State of Utah

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DAQE-MN125290003-12

M E M O R A N D U M

TO: John Jenks, NSR Engineer

FROM: Tom Orth, Air Quality Modeler

DATE: March 14, 2012

SUBJECT: Modeling Analysis Review for the Sevier Power Company Natural Gas Power Plant, Sigurd, Utah

This is a New Major Prevention of a Significant Deterioration (PSD) Source.

I. OBJECTIVE

Sevier Power Company (SPC or Applicant) has submitted a Notice of Intent (NOI) for the proposed construction of two power generation units at a site near Sigurd, Utah. The facility will consist of two combustion turbines and one heat recovery steam generator (HRSG) with a gross capacity of 580 MW. The emissions associated with the construction of this unit constitute a major modification to a Prevention of Significant Deterioration (PSD) source subject to PSD permitting rules. The rules require the Applicant to include an air quality impact analysis (AQIA) of the proposed project's impact on federal air quality standards and air quality related values, as part of a complete NOI.

This report prepared by the New Source Review (NSR) modeling staff contains a review of the Applicant's AQIA including the methodology, data sources, assumptions, and modeling results for comparison with State and Federal air quality standards. The AQIA documents reviewed and referenced in this report include the:

> NOI and Prevention of Significant Deterioration Air Quality Application for 580 Megawatt Combined-cycle Power Plant, Sevier Power Company, Volumes 1&2, submitted September 8, 2011.
>
> NOI for Sevier Power Company Project Number N12529-0003 – Addendum, submitted January 19, 2012.

This report outlines the methodology used in the dispersion modeling analysis of emissions of criteria and hazardous air pollutant proposed in the NOI and the subsequent modeling results. It makes no

determination with respect to National Ambient Air Quality Standards (NAAQS) or Utah Division of Air Quality (UDAQ)–Toxic Screening Levels for Hazardous Air pollutants or compliance thereof.

II. APPLICABLE RULES AND ANALYSES

A. Utah Air Quality Rules

The UDAQ has determined that the Applicant's NOI is subject to the following rules for conducting an AQIA:

R307-401	Permits: New and Modified Sources
R307-405	Permits: Major Sources Located in Attainment or Unclassified Area (PSD)
R307-406-2	Visibility – Source Review
R307-410-3	Use of Dispersion Models
R307-410-4	Modeling of Criteria Pollutant Impacts in Attainment Areas
R307-410-5	Documentation of Ambient Air Impacts for Hazardous Air Pollutants (HAPs)

B. Applicability

The proposed increases in emissions of NO_X, CO, PM_{10} and $PM_{2.5}$ exceed the emission thresholds outlined in R307-406-5 and R307-410-4. Therefore, an AQIA consistent with the requirements of R307-405-6, R307-406-2, and R307-410-3 was submitted as part of the Applicant's NOI. R307-410-3 establishes the U. S. Environmental Protection Agency (US EPA) – Guideline on Air Quality Models as a formal basis for defining the scope of the analysis, as well as the model's construction. The results of the AQIA are required to demonstrate the proposed project's impact on state and federal air quality standards, acceptable levels of impact, and action triggering thresholds referenced or listed in R307-401-6(2), R307-401-6(3), R307-403-3(1), R307-403-5(1)(a), R307-405-4(1), R307-405-6(2), and R307-405-6(6). Annual emissions for criteria pollutants requiring an AQIA are listed in Table 1. Dispersion modeling was also required for formaldehyde since the proposed emissions exceeded the thresholds outlines in R307-410-5.

Table 1: Proposed Annual Emissions for SPC Unit 1 and 2

Criteria Pollutants	Proposed SPC Total (TPY)	AQIA Trigger Level (TPY)	AQIA Required
NO_X	168.3	40	Yes
SO_2	25.7	40	No
PM_{10}	106	15	Yes
$PM_{2.5}$	106	15	Yes
CO	577	100	Yes
Formaldehyde	1.79 (0.41 lb/hr)	0.11 lb/hr	No

C. Required Analyses

R307-405 requires the Applicant to perform a pre-construction modeling analysis for all pollutants emitted in a significant quantity. The purpose of the analysis is to determine if the extent of the source's impact is significant enough to warrant an on-site measurement of the ambient background concentration

levels. This data would be included in the NAAQS analysis to represent the quality of the air prior to the construction of the proposed project. The Applicant included a pre-construction modeling analysis for NO_2, CO, $PM_{2.5}$, and PM10 as part of the NOI. The pre-construction analysis was also used to determine if the proposed emissions would result in a significant impact to the environment, thereby triggering the requirement for a cumulative analysis of the proposed project and other nearby existing sources.

R307-401-8 requires the Division to determine that the proposed project will comply with the NAAQS prior to the issuance of an Approval Order (AO). R307-405(6) requires the Applicant to perform a NAAQS analysis for all pollutants emitted in a significant quantity. The analysis is to include all emissions at the proposed site under normal operating conditions using maximum anticipated short-term release and annual release rates. Consistent with UDAQ policy, a cumulative analysis to include the ambient background concentration and any contribution from other nearby sources is not required if the proposed project's impact does not exceed the PSD Class II Significant Impact Level (SIL). A NAAQS modeling analysis for NO_2 was included in the NOI. A cumulative NAAQS analysis for PM_{10}, was not required since the proposed project's maximum predicted impact was less than the Class II Significant Impact Levels for this pollutant.

R307-401-8 also requires the Division to determine that the proposed project will comply with PSD increments prior to the issuance of an AO. Under R307-405(6), the Applicant is required to perform a PSD Class I and II increment consumption analysis for all pollutants emitted in significant quantities. The purpose of this analysis is to quantify any degradation in air quality since the major source baseline date. The analysis is to include all increment consuming emissions at the proposed site under normal operating conditions using maximum anticipated short-term and annual release rates. A cumulative analysis to include contributions associated with growth and other increment consuming sources is not required if the proposed project's impact does not exceed the PSD Class I or II SIL. A cumulative increment analysis was required for NO_2.

R307-410-5 requires the Applicant to perform a HAPs analysis for any pollutant emitted above a pollutant specific emission threshold value. This analysis is to include all emissions of the pollutants resulting from the proposed modification under normal operating conditions using maximum anticipated one-hour release rates. The Applicant included an analysis for formaldehyde as part of the NOI. Analysis for acrolein and cadmium were included in the NOI, however, their projected emission rates did not exceed the thresholds outlines in R307-410-5.

R307-406-2 requires the Applicant to perform a plume blight analysis. A plume blight analysis is required to determine if plumes emanating from the proposed project would be visible inside the Class I area. The plume blight analysis is to include all emissions of NO_2, SO_4, and PM_{10}.

Under R307-405-16, an AQRV analysis is performed which evaluates regional haze and acid deposition impacts at each of the Class I areas. A regional haze analysis is required to determine if the plumes would reduce the visual range of an observer inside the Class I area. The regional haze analysis is to include all emissions of SO_2, NO_X and PM_{10}. The deposition analysis examines impacts from sulfur and nitrogen compounds at the Class I areas, and is based on all emissions of SO_2 and NO_X.

R307-405 requires the Applicant to perform a soils and vegetation analysis. The analysis should quantify the effects of pollutants on soils and vegetation near the highest impact location and in areas where sensitive plant species may be impacted.

III. ON-SITE PRE-CONSTRUCTION MONITORING

A. Meteorological Data

Consistent with the US EPA - Meteorological Monitoring Guidance for Regulatory Modeling Applications, one year of on-site data was collection using a 100-meter tower during the period May 9, 2001 through May 9, 2002. Parameters collected on-site included wind speed and direction, temperature, delta-T, and solar radiation.

B. Ambient Pollutant Data

A preliminary analysis was conducted to determine the necessity for pre-construction ambient pollutant monitoring. The results indicated that all predicted pollutant concentrations were less than the monitoring trigger level listed in the rule; and therefore, no pre-construction monitoring was required for any pollutant.

IV. MODEL SELECTION

The EPA-AERMOD dispersion modeling system is the preferred model specified in the US EPA – Guideline on Air Quality Models to predict air pollutant concentrations in the near field (within 50 kilometers of the source). The US EPA - CALPUFF - Version 5.8 model is the preferred model to predict concentrations in the far field (long range transport conditions beyond 50 kilometers from the source).

V. MODELING INPUTS AND ASSUMPTIONS

A. Technical Options

The regulatory default options were selected in AERMOD model by the Applicant to quantify all concentrations.

B. Urban or Rural Area Designation

A review of the appropriate 7.5-minute quadrangles determined that the area should be classified as "rural" for air modeling purposes.

C. Topography/Terrain

The Plant is at an elevation of 5,302 feet with nearby terrain features that have an effect on concentration predictions.

a. Zone: 12
b. Location: UTM (NAD27): 414316 meters East, 4300373 meters North

D. Ambient Air

It was determined that the Plant boundary used in the AQIA meets the State's definition of an ambient air boundary.

E. Receptor and Terrain Elevations

The near-field modeling domain (25 km x 25 km) used by the Applicant consisted of ~9500 Cartesian grid receptors including property boundary receptors. The modeling domain has simple and complex terrain features in the near field. Therefore, receptor points representing actual terrain elevations from the area were used in the analysis.

The far-field modeling domain consisted of a rectangular region covering all of the five Class I areas in Utah and the CCB2, and extending 50 kilometers beyond this area so that the model can account for re-circulation of the plume.

F. Emission Rates and Release Parameters

The emission estimates and source parameters for all proposed emission sources at the site are presented in the NOI. There are several combinations of operating the facility under simple and combined cycle mode at various temperatures and at various operating loads.

G. Building Downwash

The Applicant used the US EPA Building Profile Input Program (BPIP) to determine Good Engineering Practice (GEP) stack heights and cross-sectional building dimensions for input into the model. The output from BPIP showed all stacks to be less than GEP formula stack height; thereby, requiring a wake effect evaluation.

H. Ambient Background Concentrations

Sevier County is in attainment for all criteria pollutants. Background concentrations of NO2 were obtained from the UDAQ's databases for ambient pollutant monitoring. The background values used in the NAAQS analysis are presented in Table 2.

Table 2: Background Concentrations for the SPC Analysis

Pollutant	Averaging Period	Background Concentration (µg/m3)
NO_2	1-Hour	38
NO_2	Annual	23
PM_{10}	24-hour	72
$PM_{2.5}$	24-hour	16
$PM_{2.5}$	Annual	13
CO	1-Hour	4810
CO	8-Hour	3208

I. Meteorological Data Processing

For the AERMOD model, on-site horizontal and vertical wind speed, direction, solar radiation and, temperature data was combined with National Weather Service (NWS) upper air data collected at the Salt Lake City International Airport (SLCIA) for the same period using the USEPA- AERMET processing system.

Meteorological inputs for CALPUFF were processed using CALMET. The CALMET pre-processor was run to produce data for 3 years of analysis: 2001, 2002, and 2003. For 2001, Mesoscale Meteorological Model, Version 5 (MM5) data at a 36-km resolution were used, which were obtained from Alpine Geophysics that developed the nationwide data for EPA. For 2002, 12-km MM5 data obtained from Alpine Geophysics were used. These 12-km data for 2002 were originally developed for the Western Regional Air Partnership. Data for 2003 were also obtained from Alpine Geophysics. These 2003 data, at 36-km resolution, were developed by the Wisconsin Department of Natural Resources, the Illinois Environmental Protection Agency, and the Lake Michigan Air Directors Consortium (Midwest RPO). These three datasets were selected because they are current and have all been evaluated for quality. The MM5 data were used as input to CALMET as the "initial guess" wind field. The initial guess field was adjusted by CALMET for local terrain and land-use effects to generate a Step 1 wind field. The wind field was then further refined using local surface and upper air observations to create a final Step 2 wind field for CALPUFF.

VI. RESULTS AND CONCLUSIONS

The Applicant performed a series of analyses to estimate the impact from the proposed project. Modeling results and conclusions from the review of the analyses are outlined in detail below.

A. Pre-Construction Monitoring and Significant Impact Modeling

The Applicant performed a preliminary criteria pollutant analysis of the proposed addition of the two turbines. The analysis indicated that potential increases in concentration levels of NO_2, $PM_{2.5}$, and PM_{10} were less than the pre-construction monitoring trigger levels. Therefore, no additional pre-construction monitoring was required. This analysis indicated that increases in concentration levels of NO_2, $PM_{2.5}$, and PM_{10} were greater than the Class II SIL, and therefore, a cumulative analysis for these pollutants was required.

B. NAAQS Analysis

The Applicant performed a modeling analysis to determine if the combined impact from the proposed source, other industrial sources operating in the area, and ambient background would comply with the NAAQS. The NAAQS analysis was reviewed by the Division and determined to be consistent with the requirements of R307-410-3. Table 3 provides a comparison of the Applicant's predicted air quality concentrations and the NAAQS.

Table 3: Model Predicted NAAQS Concentrations

Air Pollutant	Period	Prediction (µg/m3)	Background* (µg/m3)	Total* (µg/m3)	NAAQS (µg/m3)	Percent NAAQS
NO_2	1-Hour	120	38	158	188	84
NO_2	Annual	8	23	31	100	31
PM_{10}	24-hour	7	72	79	150	53

$PM_{2.5}$	24-hour	7	16	23	35	66
$PM_{2.5}$	Annual	1.8	13	14.8	15	98
CO	1-Hour	331	4810	5141	40,000	12
CO	8-Hour	83	3208	3291	10,000	33

The PM_{10} 24-hour average modeling analysis identified a number of receptor locations around the Western Clay facility with model predicted concentrations that exceeded the NAAQS. The results are not conclusive however since Western Clay was modeled as a single area source in the model. A more refined modeling simulation of its daily operations would be needed before it could be determined that the source is really out of compliance with respect to its dispersion modeling results. In the case where receptor have model predictions in excess of the standard, those receptor were remodeled to show whether SPC would cause or contribute to any model predicted exceedances of the NAAQS at those locations. That analysis demonstrated that the proposed SPC would not cause or contribute to a modeled exceedance of the air quality standard at any time during the year modeled.

C. PSD Class II Increments

The Applicant performed an analysis to determine if the impact from the proposed source would comply with PSD Class II increments. The analysis was reviewed by the Division and determined to be consistent with the requirements of R307-410-3. Table 4 provides a comparison of the predicted NO_2 annual concentrations and the PSD Class II increment.

Table 4: Model Predicted PSD Class II Increment Concentrations

Air Pollutant	Period	Prediction (µg/m3)	Increment (µg/m3)	Percent PSD
NO_2	Annual	8	25	32
PM_{10}	24-hour	7	30	23
$PM_{2.5}$	24-hour	6.9	9	76.6
$PM_{2.5}$	Annual	1.8	4	45

D. Hazardous Air Pollutants

The Applicant performed an analysis to determine the impact from HAPs released by the proposed source on the surrounding area. The analysis was reviewed by the Division and determined to be consistent with the requirements of R307-410-3. The analysis indicated that the predicted concentration for formaldehyde from the proposed project would be less than the UDAQ-Toxic Screening Level (TSL), and no further documentation of impacts would be required. Table 5 provides a comparison of the predicted HAP concentrations and UDAQ-TSLs.

Table 5: Model Predicted Hazardous Air Pollutant Concentrations

Air Pollutant	Period	Prediction (µg/m3)	Toxic Screening Level (µg/m3)	Percent
Formaldehyde	1-Hour	0.7	37	2

E. PSD Class I Increment Consumption Analysis

The Applicant performed a CALPUFF analysis to determine if the impact from the proposed source along with other increment consuming sources would comply with federal PSD Class I increments. The analysis was reviewed by the Division and determined to be consistent with the requirements of R307-410-2. The results for all Class I areas within 300 kilometers are provided in Table 6.

Table 6: Model Predicted PSD Class I Increment Concentrations

Air Pollutant	Period	Prediction (µg/m3)	Class I Significant Impact Level (µg/m3)	Other Sources* (µg/m3)	Total (µg/m3)	Increment (µg/m3)	Percent PSD
Arches							
NO_2	Annual	.00012	0.1			2.5	
$PM_{2.5}$	24-Hour	0.022	0.07			2	
	Annual	0.0009	0.06			1	
PM_{10}	24-Hour	0.022	0.3			8	
Bryce							
NO_2	Annual	.00012	0.1			2.5	
$PM_{2.5}$	24-Hour	0.022	0.3			2	
	Annual	0.0009	0.2			1	
PM_{10}	24-Hour	0.022	0.3			8	
Canyonlands							
NO_2	Annual	0.00034	0.1			2.5	
$PM_{2.5}$	24-Hour	0.035	0.3			2	
PM_{10}	Annual	0.0013	0.2			1	
	24-Hour	0.035	0.3			8	
Capitol Reef							
NO_2	Annual	0.0019	0.1			2.5	
$PM_{2.5}$	24-Hour	0.056	0.3			2	
	Annual	0.0038	0.2			1	

PM_{10}							
	24-Hour	0.056	0.3			8	
Zion							
NO_2	Annual	0.00018	0.1			2.5	NO_2
$PM_{2.5}$	24-Hour	0.024	0.3			2	$PM_{2.5}$
PM_{10}	Annual	0.0005	0.2			1	PM_{10}
	24-Hour	0.024	0.3			8	
Grand Canyon							
NO_2	Annual	0.00011	0.1			2.5	NO_2
$PM_{2.5}$	24-Hour	0.017	0.3			2	$PM_{2.5}$
PM_{10}	Annual	0.0007	0.2			1	PM_{10}
	24-Hour	0.017	0.3			8	

Since the proposed project's model predicted impacts at the Class I areas were less than the PSD Class I significance levels, a cumulative analysis was not warranted.

F. Visibility – Plume Blight

The Applicant performed a VISCREEN-Level 1 analyses to determine if plumes emanating from the proposed project would be visible within the six Class I areas. The analysis was reviewed by the Division and determined to be consistent with the requirements of R307-410-3. Results and discussion of the analysis included in Section 8 of the NOI indicate that plume visibility from the proposed project is within acceptable limits inside the Class I areas.

Table 7: Model Predicted VISCREEN Visibility Results

Class I Area	Delta-E		Contrast	
	Impact	Allowable	Impact	Allowable
Arches	0.3	2	0.006	0.05
Bryce Canyon	0.8		0.012	
Canyonlands	0.5		0.008	
Capitol Reef	0.3		0.004	
Zion	0.4		0.007	
Grand Canyon	0.3		0.005	

G. Visibility – Regional Haze

The Applicant did not perform a regional haze analysis on impacts within the Class I areas per FLAG 2010.

H. Acid Deposition

The Applicant did not perform a regional acid deposition analysis on impacts within the Class I areas per FLAG 2010.

I. Soils and Vegetation Analysis

The Applicant performed an analysis to determine the extent of impacts from the proposed source on soil and vegetation. Results of the analysis are listed in appendix P of the NOI. The analysis indicated that predicted concentrations would not result in an adverse impact on soils and vegetation in the Sevier Valley area.

VII. RECOMMENDED PERMIT CONDITIONS

The following suggested permit conditions should be included under the Terms and Conditions section in the AO.

The height of the turbine/HRSG stacks shall be no less than 165 feet, as measured from ground level at the base of the stack.

TO:kw