AIR QUALITY IMPACT ANALYSIS REPORT
CRAIG STATION 1-HR SO_2 DISPERSION MODELING

Prepared for:

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1.0 Introduction

On behalf of Tri-State Generation & Transmission Association, Inc. (Tri-State), CB&I is submitting this Air Dispersion Modeling Report to the Colorado Department of Public Health and Environmental (CDPHE) Air Pollution Control Division (APCD) to characterize air quality for the 2010 1-hr SO_2 National Ambient Air Quality Standards (NAAQS) at the Craig Generating Station located near Craig, CO.

Air dispersion modeling for the 1-hour averaging time for sulfur dioxide (SO_2) was conducted following guidance from the U.S. Environmental Protection Agency (USEPA) and the Colorado Department of Public Health and Environment (CDPHE). The most current version (15181) of the American Meteorological Society/USEPA Regulatory Modeling System (AERMOD) was used for the air quality impact analysis for the Craig Station 1-hr SO_2 NAAQS. The modeling protocol was submitted to CDPHE in September 2016.

2.0 Facility Details

Craig Station is located in northwestern Colorado, Moffat County, approximately 2.5 miles southwest of Craig near State Highway 13. The facility is located on approximately 1,120 acres. Craig Station has been in operation since 1979 and has been modified in the years since including a large environmental project upgrade in 2003 and 2004 to mitigate particulate matter and sulfur dioxide emissions on Units 1 and 2. Craig Station employs approximately 300 people. The current plant operations are permitted under Title V permit No. 96OPMF155 and a series of construction permits, including Unit 3 Construction Permit No. 12MF322-1.

Craig Station is a coal-fired power plant, with the capability to burn natural gas or fuel oil for startup, shutdown or flame stabilization. Craig Station has a total net electric generating capacity of 1,304 megawatts (MW), consisting of three units. Units 1 and 2 are rated at 4,318 MMBtu/hr each and were first operational in 1980 and 1979, respectively. Unit 3 construction was initiated in 1979 and is rated at 4,600 MMBtu/hr. Units 1 and 2 are each equipped with fabric filter baghouses to control particulate matter (PM), wet limestone flue gas desulfurization (FGD) systems to control SO_2, and low nitrogen oxides (NO_X) dual register burners with over-fired air to reduce NO_X. A baghouse system was installed for Unit 3 to control PM, a dry lime scrubber system is used to control SO_2, low-NO_X burners with over-fired air control NO_X, and an activated carbon injection (ACI) system is used to control mercury emissions in Unit 3. Other emission sources include cooling towers, coal handling systems, ash handling systems, and limestone handling systems. The only source of SO_2 emissions are the three boiler units.

Details regarding the SO_2 sources, emissions and modeling parameters are provided in Section 4.0 through Section 4.0. Maps of the ambient air boundary and source locations are included in Attachment A.

3.0 Air Quality Impact Analysis Methodology

This Air Quality Impact Assessment (AQIA) submitted for the Craig Station 1-hour averaging time for sulfur dioxide (SO_2) and was performed using dispersion modeling procedures and methods outlined in the October 2016 modeling protocol and in accordance with current guidance – USEPA's *SO_2 NAAQS Designations Modeling Technical Assistance Document* (TAD).

3.1 Applicability

The AQIA characterizes the emissions from the Craig Station and determines whether or not the modeled emissions cause or contribute to an exceedance of the respective NAAQS. The three-year average of the 99^{th} percentile of the yearly distribution of the 1-hr daily maximum SO_2 concentrations was obtained from the model and added internally in the model to the background concentration as described in Section 3.9. This was then compared to the NAAQS for the 1-hr averaging period to determine the attainment status of the area. It was not necessary to include cumulative nearby sources since there are no major SO_2 sources in the surrounding area and only the 1-hr SO_2 impacts were evaluated.

3.2 Model Selection

The most current version (15181) of the American Meteorological Society/USEPA Regulatory Modeling System (AERMOD) was used in the modeling analysis for Craig Station. The AERMOD model is a USEPA-approved model that was introduced to incorporate 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. The modeling was performed using the regulatory default options.

3.3 Building Downwash

Building downwash was considered for those buildings onsite which may interfere with pollutant dispersal associated with the three units. AERMOD incorporates the Plume Rise Model Enhancements (PRIME) algorithms for estimating enhanced plume growth and restricted plume rise for plumes affected by building wakes.[1] Direction-specific structure dimensions and the dominant downwash structure parameters used as input to AERMOD will be determined using BPIP-PRIME (BPIP) software (version 04274).

All nearby buildings were included in the model. The building locations, dimensions, and sources are shown in Attachment B and the BPIP electronic files are included in Attachment G.

[1] L.L. Schulman, D.G. Strimaitis, and J.S. Scire. "Development and Evaluation of the Prime Plume Rise and Building Downwash Model," AWMA 50 (2000): 378-390.

3.4 Urban or Rural Dispersion Option

AERMOD contains several options for urban dispersion that were not utilized for these analyses due to the rural characteristics of the area in which the facility is located. The USEPA prescribed Auer land use classification procedure be used to determine the appropriate model setting. The procedure requires a land use evaluation of the area surrounding the proposed facility within a three kilometer (km) radius. A United States Geological Survey (USGS) land use and land cover map of the area was used for the evaluation. The surrounding area is predominately rural (less than 50 percent of land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential). Given the facility's predominantly rural setting, all sources were modeled as rural sources.

3.5 Land Use and Terrain

A review of the land use within a 3 km radius of the proposed facility location was performed using the USGS land use map of the area in accordance with the Auer land use classification procedure. The appropriate USGS maps was reviewed to determine if terrain in the vicinity of the site would impact modeled concentrations.

The USGS maps indicate that terrain within ten kilometers of the proposed site is characterized by areas of higher elevation relative to base elevation of the emission sources. The terrain elevations for the receptors were developed using the AERMAP program. The digital terrain data (i.e., 1/3 arc-second) was obtained from the National Elevation Dataset (NED) developed by the USGS. The latest USEPA AERMOD Implementation Guide (updated March 19, 2009) was followed in processing the terrain data. Onsite sources utilized a map generated from the facility instead of the USGS data.

3.6 Deposition Modeling of SO_2

Deposition of SO_2 from the three units was not considered in this analysis.

3.7 Meteorology

Dispersion modeling was conducted using surface meteorological data collected at the National Weather Service (NWS) Craig-Moffat County station (station number 24046) and upper air data collected at Grand Junction, CO (station number 23066). These stations are the closest meteorological data stations to the Craig Station and are representative of the Craig Station topography. Three years of the most recent (2013, 2014 and 2015) pre-processed (AERMET version 15181) hourly surface meteorological data was utilized in the model. A wind rose for the metrological data utilized is included in Attachment C and the meteorological data is included electronically in Attachment G.

3.8 Receptors

Receptors were placed so that the maximum offsite ground-level concentrations could be determined. A Cartesian system (UTM) was implemented for all receptors, as well as for the property boundary and emission sources. Per CDPHE modeling guidelines, receptors were placed as listed in Table 3-3 below.

Distance	Receptor Spacing
Fenceline	50 m
Fenceline to 1 km	100 m
1 km to 3 km	250 m
3 km to 10 km	500 m

Table 3-1: Receptor Grid Spacing

The initial 10 km modeling grid indicated that the location of the maximum concentration was in the coarse grid (i.e. 500 m spacing). An additional receptor grid, with 100 m spacing, was added near the location of the maximum concentration value to ensure the true maximum concentration was determined.

Receptors were omitted from areas within the facility property, as it is inaccessible to the general public, and therefore, not considered ambient air. The modeled receptor grid is shown in Attachment D. Receptor elevations were obtained using the AERMOD preprocessor, AERMAP. Digital elevation maps of the receptor grid were obtained through AERMOD and processed to obtain the elevations at each receptor point.

3.9 Background Ambient Concentrations

NAAQS compliance demonstrations require background ambient concentrations to be added to the cumulative impact from onsite and off-property sources. Tri-State believed that the most representative background monitor was the Williams Willow Creek monitor, which has only one year of data (2012). However, after discussions with CDPHE, Tri-State agreed that the Golden Energy – Holcim, Florence (Holcim) monitor, also with only one year of data (September 2005 through September 2006), was more conservative for use in this analysis. The justification for the background concentration is described in detail in Section 3.9 of the modeling protocol, submitted in December 2016.

CDPHE provided Tri-State with the temporally varying background 1-hr SO_2 concentrations (contained in Attachment E) based on the 99^{th} percentile monitored concentrations by hour of day and season. These values were inputted into the model using the source pathway BACKGRND SEASHR. The temporally varying background concentrations were processed internally in the model and combined in the model with the impacts from the Craig Station sources to provide the overall 99^{th} percentile impact of Craig Station plus background. The justification for using the Holcim seasonal adjusted hourly data was provided in the modeling protocol.

4.0 Craig Station Emission Sources

The Craig Station facility consists of three boilers; Unit 1, Unit 2 and Unit 3. Actual hourly data for emission rate, stack temperature and stack gas flow rate were used in the model using the HOUREMIS keyword. The hourly data was obtained from the Craig Station continuous emissions monitor system as reported to the USEPA Clean Air Markets Division for the last three years (2013, 2014 and 2015), which were concurrent with the meteorological data.

The three units were modeled as point sources. The static parameters of each unit included stack height, stack diameter, and location, which are listed in Table 4-1. The stack locations are shown in Attachment A.

Source	Coordinates		Stack Parameters	
	X	Y	Height (m)	Diameter (m)
Unit 1	280423	4482344	182.88	7.62
Unit 2	280317	4482346	182.88	7.62
Unit 3	280235	4482300	182.88	7.62

Table 4-1: Stack Parameters and Location

The hourly emission files utilized in the model are included in Attachment G electronically with this report.

5.0 Results and Conclusions

NAAQS compliance was demonstrated by comparing the design modeled concentration and adding the background concentration for 1-hr SO_2. The background concentration file was added to the modeling source code; therefore, the value calculated by AERMOD includes contributions from both Craig Station and background. The results are shown in Table 5-1. Model results are displayed graphically in Attachment F, and the electronic modeling files are included in Attachment G. The modeling results demonstrate that the 99th percentile of 1-hour daily maximum SO_2 concentrations, averaged over 3 years are below the NAAQS.

Pollutant	Standard	Design Value	Modeled Impact (µg/m^3)	Background (µg/m^3)	Combined Impact (µg/m^3)	NAAQS (µg/m^3)	X Location of Max (m)	Y Location of Max (m)
SO_2	1-hour	H4H	170.42	Included	170.42	196	282361.95	4477622.03

Table 5-1: NAAQS Compliance Model Results Summary

5.1 Other Sources

There are no other emission sources within 10 km of the Craig Station that would contribute to the maximum SO_2 impact from Craig.