

# Technical Support Document

## 1-Hour SO<sub>2</sub> National Ambient Air Quality Standard Recommended Air Quality Designation Boundaries for “Round 2” Sources



**CO L O R A D O**

**Air Pollution Control Division**

Department of Public Health & Environment

April 19, 2016

Colorado Department of Public Health and Environment  
Air Pollution Control Division  
4300 Cherry Creek Drive South  
Denver, Colorado 80246



# Table of Contents

Introduction .....	3
Designation Boundary Recommendations.....	3
EPA Guidance on SO <sub>2</sub> Designations.....	3
Future EPA SO <sub>2</sub> Designations Process.....	3
Analysis of Source Specific Designations .....	4
Public Service Company of Colorado - Pawnee Power Plant.....	4
Air Quality Characterization: Ambient Monitoring or Dispersion Modeling Results .	4
Emissions-Related Data.....	5
Meteorology (Weather & Transport Patterns) .....	6
Geography and Topography (Mountain Ranges or Other Air Basin Boundaries).....	7
Jurisdictional Boundaries.....	7
Other Relevant Information .....	8
Conclusion .....	8
Colorado Springs Utilities - Martin Drake Power Plant.....	10
Air Quality Characterization: Ambient Monitoring or Dispersion Modeling Results	10
SO <sub>2</sub> Ambient Monitoring in El Paso County .....	10
Dispersion Modeling.....	10
Emissions-Related Data.....	10
Meteorology (Weather & Transport Patterns) .....	11
Geography and Topography (Mountain Ranges or Other Air Basin Boundaries).....	12
Jurisdictional Boundaries.....	12
Other Relevant Information .....	12
Conclusion .....	13

# Introduction

## Designation Boundary Recommendations

This Technical Support Document (TSD) provides the basis for the source specific sulfur dioxide (SO<sub>2</sub>) National Ambient Air Quality Standard (NAAQS) air quality designation boundary recommendations for the Public Service Company of Colorado - Pawnee Power Plant and Colorado Springs Utilities - Martin Drake Power Plant. These sources must be designated pursuant to “Round 2” of EPA’s Data Requirements Rule (DRR) (80 FR 51056). The Colorado Department of Public Health and Environment (CDPHE) Air Pollution Control Division (Division) recommended, and the U.S. Environmental Protection Agency (EPA) proposed, to designate specific areas surrounding both power plants as unclassifiable regarding compliance with the 1-hr SO<sub>2</sub> NAAQS. These areas will be subject to future additional designation requirements under the Data Requirements Rule (DRR).

## EPA Guidance on SO<sub>2</sub> Designations

Pursuant to the letter EPA sent to Governor Hickenlooper on February 16, 2016, the Division is providing additional information that EPA should consider prior to finalizing these designations. In the attached Technical Support Document of EPA’s letter, it is noted that updated designations guidance issued by EPA through a March 20, 2015 memorandum supersedes earlier designation guidance and identifies factors that the EPA intends to evaluate in determining area boundaries under the 2010 SO<sub>2</sub> NAAQS. These five factors are:

- 1) Air quality characterization via ambient monitoring or dispersion modeling results;
- 2) Emissions-related data;
- 3) Meteorology;
- 4) Geography and topography;
- 5) Jurisdictional boundaries.

In this TSD, CDPHE considers each of these five factors along with other relevant information regarding each of the detailed area boundary recommendations for Pawnee and Drake Power Plants.

## Future EPA SO<sub>2</sub> Designations Process

The DRR establishes an SO<sub>2</sub> emissions applicability threshold of 2,000 tons per year (tpy) that identifies priority sources subject to a source specific SO<sub>2</sub> designation process. States have three options under the DRR to characterize current air quality in areas with large SO<sub>2</sub> sources (2,000 tpy or greater): (1) establish federally enforceable emission limits (under 2,000 tpy) by January 13, 2017; (2) conduct air quality modeling by January 13, 2017; or (3) begin operating an appropriate monitoring network by January 1, 2017. The EPA will promulgate Round 3 SO<sub>2</sub> designations (by Court Order) no later than December 31, 2017 for areas with sources that are modeled. For sources that are monitored and any remaining undesignated areas, EPA will promulgate Round 4 SO<sub>2</sub> designations (by Court Order) no later than December 31, 2020. The Pawnee Power Plant and Martin Drake Power Plant will be subject to future DRR promulgations.

## Analysis of Source Specific Designations

This section of the TSD analyzes each of the five factors set forth in EPA's March 20, 2015 memorandum for the Pawnee Power Plant and the Martin Drake Power Plant. Boundary recommendations are presented at the conclusion of each five factor analysis.

### Public Service Company of Colorado - Pawnee Power Plant

#### Air Quality Characterization: Ambient Monitoring or Dispersion Modeling Results

As EPA noted previously, the nearest ambient SO<sub>2</sub> monitor in Adams County is over 60 miles away to the southwest. Due to the fact that there has never been ambient SO<sub>2</sub> monitoring in Morgan County, there is not any current or historical ambient monitoring for the Pawnee Power Plant available. Therefore, refined dispersion modeling is currently being conducted for this facility in consultation with the source and EPA.

For DRR modeling, EPA recommends that the model domain be based on the determination of significant concentration gradients and distance from source. The SO<sub>2</sub> Modeling Technical Assistance Document (TAD) states the following:

“Concentration gradients associated with a particular source will be generally largest between the source and the distance to the maximum ground level concentrations from the source. Beyond that distance, gradients tend to be smaller and more spatially uniform...a general guideline that the distance between a source and its maximum ground level concentration is generally **10 times the stack height**<sup>1</sup> in flat terrain. However, the potential influence of terrain can impact the location and magnitudes of significant concentration gradients. The use of significant concentration gradients can help inform the decision on the size of the modeling domain and sources to consider for modeling.” The Division notes that 10 times the stack height of Pawnee Power Plant is: 550 feet x 10 = 5,500 feet (roughly 1 mile or 1.7 kilometers (km)). This radius would be considered too narrow considering the meteorological data, including potential terrain influences, and other nearby sources in the area.

EPA's March 1, 2011 Memo, which is referenced in the TAD, also states the following:

“Even accounting for some terrain influences on the location and gradients of maximum 1-hour concentrations, these considerations suggest that the emphasis on determining which nearby sources to include in the modeling analysis should focus on the area **within about 10 kilometers of the project location**<sup>2</sup> in most cases. The routine inclusion of all sources within 50 kilometers of the project location, the nominal distance for which AERMOD is applicable, is likely to produce an overly

---

<sup>1</sup> EPA SO<sub>2</sub> NAAQS Designations Modeling Technical Assistance Document, page 8.

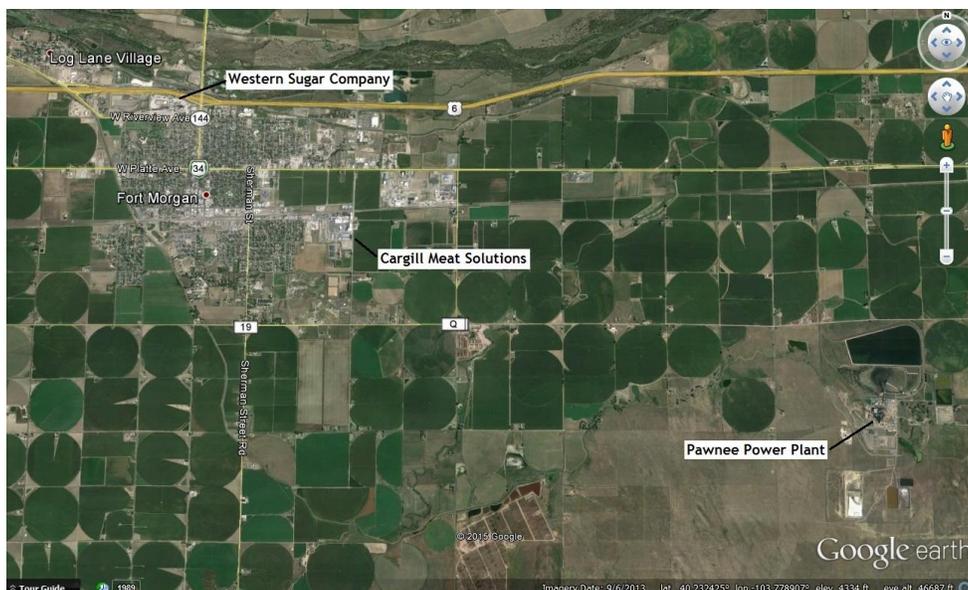
<sup>2</sup> Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO<sub>2</sub> National Ambient Air Quality Standard, March 1, 2011, page 16.



conservative result in most cases.” Based on the TAD and this Memo, the Division believes the modeling analysis should focus on the area within a 10 km radius of the Pawnee Power Plant.

Figure 1 identifies SO<sub>2</sub> sources in the vicinity of the Pawnee Power Plant. Cargill Meat Solutions is about 5.4 miles (8.7 kilometers) and Western Sugar Company is about 7.3 miles (11.8 kilometers) from the Pawnee Power Plant respectively.

**Figure 1: Significant SO<sub>2</sub> Sources in Morgan County**



When CDPHE initially submitted Round 2 designation recommendations on September 18, 2015, the appropriate area for air quality characterization had not yet been determined. Upon review of the EPA TAD and Memo, CDPHE proposes that a radius of 10 km captures potential terrain influences and the affected populations in the town of Brush and a portion of the city of Fort Morgan. The Division anticipates that the refined modeling process to be completed in 2016, which will then provide additional information for the attainment status of the Pawnee Power Plant.

### Emissions-Related Data

#### *Pawnee Power Plant - SO<sub>2</sub> Emissions Analysis*

The March 2015 Consent Decree (CD) identified subject sources for inclusion in Round 2 designations based on 2012 continuous emissions monitoring data. In 2012, the Pawnee Power Plant had no SO<sub>2</sub> controls aside from firing low-sulfur coal<sup>3</sup>; consequently, the facility’s SO<sub>2</sub> emissions were over the CD’s applicability threshold of 2,600 tpy along with an annual average emission rate exceeding 0.45 lbs/MMBtu. In 2014, pursuant to Colorado’s Regional Haze State Implementation Plan (SIP)

<sup>3</sup> The Pawnee Power Plant generally fires sub-bituminous coal that has an average sulfur content ranging from 0.24 to 0.42 percent from the Powder River Basin area in Wyoming.

(approved by EPA in January 2013), the Public Service Company of Colorado (PSCo) installed and commenced operation of a semi-dry SO<sub>2</sub> scrubber system (lime spray dryer) at the Pawnee Power Plant. Pursuant to the Regional Haze SIP, the scrubber system is subject to a federally enforceable (allowable) permit limitation of 0.12 lbs/MMBtu based on a 30-day rolling average emission rate. Table 1 provides SO<sub>2</sub> emissions data for the Pawnee Power Plant that is reported to the EPA Air Markets Program Data system. As indicated in the below table, the recently installed semi-dry SO<sub>2</sub> scrubber has resulted in a **significant SO<sub>2</sub> emission reduction of about 86%**.

**Table 1: Pawnee Power Plant SO<sub>2</sub> Emissions (updated with 2015 emissions)**

Year	Number of Months Reported	SO <sub>2</sub> Annual Emissions (tons/year)	SO <sub>2</sub> Annual Emission Rate (lb/MMBtu)
2012	12	13,510	0.76
2013	12	12,467	0.72
2014	12	5,508*	0.34
2015	12	1,810	0.08

\*SO<sub>2</sub> lime spray dryer controls started in August 2014

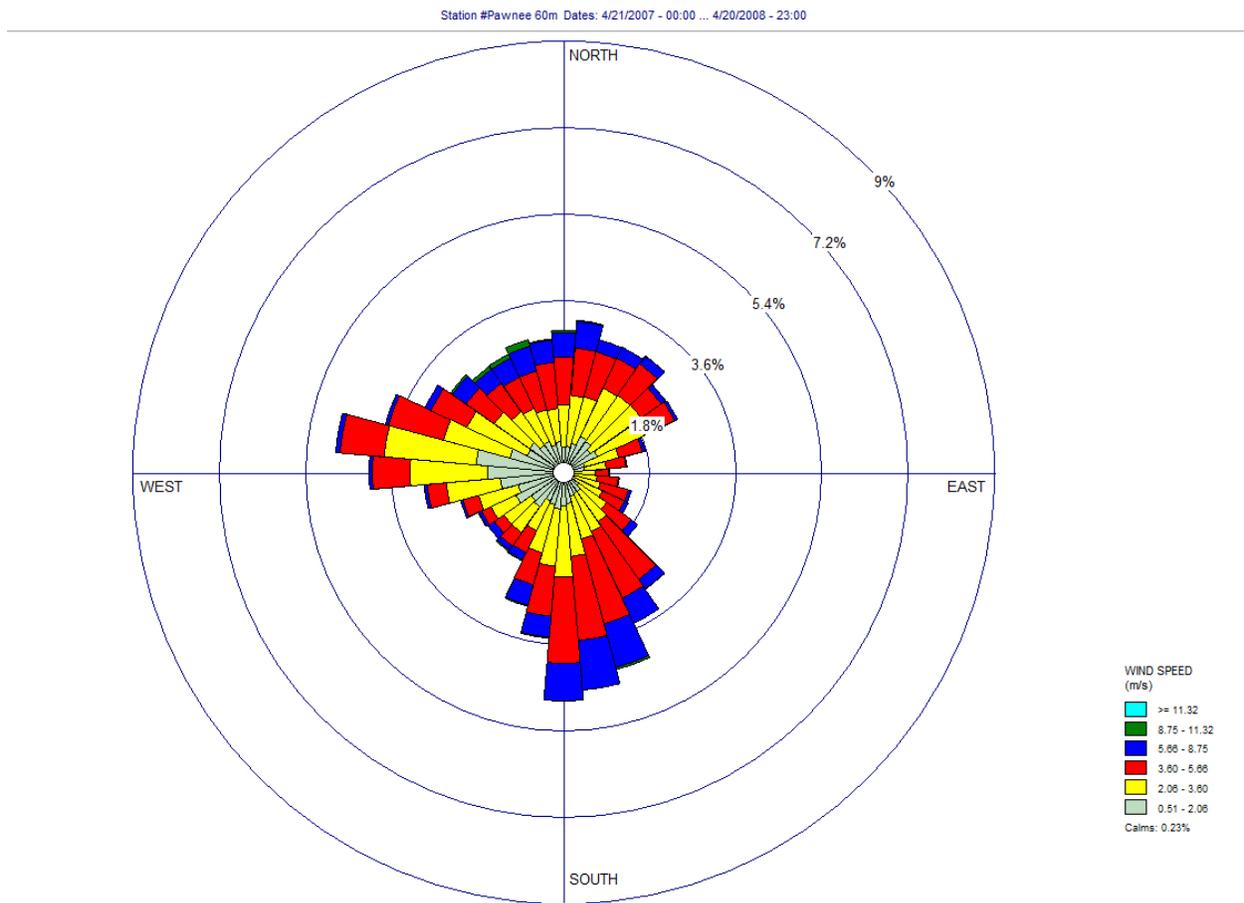
### *SO<sub>2</sub> Emissions in Morgan County*

The most current comprehensive emission inventory available from Division records for Morgan County indicates that over 99% of the 2013 SO<sub>2</sub> emissions in the county are from point sources. As indicated above, the Pawnee Power Plant began operating a semi-dry scrubber system in August of 2014 that will significantly lower SO<sub>2</sub> emissions in the future. The Pawnee Power Plant comprised 98.7% of the SO<sub>2</sub> emissions in Morgan County (as of 2013).

### **Meteorology (Weather & Transport Patterns)**

The local winds are a combination of the mountain/valley winds in the South Platte and Beaver Creek Valleys and large scale weather features (synoptic winds). During the night and early morning hours the down valley winds in the South Platte River or Beaver Creek Valleys dominate. The winds in Beaver Creek Valley are most likely enhanced by synoptic conditions. The annual 60-meter windrose, which is similar to winds at plume height, is depicted in Figure 2 below. Generally, over a year, a variety of synoptic type forcings cause winds to flow from either the west through northeast or from the south through southeast most of the time.

**Figure 2: Annual 60-meter Windrose (Pawnee Power Plant meteorological data)**



### Geography and Topography (Mountain Ranges or Other Air Basin Boundaries)

The Pawnee Power Plant is located on the southern slope of the South Platte River Valley and on the west side of Beaver Creek. Near this location the South Platte River turns from the southeast to the northeast and continues in this direction into Nebraska. Beaver Creek flows from the south to the north into the South Platte River. Outside of the South Platte River Valley the terrain gently slopes up, north to the Cheyenne Ridge and south to Monument Ridge.

### Jurisdictional Boundaries

The Pawnee Power Plant is not located within any defined town or city boundaries, but rather within the rural areas of Morgan County. The closest town is Brush (population 5,501 as of 2013), which is located approximately three miles (4.8 km) to the northeast. The closest city is Fort Morgan (population 11,407 as of 2013), located approximately five miles (8 km) to the northwest. As of 2013, the population of Morgan County was 28,404 people<sup>4</sup>. The populations of these two nearby communities comprise about 60% of Morgan County’s population.

<sup>4</sup> All population statistics are from the United States Census Bureau.

## Other Relevant Information

None.

## Conclusion

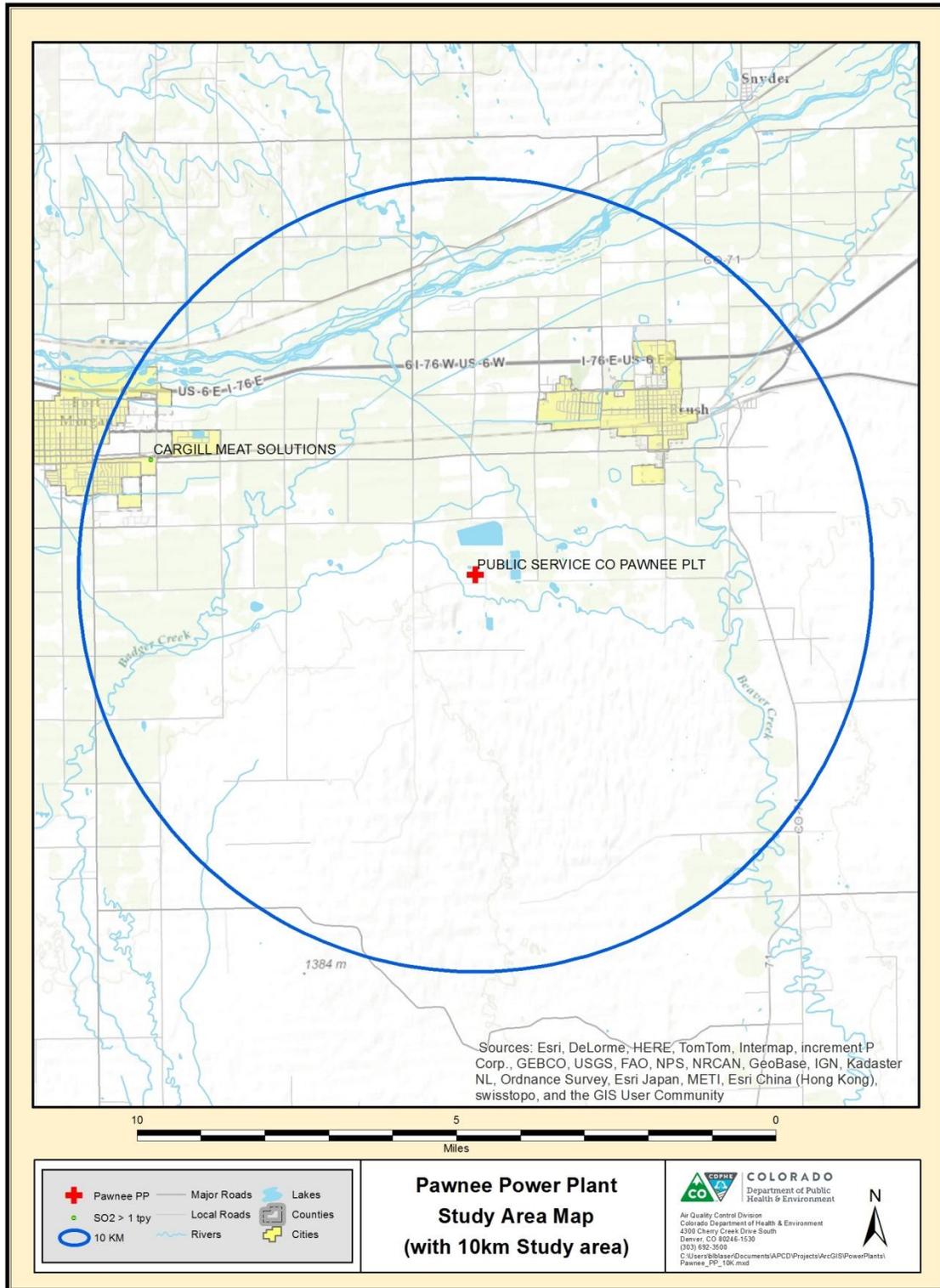
Upon consideration of the five factors, CDPHE recommends applying a radius of 10 km (6.2 miles) around the Pawnee Power Plant as the boundary for the unclassifiable area designation, shown in Figure 3. This is based on the following information:

- EPA's Modeling TAD and March 1, 2011 Memo distance guidelines indicate that a 10 km radius normally establishes an appropriate modeling domain. SO<sub>2</sub> modeling for the area around the Pawnee Power Plant will not be completed before the court ordered deadline for making Round 2 designations. No SO<sub>2</sub> ambient monitoring data is available for this area. Without completed modeling results or ambient monitoring data, it is appropriate to base the SO<sub>2</sub> area boundary on the 10 km radius outlined in EPA's March 1, 2011 Memo;
- SO<sub>2</sub> emissions from the Pawnee Power Plant have been significantly reduced since the installation of the semi-dry lime scrubber in 2014. Emissions from Cargill Meat Solutions are captured by the 10 km radius. The Western Sugar Cooperative facility is located further than 10 km from the Pawnee Power Plant, and has significantly lower emissions than the power plant;
- There are no significant meteorological, geographical or topographical features that make the 10 km radius an inappropriate area designation boundary;
- The nearby town of Brush and the affected areas of the city of Fort Morgan closest to the Pawnee Power Plant are included in this proposed radius<sup>5</sup>.

---

<sup>5</sup> Town and city boundaries applicable as of April 2016.

Figure 3: Pawnee Power Plant Boundary Recommendation



## Colorado Springs Utilities - Martin Drake Power Plant

### Air Quality Characterization: Ambient Monitoring or Dispersion Modeling Results

#### SO<sub>2</sub> Ambient Monitoring in El Paso County

Currently, there are four SO<sub>2</sub> monitoring locations in operation in Colorado, of which one is located in Colorado Springs at Highway 24 and 8<sup>th</sup> Street (AQS-ID: 08-041-0015). This site might be relocated in the future, depending on the results of any final modeling impact analysis and site availability.

Historical monitoring data for SO<sub>2</sub> in Colorado Springs (and the rest of the state) never approached the level of any SO<sub>2</sub> standard prior to the installation of the Highway 24 monitor in January 2013. There has been substantial SO<sub>2</sub> monitoring in the Colorado Springs area, with up to ten monitors operating during different periods between 1988 and 2007. Table 2 below details the concentrations at the Highway 24 monitor over the past three years. This monitor has noted four total exceedances of the 75 ppb standard since monitoring began in 2013 through the end of 2015. However, these exceedances do not indicate nonattainment because the 99<sup>th</sup> percentile value through the end of 2015 remains below the 75 ppb 1-hour NAAQS, with the 2013-2015 design value at 56 ppb. The last exceedance was in March 2015.

**Table 2: CDPHE Highway 24 Monitor Data (2013 - present)**

AQS Site ID	Site "Name"	Address	Year	1st Max 1-hour (ppb)	2nd Max 1-hour (ppb)	99 <sup>th</sup> % 1-hour (ppb)
08-041-0015	Highway 24	690 W. Highway 24	2013	99	81	58
			2014	83	57	57
			2015	87	70	53
			2013-2015	n/a	n/a	56

#### Dispersion Modeling

The Division concluded that there was no available representative meteorological dataset for the Drake Power Plant in September 2015 (and provided EPA with additional information in December 2015). Colorado Springs Utilities (CSU) began gathering representative meteorological data in October 2015. At least one year of meteorological data will be collected. Subsequently, after the quality assurance process is completed for the entire year of acquired meteorological data, modeling is anticipated to span about six months. Consequently, the Division anticipates the final impact analysis to be complete in 2017.

#### Emissions-Related Data

##### *Martin Drake Power Plant - SO<sub>2</sub> Emissions Analysis*

CSU is currently in the process of installing SO<sub>2</sub> controls on Units 6 and 7 to comply with Regional Haze SIP emission limits effective December 31, 2017. The scrubber for Drake Unit 7 is installed and in testing phases while the scrubber for Unit 6 will begin operational testing at the end of 2016. Emissions from the Drake Power Plant are



shown in Table 3 below (from the EPA Air Markets Program Data system). Additionally, the CSU Board voted January 20, 2016 to decommission Drake Unit 5 by December 31, 2017. CSU plans to accept a federally enforceable plant-wide SO<sub>2</sub> emission limit of less than 2,000 tons per year per the DRR, effective on or before January 13, 2017. This limit will reduce actual SO<sub>2</sub> emissions by approximately 2,800 tons in the year 2017 (based on initial pre-application meetings with the Division).

**Table 3: Martin Drake Power Plant SO<sub>2</sub> Emissions**

Year*	Unit	Number of Months Reported	SO <sub>2</sub> Annual Emissions (tons/year)	SO <sub>2</sub> 30-day Rolling Emission Rate (lb/MMBtu)
2012	5	12	1,108	0.52
2013		12	982	0.49
2015		12	580	0.42
2012	6	12	1,680	0.55
2013		12	1,595	0.50
2015		12	1,448	0.47
2012	7	12	2,004	0.56
2013		12	2,004	0.51
2015		12	2,004	0.53
2012	All	12	4,707	0.56
2013		12	4,580	0.51
2015		12	3,960	0.45
2015**	6 & 7	12	3,452	0.47

\*Drake Power Plant experienced a fire event that resulted in the units not operating for various periods of time. Unit 6 was down for nine weeks. Unit 5 was down for 16 weeks. Therefore, 2014 is not included in recent emission evaluations.

\*\*This row is included since Unit 5 operated at 70% of average operating hours (years 2006-2013) in the year 2015 to give perspective regarding the operation of Units 6 and 7.

### SO<sub>2</sub> Emissions in El Paso County

The most current comprehensive emission inventory available from Division records for El Paso County indicates that approximately 99% of the 2013 SO<sub>2</sub> emissions in the county are from point sources. The Nixon Power Plant, approximately 15 miles away from Drake, is the only other significant SO<sub>2</sub> source in El Paso County, and contributed about 46% of point source SO<sub>2</sub> emissions in 2013 while Drake contributed 53%. As discussed in the modeling section, air quality impacts from the Drake Power Plant have not been estimated due to the lack of available representative meteorological data. However, preliminary analysis indicates that SO<sub>2</sub> emission concentration gradients and potential hotspots from the Drake and Nixon Power Plants do not overlap because of geographical distance and terrain features that result in each plant existing in separate airsheds with regard to SO<sub>2</sub>.

### Meteorology (Weather & Transport Patterns)

As noted, the Division determined there is not currently available representative meteorological datasets for the transport and dispersion conditions at the Drake Power Plant. EPA agreed with this determination in its February 16, 2016 letter and

associated draft technical support document. The Division anticipates representative meteorological data will be collected by the end of 2016 that will then be quality assured to be used for air dispersion modeling purposes along with allowing for the development of a representative annual wind rose for the Drake Power Plant.

### Geography and Topography (Mountain Ranges or Other Air Basin Boundaries)

Fountain Creek and Monument Creek converge just to the west of the Drake Power Plant, which directly impact the plume and wind flows. There are two prominent terrain features that affect wind conditions at the Drake Power Plant: Pikes Peak approximately two miles to the west and the Palmer Divide approximately five miles to the north.

### Jurisdictional Boundaries

Clearly defined legal boundaries can be used to determine an appropriate geographic area regarding potential NAAQS impacts from the Martin Drake Power Plant. The city of Colorado Springs is the largest city in Colorado by land area, encompassing 194 square miles, and the second largest in population (445,830 as of 2014<sup>6</sup>). Many scattered unincorporated county designated areas are enclosed within city limits. The Drake Power Plant is located at the western edge of downtown Colorado Springs. Therefore, it is appropriate to examine roadway intersections as major defining lines for the designation boundary since city limits extend much farther east than the areas that monitoring, meteorological and topographical analyses suggest are being impacted. The Division also considers the city of Manitou Springs to be a clearly defined legal boundary that should be included in the designation area due to Fountain Creek airflows and potential impacts in the areas of the foothills.

### Other Relevant Information

The Division used CDPHE's public-facing Community Health Equity Map (2010-2014 data)<sup>7</sup> to examine census-tract level geographic disparities for selected social determinants of health, including income/poverty levels and race/ethnicity population percentages, and key health conditions and outcomes, including asthma-related hospitalization rates, heart disease mortality rates, and preventable conditions. An example of these maps (income/poverty rates) is shown below in Figure 4. Several areas in the southern area of the city clearly indicate above average poverty rates, increased minority populations as well as higher than state averages for asthma-related hospitalization rates, heart disease mortality rates, and preventable condition hospitalization rates. The Division also reviewed population density using this Map to incorporate appropriate potentially affected populations and assess population density in the mountains west of Manitou Springs and Colorado Springs. This information is important in considering boundary area recommendations for a source located in an urbanized area with varied population factors.

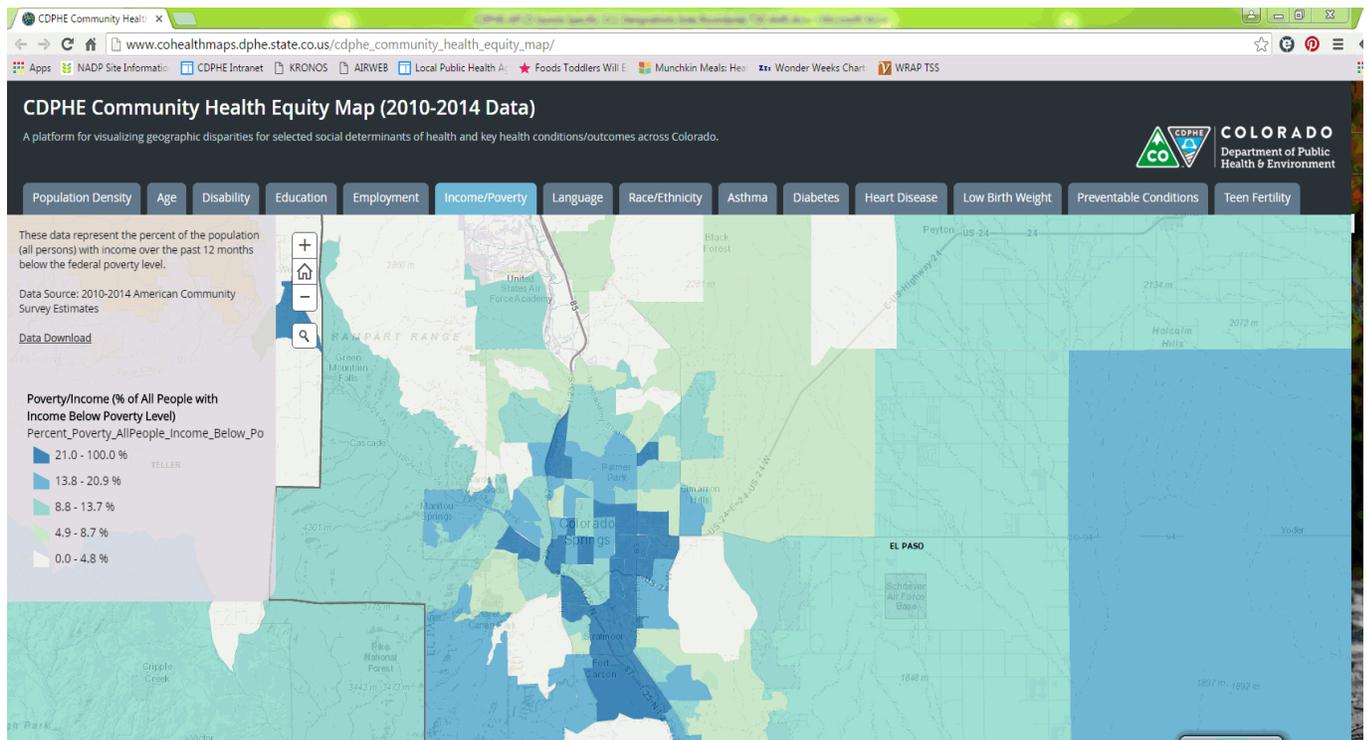
---

<sup>6</sup> All population statistics are from the United States Census Bureau.

<sup>7</sup> [http://www.cohealthmaps.dphe.state.co.us/cdphe\\_community\\_health\\_equity\\_map/](http://www.cohealthmaps.dphe.state.co.us/cdphe_community_health_equity_map/) -



Figure 4: CDPHE Community Health Equity Map Example (Income/Poverty Rate)



## Conclusion

Upon consideration of the five factors and other relevant information, CDPHE recommends a boundary around a portion of the city of Colorado Springs, including enclosed unincorporated county areas, bounded to the north by East Woodmen Road, North Academy Boulevard, and city limits, to the east by North/South Powers Boulevard, and to the south and west by city limits, with the addition of the ‘census designated place’ termed “Stratmoor” bounded by South Academy Boulevard for the designation boundary, shown in Figure 5<sup>8</sup>. This conclusion is based on the following information:

- Preliminary monitoring and emissions-related data shows that this boundary incorporates the primary source (Martin Drake Power Plant). Emissions from the only other notable SO<sub>2</sub> source in the vicinity are in a separate airshed;
- Meteorological and topographical information indicate that potential impacts would be contained within this boundary;
- The mountains that generally begin just to the west of the cities of Colorado Springs and Manitou Springs constitute a geographical boundary limit;
- Basing the area boundary on the guideline 10 km radius for a modeling domain is not appropriate because of the complex terrain and urban demographics;
- Affected populations, including sensitive subpopulations, within the city of Colorado Springs, including those living in unincorporated enclosed county areas, and the city of Manitou Springs are located within this boundary. EPA has previously approved area boundaries for other Round 2 SO<sub>2</sub> designation

<sup>8</sup> City boundaries applicable as of April 2016.

boundaries that align with roadways, rather than the outermost jurisdictional boundaries of a unit of local government<sup>9</sup>.

---

<sup>9</sup> North Dakota Mercer County (portion) SO<sub>2</sub> Designation: road boundaries specified in Technical Support Document (February 16, 2016)



Figure 5: Martin Drake Power Plant Boundary Recommendation

