# C. KCPL MONTROSE GENERATING STATION

The Kansas City Power & Light Montrose Generating Station (Montrose) is a coal-fired electric generating facility located in Henry County, Missouri. Based on the air program's technical review of this facility, current conditions support a recommendation of attainment for all of Henry County.

## *C.1 Monitoring and Modeling Data*

There are no ambient $SO_2$ monitors near Montrose 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 Montrose using the most 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 Montrose, and the modeling protocol in Appendix H contains more detail on general modeling procedures.

*Emissions Data for Model Input*

The most recent three years (2013-2015) of hourly emissions (CEMS) data was obtained through EPA's Clean Air Markets Division program database (CAMD) and the downloaded $SO_2$ hourly mass emissions data was formatted for direct input into AERMOD. Montrose 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 C.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 Montrose. Montrose 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 upper air station is closest to Montrose at 128 km and best represents the vertical atmospheric characteristics of the region surrounding Montrose.

For surface data, the Whiteman (56 km), Sedalia (80 km), and Lee's Summit (81 km) stations are the closest to the Montrose facility. Explicit criteria for each of the respective stations are compared below.

> Whiteman: The surface roughness values differ by 39 to 46% in summer and fall, and 10-16% in winter and spring. The main difference in land cover is the 52% water cover within 1km of Montrose, with remaining classifications of30% planted/cultivated and 11% developed cover. Whiteman is 74% planted/cultivated and 21% developed, with no significant water. Albedo agrees within 10%. Bowen ratio differ by 45 to 80% for dry conditions, 30-65% for average conditions, and 25-40% for wet conditions.
>
> Sedalia: The surface roughness values differ by over 120% in summer and fall, and by 10% for winter and spring. The land cover at Sedalia is mainly planted/cultivated at 88%, compared to Montrose at 52% water and 30% planted. Albedo agrees within 6-7% for all seasons. Bowen

ration differs by 70-90% for dry conditions, 40-60% for average conditions, and 35-45% for wet conditions.

Lee's Summit: The surface roughness values differ by 90-100% for summer and fall, and 10% for winter and spring. The surface cover responsible for the surface roughness difference includes the 87% planted/cultivated area around Lee's Summit, and 52% water and 30% planted/cultivated area around Montrose. Albedo agrees within 7% for all seasons. Bowen ratio differs by 40-70% for dry conditions, 35-70% for average conditions, and 35-55% for wet conditions.

The next closest airports (Kansas City Downtown 107 km, Kaiser/Lake Ozark 124km) offer no improvement to the comparison of combined surface roughness, albedo, or Bowen ratios than the three closest surface weather stations. These two airports have significant developed area and tall tree canopy that creates significant differences with surface roughness values at Montrose.

The next closest airport is the Springfield-Branson Airport at 128 km south-southeast from Montrose. This airport does offer better comparability of surface roughness values with Montrose (less than 20% difference for all seasons). The land cover near Springfield is 73% planted/cultivated, mostly grasses and hay pasture. The combination of the 52% water and 30% planted/cultivated land at Montrose collectively creates surface roughness values comparable to the Springfield airport. Despite the agreement in surface roughness values, the overall proximity of Springfield to Montrose should also be considered according to Appendix W section 8.3 representativeness criteria. The distance of 128 km to Springfield is more than double the 56 km distance northeast to Whiteman. Though there are no firm distance cutoffs to be used in evaluating representativeness, proximity of the meteorological observations is a key element to consider. Appendix W also directs states to consider the terrain as a secondary element after distance. Springfield is located at the crest of the Ozark Plateau, unlike the placement of Whiteman and Montrose. The Springfield airport is at an elevation of 386 meters, higher than either Montrose at 228 meters and Whiteman at 265 meters located in the plains areas north of the Ozark Plateau. The elevation of Springfield, coupled with ridges northeast and southwest of the airport, lead to a funneling effect with increases in wind speeds from the southeast. The plateau also moderates winter temperatures compared to the plains north of Springfield, and summer temperatures are also cooler. The distance of Springfield from Montrose, along with the meteorological changes associated with its elevation, mean that despite the agreement in surface roughness values, the overall meteorology of Springfield is not representative of Montrose.

The influence of water surface cover near the Montrose facility strongly impacts the surface roughness comparisons with meteorological stations. Of the three nearest locations, Whiteman shows the closest surface roughness values and Bowen ratios across the seasons and precipitation conditions. Because of the relative similarity across the three meteorological input parameters between the Montrose location and the Whiteman meteorological station, the weather data for Whiteman will be used to represent conditions at Montrose.

Whiteman is not currently an ASOS station; it is an AWOS (Automated Weather Observing System) station, which means it does not collect minute level data for use in AERMINUTE. Prior to choosing this station, AERMET Stage 1 was run to determine the data completeness for the years of interest. The results range from 97-99.9% complete which are all above EPA's recommended completeness criteria of 90%; therefore, the data is deemed suitable for use in the modeling exercise.

```
SURFACE DATA          |------VIOLATION SUMMARY------|    |-----TEST VALUES-----|
                TOTAL      #     LOWER  UPPER      %      MISSING   LOWER   UPPER
                # OBS  MISSING  BOUND  BOUND  ACCEPTED     FLAG    BOUND   BOUND
       TMPD    26048        4      0      0     99.98      999.0, -300.0,  400.0
       WDIR    26048      640      0      0     97.54      999.0,    0.0,   36.0
       WSPD    26048        3      0      0     99.99      999.0,    0.0,  500.0

NOTE: Test values were also multiplied by the same factors applied to the data
      (see Appendix B of the AERMET User's Guide)
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The recommended representative meteorological stations used in this modeling analysis are shown in Table 1.

**Table 1 – Montrose Meteorological Datasets**

| Facility of Interest | Surface Data Location | Upper Air Location |
|---|---|---|
| Montrose | Whiteman AFB | Springfield, MO |

For purposes of evaluating the entire county, the receptor grid was expanded to cover all of Henry County. The same tiered grid spacing as detailed in the modeling protocol was used for Montrose, except the last tier was extended to encompass all of Henry County. The model domain and receptor grid extended to 40 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 151.2 µg/m$^3$ or 57.7 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.

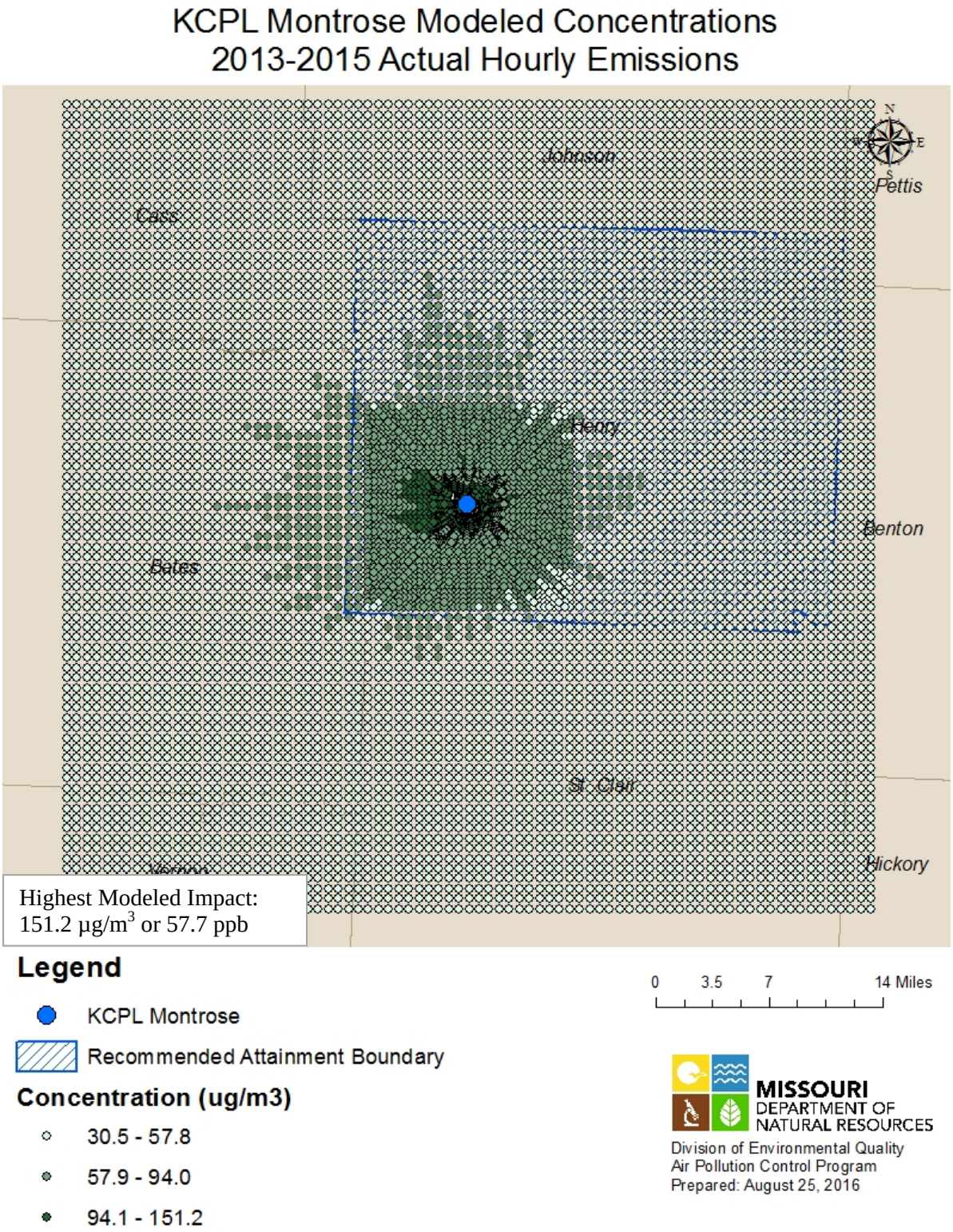


**Figure 1 – Montrose Modeled $SO_2$ Concentrations**

## *C.2 Emissions Data*

The emissions sources surrounding Montrose were evaluated to determine an interactive source inventory for the dispersion modeling analysis. Figure 2 displays a map of Henry and surrounding counties along with permitted $SO_2$ source(s) that were evaluated for inclusion in the modeling inventory. There are no interactive sources located within the 20 km buffer but one interactive source located within 40 km of Montrose has annual $SO_2$ emissions larger than 1 ton per year (tpy). Table 2 lists all sources included on the map along with their 2013-2015 actual emissions.

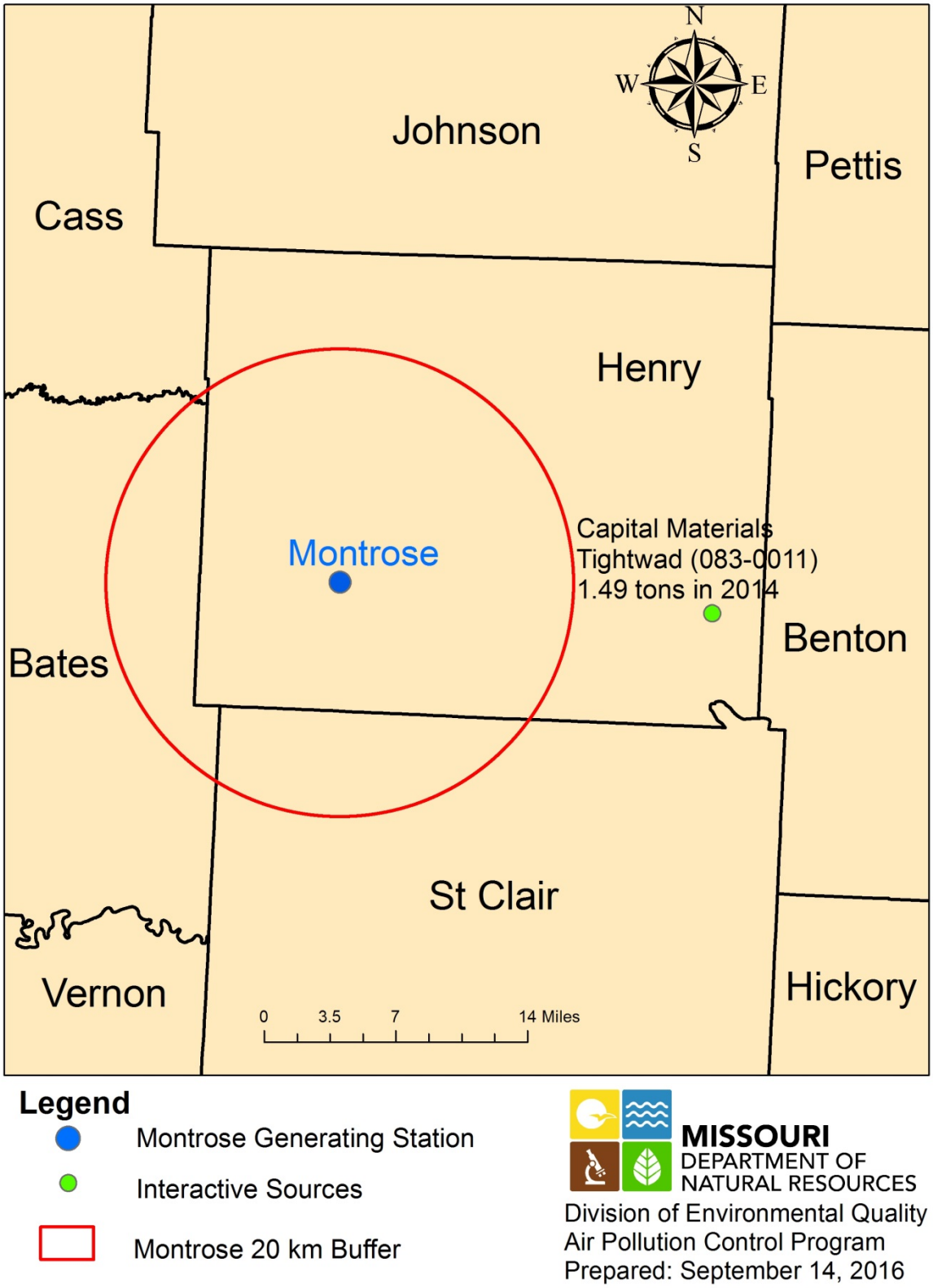


**Figure 2 – Montrose with Nearby Interactive Source(s)**

**Table 2 – Modeled Source Inventory: 2013-2015 $SO_2$ Emissions**

| Source Name | 2013 $SO_2$ Emissions (tpy) | 2014 $SO_2$ Emissions (tpy) | 2015 $SO_2$ Emissions (tpy) | Distance to the facility (km) |
|---|---|---|---|---|
| Montrose (083-0001) | 17,440.2 | 16,574.8 | 15,730.9 | 0 |
| Capital Materials Tightwad (083-0011) | 1.49 | 1.49 | 1.49 | 32.0 |

### C.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. The following bullets describe each of the sources listed in Table 2 along with a discussion about how each source was characterized in the modeling analysis:

- KCP&L Montrose – Montrose includes three coal-fired boilers that generate electricity that is supplied to the grid. The plant is owned by Kansas City Power and Light Company (KCP & L). The air program used actual $SO_2$ emissions data from the continuous emission monitoring system (CEMS) located at this facility. The modeled years include the most recent three years (2013 – 2015). The use of CEMS data in the model for this facility allows the model to act as a surrogate for monitoring data, which EPA guidance deems appropriate when developing boundary designation recommendations. Units 2 and 3 vent to a combined stack. Their emissions are reported separately by unit; however, stack release parameters are only measured at the combined stack. The units are modeled separately but with the same hourly release parameter information as provided by the facility.

- Capital Materials LLC – Tightwad (Leesville) Quarry – This source is located approximately 32 km east of Montrose. This source is an asphalt rotary dryer with total $SO_2$ emissions less than 2 tons per year. This source was included in the interactive inventory and modeled using 2014 actual emissions. This major $SO_2$ emitting unit at this source does not have a stack release therefore common volume source parameters for a dryer were used.

Beyond these two sources, an additional five $SO_2$ sources within 40 km of Montrose were excluded from the model analysis since their emission levels were below one ton per year. These five sources cumulatively emitted less than 0.2 tons of $SO_2$ in 2014, and averaged only 0.037 tons per source. Possible impacts from these sources are accounted for through the use of a regional background concentration.

Table 3 details the unit and emission release parameter information used for the boilers at Montrose, and Table 4 shows an excerpt from the hourly emissions file.

**Table 3 – Montrose Emission Release Parameters**

| Facility I.D. | Facility Name | Site Name | Emission Point I.D. | Model ID | Description | Release Type |
|---|---|---|---|---|---|---|
| 083-0001 | Kansas City Power and Light | Montrose | 1 | EP06 | Boiler #1 | POINT |
| 083-0001 | Kansas City Power and Light | Montrose | 2 | EP07 | Boiler #2 (Vents to Combined Stack) | POINT |
| 083-0001 | Kansas City Power and Light | Montrose | 3 | EP08 | Boiler #3(Vents to Combined Stack) | POINT |

| **Easting** *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* | **Stack Area (sqft)** |
|---|---|---|---|---|---|---|---|
| 418350.60 | 4240717.60 | 230.73 | 137.16 | Used hourly temperatures in lieu of static values (see Table 4) | Used hourly velocity values in lieu of static values (see Table 4) | 3.63 | 111 |
| 418248.20 | 4240719.30 | 230.73 | 135.94 | Used hourly temperatures in lieu of static values (see Table 4) | Used hourly velocity values in lieu of static values (see Table 4) | 5.09 | 218 |
| 418248.20 | 4240719.30 | 230.73 | 135.94 | Used hourly temperatures in lieu of static values (see Table 4) | Used hourly velocity values in lieu of static values (see Table 4) | 5.09 | 218 |

**Table 4 – Excerpt from 2013-2015 Combined Hourly CEMS Emission File for Montrose**

| | Year | Month | Day | Hour | Unit ID | $SO_2$ ER (g/s) | Temp (K) | Velocity (m/s) |
|---|---|---|---|---|---|---|---|---|
| SO HOUREMIS | 13 | 1 | 1 | 1 | EP06 | 114.305 | 418.26 | 26.720 |
| SO HOUREMIS | 13 | 1 | 1 | 1 | EP07 | 100.014 | 396.37 | 24.131 |
| SO HOUREMIS | 13 | 1 | 1 | 1 | EP08 | 102.678 | 396.37 | 24.131 |
| SO HOUREMIS | 13 | 1 | 1 | 2 | EP06 | 113.234 | 416.82 | 26.403 |
| SO HOUREMIS | 13 | 1 | 1 | 2 | EP07 | 100.162 | 395.98 | 23.984 |
| SO HOUREMIS | 13 | 1 | 1 | 2 | EP08 | 102.177 | 395.98 | 23.984 |
| SO HOUREMIS | 13 | 1 | 1 | 3 | EP06 | 116.598 | 416.32 | 26.487 |
| SO HOUREMIS | 13 | 1 | 1 | 3 | EP07 | 100.694 | 396.48 | 23.793 |
| SO HOUREMIS | 13 | 1 | 1 | 3 | EP08 | 102.048 | 396.48 | 23.793 |
| SO HOUREMIS | 13 | 1 | 1 | 4 | EP06 | 118.223 | 415.59 | 26.426 |
| SO HOUREMIS | 13 | 1 | 1 | 4 | EP07 | 103.377 | 395.76 | 23.771 |
| SO HOUREMIS | 13 | 1 | 1 | 4 | EP08 | 104.758 | 395.76 | 23.771 |

## *C.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 Montrose that would greatly impact dispersion, such as mountain ranges. The surrounding terrain and meteorological effects were represented in Montrose's modeling analysis to best simulate monitoring of the area's ambient air quality. Since no significant terrain or meteorological features exist around Montrose, topography and meteorology were not used to set the recommended area boundary.

## *C.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 Montrose's modeled impact attains the standard, the main considerations are that the boundary include Montrose and be easily identifiable.

All permitted $SO_2$ emitting sources located within Henry County were evaluated in this analysis, and the receptor grid for this modeling analysis was increased to include the entire county. As discussed previously, the modeling evaluation performed for Montrose resulted in no modeled violations of the 2010 1-hour $SO_2$ NAAQS. Therefore, the county boundary is considered representative of the recommended attainment area. The recommended attainment boundary for Montrose consists of the county lines for Henry County. Figure 3 displays a map with the recommended boundary.

Northern Boundary: County Line dividing Henry County from Johnson County
Eastern Boundary: County Line dividing Henry County from Pettis and Benton Counties
Southern Boundary: County Line dividing Henry County from St. Clair County
Western Boundary: County Line dividing Henry County from Cass and Bates Counties

**Figure 3 – Montrose Recommended 2010 1-hour $SO_2$ NAAQS Attainment Area**