

B. EMPIRE ASBURY PLANT

The Empire District Electric Company Asbury Plant (Asbury) is a coal-fired electric generating facility located in Barton and Jasper Counties, Missouri. Based on the air program's technical review of this facility, current conditions support a recommendation of attainment for all of Barton and Jasper Counties.

B.1 Monitoring and Modeling Data

There are no ambient SO₂ monitors near Asbury that can be relied upon to characterize the air quality around the source. Instead, the air program performed extensive air dispersion modeling to characterize air quality for the area. The air program modeled Asbury using the most representative recent three years of actual emissions data and concurrent representative meteorological data to approximate a monitored design value for the area. The following paragraphs summarize the modeling analysis performed specific to Asbury, and the modeling protocol in Appendix H contains more detail on general modeling procedures.

Emissions Data for Model Input

Three years (2012-2014) of recent hourly emissions (CEMS) data was obtained through EPA's Clean Air Markets Division program database (CAMD) and the downloaded SO₂ hourly mass emissions data was formatted for direct input into AERMOD. Asbury provided hourly recorded varying stack release parameters including exit temperature and exit flow rate that were evaluated and paired with the CAMD retrieved CEMS emissions. Further emissions information including interactive source evaluation is included in Section B.2.

Meteorological Data for Model Input

An air program staff meteorologist performed a technical evaluation to determine which surface and upper air stations are most representative of Asbury. Asbury has no on-site or nearby collected surface or upper air meteorological data. Offsite NWS data is evaluated for representativeness in the following discussion. In general, meteorological stations within 200 km of the facility of interest are preferred as their prevailing weather conditions would be most similar to the facility. However, locations more than 200 km from the facility of interest can be considered when surface conditions of nearby meteorological stations are not deemed representative.

For upper air data, the Springfield, MO National Weather Service upper air station is closest to Asbury at 107 km and best represents the vertical atmospheric characteristics of the region.

For surface data, the Joplin (24 km), Springfield (107 km), and Whiteman Air Force Base (176 km) airports are the closest to the Asbury facility. Four other surface weather stations are within 200 km of Asbury. Explicit criteria for each of the respective stations are compared below.

Joplin: The surface roughness values are significantly different between Joplin's airport and the Asbury facility. Land cover at Asbury is 41% herbaceous planted or cultivated land followed by 25% water and 12% barren and 10% forest. Joplin land cover is also mostly (49%) herbaceous planted or cultivated, but is followed by 30% forest and 19% developed land. The surface roughness values are the same for the planted/cultivated areas, but are vastly different for the developed and forest land at Joplin compared to the water and barren cover at Asbury. The surface roughness values differ by 90 to over 150% across the seasons due to the land cover differences with taller obstructions at Joplin. The albedos agree within 5%. The Bowen ratios differ by only 5 to 53% across all seasons and show good agreement.

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Springfield: The surface roughness values differ by only 7-34% across all seasons between Asbury and Springfield. Springfield land cover is over 70% herbaceous planted or cultivated land. This is much more cultivated land than Asbury at 41%, but Asbury's other relative short land cover types (water and barren) have surface roughness values similar to cultivated land. Springfield's taller land cover types, 11% developed and 9% forest cover within 1km, are slightly more than the 10% forest cover near Asbury, but do not cause significant disagreement in surface roughness values throughout the year. Albedo values agree within 1%. Bowen ratios differ by 4 to 25% for all seasons and precipitation schemes, and shows very close agreement.

Whiteman: The surface roughness values differ by 19-31% between Whiteman and Asbury. Whiteman land cover is similar to Springfield as described above, with 74% herbaceous or cultivated land cover, and smaller amounts (21% developed) of taller surface cover. Both Springfield and Whiteman offer surface roughness values close to Asbury. Albedo values agree within 5%. Bowen ratios differ by only 1 to 25% across the seasons and precipitation schemes.

The remaining 4 weather stations within 200 km of Asbury offer no improvement to the comparison of combined surface roughness, albedo, or Bowen ratios than the three closest surface weather stations. The strong disagreement between surface roughness between Asbury and Joplin makes the closest NWS location a poor choice to represent Asbury meteorology. The next closest NWS location, the Springfield NWS surface weather station, improves upon the surface roughness values and has good agreement for albedo and bowen ratio. Though the values for Whiteman's albedo and Bowen ratio are slightly better than Springfield, the proximity of Springfield (107 km vs 176) is a more important factor than the small improvements in two variables. Despite the very close location of the Joplin surface NWS site, the significant differences in surface roughness eliminate it as a representative meteorological site for Asbury. The Springfield surface NWS site data is preferable to represent the meteorological conditions at Asbury.

The recommended representative meteorological stations used in this modeling analysis are shown in Table 1.

Table 1 – Empire District-Asbury Meteorological Datasets

Facility of Interest	Surface Data Location	Upper Air Location
Empire District - Asbury	Springfield, MO	Springfield, MO

For purposes of evaluating the entire two-county area, the receptor grid was expanded to cover all of Barton and Jasper Counties. The same tiered grid spacing as detailed in the modeling protocol was used for Asbury, except the last tier was extended to encompass all of both Barton and Jasper Counties. The receptor grid and domain extends to 50 km from the facility.

The regional background concentration was established at 9 ppb for rural areas. This was based on an analysis of the East St. Louis monitor in Illinois. The modeling protocol in Appendix H further details this analysis. The background was added to model predicted concentrations to account for natural sources and sources not included in the modeling inventory. The maximum modeled concentration for the area was 102.2 $\mu\text{g}/\text{m}^3$ or 39.0 ppb. This demonstrates the area is currently in compliance with the 1-hour SO_2 standard of 75 ppb. A map including plotted output concentrations is shown in Figure 1.

Empire Asbury Modeled Concentrations 2012-2014 Actual Emissions

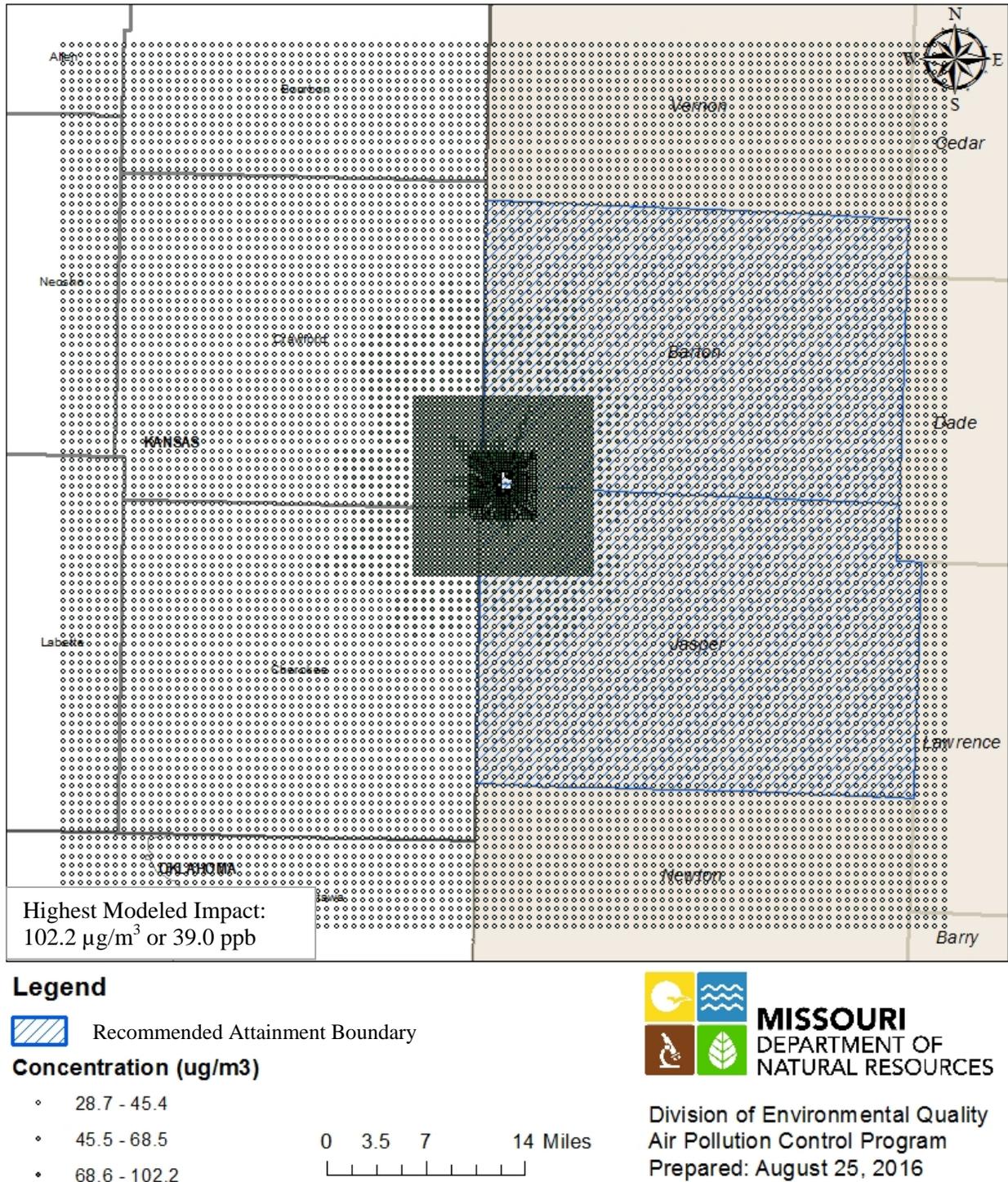
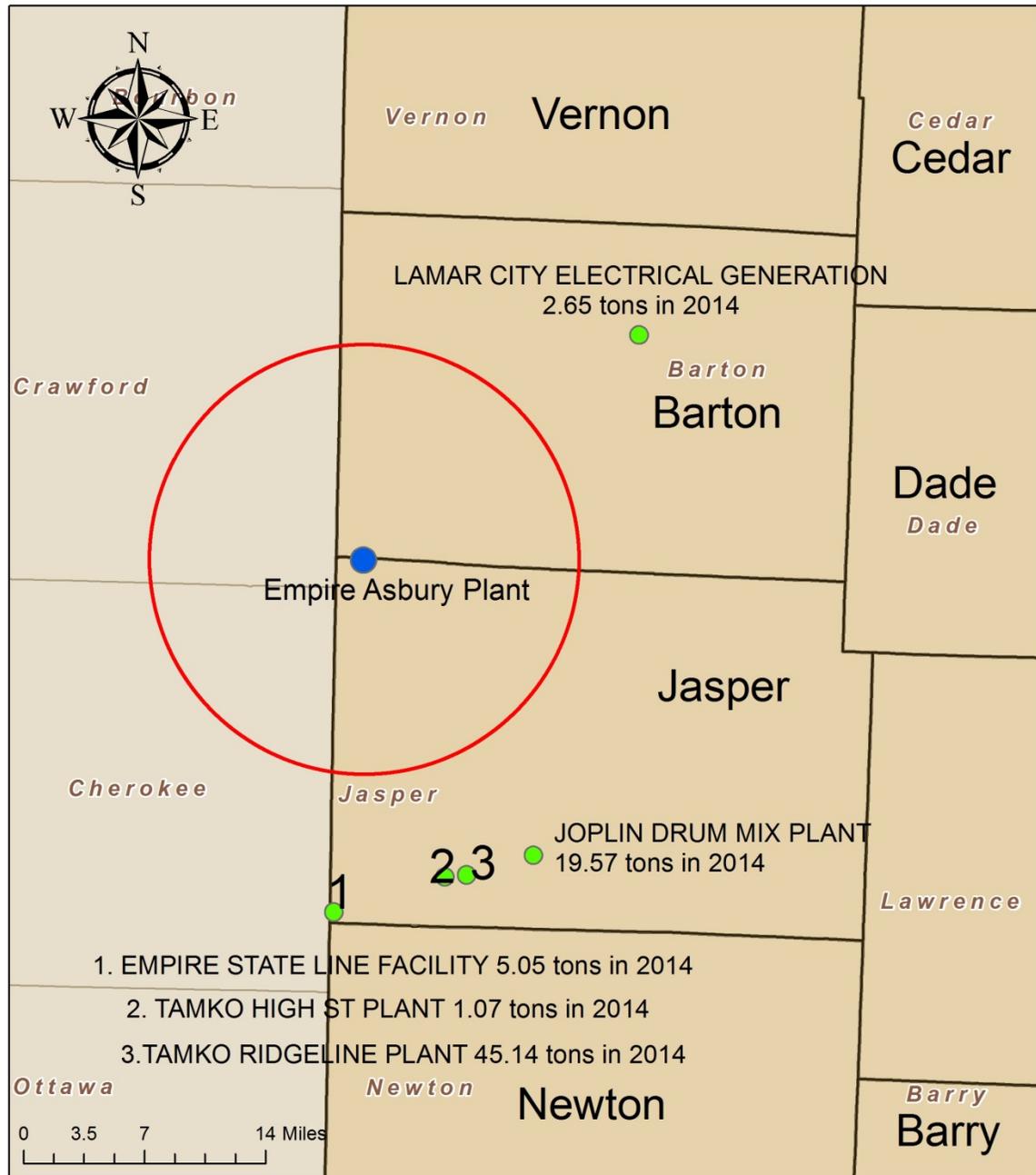


Figure 1 – Asbury Modeled SO₂ Concentrations

B.2 Emissions Data

The emission sources surrounding Asbury were evaluated to determine an interactive source inventory for the dispersion modeling analysis. There are no interactive sources in the 20 km buffer of Asbury plant but there are 5 interactive sources in Barton and Jasper Counties. Figure 2 displays a map of Barton and Jasper Counties along with all permitted SO₂ sources that were evaluated for inclusion in the modeling inventory. Table 2 lists all sources included on the map along with their 2012-2015 actual emissions.



Legend

- Empire Asbury Plant
- Interactive Sources
- Asbury 20 km Buffer

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Air Pollution Control Program
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Figure 2 – Asbury with Nearby Interactive Sources

Table 3 – Asbury and Interactive Source 2012-2015 SO₂ Emissions

Source Name	2012 SO ₂ Emissions (TPY)	2013 SO ₂ Emissions (TPY)	2014 SO ₂ Emissions (TPY)	2015 SO ₂ Emissions (TPY)	Distance to Asbury (km)
Empire District Asbury Plant	6261	7505.5	6318.4	1134.1	0
Lamar City Electrical Generation	1.9	2.92	2.65	2.49	32
APAC-Central Joplin Drum Mix Plant	N/A	0	19.57	19.57	30.9
Empire State Line Facility	4.4	4.9	5.05	3.85	33.2
Tamko Building Products Inc. High St. Plant	1.12	1.04	1.06	1.09	32.3
Tamko Building Products Inc-Rangeline Plant	47.94	41.56	45.14	41.71	31.3

B.2.1 Evaluation of Sources to Model

All sources included on the map in Figure 2 were evaluated for possible inclusion in the modeling inventory. There are five sources that reported actual emissions larger than 1 ton per year (tpy) in 2014 located in Barton and Jasper Counties. The following bullets describe each of the sources listed in Table 3 along with a discussion about how each source was characterized in the modeling analysis:

- Empire District – Asbury Plant (097-0001) – Asbury includes one coal-fired boiler that generates electricity that is supplied to the grid. The plant is owned by Empire District Electric Company. The air program used actual SO₂ emissions data from the continuous emission monitoring system (CEMS) located at this facility. The modeled years include the three year period (2012 – 2014). This time period was used to reflect emissions prior to scrubber installation. Asbury installed a scrubber to control SO₂ emissions near the end of 2014. See Section B.2 for more details. Pre-scrubber emissions were used in this analysis to be conservative and because scrubber usage/associated emission limits are not yet federally enforceable.
- Lamar City Electrical Generation (011-0031) – This source is located 32 km northeast of Asbury in northern Barton County. This source primarily combusts landfill gas/natural gas. This source reported 2.65 tons of SO₂ emissions in 2014 and was included in the modeling inventory as an interactive source. This source has four SO₂ emission points with stack releases. All four releases were modeled using parameters as reported to MoEIS.
- APAC-Central Joplin Drum Mix Plant (097-0091) – This source is located 30.9 km south of Asbury. This source produces asphalt through hot drum mixers and dryers. The primary SO₂ emitting unit is EU-04 (Drum Mix Hot Mix Asphalt Plant). This source reported 19.57 tons of SO₂ emissions in 2014 and was included in the modeling inventory as an interactive source. The single unit has a stack release and was modeled with parameters as reported to MoEIS.
- Empire - State Line Facility (097-0104) - This source is located 33.2 km south of Asbury. This source is a natural gas fired electric generating facility also owned by Empire District Electric Company. This source reported 5.05 tons of SO₂ emissions in 2014 and was included in the modeling inventory as an interactive source. Both units have stack releases and were modeled with parameters as reported to MoEIS.
- Tamko Building Products Inc.-High St. Plant (097-0013) – This source is located 32.3 km south of Asbury. This source is a roofing products manufacturing plant in Joplin, Missouri. This facility primarily produces SO₂ emissions through the process of asphalt roof coating and manufacturing.

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This source reported 1.07 tons of SO₂ emissions in 2014 and was included in the modeling inventory as an interactive source. The three SO₂ emitting units have stack releases and were modeled with parameters as reported to MoEIS.

- Tamko Building Products Inc.-Rangeline Plant (097-0094) – This source is located 31.3 km south of Asbury. TAMKO Building Products, Inc. (Rangeline Facility) manufactures roofing products and includes such processes and products as felt mat, glass mat, asphalt coatings and saturants. This source reported 45.14 tons of SO₂ emissions in 2014 and was included in the modeling inventory as an interactive source. The single unit has a stack release and was modeled with parameters as reported to MoEIS.

Beyond these 6 included sources, an additional 34 sources located in Barton and Jasper Counties were excluded from the model analysis due to emission levels below 1 ton. These 34 sources cumulatively emitted less than 2.65 tons of SO₂ in 2014 and averaged 0.078 tons per source. Possible impacts from these sources are accounted for through the use of a regional background concentration.

Table 4 details the emission release parameters used for the main boiler at Asbury, and Table 5 shows an excerpt from the hourly emissions file for Asbury's boiler.

Table 4 – Asbury Emission Release Parameters

Facility I.D.	Facility Name	Site Name	Emission Point I.D.	Model ID	Description	Release Type
097-0001	Empire District Electric Company	Asbury	1	EP7	Boiler #1	POINT

Eastings Meters	Northing Meters	Base Elevation Meters	Actual Stack Height Meters	Stack Temperature Kelvin (From MoEIS)	Stack Exit Velocity Meters/Second (From MoEIS)	Stack Diameter Meters
359323	4136147	287.426	123.44	Used varying hourly temperatures provided by the facility(see Table 5)	Used varying hourly velocity values provided by the facility (see Table 5)	3.962

Table 5 – Excerpt from 2012-2014 Hourly Emission File for Asbury

	Year	Month	Day	Hour	Unit ID	SO ₂ ER (g/s)	Temp (K)	Velocity (m/s)
SO HOUREMIS	12	1	4	1	EP7	163.3428	347.5	8.565722
SO HOUREMIS	12	1	4	2	EP7	163.3428	351.8889	8.565722
SO HOUREMIS	12	1	4	3	EP7	163.3428	354.7778	8.565722
SO HOUREMIS	12	1	4	4	EP7	163.3428	355.6667	8.565722
SO HOUREMIS	12	1	4	5	EP7	192.9395	355.0556	10.1175
SO HOUREMIS	12	1	4	6	EP7	288.5588	383.1667	15.13156

B.3 Meteorology and Topography

Meteorology and topography are interrelated as significant topographical features often cause localized meteorological effects. Due to this related nature, these two factors were evaluated together. Topography and surrounding land features can have a significant impact on the wind patterns and thus the dispersion of air pollutants from emission sources. There are no significant terrain features in the area around Asbury that would greatly impact dispersion, such as mountain ranges. The surrounding terrain and meteorological effects were represented in Asbury's modeling analysis to best simulate monitoring of the area's ambient air quality. Since no significant terrain or meteorological features exist around Asbury, topography and meteorology were not used to set the recommended area boundary.

B.4 Jurisdictional Boundaries

Attainment area boundaries are typically defined by easily identifiable features such as county, municipal, or township boundaries. Large, immovable features such as rivers or highways can also be used. In this case, since Asbury's modeled impact attains the standard, the main considerations are that the boundary include Asbury and be easily identifiable.

All permitted SO₂ emitting sources located within Barton and Jasper Counties were evaluated in this analysis, and the receptor grid for this modeling analysis was increased to include the entire two counties. As discussed previously, the modeling evaluation performed for Asbury resulted in no modeled violations of the 2010 1-hour SO₂ NAAQS. Therefore, the county boundaries were considered representative of the recommended attainment area. The recommended attainment boundary for Asbury consists of the county lines for Barton and Jasper Counties. Figure 3 displays a map with the recommended boundary.

Northern Boundary: County Line dividing Barton County from Vernon County

Eastern Boundary: County Line dividing Barton County and Jasper County from Cedar, Dade and Lawrence Counties

Southern Boundary: County Line dividing Jasper County from Newton County

Western Boundary: Missouri State Line

Empire District Asbury Plant: 2010 1-hour SO₂ NAAQS Recommended Attainment Area Boundary



Legend

- Empire Property Boundary
-  Recommended Attainment Boundary

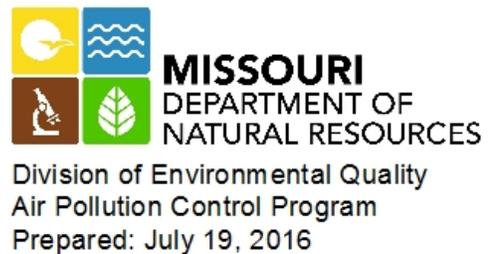


Figure 3 – Asbury Recommended 2010 1-hour SO₂ NAAQS Attainment Area