. [1, 2]

2. Compliance with the 1-hour SO_2 NAAQS

2.1 1-hour SO_2 NAAQS

The 1-hour SO_2 NAAQS takes the form of a three-year average of the 99^{th}-percentile of the annual distribution of daily maximum 1-hour concentrations, which cannot exceed 75 ppb.[3] Compliance with this standard was verified using USEPA's AERMOD air dispersion model, which produces air concentrations in units of $\mu g/m^3$. The 1-hour SO_2 NAAQS of 75 ppb equals 196.2 $\mu g/m^3$, and this is the value used for determining whether modeled impacts exceed the NAAQS.[4] The 99^{th}-percentile of the annual distribution of daily maximum 1-hour concentrations corresponds to the fourth-highest value at each receptor for a given year.

2.2 Modeling Results

Modeling results for Joppa Steam Electric Station are summarized in Table 1. It was determined that based on either currently permitted emissions or measured actual emissions, the Joppa Steam Electric Station is estimated to create SO_2 concentrations which exceed the 1-hour NAAQS.

---

[1] Illinois EPA, Modeling Unit, Prevention of Significant Deterioration, The Art and Science of the PSD Air Quality Analysis, The Modeling Perspective, April 19, 2013.
[2] http://www.epa.gov/scram001/so2_modeling_guidance.htm
[3] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010.
[4] The ppb to $\mu g/m^3$ conversion is found in the source code to AERMOD v. 12345, subroutine Modules. The conversion calculation is 75/0.3823 = 196.2 $\mu g/m^3$.

For the modeling results presented in Table 1, the evaluated emission rates include the allowable and maximum. "Allowable" is the peak emission rate from each unit as approved by the current air quality operation permit for the facility. "Maximum" is the highest combined emission rate from all units during any single hour as measured during 2012.

Air quality impacts in Illinois are based on a background concentration of 23.5 µg/m^3. This is the 2010-12 design value for LaSalle County, Illinois - the lowest measured background concentration in the state. This is the most recently available design value.

Table 1 - SO_2 Modeling Results for Joppa Steam Electric Station Modeling Analysis

Emission Rates	Averaging Period	99th Percentile 1-hour Daily Maximum (µg/m^3)				Complies with NAAQS?
		Impact	Background	Total	NAAQS	
Allowable	1-hour	1,112.9	23.5	1,136.4	196.2	No
Maximum	1-hour	337.9	23.5	361.4	196.2	No

The currently permitted emissions and measured maximum emissions used for the modeling analysis are summarized in Table 2.

Table 2 - Modeled SO_2 Emissions from Joppa Steam Electric Station [5,6]

Stack ID	Unit ID	Allowable Emissions 1-hour Average (lbs/hr)	Maximum Emissions 1-hour Average (lbs/hr)
S01	Boiler 1	6,144.2	1,834.1
	Boiler 2	6,144.2	1,844.2
	Subtotal	12,288.3	3,678.3
S02	Boiler 3	6,144.2	1,857.6
	Boiler 4	6,144.2	1,847.4
	Subtotal	12,288.3	3,705.0
S03	Boiler 5	6,144.2	1,920.3
	Boiler 6	6,144.2	1,888.4
	Subtotal	12,288.3	3,808.7
Stack Total	All Units	36,865	11,192

[5] Total SO_2 emissions from Units 1-6 are limited to 36,865 lbs/hr. Operating Permit for ID No. 127855AAC issued September 29, 2005 by Illinois EPA. Allowable emissions are based on a limitation with an hourly average. However, compliance demonstration in the operating permit requires reporting only when the 3-hour average emission rate exceeds the 1-hour average limitation.

[6] Maximum emissions are measured hourly rates reported for 2012 in USEPA, Clean Air Markets - Data and Maps.

Based on the modeling results, emission reductions from current rates considered necessary to achieve compliance with the 1-hour NAAQS were calculated and presented in Table 3.

Table 3 - Required Emission Reductions for Compliance with 1-hour SO_2 NAAQS

Acceptable Impact (NAAQS - Background) 99th Percentile 1-hour Daily Max (µg/m^3)	Required Total Facility Reduction Based on Allowable Emissions (%)	Required Total Facility Emission Rate (lbs/hr)	Required Total Facility 1-hour Average Emission Rate (lbs/mmbtu)
172.7	84.5%	5,714.1	0.53

Predicted exceedences of the 1-hour NAAQS for SO_2 extend throughout the region to a maximum distance of 50 kilometers.

Figure 1 shows the extent of NAAQS violations throughout the entire 50 kilometer modeling domain.

Figure 2 provides a close-up local view of NAAQS violations.

2.3 Conservative Modeling Assumptions

A dispersion modeling analysis requires the selection of numerous parameters which affect the predicted concentrations. For the enclosed analysis, several parameters were selected which under-predict facility impacts.

Assumptions used in this modeling analysis which likely under-estimate concentrations include the following:

- Allowable emissions are based on a limitation with an averaging period similar to the 1-hour average as used for the SO_2 air quality standard. However, compliance demonstration in the operating permit requires reporting only when the 3-hour average emission rate exceeds the 1-hour average limitation. Emissions and impacts during any 1-hour period may be higher than assumed for the modeling analysis.
- No consideration of facility operation at less than 100% load. Stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts.
- No consideration of off-site sources. These other sources of SO_2 will increase the predicted impacts.

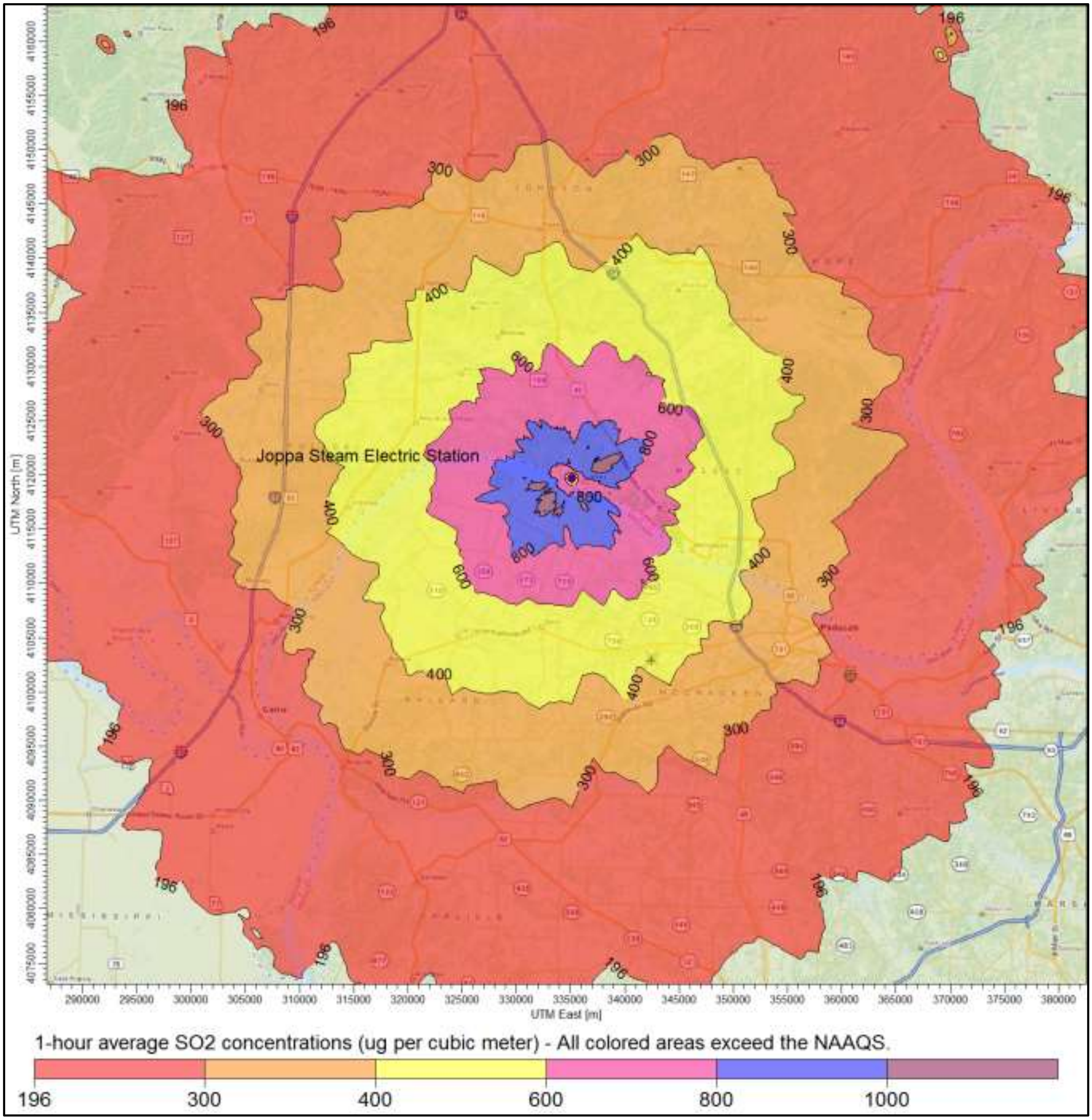


Figure 1 - Regional View of SO_2 Concentrations for Joppa Steam Electric Station

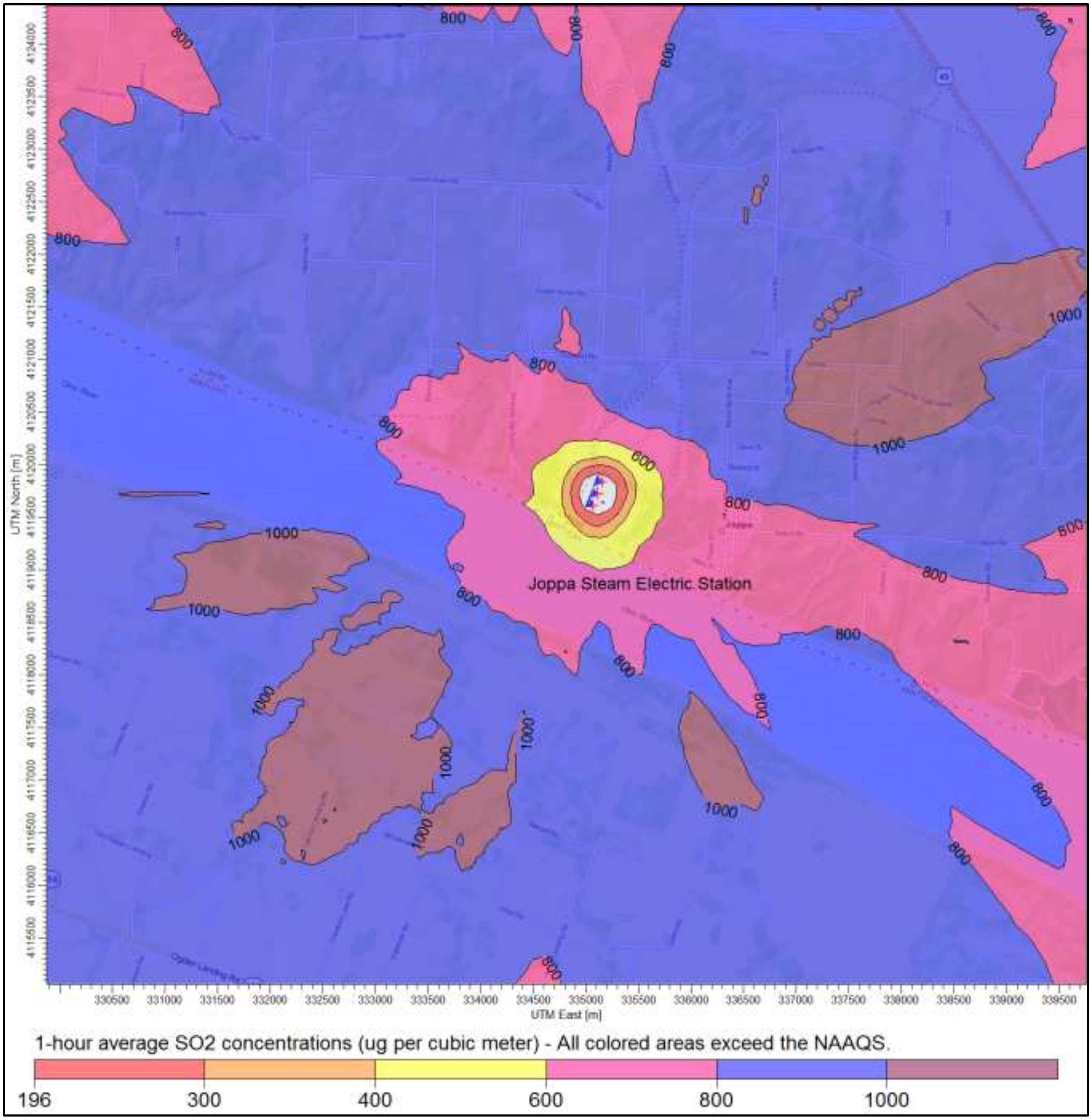


Figure 2 - Local View of SO_2 Concentrations for Joppa Steam Electric Station

3. Modeling Methodology

3.1 Air Dispersion Model

The modeling analysis used USEPA's AERMOD program, v. 12345. AERMOD, as available from the Support Center for Regulatory Atmospheric Modeling (SCRAM) website, was used in conjunction with a third-party modeling software program, *AERMOD View*, sold by Lakes Environmental Software.

3.2 Control Options

The AERMOD model was run with the following control options:

- 1-hour average air concentrations
- Regulatory defaults
- Flagpole receptors

To reflect a representative inhalation level, a flagpole height of 1.5 meters was used for all modeled receptors. This parameter was added to the receptor file when running AERMAP, as described in Section 4.4.

An evaluation was conducted to determine if the modeled facility was located in a rural or urban setting using USEPA's methodology outlined in Section 7.2.3 of the Guideline on Air Quality Models.[7] For urban sources, the URBANOPT option is used in conjunction with the urban population from an appropriate nearby city and a default surface roughness of 1.0 meter. Methods described in Section 4.1 were used to determine whether rural or urban dispersion coefficients were appropriate for the modeling analysis.

3.3 Output Options

The AERMOD analysis was based on five years of recent meteorological data. The modeling analyses used one run with five years of sequential meteorological data from 2008-2012. Consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations, AERMOD provided a table of fourth-high 1-hour SO_2 impacts concentrations consistent with the form of the 1-hour SO_2 NAAQS.[8]

Please refer to Table 1 for the modeling results.

---

[7] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005.
[8] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 24-26.

4. Model Inputs

4.1 Geographical Inputs

The "ground floor" of all air dispersion modeling analyses is establishing a coordinate system for identifying the geographical location of emission sources and receptors. These geographical locations are used to determine local characteristics (such as land use and elevation), and also to ascertain source to receptor distances and relationships.

The Universal Transverse Mercator (UTM) NAD83 coordinate system was used for identifying the easting (x) and northing (y) coordinates of the modeled sources and receptors. Stack locations were obtained from facility permits and prior modeling files provided by the state regulatory agency. The stack locations were then verified using aerial photographs.

The facility was evaluated to determine if it should be modeled using the rural or urban dispersion coefficient option in AERMOD. A GIS was used to determine whether rural or urban dispersion coefficients apply to a site. Land use within a three-kilometer radius circle surrounding the facility was considered. USEPA guidance states that urban dispersion coefficients are used if more than 50% of the area within 3 kilometers has urban land uses. Otherwise, rural dispersion coefficients are appropriate.[9]

USEPA's AERSURACE model v. 13016 was used to develop the meteorological data for the modeling analysis. This model was also used to evaluate surrounding land use within 3 kilometers. Based on the output from the AERSURFACE, approximately 6.3% of surrounding land use around the modeled facility was of urban land use types including Type 21 – Low Intensity Residential, Type 22 – High Intensity Residential and Type 23 – Commercial / Industrial / Transportation.

This is less than the 50% value considered appropriate for the use of urban dispersion coefficients. Based on the AERSURFACE analysis, it was concluded that the rural option would be used for the modeling summarized in this report. Please refer to Section 4.5.3 for a discussion of the AERSURFACE analysis.

---

[9] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005, Section 7.2.3.

4.2 Emission Rates and Source Parameters

The modeling analyses only considered SO_2 emissions from the facility. Off-site sources were not considered. Concentrations were predicted for two scenarios shown in Table 2:

1) approved or allowable emissions based on permits issued by the regulatory agency, and

2) measured actual hourly SO_2 emissions obtained from USEPA's Clean Air Markets Database. To assure realistic emission rates were used, emissions from all units at the facility were combined and the hour with the maximum total facility emissions was used to determine the actual emissions.

Stack parameters and emissions used for the modeling analysis are summarized in Table 4.

Table 4 – Facility Stack Parameters and Emissions [10]

Stack	S01	S02	S03
Description	Boilers 1 and 2	Boilers 3 and 4	Boilers 5 and 6
X Coord. [m]	335066	335110	335154
Y Coord. [m]	4119613	4119719	4119837
Base Elevation [m]	104.52	105.48	106.31
Release Height [m]	124.15	124.15	124.15
Gas Exit Temperature [°K]	427.594	427.594	427.594
Gas Exit Velocity [m/s]	25.938	25.938	25.938
Inside Diameter [m]	5.486	5.486	5.486
Allowable Emission Rate [g/s]	1,548	1,548	1,548
Maximum Emission Rate [g/s]	463.5	466.8	479.9

The above stack parameters and emissions were obtained from regulatory agency documents and databases identified in Section 2.3. The analysis was conducted based on 100% operating load using maximum exhaust flow rates and emission rates. Operation at less than full capacity loads was not considered. This assumption tends to under-predict impacts since stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts. Stack location, height and diameter were verified using aerial photographs, and flue gas flow rate and temperature were verified using combustion calculations.

---

[10] Stack parameters were obtained from the Illinois EPA modeling file "massac_allowables.txt" for the Joppa Steam Generating Station. The actual stack height of 550 feet was reduced to 407.33 feet. This is the Good Engineering Practice or GEP height allowed in the operating permit for modeling anlayses.

4.3 Building Dimensions and GEP

Building dimensions were obtained from a prior Illinois EPA modeling analysis for the Joppa Steam Generating Station.11 The BPIP modeling program was then run to incorporate downwash effects into the AERMOD modeling file.

4.4 Receptors

For Joppa Steam Electric Station, three receptor grids were employed:

1. A 100-meter Cartesian receptor grid centered on Joppa Steam Electric Station and extending out 5 kilometers.
2. A 500-meter Cartesian receptor grid centered on Joppa Steam Electric Station and extending out 10 kilometers.
3. A 1,000-meter Cartesian receptor grid centered on Joppa Steam Electric Station and extending out 50 kilometers. 50 kilometers is the maximum distance accepted by USEPA for the use of the AERMOD dispersion model.[12]

A flagpole height of 1.5 meters was used for all these receptors.

Elevations from stacks and receptors were obtained from National Elevation Dataset (NED) GeoTiff data. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. These elevations were extracted from 1 arc-second (30 meter) resolution NED files. The USEPA software program AERMAP v. 11103 is used for these tasks.

4.5 Meteorological Data

To improve the accuracy of the modeling analysis, recent meteorological data for the 2008-2012 period were prepared using the USEPA's program AERMET which creates the model-ready surface and profile data files required by AERMOD. Required data inputs to AERMET included surface meteorological measurements, twice-daily soundings of upper air measurements, and the micrometeorological parameters surface roughness, albedo, and Bowen ratio. One-minute ASOS data were available so USEPA methods were used to reduce calm and missing hours.[13] The USEPA software program AERMINUTE v. 13016 is used for these tasks.

---

[11] Building dimensions were obtained from a 2011 modeling file for the Joppa Steam Electric Station provided by Illinois EPA entitled, "127855AAC.PIP".

[12] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, Section A.1.(1), November 9, 2005.

[13] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, p. 19.

This section discusses how the meteorological data was prepared for use in the 1-hour SO_2 NAAQS modeling analyses. The USEPA software program AERMET v. 12345 is used for these tasks.

4.5.1 Surface Meteorology

Surface meteorology was obtained for Paducah Barkley Regional Airport located in Kentucky and near the Joppa Steam Electric Station. Integrated Surface Hourly (ISH) data for the 2008-2012 period were obtained from the National Climatic Data Center (NCDC). The ISH surface data was processed through AERMET Stage 1, which performs data extraction and quality control checks.

4.5.2 Upper Air Data

Upper-air data are collected by a "weather balloon" that is released twice per day at selected locations. As the balloon is released, it rises through the atmosphere, and radios the data back to the surface. The measuring and transmitting device is known as either a radiosonde, or rawindsonde. Data collected and radioed back include: air pressure, height, temperature, dew point, wind speed, and wind direction. The upper air data were processed through AERMET Stage 1, which performs data extraction and quality control checks.

For Joppa Steam Electric Station, the concurrent 2008-2012 upper air data from twice-daily radiosonde measurements obtained at the most representative location were used. This location was the Nashville, Tennessee measurement station. These data are in Forecast Systems Laboratory (FSL) format and were downloaded in ASCII text format from NOAA's FSL website.[14] All reporting levels were downloaded and processed with AERMET.

4.5.3 AERSURFACE

AERSURFACE is a program that extracts surface roughness, albedo, and daytime Bowen ratio for an area surrounding a given location. AERSURFACE uses land use and land cover (LULC) data in the U.S. Geological Survey's 1992 National Land Cover Dataset to extract the necessary micrometeorological data. LULC data was used for processing meteorological data sets used as input to AERMOD.

Illinois EPA provided the AERSURFACE output files for 2008 to 2012 for the Paducah Barkley Regional Airport. These were combined with the surface and upper air meteorological data and processed with AERMET Stage 3.

---

[14] Available at: http://esrl.noaa.gov/raobs/

4.5.4 Data Review

Missing meteorological data were not filled as the data file met USEPA's 90% data completeness requirement.[15] The AERMOD output file shows there were 2.69% missing data.

To confirm the representativeness of the airport meteorological data, Illinois EPA staff were contacted to determine the meteorological data collection station most suitable for the Joppa Steam Electric Station.[16] They recommended the use of data from the Paducah Barkley Regional Airport for the surface measurements and Nashville, Tennessee for the upper air measurements. Illinois EPA staff provided AERSURFACE output files to assist with processing of the most recent surface and upper air measurements. In addition, the surface characteristics of the airport data collection site and the modeled source location were compared. Since the Paducah Barkley Regional Airport is located close to Joppa Steam Electric Station with similar rural surroundings, this meteorological data set was considered appropriate for this modeling analysis.[17]

5. Background SO_2 Concentrations

Background concentrations were determined consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations.[18] To preserve the form of the 1-hour SO_2 standard, based on the 99th percentile of the annual distribution of daily maximum 1-hour concentrations averaged across the number of years modeled, the <u>background</u> fourth-highest daily maximum 1-hour SO_2 concentration was added to the <u>modeled</u> fourth-highest daily maximum 1-hour SO_2 concentration.[19]

Background concentrations were based on the 2010-12 design value measured by the ambient monitors located in Illinois.[20]

6. Reporting

All files from the programs used for this modeling analysis are available to regulatory agencies. These include analyses prepared with AERSURFACE, AERMET, AERMAP, and AERMOD.

---

[15] USEPA, Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-05, February 2000, Section 5.3.2, pp. 5-4 to 5-5.
16 Email Correspondence, M. Will – Illinois EPA to S. Klafka – Wingra Engineering, S.C., Illinois EPA Modeling Guidance, September 6, 2013.
[17] USEPA, AERMOD Implementation Guide, March 19, 2009, pp. 3-4.
[18] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 20-23.
[19] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010, p. 3.
[20] http://www.epa.gov/airtrends/values.html

Newton Power Station

Newton, Illinois

Sierra Club Evaluation of Compliance with 1-hour SO_2 NAAQS

September 13, 2013

Conducted by:

Steven Klafka, P.E., BCEE

Wingra Engineering, S.C.

Madison, Wisconsin

1. Introduction

The Sierra Club prepared an air modeling impact analysis to help USEPA, state and local air agencies identify facilities that are likely causing violations of the 1-hour sulfur dioxide (SO_2) national ambient air quality standard (NAAQS). This document describes the results and procedures for an evaluation conducted for the Newton Power Station located in Newton, Illinois.

The dispersion modeling analysis predicted ambient air concentrations for comparison with the one hour SO_2 NAAQS. The modeling was performed using the most recent version of AERMOD, AERMET, and AERMINUTE, with data provided to the Sierra Club by regulatory air agencies and through other publicly-available sources as documented below. The analysis was conducted following IEPA and USEPA guidance for evaluating source impacts on attainment of the 1-hour SO_2 NAAQS via aerial dispersion modeling, including the AERMOD Implementation Guide; USEPA's Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010; modeling guidance promulgated by USEPA in Appendix W to 40 CFR Part 51; and, USEPA's March 2011 Modeling Guidance for SO_2 NAAQS Designations.[1, 2]

2. Compliance with the 1-hour SO_2 NAAQS

2.1 1-hour SO_2 NAAQS

The 1-hour SO_2 NAAQS takes the form of a three-year average of the 99^{th}-percentile of the annual distribution of daily maximum 1-hour concentrations, which cannot exceed 75 ppb.[3] Compliance with this standard was verified using USEPA's AERMOD air dispersion model, which produces air concentrations in units of $\mu g/m^3$. The 1-hour SO_2 NAAQS of 75 ppb equals 196.2 $\mu g/m^3$, and this is the value used for determining whether modeled impacts exceed the NAAQS.[4] The 99^{th}-percentile of the annual distribution of daily maximum 1-hour concentrations corresponds to the fourth-highest value at each receptor for a given year.

2.2 Modeling Results

Modeling results for Newton Power Station are summarized in Table 1. It was determined that based on either currently permitted emissions or measured actual emissions, the Newton Power Station is estimated to create downwind SO_2 concentrations which exceed the 1-hour NAAQS.

---

[1] Illinois EPA, Modeling Unit, Prevention of Significant Deterioration, The Art and Science of the PSD Air Quality Analysis, The Modeling Perspective, April 19, 2013.
[2] http://www.epa.gov/scram001/so2_modeling_guidance.htm
[3] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010.
[4] The ppb to $\mu g/m^3$ conversion is found in the source code to AERMOD v. 12345, subroutine Modules. The conversion calculation is $75/0.3823 = 196.2\ \mu g/m^3$.

For the modeling results presented in Table 1, the evaluated emission rates include the allowable and maximum. "Allowable" is the peak emission rate from each unit as approved by the current air quality operation permit for the facility. "Maximum" is the highest combined emission rate from all units during any single hour as measured during 2012.

Air quality impacts in Illinois are based on a background concentration of 23.5 µg/m^3. This is the 2010-12 design value for LaSalle County, Illinois - the lowest measured background concentration in the state. This is the most recently available design value.

Table 1 - SO_2 Modeling Results for Newton Power Station Modeling Analysis

Emission Rates	Averaging Period	99th Percentile 1-hour Daily Maximum (µg/m^3)				Complies with NAAQS?
		Impact	Background	Total	NAAQS	
Allowable	1-hour	294.1	23.5	317.6	196.2	No
Maximum	1-hour	214.5	23.5	238.0	196.2	No

The currently permitted emissions and measured maximum emissions used for the modeling analysis are summarized in Table 2.

Table 2 - Modeled SO_2 Emissions from Newton Power Station [5,6]

Stack ID	Unit ID	Allowable Emissions 1-hour Average (lbs/hr)	Maximum Emissions 1-hour Average (lbs/hr)
S01	Boiler NB-1	6,600	4,896
S02	Boiler NB-2	6,600	4,728
Stack Total	All Units	13,200	9,624

Based on the modeling results, emission reductions from current rates considered necessary to achieve compliance with the 1-hour NAAQS were calculated and presented in Table 3.

---

[5] SO_2 emissions from Boilers NB-1 and NB-2 are limited to 1.2 lbs/mmbtu. Operating Permit for ID No. 079808AAA issued September 29, 2005 by Illinois EPA. Allowable emissions are based on a limitation with an hourly average. However, compliance demonstration in the operating permit requires reporting only when the 3-hour average emission rate exceeds the 1-hour average limitation.

[6] Maximum emissions are measured hourly rates reported for 2012 in USEPA, Clean Air Markets - Data and Maps.

Table 3 - Required Emission Reductions for Compliance with 1-hour SO_2 NAAQS

Acceptable Impact (NAAQS - Background) 99th Percentile 1-hour Daily Max (µg/m^3)	Required Total Facility Reduction Based on Allowable Emissions (%)	Required Total Facility Emission Rate (lbs/hr)	Required Total Facility 1-hour Average Emission Rate (lbs/mmbtu)
172.7	41.3%	7,751.2 lbs/hr	0.70

Predicted exceedences of the 1-hour NAAQS for SO_2 extend throughout the region to a maximum distance of 8 kilometers.

Figure 1 shows the extent of NAAQS violations throughout the entire 50 kilometer modeling domain.

Figure 2 provides a close-up local view of NAAQS violations.

2.3 Conservative Modeling Assumptions

A dispersion modeling analysis requires the selection of numerous parameters which affect the predicted concentrations. For the enclosed analysis, several parameters were selected which under-predict facility impacts.

Assumptions used in this modeling analysis which likely under-estimate concentrations include the following:

- Allowable emissions are based on a limitation with an averaging period similar to the 1-hour average as used for the SO_2 air quality standard. However, compliance demonstration in the operating permit requires reporting only when the 3-hour average emission rate exceeds the 1-hour average limitation. Emissions and impacts during any 1-hour period may be higher than assumed for the modeling analysis.
- No consideration of facility operation at less than 100% load. Stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts.
- No consideration of building or structure downwash. These downwash effects typically increase predicted concentrations near the facility.
- The actual stack height of 530 feet was used for the modeling analysis. Good Engineering Practice stack height is 213 feet unless surrounding buildings or structures require a tall stack. When an evaluation of surrounding buildings or structures is conducted, it may show the modeling analysis should be based on a shorter stack than 530 feet. A shorter stack generally results in an increase in predicted air quality impacts.
- No consideration of off-site sources. These other sources of SO_2 will increase the predicted impacts.

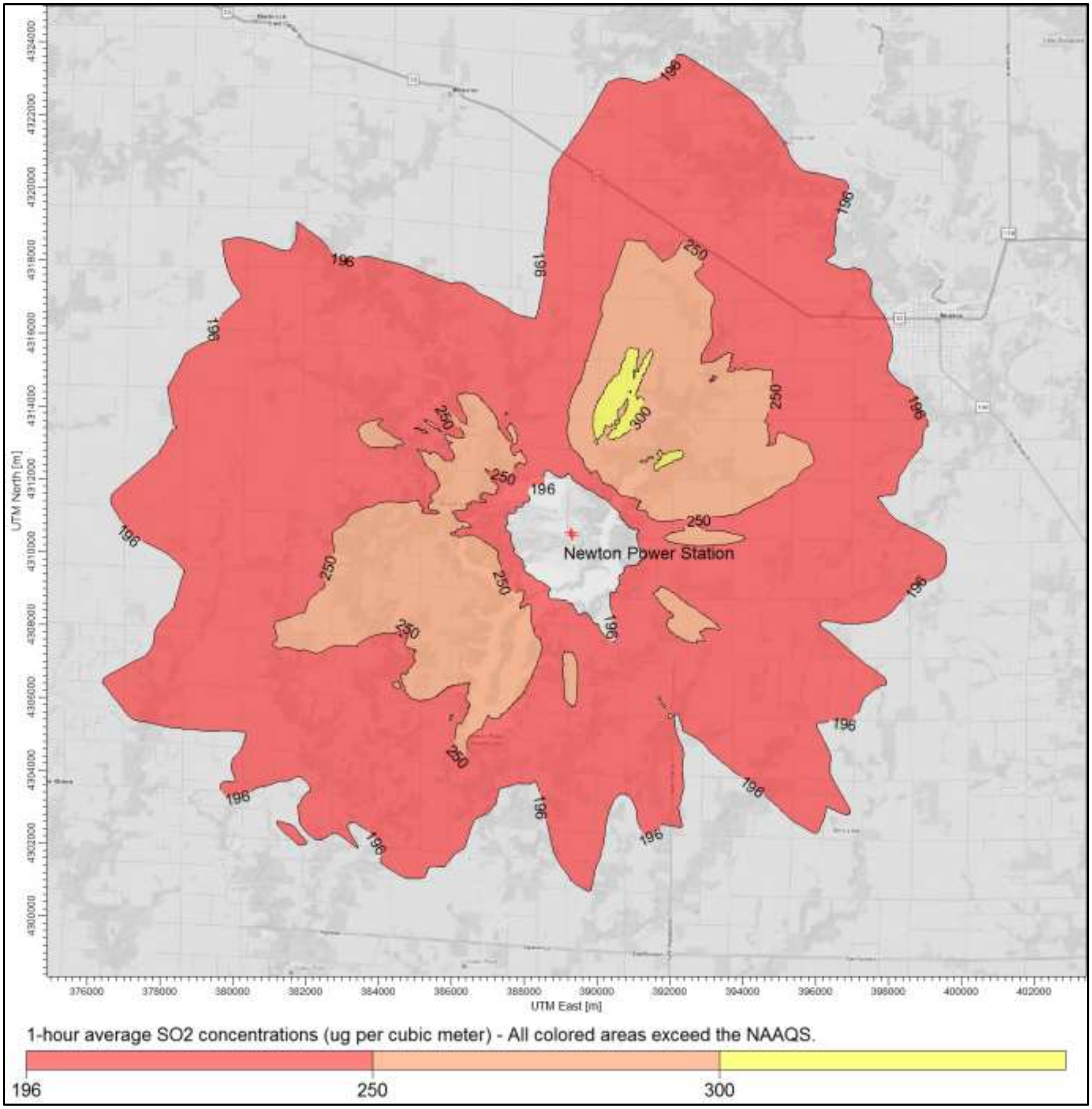


Figure 1 - Regional View of SO_2 Concentrations for Newton Power Station

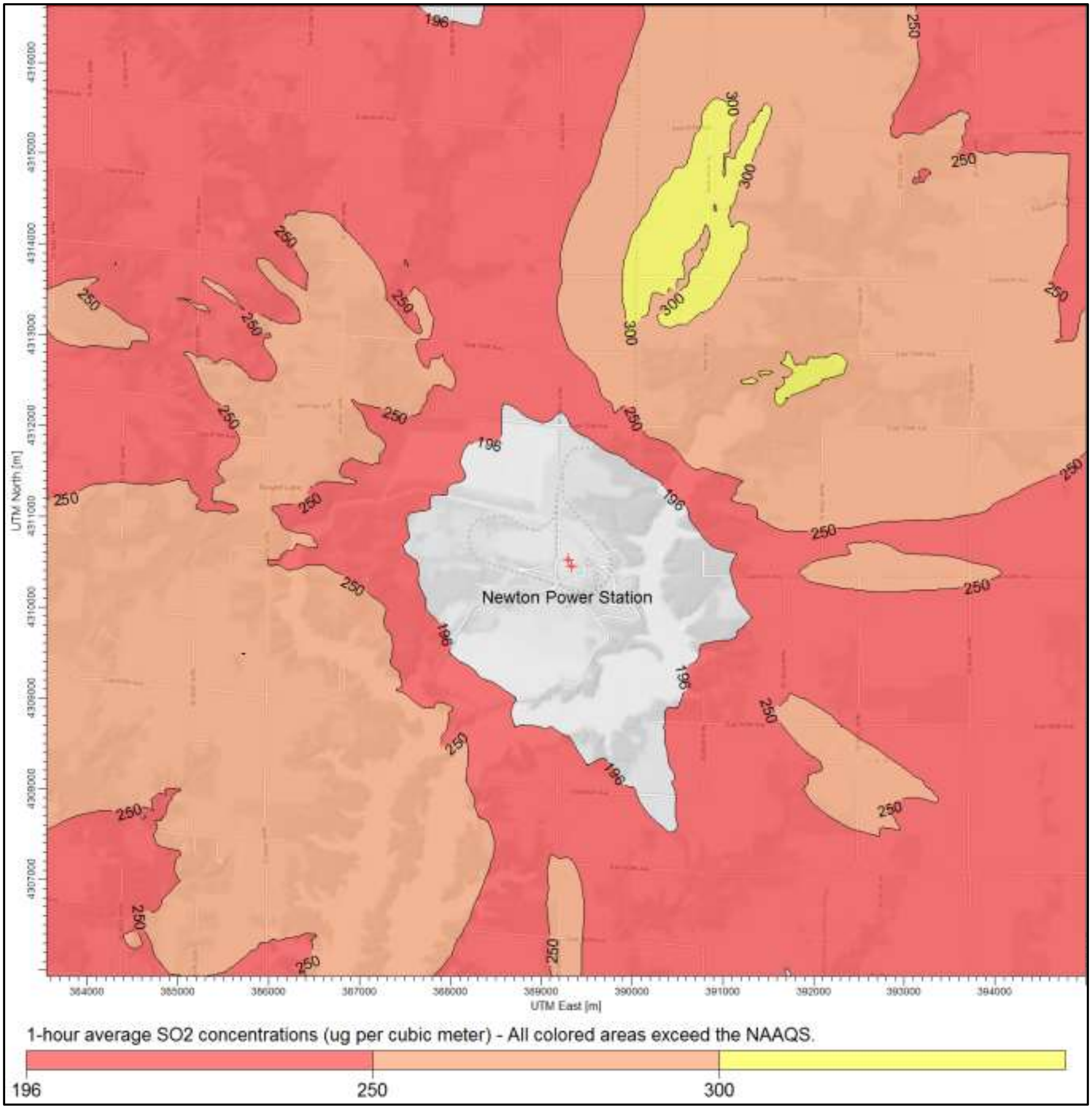


Figure 2 – Local View of SO_2 Concentrations for Newton Power Station

3. Modeling Methodology

3.1 Air Dispersion Model

The modeling analysis used USEPA's AERMOD program, v. 12345. AERMOD, as available from the Support Center for Regulatory Atmospheric Modeling (SCRAM) website, was used in conjunction with a third-party modeling software program, *AERMOD View*, sold by Lakes Environmental Software.

3.2 Control Options

The AERMOD model was run with the following control options:

- 1-hour average air concentrations
- Regulatory defaults
- Flagpole receptors

To reflect a representative inhalation level, a flagpole height of 1.5 meters was used for all modeled receptors. This parameter was added to the receptor file when running AERMAP, as described in Section 4.4.

An evaluation was conducted to determine if the modeled facility was located in a rural or urban setting using USEPA's methodology outlined in Section 7.2.3 of the Guideline on Air Quality Models.[7] For urban sources, the URBANOPT option is used in conjunction with the urban population from an appropriate nearby city and a default surface roughness of 1.0 meter. Methods described in Section 4.1 were used to determine whether rural or urban dispersion coefficients were appropriate for the modeling analysis.

3.3 Output Options

The AERMOD analysis was based on five years of recent meteorological data. The modeling analyses used one run with five years of sequential meteorological data from 2008-2012. Consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations, AERMOD provided a table of fourth-high 1-hour SO_2 impacts concentrations consistent with the form of the 1-hour SO_2 NAAQS.[8]

Please refer to Table 1 for the modeling results.

---

[7] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005.
[8] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 24-26.

4. Model Inputs

4.1 Geographical Inputs

The "ground floor" of all air dispersion modeling analyses is establishing a coordinate system for identifying the geographical location of emission sources and receptors. These geographical locations are used to determine local characteristics (such as land use and elevation), and also to ascertain source to receptor distances and relationships.

The Universal Transverse Mercator (UTM) NAD83 coordinate system was used for identifying the easting (x) and northing (y) coordinates of the modeled sources and receptors. Stack locations were obtained from facility permits and prior modeling files provided by the state regulatory agency. The stack locations were then verified using aerial photographs.

The facility was evaluated to determine if it should be modeled using the rural or urban dispersion coefficient option in AERMOD. A GIS was used to determine whether rural or urban dispersion coefficients apply to a site. Land use within a three-kilometer radius circle surrounding the facility was considered. USEPA guidance states that urban dispersion coefficients are used if more than 50% of the area within 3 kilometers has urban land uses. Otherwise, rural dispersion coefficients are appropriate.[9]

USEPA's AERSURACE model v. 13016 was used to develop the meteorological data for the modeling analysis. This model was also used to evaluate surrounding land use within 3 kilometers. Based on the output from the AERSURFACE, approximately 0.3% of surrounding land use around the modeled facility was of urban land use types including Type 21 – Low Intensity Residential, Type 22 – High Intensity Residential and Type 23 – Commercial / Industrial / Transportation.

This is less than the 50% value considered appropriate for the use of urban dispersion coefficients. Based on the AERSURFACE analysis, it was concluded that the rural option would be used for the modeling summarized in this report. Please refer to Section 4.5.3 for a discussion of the AERSURFACE analysis.

[9] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005, Section 7.2.3.

4.2 Emission Rates and Source Parameters

The modeling analyses only considered SO_2 emissions from the facility. Off-site sources were not considered. Concentrations were predicted for two scenarios shown in Table 2:

1) approved or allowable emissions based on permits issued by the regulatory agency, and

2) measured actual hourly SO_2 emissions obtained from USEPA's Clean Air Markets Database. To assure realistic emission rates were used, emissions from all units at the facility were combined and the hour with the maximum total facility emissions was used to determine the actual emissions.

Stack parameters and emissions used for the modeling analysis are summarized in Table 4.

Table 4 – Facility Stack Parameters and Emissions [10]

Stack	S01	S02
Description	Boiler NB-1	Boiler NB-2
X Coord. [m]	389292	389331
Y Coord. [m]	4310519	4310453
Base Elevation [m]	165.48	165.73
Release Height [m]	161.54	161.54
Gas Exit Temperature [°K]	435.928	435.928
Gas Exit Velocity [m/s]	33.587	39.956
Inside Diameter [m]	6.401	6.096
Allowable Emission Rate [g/s]	831.6	831.6
Maximum Emission Rate [g/s]	616.9	595.7

The above stack parameters and emissions were obtained from regulatory agency documents and databases identified in Section 2.3. The analysis was conducted based on 100% operating load using maximum exhaust flow rates and emission rates. Operation at less than full capacity loads was not considered. This assumption tends to under-predict impacts since stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts. Stack location, height and diameter were verified using aerial photographs, and flue gas flow rate and temperature were verified using combustion calculations.

---

[10] Stack parameters were obtained from the annual survey compiled by the U.S. Energy Information Administration. http://www.eia.gov/electricity/data/eia860/

4.3 Building Dimensions and GEP

No building dimensions or prior downwash evaluations were available. Therefore this modeling analysis did not address the effects of downwash which may increase predicted concentrations. No evaluation was conducted to determine if the actual stack height of 530 feet complies with USEPA requirements for Good Engineering Practice or GEP stack height.

4.4 Receptors

For Newton Power Station, three receptor grids were employed:

1. A 100-meter Cartesian receptor grid centered on Newton Power Station and extending out 5 kilometers.
2. A 500-meter Cartesian receptor grid centered on Newton Power Station and extending out 10 kilometers.
3. A 1,000-meter Cartesian receptor grid centered on Newton Power Station and extending out 50 kilometers. 50 kilometers is the maximum distance accepted by USEPA for the use of the AERMOD dispersion model.[11]

A flagpole height of 1.5 meters was used for all these receptors.

Elevations from stacks and receptors were obtained from National Elevation Dataset (NED) GeoTiff data. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. These elevations were extracted from 1 arc-second (30 meter) resolution NED files. The USEPA software program AERMAP v. 11103 is used for these tasks.

4.5 Meteorological Data

To improve the accuracy of the modeling analysis, recent meteorological data for the 2008-2012 period were prepared using the USEPA's program AERMET which creates the model-ready surface and profile data files required by AERMOD. Required data inputs to AERMET included surface meteorological measurements, twice-daily soundings of upper air measurements, and the micrometeorological parameters surface roughness, albedo, and Bowen ratio. One-minute ASOS data were available so USEPA methods were used to reduce calm and missing hours.[12] The USEPA software program AERMINUTE v. 13016 is used for these tasks.

---

[11] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, Section A.1.(1), November 9, 2005.

[12] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, p. 19.

This section discusses how the meteorological data was prepared for use in the 1-hour SO_2 NAAQS modeling analyses. The USEPA software program AERMET v. 12345 is used for these tasks.

4.5.1 Surface Meteorology

Surface meteorology was obtained for Evansville Regional Airport in Evansville, Indiana. Integrated Surface Hourly (ISH) data for the 2008-2012 period were obtained from the National Climatic Data Center (NCDC). The ISH surface data was processed through AERMET Stage 1, which performs data extraction and quality control checks.

4.5.2 Upper Air Data

Upper-air data are collected by a "weather balloon" that is released twice per day at selected locations. As the balloon is released, it rises through the atmosphere, and radios the data back to the surface. The measuring and transmitting device is known as either a radiosonde, or rawindsonde. Data collected and radioed back include: air pressure, height, temperature, dew point, wind speed, and wind direction. The upper air data were processed through AERMET Stage 1, which performs data extraction and quality control checks.

For Newton Power Station, the concurrent 2008-2012 upper air data from twice-daily radiosonde measurements obtained at the most representative location were used. This location was the Lincoln, Illinois measurement station. These data are in Forecast Systems Laboratory (FSL) format and were downloaded in ASCII text format from NOAA's FSL website.[13] All reporting levels were downloaded and processed with AERMET.

4.5.3 AERSURFACE

AERSURFACE is a program that extracts surface roughness, albedo, and daytime Bowen ratio for an area surrounding a given location. AERSURFACE uses land use and land cover (LULC) data in the U.S. Geological Survey's 1992 National Land Cover Dataset to extract the necessary micrometeorological data. LULC data was used for processing meteorological data sets used as input to AERMOD.

Illinois EPA provided the AERSURFACE output files for 2008 to 2012 for the Evansville Regional Airport. These were combined with the surface and upper air meteorological data and processed with AERMET Stage 3.

---

[13] Available at: http://esrl.noaa.gov/raobs/

4.5.4 Data Review

Missing meteorological data were not filled as the data file met USEPA's 90% data completeness requirement.[14] The AERMOD output file shows there were 2.99% missing data.

To confirm the representativeness of the airport meteorological data, Illinois EPA staff were contacted to determine the meteorological data collection station most suitable for the Newton Power Plant.[15] They recommended the use of data from the Evansville Regional Airport for the surface measurements and Nashville, Tennessee for the upper air measurements. Illinois EPA staff provided AERSURFACE output files to assist with processing of the most recent surface and upper air measurements.

5. Background SO_2 Concentrations

Background concentrations were determined consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations.[16] To preserve the form of the 1-hour SO_2 standard, based on the 99^{th} percentile of the annual distribution of daily maximum 1-hour concentrations averaged across the number of years modeled, the <u>background</u> fourth-highest daily maximum 1-hour SO_2 concentration was added to the <u>modeled</u> fourth-highest daily maximum 1-hour SO_2 concentration.[17]

Background concentrations were based on the 2010-12 design value measured by the ambient monitors located in Illinois.[18]

6. Reporting

All files from the programs used for this modeling analysis are available to regulatory agencies. These include analyses prepared with AERSURFACE, AERMET, AERMAP, and AERMOD.

---

[14] USEPA, Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-05, February 2000, Section 5.3.2, pp. 5-4 to 5-5.
[15] Email Correspondence, M. Will – Illinois EPA to S. Klafka – Wingra Engineering, S.C., Illinois EPA Modeling Guidance, September 12, 2013.
[16] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 20-23.
[17] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010, p. 3.
[18] http://www.epa.gov/airtrends/values.html

CERTIFICATE OF SERVICE

I, Andrew Armstrong, hereby certify that I have filed the attached WRITTEN STATEMENT OF STEVEN KLAFKA in PCB 2014-010. The aforementioned documents have been served upon the attached service list by email and by depositing said documents in the United States Mail, postage prepaid, in Chicago, Illinois on September 16, 2013.

Respectfully submitted,

Andrew Armstrong

Andrew Armstrong
Staff Attorney
Environmental Law & Policy Center
35 East Wacker Drive, Suite 1600
Chicago, Illinois 60601
312-795-3738
aarmstrong@elpc.org

SERVICE LIST

September 16, 2013

Gina Roccaforte, Assistant Counsel
Illinois EPA
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Renee Cipriano
Amy Antoniolli
Schiff Hardin, LLP
6600 Willis Tower
233 South Wacker Drive
Chicago, IL 60606

Claire A. Manning
William D. Ingersoll
Brown, Hay & Stephens LLP
205 South Fifth Street, Suite 700
P.O. Box 2459
Springfield, Illinois 62705-2459

John Therriault, Assistant Clerk
Illinois Pollution Control Board
James R. Thompson Center
Suite 11-500
100 West Randolph
Chicago, Illinois 60601