2010 1-Hour Sulfur Dioxide Standard Designation Recommendations

Technical Support Document

Iowa Department of Natural Resources
Environmental Services Division

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i. Executive Summary

The State of Iowa is providing to the U.S. Environmental Protection Agency (EPA) updated designation recommendations for the 2010 1-hour sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS). The updated designations recommendations address three areas in the state that contain the following sources:

- IPL - Burlington Generating station (located in Des Moines County)
- IPL - Ottumwa Generating Station (located in Wapello County)
- MidAmerican Energy Company - George Neal South facility (located in Woodbury County)

These three facilities are identified because EPA determined they meet criteria specified in the March 2, 2015, federal Consent Decree between EPA and plaintiffs Sierra Club and Natural Resources Defense Council. The federal Consent Decree establishes deadlines for finalizing three new rounds of area designations under the 2010 1-hour SO_2 NAAQS (75 FR 35520; June 22, 2010). For the first new round the Consent Decree requires that by June 2, 2016, EPA must sign for publication in the Federal Register designations for areas which contain (in simple and incomplete terms) any power plant that in 2012 emitted more than 2,600 tons of SO_2 and had an SO_2 emission rate of 0.45 lb/MMBtu or more and had not announced any units for retirement.

One round of designations for the 1-hour SO_2 NAAQS was completed in 2013. At that time EPA only issued nonattainment designations and most areas in the U.S. were left undesignated for the 1-hour SO_2 NAAQS. Although states were required to submit initial designation recommendations to EPA in 2011, those recommendations have largely not been acted upon and may no longer be appropriate. EPA is now providing states with an opportunity to update their designation recommendations for the first new round of SO_2 designations required by the Consent Decree. EPA is requesting any updated recommendations and supporting information by September 18, 2015.

Revised Designation Recommendations

The State is revising the unclassifiable designation recommendations submitted to EPA on June 2, 2011, for the three counties in Iowa that contain the identified sources. The revised 1-hour SO_2 designations recommendations are based on air dispersion modeling using maximum allowable emissions.

Burlington Generating station is a power plant operated by Interstate Power and Light (IPL), a subsidiary of Alliant Energy. The facility is located in Des Moines County in far southeast Iowa. The State of Iowa is recommending that all of Des Moines County be designated attainment.

Ottumwa Generating station is a power plant operated by IPL. The facility is located in Wapello County in southeast Iowa. The State of Iowa is recommending that all of Wapello County be designated attainment.

George Neal South is a power plant operated by MidAmerican Energy Company. The facility is located in Woodbury County in northwest Iowa. The State of Iowa is recommending that all of Woodbury County be designated attainment.

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1. Background

On June 2, 2010, the U.S. Environmental Protection Agency (EPA) signed a final rule revising the SO_2 National Ambient Air Quality Standards (NAAQS). EPA established a new 1-hour (hr) SO_2 primary NAAQS of 75 parts per billion (ppb), based on the three-year average of the annual 99th percentile of daily 1-hour maximum concentrations. The NAAQS revision was published in the Federal register on June 22, 2010 (75 FR 35520).

Whenever EPA revises a NAAQS the Clean Air Act (CAA) requires EPA to designate areas as "attainment" (meeting), "nonattainment" (not meeting), or "unclassifiable" (insufficient data). Compared to other criteria pollutants EPA has chosen a different approach to determine an area's attainment status for the 1-hr SO_2 NAAQS. Unlike other criteria pollutants SO_2 is almost exclusively emitted by point sources and "[d]ue to the generally localized impacts of SO_2, [EPA has] not historically considered monitoring alone to be an adequate, nor the most appropriate, tool to identify all maximum concentrations of SO_2" (75 FR 35520). Instead of using only monitoring data to assess compliance with the 1-hr SO_2 NAAQS, which would require a prohibitively expensive SO_2 monitoring network, EPA is supporting a hybrid approach to the designations process, allowing the use of either modeling or monitoring data.

In the March 20, 2015, document, "*Updated Guidance for Area Designations for the 2010 Primary Sulfur Dioxide National Ambient Air Quality Standard*," EPA defines area designation categories for this standard as follows:

- Nonattainment: An area that the EPA has determined violates the 2010 1-hr SO_2 NAAQS, based on the most recent three years of ambient air quality monitoring data or an appropriate modeling analysis, or that EPA has determined contributes to a violation in a nearby area.

- Attainment: An area that the EPA has determined meets the 2010 1-hr SO_2 NAAQS and does not contribute to a violation of the NAAQS in a nearby area based on either: 1) the most recent three years of ambient air quality monitoring data from a monitoring network in an area that is sufficient to be compared to the NAAQS per EPA interpretations in the Monitoring Technical Assistance Document,[1] or 2) an appropriate modeling analysis.

- Unclassifiable: An area where the EPA cannot determine, based on available information, whether the area is or is not meeting the 2010 1-hr SO_2 NAAQS and whether the area contributes to a violation in a nearby area.

EPA is promulgating designations under the 1-hr SO_2 standard for areas throughout the nation in multiple phases. In the initial round completed in 2013 EPA designated 29 areas in 16 states as nonattainment based on available monitoring data (78 FR 47191, August 5, 2013). That action included a nonattainment designation for a portion of Muscatine County. However, no other areas in Iowa have yet been designated for the 1-hr SO_2 NAAQS, and most areas across the U.S. remain undesignated. To address that deficiency three additional rounds of designations are required by a Consent Decree entered in federal court on March 2, 2015, between EPA and the plaintiffs Sierra Club and Natural Resources Defense Council.

[1] http://www.epa.gov/airquality/sulfurdioxide/pdfs/SO2MonitoringTAD.pdf

The first new round of designations required by the Consent Decree must be completed (meaning the designations must be signed for publication in the Federal Register) within sixteen months of the court's entry of the Consent Decree, which is by July 2, 2016. By that date EPA must have signed for publication in the Federal Register designations for areas that contain sources meeting specific criteria identified in the Consent Decree. The Consent Decree criteria include emissions related thresholds affecting sources that report emissions and other data to EPA's Clean Air Markets Division (CAMD). In Iowa only electric generating units (EGUs), more commonly known as power plants, report data to CAMD. The EGUs subject to the first new round of Consent Decree designations are those that (in simple and incomplete terms) had not announced any units for retirement and had, according to the data in EPA's Air Markets Database:

- more than 16,000 tons of SO_2 emissions in 2012; or
- more than 2,600 tons of SO_2 emissions in 2012 and an annual average emission rate of at least 0.45 lbs SO_2/MMBtu.

The second and third rounds of designations required by the Consent Decree must be completed by December 31, 2017, and December 31, 2020. The designations completed under those deadlines are expected to be made pursuant to EPA's final Data Requirements Rule (DRR), published in the Federal Register on August 21, 2015 (80 FR 51051). The DRR does not directly govern the first new round of Consent Decree designations.

In a letter to the State of Iowa dated March 20, 2015, EPA notes their responsibility to issue designations by June 2, 2016, and their intent to use the latest available information when making designations and boundary determinations. States may update or submit new designations recommendations to EPA before (or around) September 18, 2015. EPA's March 20, 2015 "*Updated Guidance for Area Designations for the 2010 Primary Sulfur Dioxide National Ambient Air Quality Standard*" lists five factors to be considered when developing boundary designation recommendations:

- Monitoring/Modeling data
- Emissions information, including growth, controls, and regional emission reductions
- Meteorology
- Topography
- Jurisdictional boundaries

The first factor listed provides for the consideration of modeling or monitoring data as a means of evaluating air quality. In December 2013 EPA released draft technical assistance documents that aid in the technical aspects of evaluating air quality using either modeling or monitoring approaches for designation purposes. The other factors are summarized within EPA's March 20, 2015, guidance document, although dispersion modeling is capable of addressing several of the factors simultaneously.

The State has evaluated EPA's SO_2 designations guidance and is providing updated designation recommendations developed using methods consistent with current guidance. This document provides a discussion and technical justification of the boundary recommendations for the three areas in Iowa affected by the first new round of designations required under the federal Consent Decree.

2. Affected Sources and Revised Recommendations Summary

According to EPA's March 20, 2015, letter to the Iowa DNR, three EGUs in Iowa meet the Consent Decree criteria. These facilities are listed in Table 2-1 and shown in Figure 2-1.

Table 2-1. Facilities in Iowa subject to the first new round of Consent Decree designations.

Facility Name (Owner)	Facility ID	County	2012 SO_2 Emissions (tons)†	2012 SO_2 Rate (lb/MMBtu)†
Burlington Generating Station (Alliant/IPL)	29-01-013	Des Moines	4,697	0.672
Ottumwa Generating Station (Alliant/IPL)	90-07-001	Wapello	11,985	0.666
George Neal South (MidAmerican)	97-04-010	Woodbury	14,273	0.638

†The 2012 emissions and emission rate data are from EPA's Clean Air Markets Division.

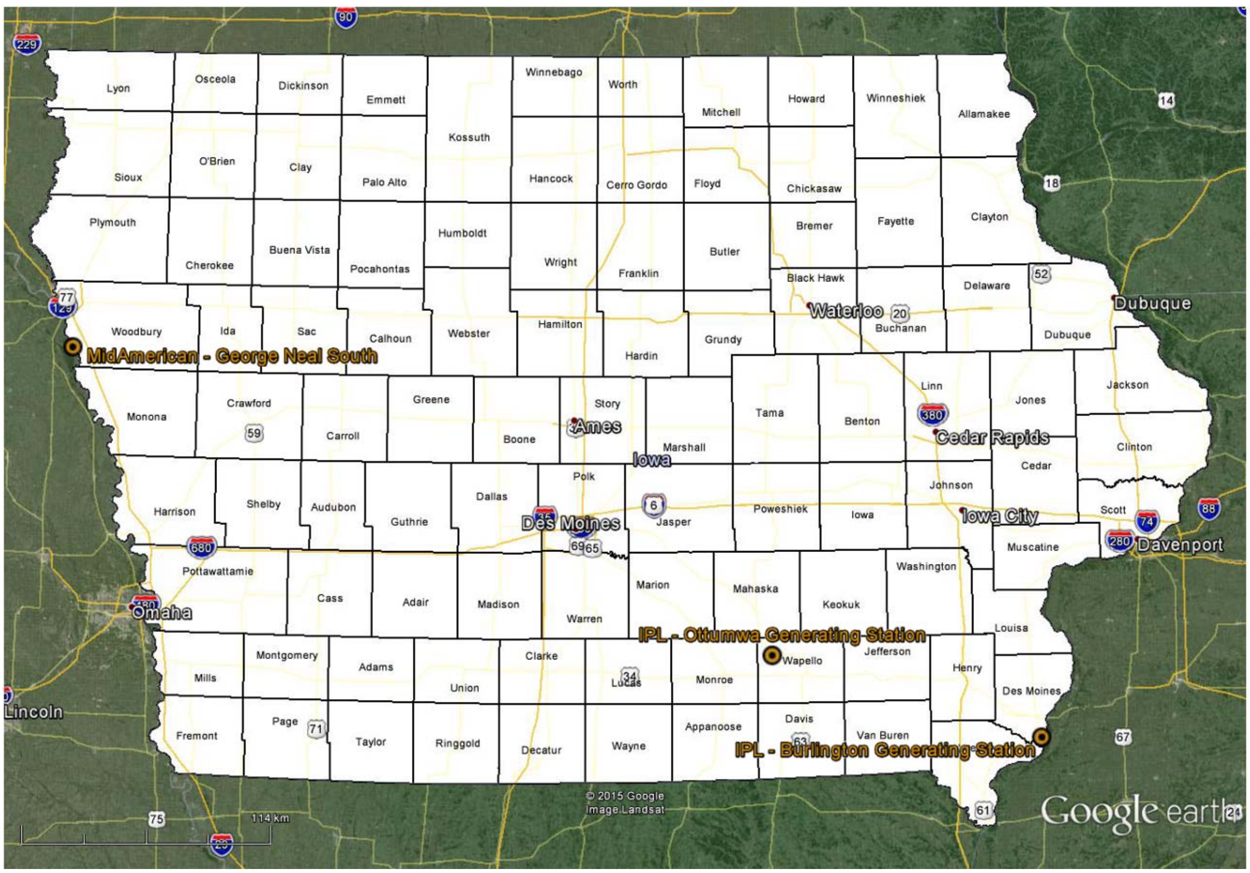

Figure 2-1. Locations of the 3 facilities affected by the first new round of Consent Decree designations.

The State is revising the unclassifiable designation recommendations submitted to EPA on June 2, 2011, and is now recommending that each of the three counties (Des Moines, Wapello, and Woodbury) that contain an identified source be designated attainment. The updated designation recommendations are based on dispersion modeling results (discussed below) conducted by the facilities in accordance with EPA's most recent modeling Technical Assistant Document and reviewed by the Iowa DNR.[2]

[2] While an SO_2 monitor is located in Woodbury County, it is not sited to assess the maximum 1-hr impacts from George Neal South and has not been in operation long enough to produce a (three-year) design value. No ambient SO_2 monitors are located in either Des Moines or Wapello counties.

3. IPL – Burlington Generating Station

Burlington Generating Station is a coal-fired electric generating facility located in Des Moines County, Iowa, (see Figure 3-1) and is operated by Interstate Power and Light (IPL), a subsidiary of Alliant Energy. There are no ambient SO_2 monitors near Burlington Generating Station that can be relied upon to characterize the air quality around the source. Instead, dispersion modeling was conducted. Based on the DNR's technical review of this facility an attainment recommendation for all of Des Moines County is appropriate.

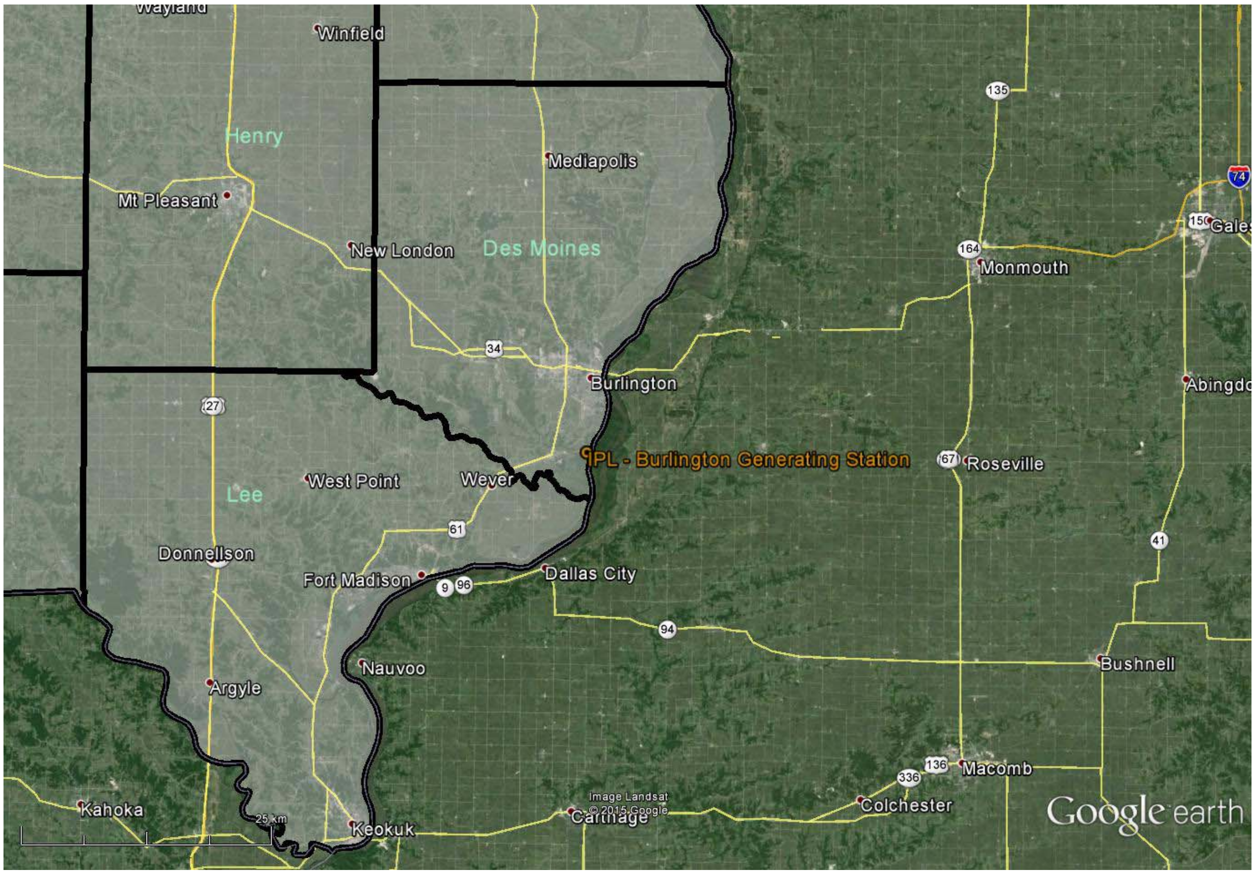

Figure 3-1. Location of IPL's Burlington Generating Station. Counties in Iowa are shaded slightly.

3.1. Source Characterization and Emission Rates

The SO_2 emission sources at Burlington Generating Station are a coal-fired main boiler, a natural gas-fired auxiliary boiler for heating, and four natural gas combustion turbines. The emergency generator is an intermittent emission source that will be excluded in this modeling analysis pursuant to Section 5.4 of EPA's draft *"SO_2 NAAQS Designations Modeling Technical Assistance Document"* (TAD), dated December 2013.

The SO_2 emission rates used in the modeling analysis are summarized in Table 3-1. The emission rates reflect a mix of existing and proposed new maximum allowable emission limits. Construction permit modifications will be made to enforce the new emission limits once EPA approves the modeling results.

Table 3-1. Burlington Generating Station modeled SO_2 emission rates.

Model ID	SO_2 Emission Points	Rated Capacity (MMBtu/hr)	SO_2 Limit	Notes	Modeling Emission Rate (lb/hr)
EP01	Combustion Turbine #1 (NG)	288	1.8 lb/hr	Existing Limit	1.8
EP02	Combustion Turbine #2 (NG)	288	1.8 lb/hr	Existing Limit	1.8
EP03	Combustion Turbine #3 (NG)	288	1.8 lb/hr	Existing Limit	1.8
EP04	Combustion Turbine #4 (NG)	288	1.8 lb/hr	Existing Limit	1.8
EP16	Auxiliary (Aux.) Boiler (NG)	15	0.06 lb/MMBtu	New Limit	0.9
EP17	Main Boiler (Coal)	2077	1.0 lb/MMBtu	New Limit	2,077

Table 3-2 summarizes the stack characteristics used in the 1-hr SO_2 modeling demonstration. Based on the recommendation in the TAD and the use of allowable emissions in the modeling analysis, the actual stack height was modeled for the main boiler stack (EP17) since the good engineering practice (GEP) stack height was higher than the actual stack height.

Table 3-2. Burlington Generating Station point source exhaust characteristics.

Model ID	UTM Easting (m)	UTM Northing (m)	Base Elevation (m)	Stack Height (m)	Stack Diameter (m)	Exhaust Temperature (K)	Exhaust Velocity (m/s)
EP01	658898.2	4511791.1	161.05	11.28	3.08	788.7	24.56
EP02	658907.1	4511790.0	161.28	11.28	3.08	788.7	24.56
EP03	658916.8	4511788.9	161.65	11.28	3.08	788.7	24.56
EP04	658925.8	4511787.8	162.01	11.28	3.08	788.7	24.56
EP16	658985.4	4511701.9	162.1	52.36	0.59	533.2	10.17
EP17	659014.6	4511681.0	161.91	93.27	3.58	477.6	34.98

3.2. Nearby Sources of SO_2

The SO_2 emission levels from all facilities within 10 km were evaluated to determine if additional sources of SO_2 should be included in the modeling analysis. Table 3-3 summarizes the sources within 10 km of Burlington Generating Station and their recent SO_2 emissions. Any source that would contribute a significant portion of the total SO_2 emissions in the area was identified to be included in the modeling analysis. The total average emissions for the area were 4,098.5 tons per year (tpy), of which Burlington Generating Station is the primary contributor. All other sources combined only contribute 0.005%. Therefore no other sources within 10 km were included in the modeling analysis.

Table 3-3. Facilities within 10 km of Burlington Generating Station.

		SO_2 Emissions (tpy)‡			
Facility Name	**Address**	**2012**	**2013**	**2014**	**Most Recent (or average)**
Cessford Construction Company - Burlington	3808 Old Hwy 61 Burlington, IA 52601	-	-	-	0.09
IPL - Burlington Agency Street Combustion Turbines	3320 Agency St. Burlington, IA 52601	0	0	0	0

Lamont Limited	1530 Bluff Rd. Burlington, IA 52601	-	-	-	0
Champion Spark Plug	3009 Sylvania Dr. Burlington, IA 52601	-	-	-	NA
Riley Paint Company	860 Washington St. Burlington, IA 52601	-	-	-	0
Great River Medical Center	1221 S Gear Ave. West Burlington, IA 52655	-	-	-	0
Ideal Ready Mix Co Inc. - dba Burlington Ready Mix	520 S. Main St. Burlington, IA 52601	-	-	-	0
Ideal Ready Mix Co Inc. - Burlington Block	3810 HWY 61 Burlington, IA 52601	-	-	-	0
PPG Industries Inc.	3700 Division St. Burlington, IA 52601	-	-	-	0
Dresser-rand Company	1106 Washington St. Burlington, IA 52601	-	-	-	0.01
Burlington High School	421 Terrance Burlington, IA 52601	-	-	-	0
ADM / Growmark - Burlington	701 Cash St. Burlington, IA 52601	-	-	-	0
Exide Technologies - Burlington	3400 West Ave. Burlington, IA 52601	-	-	-	0
Burlington Basket Company	922 Bluff Rd. Burlington, IA 52601	-	-	-	0
Simpson Security Papers	3355 Agency St. Burlington, IA 52601	-	-	-	0
Burlington Wilbert Vault	2845 Mount Pleasant St. Burlington, IA 52601	-	-	-	0
Flint Cliffs Manufacturing Corp.	1600 Bluff Road Burlington, IA 52601	-	-	-	0
Qwest Communications Dba Century Link - Burlington	421 Columbia St. Burlington, IA 52601	-	-	-	NA
General Electric - Consumer & Industrial Division	510 E Agency Road West Burlington, IA 52655	-	-	-	0.08
Borghi USA	402 West Division St. West Burlington, IA 52655	-	-	-	NA
Modern Welding Co Of Iowa Inc.	2818 Mount Pleasant St. Burlington, IA 52601	-	-	-	0
Summer Street Animal Clinic	6457 Summer St. Burlington, IA 52601	-	-	-	NA
Burlington Generating Station	4282 Sullivan Slough Rd. Burlington, IA 52601	4697.1	3940.9	3657	4098.3 (avg)
Olympic Foundry Inc.	2825 Mount Pleasant Burlington, IA 52601	-	-	-	NA

Winegard Company	3000 Kirkwood St. Burlington, IA 52601	-	-	-	NA
OMG Midwest Dba Cessford Const Co.	121ST AVE and HWY 61 S Burlington, IA 52601	-	-	-	0
CNH America LLC.	1930 Des Moines Ave. Burlington, IA 52601	0.05	0.01	0.06	0.04 (avg)
	Total Average Emissions	**4,098.5**			

‡ Major sources report emissions every year while minor sources report at most once every three years. If the latest available inventory for a minor source predates 2012 then the facility's emissions are listed only in the "Most Recent" column. The "Most Recent" column also includes the 3-year average emission rates for major sources.

In addition, a search was performed for major sources of SO_2 within 10-20 km. One facility was identified for additional review during this search, Iowa Army Ammunition Plant. This facility had a maximum SO_2 emission rate of 753.26 tpy during the three-year period 2012-2014. The SO_2 emissions from this facility are attributable to a pair of coal-fired boilers venting through a common stack. The facility is unique in that it has a very large property, which places the coal boilers far from ambient air (see Figure 3-2). The nearest ambient air is 1.9 km to the north of the boiler stack, which restricts the largest concentration gradients to the property. A screening analysis was performed for the Iowa Army Ammunition Plant to determine if it would need to be included in the IPL-Burlington modeling analysis. The screening modeling consisted of a single point source (EP 500-139-1) with the parameters listed in Table 3-4.

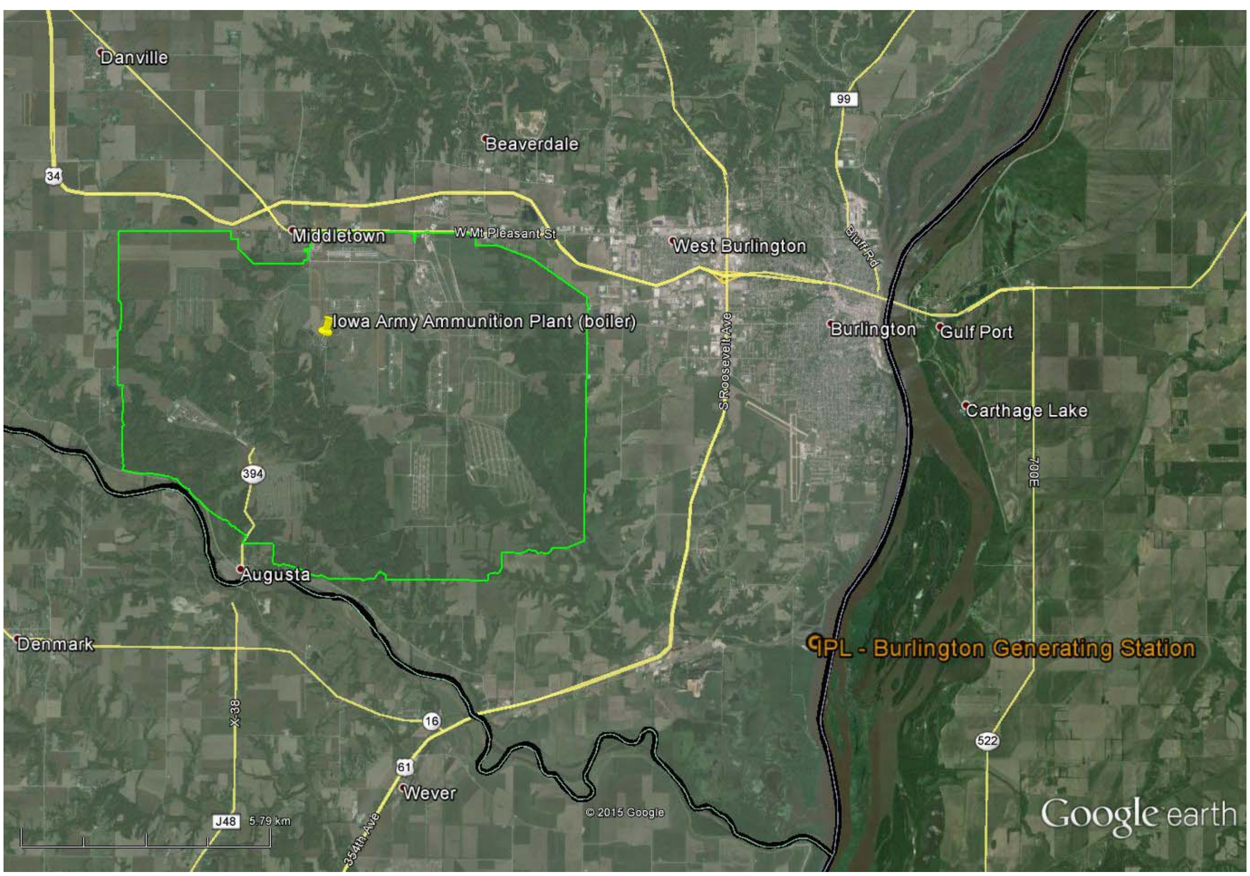

Figure 3-2. Iowa Army Ammunition Plant overview. Their fence line is shown in green.

Table 3-4. Iowa Army Ammunition Plant boiler point source characteristics.

Emission units:	Two (2) Zurn boilers
Emissions:	753.26 tpy (171.98 lbs/hr), based on maximum reported emissions from 2012-2014
Stack Height:	150 ft
Discharge type:	Vertical/unobstructed
Diameter:	108 in
Temperature:	403 degrees F
Flow rate:	78,690 scfm (128,162 acfm)

Two iterations of the modeling were conducted. The first assuming no downwash, and the second using conservative estimates of the building dimensions based on recent aerial photography (see Figure 3-3 and Figure 3-4). The maximum results of these two analyses were the same, indicating that building downwash is not an important factor in determining the maximum concentration from the boiler stack. Both analyses were evaluated using meteorological inputs from the nearby Burlington airport for the period 2012-2014. Actual terrain elevations were used based on the National Elevation Dataset (NED).

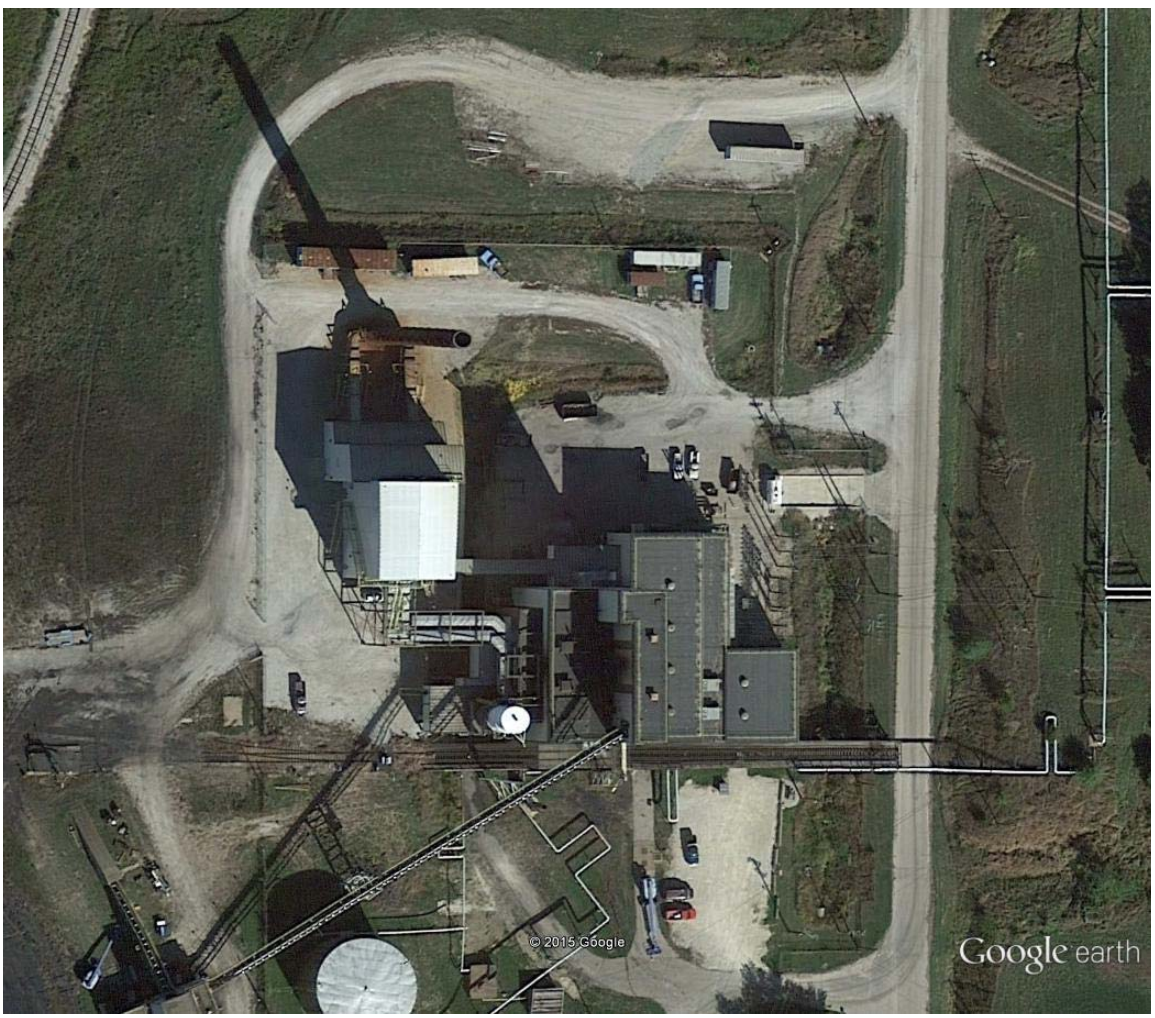

Figure 3-3 . Iowa Army Ammunition Plant boiler.

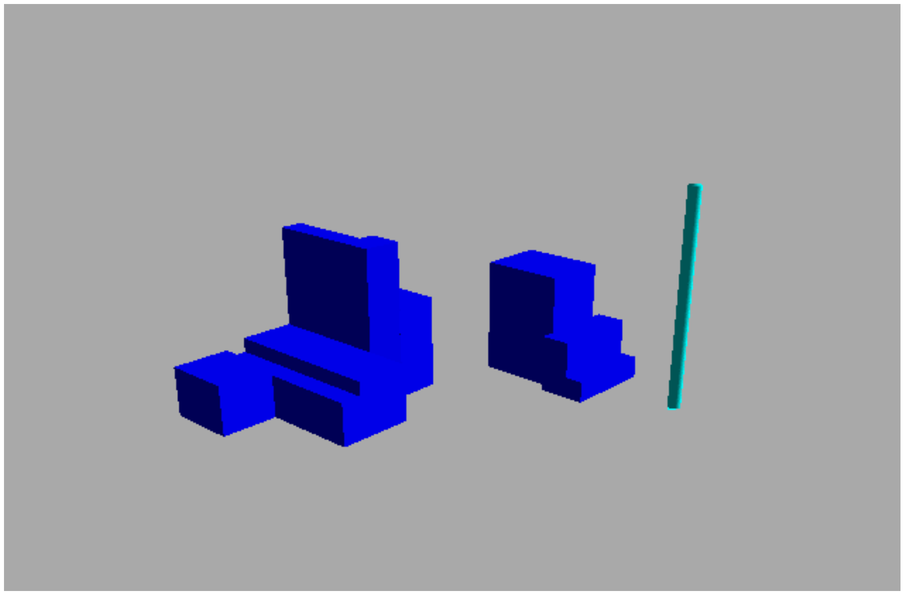

Figure 3-4. Iowa Army Ammunition Plant model input (Facing SW).

Given the size of the facility's property it is likely that the maximum concentration from the boiler actually occurs on their property (the nearest fence line to the boiler stack is 1.9 km away). Therefore, receptors were only placed along the fence line of the facility to determine the location and magnitude of the maximum concentration.

The highest-fourth-highest predicted concentration averaged over three years was 21.29 $\mu g/m^3$. This value is far below the standard (196 $\mu g/m^3$) and the cumulative result remains below the standard if it is conservatively added to the total results from Burlington Generating Station and background (discussed below).

The State of Illinois was also contacted to determine if there were any facilities that would need to be included from that state. No such sources were identified.

3.3. Dispersion Model

The EPA recommended American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD) was used to perform the analysis. The most current version (Version 14134) of AERMOD available at the time of the analysis was used with regulatory default options as recommended in the EPA Guideline on Air Quality Models. The following supporting pre-processing programs for AERMOD were also used:

- BPIP-Prime (Version 04274)
- AERMET (Version 14134)
- AERMAP (Version 11103)

AERMOD is a steady-state plume model that simulates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. This model is recommended for short-range (< 50 kilometers [km]) dispersion from the source. The model incorporates the Plume Rise Model Enhancement (PRIME) algorithm for modeling building downwash. AERMOD is designed to accept input data prepared by two specific pre-processor programs, AERMET and AERMAP. AERMOD was run with the following options:

- Regulatory default options
- Direction-specific building downwash characterized by BPIP-PRIME
- Actual receptor elevations and hill height scales obtained from AERMAP
- SO_2 pollutant keyword

3.4. Receptor Grid

Receptors were sited outside of the fence line boundary of the Burlington Generating Station. Receptor placement grid spacing was:

- 50 meters along the facility fence line
- 50 meters from the fence line to 0.5 km
- 100 meters extending from 0.5 km to 1.5 km
- 250 meters extending from 1.5 km to 3 km
- 500 meters extending from 3 km to 5 km

Consistent with Section 4.2 of the TAD, receptors were not placed on water bodies within the gridded area. This would include removing receptors on the adjacent Mississippi River. Figure 3-5 shows the receptor grid for the modeling analysis.

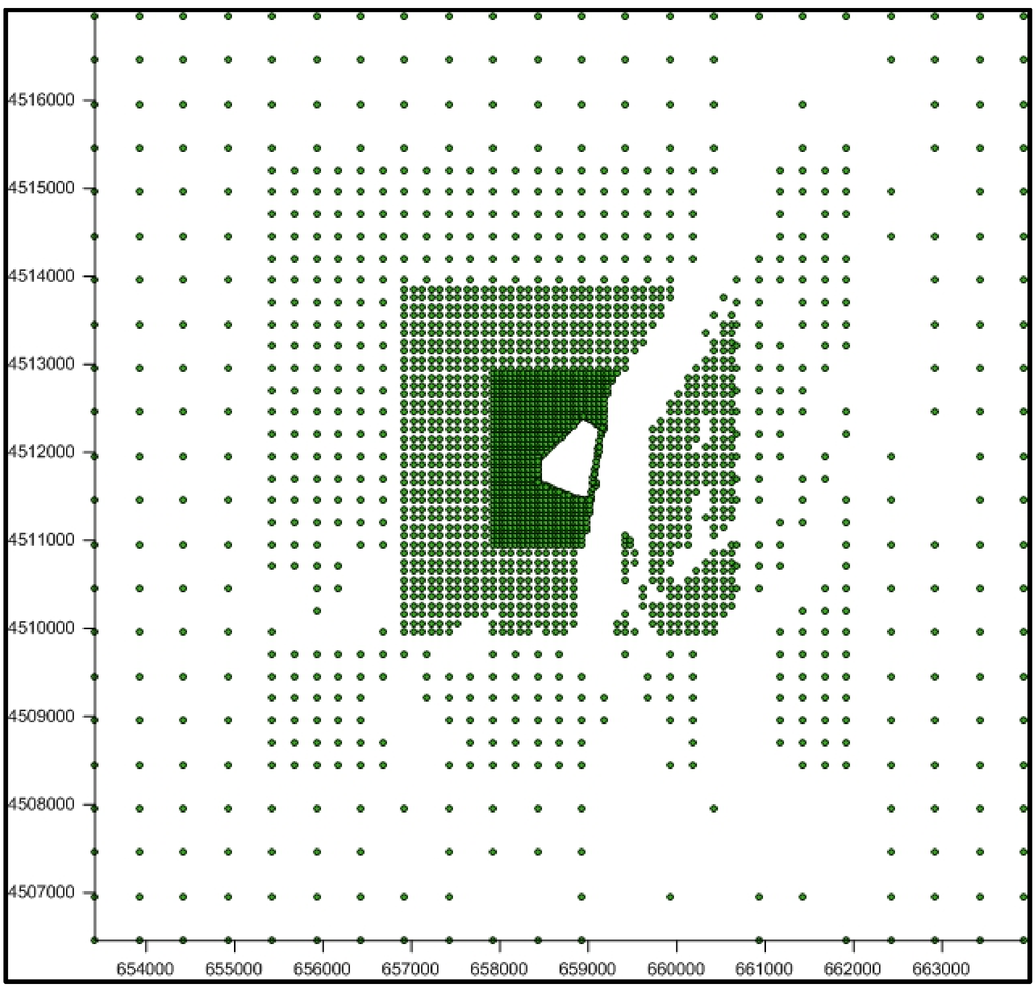

Figure 3-5. Dispersion modeling receptor grid surrounding Burlington Generating Station.

Interpolated terrain elevations were input to the model using United States Geological Survey (USGS) National Elevation Dataset (NED) data for Des Moines County in North American Datum 1983 (NAD83). All receptors were assigned a terrain height and hill height using the terrain preprocessor AERMAP.

3.5. Meteorological Data

Hourly meteorological data for the dispersion modeling analysis was preprocessed with the AERMET program by the Iowa DNR. The surface data was collected from the Burlington (KBRL) station with upper air data from the Davenport NWS station (KDVN) for calendar years 2012 through 2014. Based on the results from a representivity study conducted by the Iowa DNR,[3] these meteorological data are considered representative of the conditions near the Burlington Generating Station. Figure 3-6 shows the 2012-2014 3-year wind rose for the KBRL station.

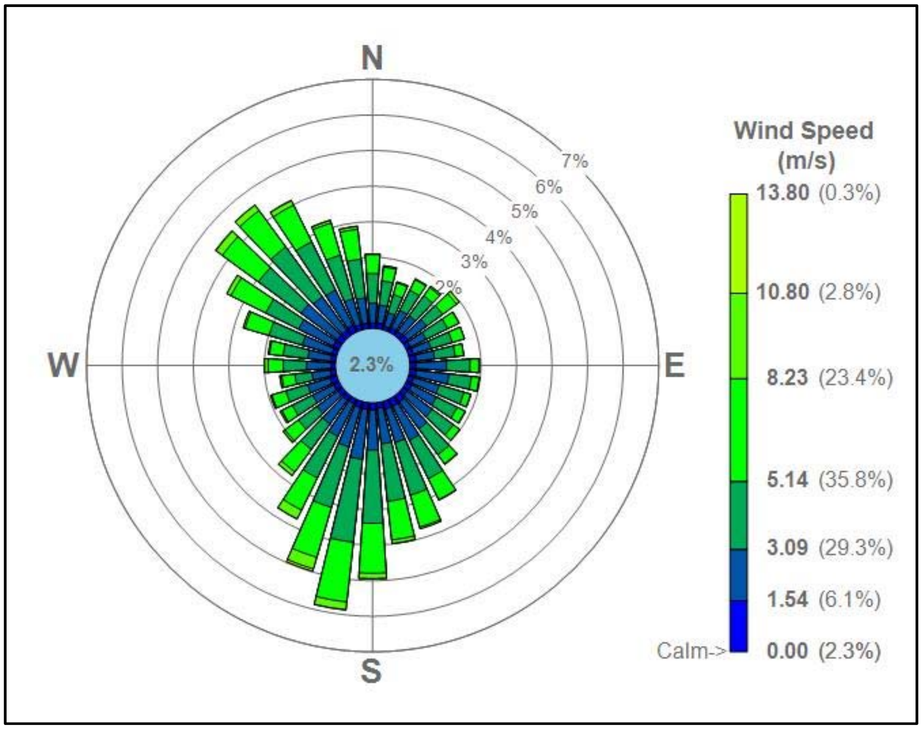

Figure 3-6. Burlington (KBRL) 3-year wind rose (2012-2014).

3.6. Background Concentration

The statewide default 1-hr SO_2 background concentration of 32 µg/m^3 was added to the model design value for comparison to the NAAQS. The background concentration was derived using a multiple-monitor average of design concentrations from 2009-2011 data.

The model design value was used in conjunction with the conservative background concentration for comparison to the NAAQS. For SO_2, consistent with EPA guidance, the receptor with the highest 3-year average of the 99th percentile maximum daily 1-hr modeled concentration was added to the background concentration identified above. AERMOD internally calculates the 3-year average of the 99th percentile 1-hr concentration at each receptor using the SO_2 pollutant keyword.

[3] The "*2005 - 2009 AERMOD Met Data Technical Support Document*" available at: http://www.iowadnr.gov/InsideDNR/RegulatoryAir/Modeling/DispersionModeling/MeteorologicalData.aspx

3.7. Modeling Results

Following the AERMOD dispersion modeling approach described above, Table 3-5 summarizes the AERMOD output model design value, background concentration, and total concentration for comparison to the 1-hr SO_2 NAAQS. The maximum concentration of 116.5 µg/m^3 is less than the 1-hr SO_2 NAAQS. Adding 21.29 µg/m^3 to the cumulative modeling results, to conservatively represent the Iowa Army Ammunition Plant, still yields a total concentration (137.79 µg/m^3) which meets the 1-hr SO_2 NAAQS.

Table 3-5. Model predicted concentration (µg/m^3) for the Burlington Generation Station analysis.

Model Design Value	Background Concentration	Total Concentration	1-Hour SO_2 NAAQS	Above NAAQS?
84.5	32	116.5	196	No

3.8. Designation Recommendation

The Burlington Generating Station will not cause or contribute to a modeled violation of the 1-hr SO_2 NAAQS. Within Des Moines County there are two additional major (Title V) stationary sources (see Figure 3-7) not previously discussed: Big River Resources West Burlington, LLC; and United States Gypsum Co. – Sperry. For calendar year 2014, Big River Resources reported 68 tons of SO_2 emissions, while US Gypsum reported less than 1 ton. The 68 tpy emission rate represents only 3.4% of the 2,000 tpy threshold finalized in the Data Requirements Rule (80 FR 51051; August 21, 2015). There is one additional major source within 20 km of Des Moines County's borders, Natural Gas Pipeline Co. of America - Station 204. The 2014 SO_2 emissions reported for this facility were less than 1 ton, which will not affect the attainment status of the area.

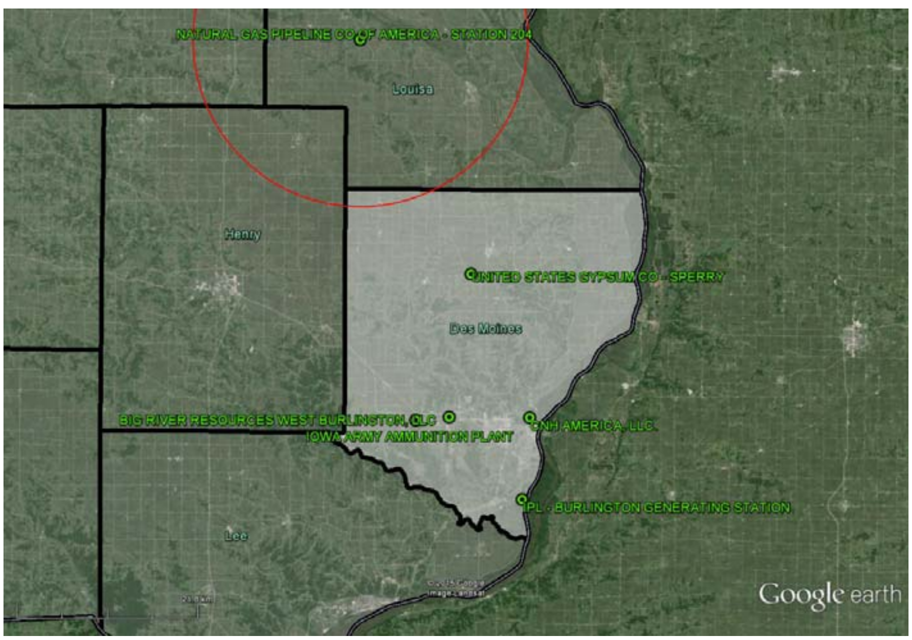

Figure 3-7. Major sources in and within 20 km (as indicated by the red circle) of Des Moines County.

Minor sources in the area do not emit a significant quantity of SO_2 and are adequately represented by the background concentration included in the cumulative modeling results. No sources within Des Moines County or within 20 km of the county's border are expected to cause or contribute to a violation of the 1-hr SO_2 NAAQS. Based on the technical review completed for this area all of Des Moines County should be designated attainment for the 1-hr SO_2 NAAQS.

4. IPL – Ottumwa Generating Station

Ottumwa Generating Station is a coal-fired electric generating facility located in Wapello County, Iowa, (see Figure 4-1) and is operated by Interstate Power and Light (IPL), a subsidiary of Alliant Energy. There are no ambient SO_2 monitors near Ottumwa Generating Station that can be relied upon to characterize the air quality around the source. Instead, dispersion modeling was conducted. Based on the DNR's technical review of this facility an attainment recommendation for all of Wapello County is appropriate.

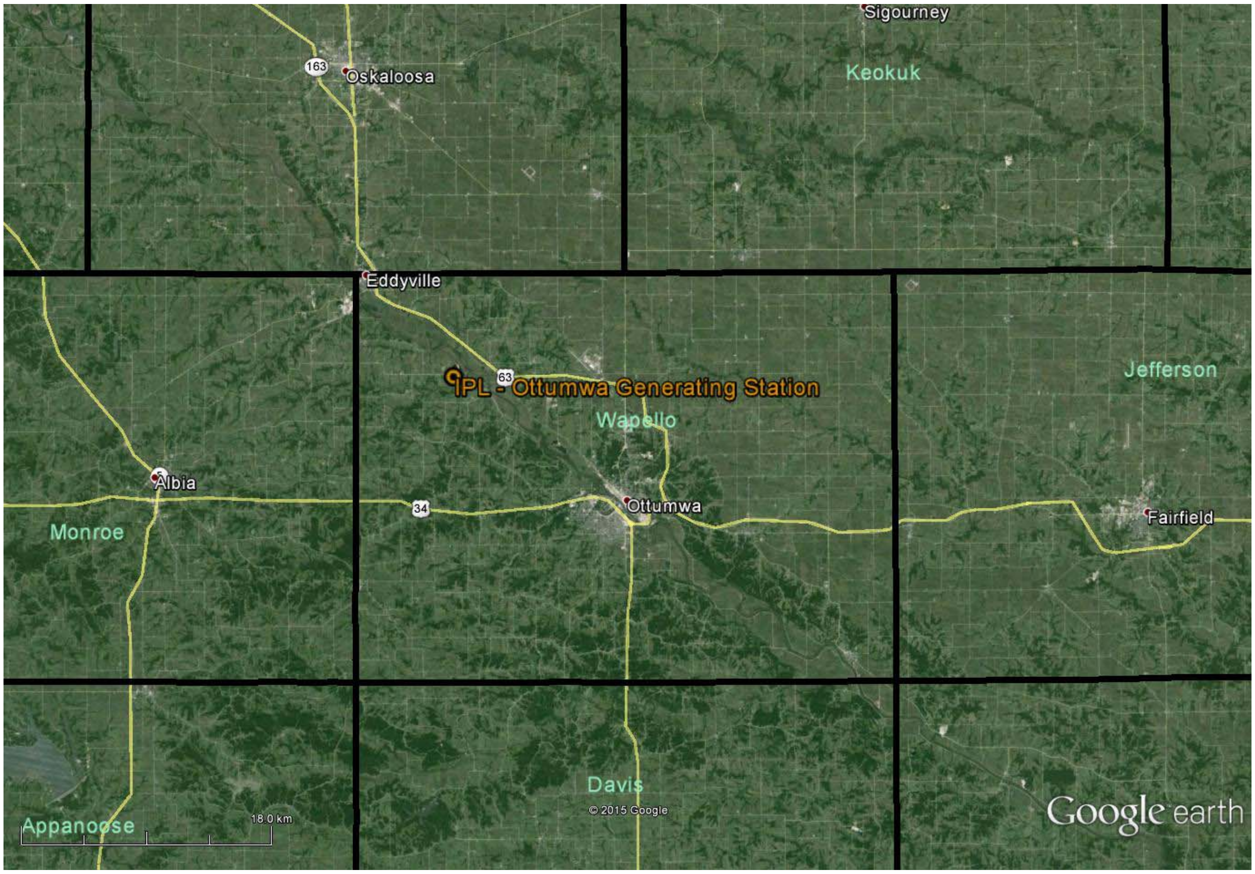

Figure 4-1. Location of IPL's Ottumwa Generating Station. (All Counties shown are in Iowa.)

4.1. Source Characterization and Emission Rates

The SO_2 emission sources at Ottumwa Generating Station are a coal-fired main boiler and a fuel oil-fired auxiliary boiler for house heating. The emergency generator is an intermittent emission source that will be excluded in this modeling analysis pursuant to Section 5.4 of EPA's draft *"SO_2 NAAQS Designations Modeling Technical Assistance Document"* (TAD), dated December 2013.

The SO_2 emission rates used in the modeling analysis are summarized in Table 4-1. The emission rates reflect a mix of existing and proposed new maximum allowable emission limits. Construction permit modifications will be made to enforce the new emission limits once EPA approves the modeling results.

Table 4-1. Ottumwa Generating Station modeled SO_2 emission rates.

Model ID	SO_2 Emission Points	Rated Capacity (MMBtu/hr)	SO_2 Limit	Notes	Modeling Emission Rate (lb/hr)
EP1	Main Boiler	8669	0.2 lb/MMBtu	New (MATs) Limit	1,733.8
EP67	Plant Heat Boiler	77.413	0.10143 lb/MMBtu	Existing Operating Limit, 0.1% sulfur	7.852

Table 4-2 summarizes the stack characteristics used in the 1-hr SO_2 modeling demonstration. Based on the recommendation in the TAD and the use of allowable emissions in the modeling analysis, the GEP stack height was modeled for the main boiler stack (EP1) since the GEP stack height was lower than the actual stack height.

Table 4-2. Ottumwa Generating Station point source exhaust characteristics.

Model ID	UTM Easting (m)	UTM Northing (m)	Base Elevation (m)	Stack Height (m)	Stack Diameter (m)	Exhaust Temperature (K)	Exhaust Velocity (m/s)
EP1	537387.3	4549481.6	208.12	152.5	7.62	344.3	29.39
EP67	537421.6	4549359	197.9	66.75	1.22	477.6	1.74

4.2. Nearby Sources of SO_2

The SO_2 emission levels from all facilities within 10 km were evaluated to determine if additional sources of SO_2 should be included in the modeling analysis. Table 4-3 summarizes the sources within 10 km of Ottumwa Generating Station and their recent SO_2 emissions. Any source that would contribute a significant portion of the total SO_2 emissions in the area was identified to be included in the modeling analysis. The total average emissions for the area were 13,105.0 tpy, of which Ottumwa Generating Station is the primary contributor at 87.3% and Cargill, Inc. – Eddyville (Cargill) a secondary contributor at 12.7%. All other sources combined only contribute 0.005%. Based on this information both Ottumwa Generating Station and Cargill should be included in the analysis.

After further investigation it was determined that Cargill will no longer contribute a significant amount of SO_2 emissions to the area. Cargill recently had two new natural gas-fired boilers permitted to replace the three existing coal-fired boilers that currently account for approximately 94% of the potential SO_2 emissions from the plant. This change from the three coal-fired boilers to the two natural gas-fired boilers will result in over a 99% reduction in SO_2 emissions from Cargill's boilers. When the transition from coal to gas is complete in the fall of 2015, the quantity of SO_2 emissions from Cargill, in combination with the six other facilities found within the 10 km radius of the Ottumwa Generating Station, will be approximately 1% of the total emissions from Ottumwa Generating Station. These low levels of SO_2 emissions should be adequately represented in the background concentration. Therefore no other sources within 10 km were included in the modeling analysis.

In addition, a search was performed for major sources of SO_2 within 10-20 km. One additional facility was identified during this search, John Deere Ottumwa Works. For calendar year 2014 John Deere reported less than 1 ton of SO_2 emissions, therefore, only Ottumwa Generating Station was included in this modeling analysis.

Table 4-3. Facilities within 10 km of Ottumwa Generating Station.

Facility Name	Address	SO₂ Emissions (tpy)‡ 2012	2013	2014	Most Recent (or average)
Ajinomoto Heartland Inc.	1 Heartland Dr. Eddyville, IA 52553	0.61	0.65	0.49	0.58
Cargill Inc. - Eddyville	1 Cargill Dr. Eddyville, IA 52553	1,626.5	1,771.6	1,576.5	1,658.2
The American Bottling Company	14955 Truman Street Ottumwa, IA 52501	-	-	-	0.02
Ideal Ready Mix Co Inc. - Eddyville	17535 Monroe Wapello Rd. Eddyville, IA 52553	-	-	-	0.00
Chamness Technology Inc.	24820 160th St. Eddyville, IA 52553	-	-	-	0.03
Al-jon Inc.	15075 Al-Jon Ave. Ottumwa, IA 52501	-	-	-	0.00
Ottumwa Generating Station - Alliant Energy	20775 Power Plant Rd. Ottumwa, IA 52501	11,985.0	13,125.8	9,227.4	11,446.1
Wacker Chemical Corporation	1 Wacker Dr. Eddyville, IA 52553	0.07	0.07	0.08	0.07
	Total Average Emissions	**13,105.0**			

‡ Major sources report emissions every year while minor sources report at most once every three years. If the latest available inventory for a minor source predates 2012 then the facility's emissions are listed only in the "Most Recent" column. The "Most Recent" column also includes the 3-year average emission rates for major sources.

4.3. Dispersion Model

The EPA recommended American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD) was used to perform the analysis. The most current version (Version 14134) of AERMOD available at the time of the analysis was used with regulatory default options as recommended in the EPA Guideline on Air Quality Models. The following supporting pre-processing programs for AERMOD were also used:

- BPIP-Prime (Version 04274)
- AERMET (Version 14134)
- AERMAP (Version 11103)

AERMOD is a steady-state plume model that simulates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. This model is recommended for short-range (< 50 kilometers [km]) dispersion from the source. The model incorporates the Plume Rise Model Enhancement (PRIME) algorithm for modeling building downwash. AERMOD is designed to accept input data prepared by two specific pre-processor programs, AERMET and AERMAP. AERMOD was run with the following options:

- Regulatory default options
- Direction-specific building downwash characterized by BPIP-PRIME
- Actual receptor elevations and hill height scales obtained from AERMAP

- SO_2 pollutant keyword

4.4. Receptor Grid

Receptors were sited outside of the fence line boundary of the Ottumwa Generating Station. Figure 4-2 shows the receptor grid for the modeling analysis. Receptor placement grid spacing was:

- 50 meters along the facility fence line
- 50 meters from the fence line to 0.5 km
- 100 meters extending from 0.5 km to 1.5 km
- 250 meters extending from 1.5 km to 3 km
- 500 meters extending from 3 km to 5 km

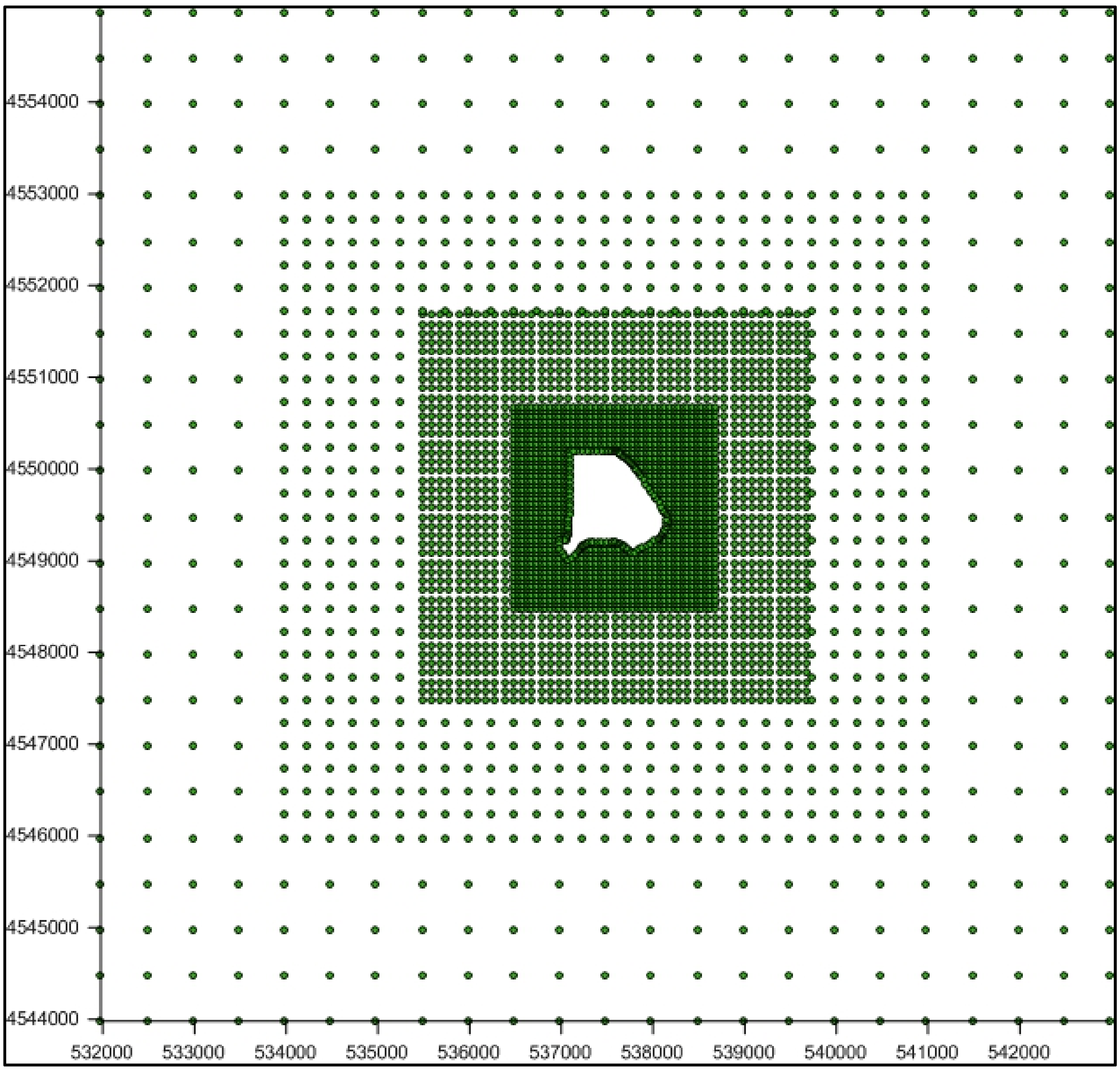

Figure 4-2. Dispersion modeling receptor grid surrounding Ottumwa Generating Station.

Interpolated terrain elevations were input to the model using United States Geological Survey (USGS) National Elevation Dataset (NED) data for Wapello County in North American Datum 1983 (NAD83). All receptors were assigned a terrain height and hill height using the terrain preprocessor AERMAP.

4.5. Meteorological Data

Hourly meteorological data for the dispersion modeling analysis was preprocessed with the AERMET program by the Iowa DNR. The surface data was collected from the Ottumwa (KOTM) station with upper air data from the Davenport NWS station (KDVN) for calendar years 2012 through 2014. Based on the results from a representivity study conducted by the Iowa DNR,[4] these meteorological data are considered representative of the conditions near the Ottumwa Generating Station. Figure 4-3 shows the 2012-2014 3-year wind rose for the KOTM station.

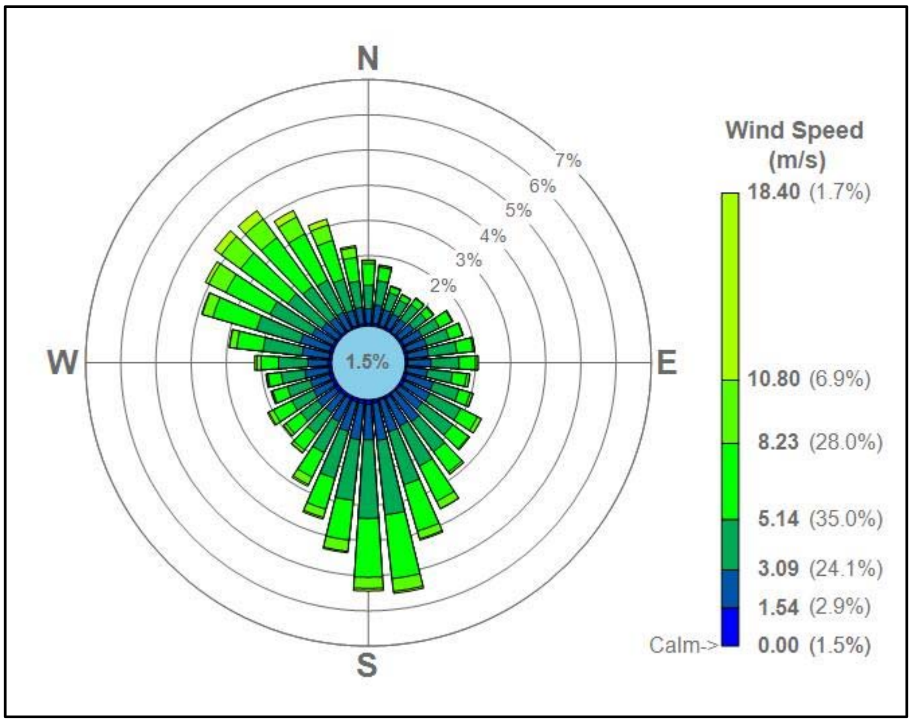

Figure 4-3. Ottumwa (KOTM) 3-year wind rose (2012-2014).

4.6. Background Concentration

The statewide default 1-hr SO_2 background concentration of 32 µg/m^3 was added to the model design value for comparison to the NAAQS. The background concentration was derived using a multiple-monitor average of design concentrations from 2009-2011 data.

The model design value was used in conjunction with the conservative background concentration for comparison to the NAAQS. For SO_2, consistent with EPA guidance, the receptor with the highest 3-year average of the 99th percentile maximum daily 1-hr modeled concentration was added to the background concentration identified above. AERMOD internally calculates the 3-year average of the 99th percentile 1-hr concentration at each receptor using the SO_2 pollutant keyword.

[4] The "*2005 - 2009 AERMOD Met Data Technical Support Document*" available at: http://www.iowadnr.gov/InsideDNR/RegulatoryAir/Modeling/DispersionModeling/MeteorologicalData.aspx

4.7. Modeling Results

Following the AERMOD dispersion modeling approach described above, Table 4-4 summarizes the AERMOD output model design value, background concentration, and total concentration for comparison to the 1-hr SO_2 NAAQS. The maximum concentration of 89.7µg/m^3 is less than the 1-hr SO_2 NAAQS.

Table 4-4. Model predicted concentration (µg/m^3) for the Ottumwa Generation Station analysis.

Model Design Value	Background Concentration	Total Concentration	1-Hour SO_2 NAAQS	Above NAAQS?
57.7	32	89.7	196	No

4.8. Designation Recommendation

The Ottumwa Generating Station will not cause or contribute to a modeled violation of the 1-hr SO_2 NAAQS. All major sources within Wapello County were previously discussed. There are three major (Title V) stationary sources (see Figure 4-4) within 20 km of Wapello County's borders not previously discussed: Fairfield Casting, LLC; ANR Pipeline Co - Birmingham Compressor; and Clow Valve Company. These three facilities emitted a combined 11.5 tons of SO_2 in 2014, with the largest source emitting 8.5 tons, which is less than 0.5% of the 2,000 tpy threshold finalized in the Data Requirements Rule.

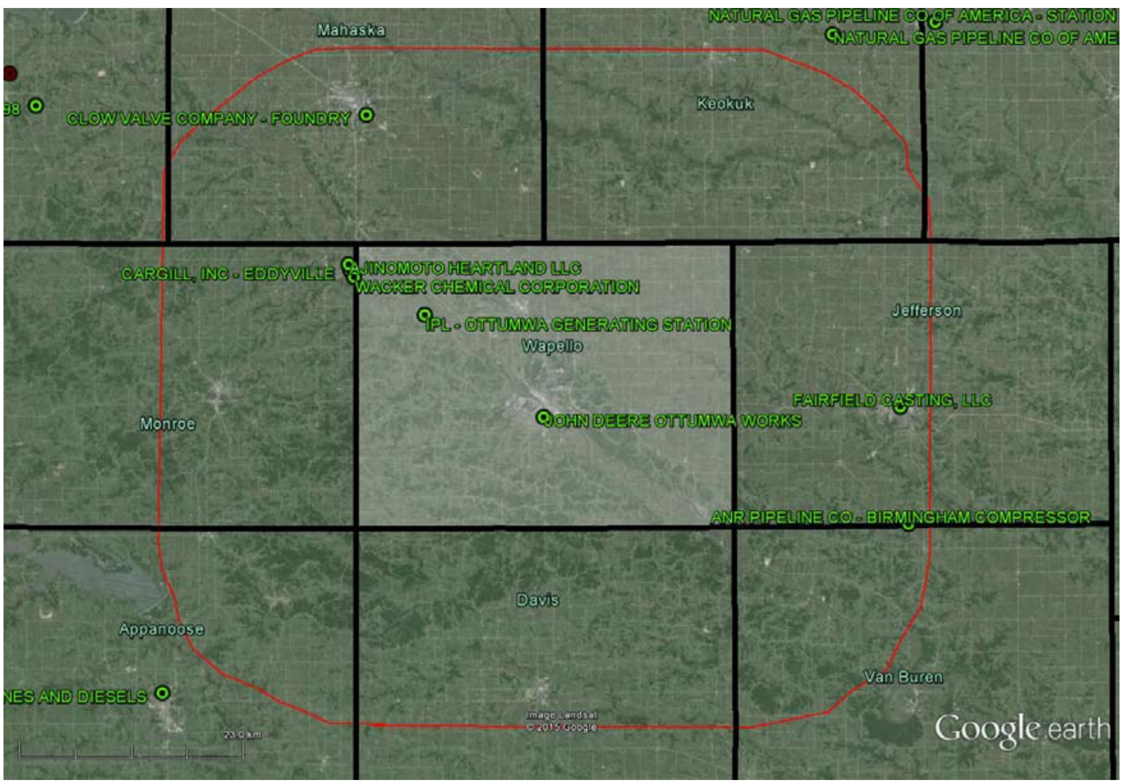

Figure 4-4. Major sources in and within 20 km (crudely indicted by the red outline) of Wapello County.

Minor sources in the area do not emit a significant quantity of SO_2 and are adequately represented by the background concentration included in the cumulative modeling results. No sources within Wapello County or within 20 km of the county's border are expected to cause or contribute to a violation of the 1-hr SO_2 NAAQS. Based on the technical review completed for this area all of Wapello County should be designated attainment for the 1-hr SO_2 NAAQS.

5. MidAmerican – George Neal South

George Neal South is a coal-fired electric generating facility located in Woodbury County, Iowa, (see Figure 5-1) and is operated by MidAmerican Energy Company (MidAmerican). While there is an ambient SO_2 monitor (ID 19-193-0020) in Woodbury County it is sited near the George Neal North facility. George Neal North is also operated by MidAmerican and is classified as a coal-fired electric generating facility. The George Neal North monitor began operation in July 2012 and three calendar years of a data are not yet available to compute a design value. As an alternative, dispersion modeling was conducted to characterize air quality for the area. Based on the DNR's technical review of this facility an attainment recommendation for all of Woodbury County is appropriate.

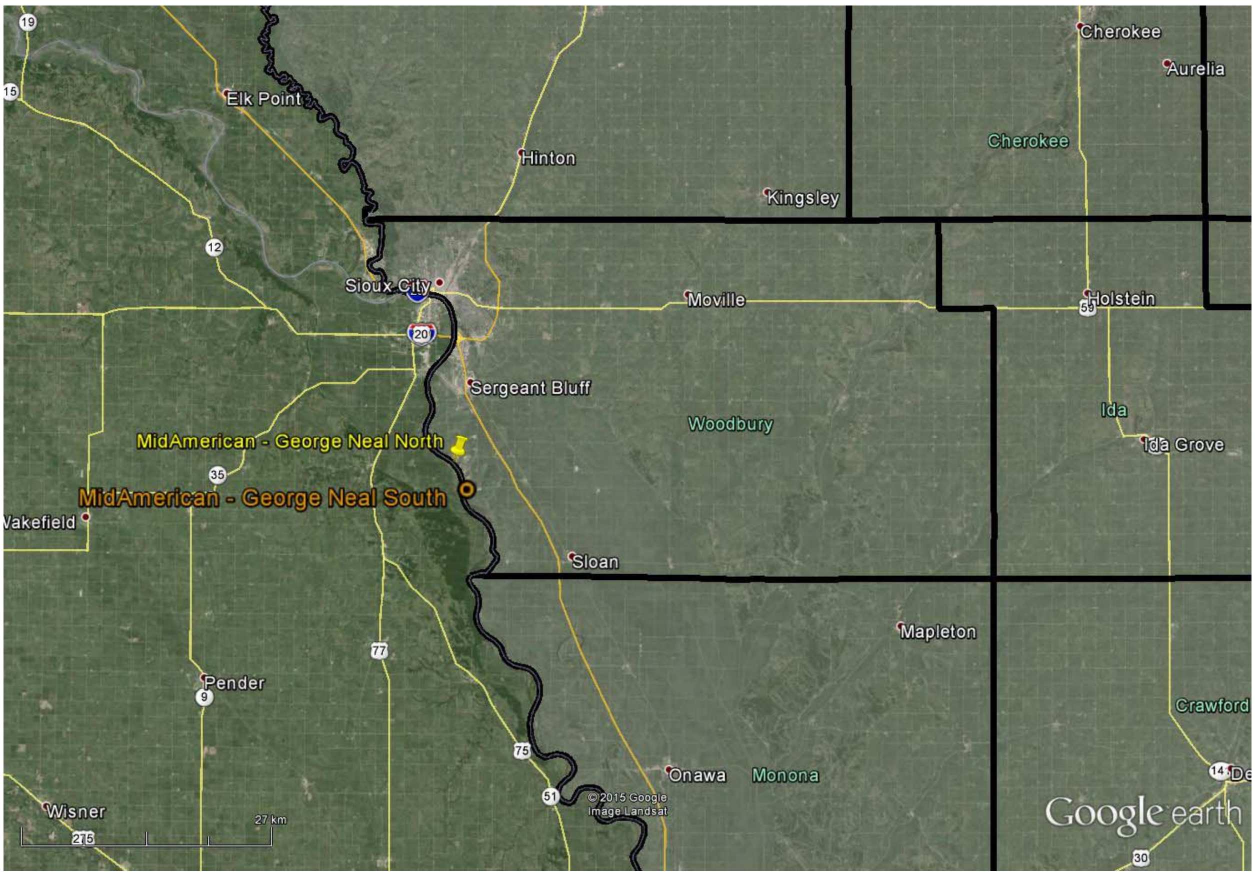

Figure 5-1. Location of MidAmerican's George Neal facilities. Counties in Iowa are shaded slightly.

5.1. Source Characterization and Emission Rates

The MidAmerican George Neal South and George Neal North facilities include a number of emission units that emit SO_2. All emission units modeled in AERMOD were characterized as point sources. Small sources of SO_2, such as emergency generators and comfort heating, were not included in the analysis.

The emission units were modeled at their maximum potential SO_2 hourly emission rate, except George Neal South Unit 4 and George Neal North Unit 3. The paragraphs below summarize the development of the emission factors for these units. Table 4-1 summarizes the emission rate modeled for each emission unit and Table 4-2 summarizes the stack characteristics used in the 1-hr SO_2 modeling demonstration.

Table 5-1. George Neal South and George Neal North modeled SO_2 emission rates.[5]

Model ID	SO_2 Emission Points	Modeling Emission Rate (lb/hr)
EP3	George Neal South Unit 4	3,396.7
EP001	George Neal North Unit 1	0.8018
EP002	George Neal North Unit 2	1.812
EP003	George Neal North Unit 3	2,707.5
EP301	George Neal North Unit 3 Auxiliary Boiler	0.03

Table 5-2. George Neal South and George Neal North point source exhaust characteristics.

Model ID	UTM Easting (m)	UTM Northing (m)	Base Elevation (m)	Stack Height (m)	Stack Diameter (m)	Exhaust Temperature (K)	Exhaust Velocity (m/s)
EP3	222828.6	4688308.0	327.40	142.95	7.85	355.37	25.54
EP001	221572.3	4691127.5	327.61	68.58	2.87	433.15	39.47
EP002	221601.0	4691046.0	327.85	91.44	4.65	416.48	31.83
EP003	221397.6	4691272.0	322.34	121.92	6.10	355.37	28.40
EP301	221531.9	4691230.5	322.87	15.24	0.86	466.48	12.31

In 2014 George Neal South Unit 4 and George Neal North Unit 3 installed SO_2 scrubbers; the corresponding permitted emission limit with scrubber technology is based on a 30-day rolling average of 2,760 lb/hr and 2,200 lb/hr for George Neal South Unit 4 and George Neal North Unit 3, respectively. An evaluation of the current 30-day rolling permit limits for both emission units was conducted to develop an hourly emission rate which would preserve the variability of the hour-to-hour emission profile with scrubber controls, yet be conservative to protect the ambient air quality standard for the attainment demonstration. This approach relies on the EPA *Guidance for 1-Hour SO2 Nonattainment Area [State Implementation Plan] Submissions* memorandum. Based on that guidance a review of continuous emissions monitoring system (CEMS) data for similar MidAmerican units with similar control technology was conducted to assist in establishing an appropriate emission rate for this modeling. Surrogate units must be used since George Neal South Unit 4 and George Neal North Unit 3 do not have 3-years of corresponding SO_2 CEMS data after installation of the scrubber controls.

Walter Scott, Jr. Energy Center Unit 3 and Louisa Generating Station are coal-fired boilers similar to George Neal South Unit 4 and George Neal North Unit 3. Walter Scott, Jr. Energy Center Unit 3 and Louisa Generating Station have CEMS data available that reflects scrubber operation. The EPA guidance allows an evaluation of the data to determine a corresponding ratio to apply to the 30-day limits. The steps below outline the approach:

1. Collect 5-years of suitable hourly CEMS data.
2. Calculate the 99^{th} percentile 1-hr emission rate, over the 5-year period.

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[5] Emission rates modeled for George Neal North Unit 1 and George Neal North Unit 2 reflect potential emissions with natural gas. These units are required to cease utilization of coal as a fuel by April 16, 2016, per a consent agreement between MidAmerican and the Sierra Club.

The George Neal North Auxiliary Boiler was under construction at the time of modeling. This unit is scheduled to become operational in the fall of 2015. The modeled emission rate represents emissions at maximum design capacity while using natural gas fuel, as permitted.

3. Calculate the 99th percentile 30-day rolling average, over the 5-year period.
4. Calculate the ratio of the 99th percentile 30-day rolling average from Step 3 to the 99th percentile 1-hr value calculated from Step 2.
5. Apply that calculated ratio to the similar unit 30-day rolling limit that does not have corresponding CEMS data to back-calculate the corresponding hourly emission rate to model (the permitted 30-day rolling limit divided by the calculated ratio).

Based on the procedure outlined above, the ratios at Walter Scott, Jr. Energy Center Unit 3 and Louisa Generating Station are ~0.817 and ~0.808, respectively. The average of the two ratios, 0.81255, was divided into the 30-day rolling limits for the George Neal South Unit 4 and George Neal North Unit 3 to compute the hourly SO_2 emission rates used in the modeling analysis (and shown in Table 5-1).

5.2. Nearby Sources of SO_2

The SO_2 emission levels from all facilities within 10 km were evaluated to determine if additional sources of SO_2 should be included in the modeling analysis. Table 5-3 summarizes the sources within 10 km of George Neal South. Any source that would contribute a significant portion of the total SO_2 emissions in the area was identified to be included in the modeling analysis. The total average emissions for the area were 21,967.4 tpy, of which George Neal South is the primary contributor at 62.5% and George Neal North a secondary contributor at 37.5%. All other sources combined only contribute 0.009%. Therefore both George Neal South and George Neal North were included in the modeling analysis but no other sources within 10 km were included.

In addition, a search was performed for major sources of SO_2 within 10-20 km. One additional facility was identified during this search, Sioux City Brick and Tile. This facility had a maximum SO_2 emission rate of 89.26 tpy during the three-year period 2012-2014 and an average of 73.97 tpy. When this average is added to the total average emissions from all sources within 10 km of George Neal South this accounts for only 0.3% of the total emissions in the area. For this reason, and the fact that it is 12 km away, Sioux City Brick and Tile was screened out of the modeling analysis.

The State of Nebraska was also contacted to determine if there were any facilities that would need to be included from that state. No such sources were identified.

Table 5-3. Facilities within 10 km of George Neal South.

		SO_2 Emissions (tpy) ‡			
Facility Name	**Address**	**2012**	**2013**	**2014**	**Most Recent (or average)**
MidAmerican - Neal South	2761 Port Neal Rd. Salix, IA 51052	14,272.8	20,099.4	6,813.3	13728.5
MidAmerican - Neal North Energy Center	1151 260th St. Sergeant Bluff, IA 51054	9788	8421.2	6501.2	8,236.8
CF Industries - Port Neal Complex	1182 260th St. Sergeant Bluff, IA 51054	2.56	1.41	1.3	1.76
Gelita USA Sioux City	2445 Port Neal Rd. Sergeant Bluff, IA 51054	0.18	-	-	-
Ag Processing, Inc. - Sergeant Bluff	2735 Port Neal Rd. Sergeant Bluff, IA 51054	0.18	0.14	0.08	0.13

Sabre Industries Towers And Poles	7101 Southbridge Dr. Sioux City, IA 51111	-	0.01	-	-
Nutra - Flo Company - Sergeant Bluff: Nulex	2717 Port Neal Rd. Sergeant Bluff, IA 51054	-	-	-	0
	Total Average Emissions	**21,967.4**			

‡ Major sources report emissions every year while minor sources report at most once every three years. If the latest available inventory for a minor source predates 2012 then the facility's emissions are listed only in the "Most Recent" column. The "Most Recent" column also includes the 3-year average emission rates for major sources.

5.3. Dispersion Model

The EPA recommended American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD) was used to perform the analysis. The most current version (Version 14134) of AERMOD available at the time of the analysis was used with regulatory default options as recommended in the EPA Guideline on Air Quality Models. The following supporting pre-processing programs for AERMOD were also used:

- BPIP-Prime (Version 04274)
- AERMET (Version 14134)
- AERMAP (Version 11103)

AERMOD is a steady-state plume model that simulates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. This model is recommended for short-range (< 50 kilometers [km]) dispersion from the source. The model incorporates the Plume Rise Model Enhancement (PRIME) algorithm for modeling building downwash. AERMOD is designed to accept input data prepared by two specific pre-processor programs, AERMET and AERMAP. AERMOD was run with the following options:

- Regulatory default options
- Direction-specific building downwash characterized by BPIP-PRIME
- Actual receptor elevations and hill height scales obtained from AERMAP
- SO_2 pollutant keyword

5.4. Receptor Grid

Receptors were sited outside of the fence line boundary of the George Neal South and George Neal North facilities. Receptor placement grid spacing was:

- 50 meters along the facility fence line
- 50 meters from the fence line to 0.5 km
- 100 meters extending from 0.5 km to 1.5 km
- 250 meters extending from 1.5 km to 3 km
- 500 meters extending from 3 km to 5 km

Consistent with Section 4.2 of EPA's TAD, receptors were not placed on water bodies within the gridded area. This would include removing receptors on the adjacent Missouri River. Figure 5-2 shows the receptor grid for the modeling analysis.

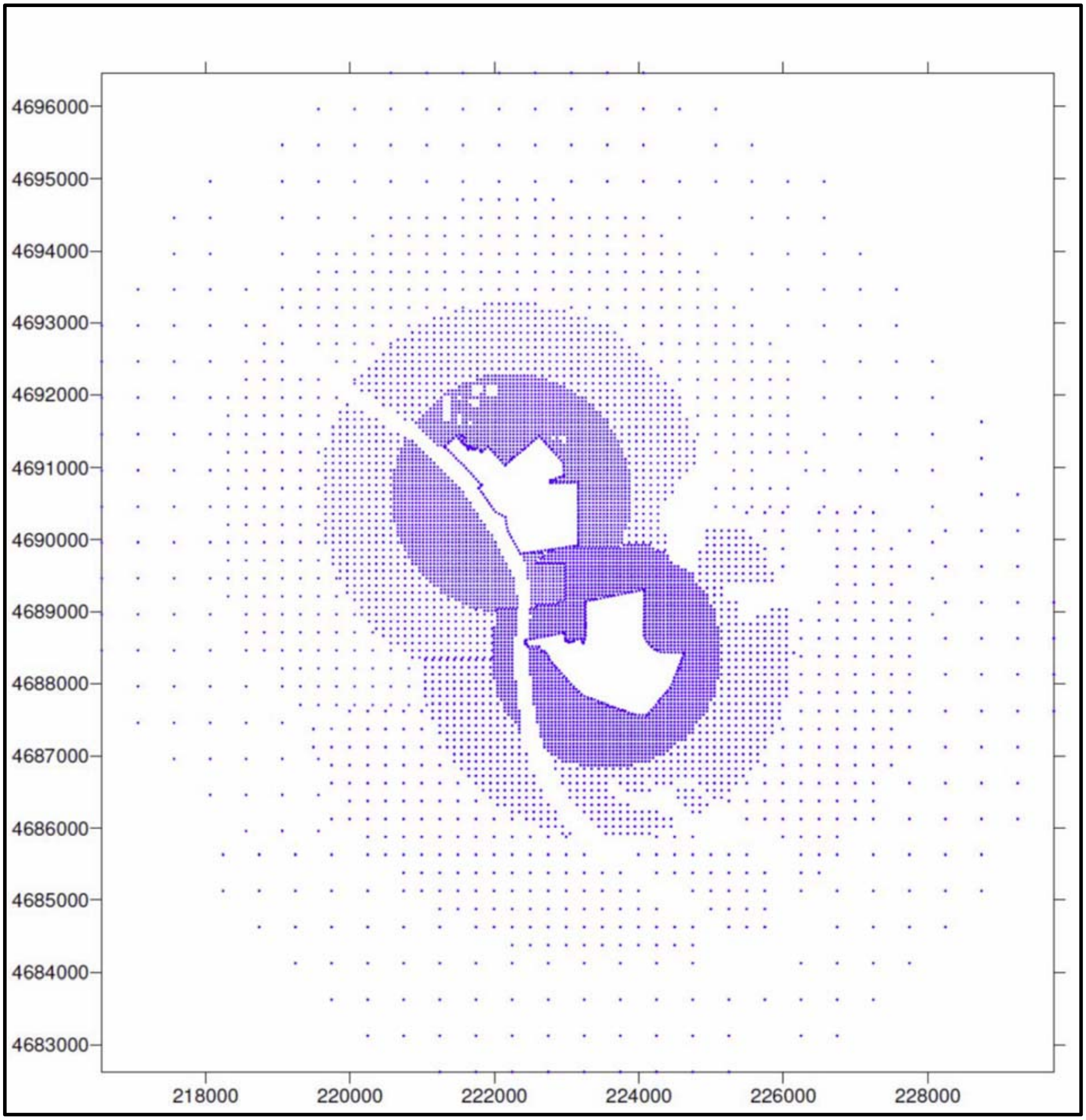

Figure 5-2. Dispersion modeling receptor grid surrounding George Neal South.

Interpolated terrain elevations were input to the model using United States Geological Survey (USGS) National Elevation Dataset (NED) data for Woodbury County in North American Datum 1983 (NAD83). All receptors were assigned a terrain height and hill height using the terrain preprocessor AERMAP.

5.5. Meteorological Data

Hourly meteorological data for the dispersion modeling analysis was preprocessed with the AERMET program by the Iowa DNR. The surface data was collected from the Sioux City (KSUX) station with upper air data from the Omaha NWS station (KOMA) for calendar years 2012 through 2014. Based on the results from a representivity study conducted by the Iowa DNR,[6] these meteorological data are considered representative of the conditions near the George Neal South and George Neal North facilities. Figure 5-3 shows the 2012-2014 3-year wind rose for the KSUX station.

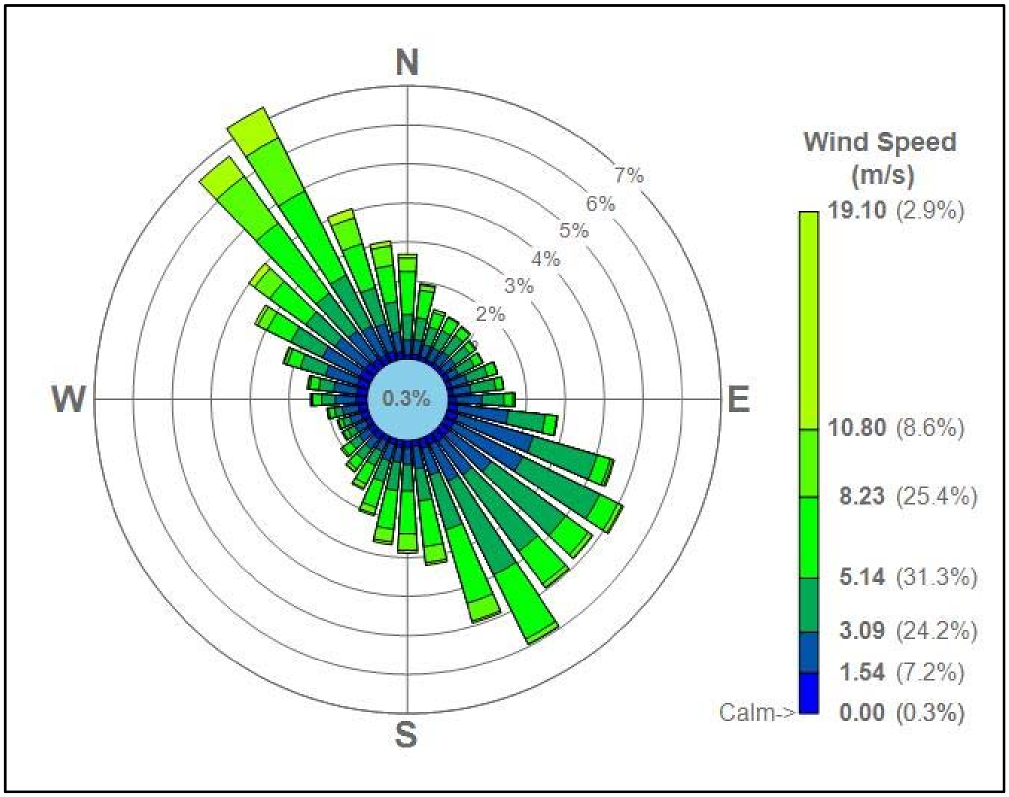

Figure 5-3. Sioux City (KSUX) 3-year wind rose (2012-2014).

5.6. Background Concentration

The statewide default 1-hr SO_2 background concentration of 32 μg/m^3 was added to the model design value for comparison to the NAAQS. The background concentration was derived using a multiple-monitor average of design concentrations from 2009-2011 data.

The model design value was used in conjunction with the conservative background concentration for comparison to the NAAQS. For SO_2, consistent with EPA guidance, the receptor with the highest 3-year average of the 99th percentile maximum daily 1-hr modeled concentration was added to the background concentration identified above. AERMOD internally calculates the 3-year average of the 99th percentile 1-hr concentration at each receptor using the SO_2 pollutant keyword.

5.7. Modeling Results

Following the AERMOD dispersion modeling approach described above, Table 5-4 summarizes the AERMOD output model design value, background concentration, and total concentration for comparison to the 1-hr SO_2 NAAQS. The maximum concentration of 194.8 μg/m^3 is less than the 1-hr SO_2 NAAQS.

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[6] The "*2005 - 2009 AERMOD Met Data Technical Support Document*" available at: http://www.iowadnr.gov/InsideDNR/RegulatoryAir/Modeling/DispersionModeling/MeteorologicalData.aspx

Table 5-4. Model predicted concentration (µg/m^3) for the George Neal South analysis.

Model Design Value	Background Concentration	Total Concentration	1-Hour SO_2 NAAQS	Above NAAQS?
162.8	32	194.8	196	No

5.8. Designation Recommendation

The George Neal South and George Neal North facilities will not cause or contribute to a modeled violation of the 1-hr SO_2 NAAQS. Within Woodbury County there is one additional major (Title V) stationary source (see Figure 5-4) not previously discussed, Cargill Inc. – Sioux City. For calendar year 2014, Cargill reported less than 1 ton of SO_2 emissions, which will not affect the attainment status of the area. There is one additional major source within 20 km of Woodbury County's borders, Prairie Sun Foods (previously Plymouth Energy, LLC). Again, the 2014 SO_2 emissions from this facility were less than 1 ton.

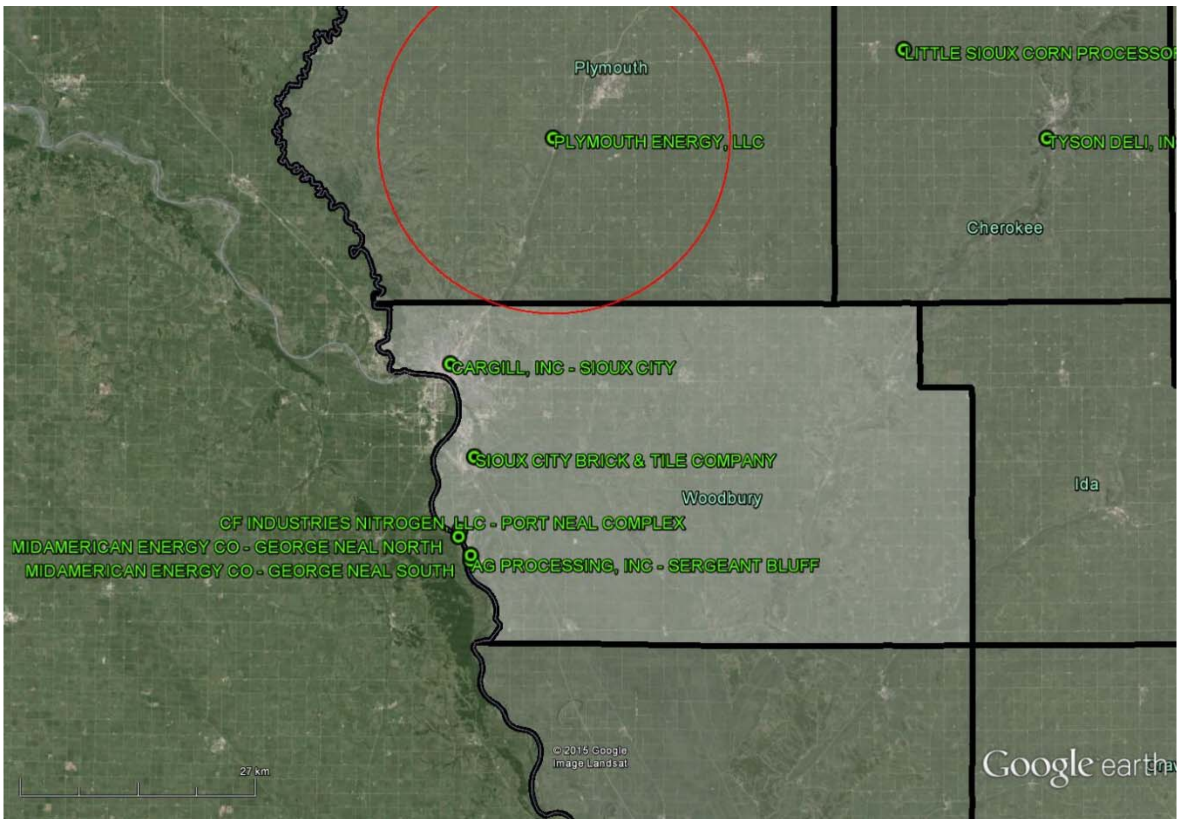

Figure 5-4. Major sources in and within 20 km (as indicated by the red circle) of Woodbury County.

Minor sources in the area do not emit a significant quantity of SO_2 and are adequately represented by the background concentration included in the cumulative modeling results. No sources within Woodbury County or within 20 km of the county's border are expected to cause or contribute to a violation of the 1-hr SO_2 NAAQS. Based on the technical review completed for this area all off Woodbury County should be designated attainment for the 1-hr SO_2 NAAQS.