Mid Kansas Electric Company, LLC
Rubart Station
Source ID No. 0670173
PSD Construction Permit Application Supplements

Supplement Number	Description	Date
1	Air Dispersion Modeling Analysis – 25% Load	07/13/12
2	Construction Permit Application, Table 6-2 Update	08/01/12
3	OLM Request for Approval	08/23/12
4	VISCREEN Level 2 Visibility Analysis	08/28/12
5	Carbon Capture Technology for Rubart Station Memo	10/09/12
6	BACT Analysis for Circuit Breakers and Switchers	10/24/12
7	RMB RICE Analysis Memo (Analysis of NO_x Emission Data)	11/02/12
8	NO_x Emission Limitation Review	11/20/12
9	Request for Redundant Emergency AC Generator	11/28/12
10	PM BACT Email	12/05/12

Mid-Kansas
ELECTRIC COMPANY, LLC
neighbors serving neighbors

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JUL 16 2012
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July 13, 2012

Via: FedEx #

Ms. Marion Massoth
Kansas Department of Health and Environment
Bureau of Air and Radiation
1000 SW Jackson, Suite 310
Topeka, Kansas 66612-1366

Re: Air dispersion modeling files

Dear Ms. Marion Massoth:

A Prevention of Significant Deterioration (PSD) air construction permit application associated with the development and construction of a new electrical generating facility was submitted by Mid-Kansas Electric Company (Mid-Kansas) on July 9, 2012. The Project will consist of 24 reciprocating internal combustion engines (RICE) plus auxiliary equipment at the proposed Rubart Station (hereinafter referred to as Project). The Project will be located in Grant County, Kansas.

To account for representative seasonal climatic variations, the potential emissions and air dispersion modeling impacts from the RICE were analyzed at 50, 75, 85, and 100 percent load conditions. In addition to these load conditions, the engines will operate at 25 percent load. Therefore, air dispersion modeling was performed for 25 percent load conditions to confirm these load conditions will not result in or contribute to exceedances of any NAAQS or PSD Class II increment consumption allowance. This letter and attached modeling files confirm that no NAAQS or PSD Class II increment consumption allowance will occur while the Rubart Station operates at 25 percent load.

PO Box 980~Hays, KS 67601-0980~Tel.800.354.3638~Fax.785.623.3395 midkansaselectric.net

The expected hourly emission rates and modeling parameters at 25 percent load for a single RICE are shown below in Table 1.

Table 1. RICE Emissions and Stack Parameters at 25% Load

Parameter	25% Load
NO_x	0.45 lb/hr
CO	1.15 lb/hr
$PM_{10}/PM_{2.5}$	0.28 lb/hr
Stack Temperature	716 °F
Exit Velocity	33.76 feet per second
Stack Height	106 feet
Stack Diameter	4 feet

The 25 percent load modeling results do not change any conclusions presented in the Air Dispersion Modeling section (Part 6) of the PSD Air Permit Application Report. All modeled impacts for 25 percent load were equal to or less than the results presented in the Air Dispersion modeling section (Part 6). The Project will not result in or contribute to any exceedances of any NAAQS or PSD Class II increment consumption allowance for operation of the facility at 25 percent load up to 100 percent load.

Three CD copies of the air dispersion modeling files for the 25 percent load operating case for Rubart Station are attached for your review, which is an addendum to Appendix H. An updated specification sheet, which includes the 25 percent load information, is also attached to this letter.

As KDHE proceeds with the evaluation process, please contact the following persons with questions or for additional information:

Paul Reynolds
Sunflower Electric Power Corporation
2440 Holcomb Lane/PO Box 430
Holcomb, KS 67851
Phone: 620-277-4522
E-mail: preynolds@sunflower.net

Mary Hauner-Davis
Burns & McDonnell
9400 Ward Parkway
Kansas City, Missouri 64114
Phone: 816-822-4252
e-mail: mhauner@burnsmcd.com

Mid-Kansas appreciates the input and efforts to date by your office to help expedite this permit application and the subsequent review process. If we can be of any assistance to facilitate your staff's efforts, please do not hesitate to contact us.

Sincerely,

Paul Reynolds
Sr. Manager, Generation Engineering/Environment

Encl. CD copies of the air dispersion modeling files for the 25 percent load
Updated specification sheet for RICE

c. Mary Hauner, Burns & McDonnell
_SunflowerRecords@sunflower.net

PER/ckb

Mid-Kansas Electric Company, LLC - Rubart Station Project
Caterpillar Spec Sheet for RICE

Maximum Hourly Emissions and Modeling Parameters for Each RICE

Post-treatment Emissions Data (Per RICE Basis - BACT):		100% Load	85% Load	75% Load	50% Load	25% Load	Startup[A]
		Cat	Cat	Cat	Cat	Cat	Cat
NO_x	g/kWh	0.10	0.10	0.10	0.10	0.10	
	g/bhp-hr	0.07	0.07	0.07	0.07	0.07	
	lb/hr	2.13	1.81	1.60	1.07	0.45	
	lbs/start						13.34
CO	g/kWh	0.18	0.18	0.18	0.25	0.25	
	g/bhp-hr	0.13	0.13	0.13	0.18	0.18	
	lb/hr	3.86	3.28	2.89	2.70	1.15	
	lbs/start						37.30
$PM/PM_{10}/PM_{2.5}$ (TOTAL)[B]	g/kWh	0.059	0.059	0.059	0.059	0.059	
	g/bhp-hr	0.044	0.044	0.044	0.044	0.044	
	lb/hr	1.31	1.11	0.98	0.65	0.28	
	lbs/start						1.02
SO_2	g/kWh	0.006	0.006	0.006	0.006	0.006	
	g/bhp-hr	0.004	0.004	0.004	0.004	0.004	
	lb/hr	0.13	0.11	0.10	0.07	0.03	
	lbs/start						0.07
VOC (as NMNEHC)	g/kWh	0.26	0.26	0.26	0.26	0.260	
	g/bhp-hr	0.20	0.20	0.20	0.20	0.200	
	lb/hr	5.82	4.95	4.37	2.91	1.24	
	lbs/start						5.53
CO_2	g/kWh	484	488	501	543	450	
	g/bhp-hr	361	364	374	405	336	
	lb/hr	10,683	9,155	8,293	5,991	2,109	
	lbs/start						5,126
Formaldehyde[C]	g/kWh	0.10	0.10	0.10	0.10	0.10	
	g/bhp-hr	0.07	0.07	0.07	0.07	0.07	
	lb/hr	2.14	1.82	1.62	1.07	0.45	
	lbs/start						2.14
Acetaldehyde[C]	lb/hr	1.38					
Acrolein[C]	lb/hr	0.85					
Methanol[C]	lb/hr	0.41					

Stack/Emission Calculation Parameters		100% Load	85% Load	75% Load	50% Load	25% Load	Startup
		Cat	Cat	Cat	Cat	Cat	Cat
Stack Temperature	°F	635	662	698	707	716	641.00
Exhaust Gas Flow	m^3/hr	100,323	87,379	79,574	56,276	43,242	--
	ft^3/s	984	857	781	552	424	--
Exit Velocity	ft/sec	78.31	68.21	62.12	43.93	33.76	75.45
Stack Height	ft	106	106	106	106	106	106
Stack Diameter	ft	4	4	4	4	4	4
Heat Input (HHV basis)	MMBtu/hr	78.6	68.67	61.78	46.45	24.80	
Max. Engine Output	kW	10,000	8,500	7,500	5,000	2,125	
Max. Horsepower	bhp	13,400	11,390	10,050	6,700	2,848	
Stack Circular Area	ft^2	12.6					

[A] Startup emissions include 30 minutes of startup emissions

[B] All CAT particulate numbers were multiplied by 2 to account for front/back

[C] Reduction of 50% across the catalyst

Table 6-2. Fuel-gas heater, Emergency fire pump and Emergency AC generator Emissions and Modeling Parameters

Parameter	Fuel-gas heater	Emergency fire pump	Emergency AC generator
NO_x	0.2 lb/hr	5.89 lb/hr (0.067 lb/hr)[A]	2.66 lb/hr (0.0304 lb/hr)[A]
CO	0.16 lb/hr	1.09 lb/hr	5.32 lb/hr
$PM_{10}/PM_{2.5}$	0.015 lb/hr	0.063 lb/hr (0.0007 lb/hr)[A]	0.0001 lb/hr (1.2×10^{-6} lb/hr)[A]
Stack Temperature	500 °F	986 °F	936 °F
Exit Velocity	44.33 ft/s	145.33 ft/s	149.16 ft/s
Stack Height	15 feet	15 feet	15 feet
Stack Diameter	0.83 feet	0.42 feet	0.67 feet

[A] Equivalent lb/hr emissions averaged over 8,760 hours per year, based on operation of 100 hours.

6.2.1 Good Engineering Practice

Sources included in a PSD permit application are subject to Good Engineering Practice (GEP) stack height requirements established by K.A.R 28-19-18a through K.A.R 28-19-18f. As defined by the regulations, GEP height is calculated as the greater of 65 meters (measured from the ground level elevation at the base of the stack) or the height resulting from the following formula:

$$GEP = H + 1.5L$$

Where

H = the height of nearby structure(s) measured from the ground level elevation at the base of the stack; and

L = the lesser dimension (height or projected width) of nearby structure(s) (i.e., building height or the greatest crosswind distance of the building - also known as maximum projected width).

To meet stack height requirements, each point source was evaluated in terms of its proximity to nearby structures. The purpose of this evaluation was to determine if the discharge from the stack will become caught in the turbulent wake of a building or other structure, resulting in downwash of the plume. Downwash of the plume can result in elevated ground-level concentrations. The KDHE provides guidance for determining whether building downwash will occur in K.A.R 28-19-18. The downwash analysis was performed in accordance with the methods prescribed in K.A.R 28-19-18c.

Calculations for determining the direction-specific downwash parameters were performed using the most current version of EPA's Building Profile Input Program – Plume Rise Model Enhancements (Version

Burns & McDonnell
SINCE 1898

August 23, 2012

Mr. Richard Daye
Air and Waste Management Division
Air Permitting and Compliance Branch
US EPA Region 7
901 North 5th Street
Kansas City, KS 66101

Re: Ozone Limiting Method approval for use in compliance demonstrations for the 1-hour and annual NO2 standard.

Dear Mr. Daye:

A Prevention of Significant Deterioration (PSD) air construction permit application associated with the development and construction of a new electrical generating facility was submitted by Mid-Kansas Electric Company (Mid-Kansas) on July 9, 2012. The Project will consist of 24 reciprocating internal combustion engines (RICE) plus auxiliary equipment at the proposed Rubart Station (hereinafter referred to as Project). The Project will be located in Grant County, Kansas.

On behalf of Mid-Kansas, Burns & McDonnell is submitting this letter to obtain approval for the use of the Ozone Limiting Method (OLM) in AERMOD for predicting NO_2 impacts for the Project. The use of the OLM option within AERMOD, for use in compliance demonstrations for the 1-hour and annual NO_2 standard as alternative modeling techniques under Appendix W, should be justified in accordance with Section 3.2.2, paragraph (e), as follows:

"...an alternative refined model may be used provided that:

i. The model has received a scientific peer review;
ii. The model can be demonstrated to be applicable to the problem on a theoretical basis;
iii. The data bases which are necessary to perform the analysis are available and adequate;
iv. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates; and
v. A protocol on methods and procedures to be followed has been established."

In accordance with EPA's June 2010 memo, *items i* and *iv* of the alternative model demonstration for the OLM option can be fulfilled, in part, based on existing documentation (Cole and Summerhays, 1979; Hanrahan, 1999a; Hanrahan, 1999b; MACTEC, 2005 – see EPA's June 2010 memo for full references).

EPA's June 2010 memo also addresses *item ii*, "The issue of applicability to the problem on a theoretical basis (item ii) is a case-by-case determination based on an assessment of the adequacy

of the ozone titration mechanism utilized by these options to account for NOx chemistry within the AERMOD model based on "the chemical environment into which the source's plume is to be emitted" (Appendix W, Section 5.1.j)."

Appendix B of the OLM modeling protocol submitted to KDHE in February 2012 and the Appendix H modeling CD of the PSD air permit application address *items iii* and *v* above. The documents are also attached to this letter for your review. The attached submittals include documentation of the methodologies used for the following:

- In-stack NO_2/NO_x ratios
- Equilibrium NO_2/NO_x ratio
- Background ozone
- NO_2 background value

Mid-Kansas proposes that the OLM is an appropriate method to utilize in estimating the 1-hour and annual NO_2 impacts for the proposed Rubart Station.

As EPA proceeds with the evaluation process, please contact the following persons with questions or for additional information:

Paul Reynolds
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2440 Holcomb Lane/PO Box 430
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Mid-Kansas appreciates the input and efforts to date by your office to help expedite this permit application and the subsequent review process. If we can be of any assistance to facilitate your staff's efforts, please do not hesitate to contact us.

Sincerely,

Mary Hauner-Davis

Mary Hauner-Davis
Project Manager

Attachments

cc: Paul Reynolds, Mid-Kansas
Mindy Bowman, KDHE
Susanna Pjesky, KDHE
Minda Nelson, Burns & McDonnell

Prevention of Significant Deterioration Class II Air Dispersion Modeling Protocol

Mid-Kansas Electric Company, LLC

Rubart Station Project

Project No. 63716

February 2012

Prevention of Significant Deterioration Class II Air Dispersion Modeling Protocol

prepared for

Mid-Kansas Electric Company, LLC.

February 2012

Project No. 63716

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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* * * * *

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1.0 INTRODUCTION

Mid-Kansas Electric Company, LLC (MKEC), is proposing to construct a nominal 120-megawatt (MW) power facility in Grant County, Kansas. The proposed facility will consist of twelve nominal 10-MW internal combustion engines and associated equipment and will be operated by Sunflower Electric Power Corporation. The Rubart Station Project (hereinafter referred to as Project) will be located on a greenfield site in the north half of Section 1, T29S, R35W. Preliminary estimated potential emissions indicate that the proposed Project will be considered a major source under Prevention of Significant Deterioration (PSD) rules; as a result, the project will be subject to PSD construction permit review. Since a PSD permit requires an assessment of ambient impacts for those pollutants subject to PSD review, this document presents a Class II air dispersion modeling protocol to be used in developing the PSD application. Submittal of this protocol will allow the Kansas Department of Health and Environment (KDHE) to review and comment upon the methodology to be employed in the modeling analysis.

Included in this document is a brief description of the project, proposed model to be used, and input parameters for the proposed model. This modeling protocol has been drafted in accordance with the U.S. Environmental Protection Agency (EPA) and KDHE modeling guidelines.

2.0 PROJECT DESCRIPTION

MKEC is proposing to build twelve nominal 10-MW internal combustion engines and associated equipment on a greenfield site in the north half of Section 1, T29S, R35W in Grant County, Kansas. The proposed site will be located within the area shown on Figure 1, Appendix A.

Grant County is currently designated as an attainment/unclassified area for all criteria pollutants; therefore, the Project is not subject to non-attainment new source review.

The preliminary estimated air emissions for the proposed Project are presented in Table 1. The estimated potential air emissions are based on all engines operating year-round (8,760 hours per year, per engine). The project preliminary estimated potential emissions shown in Table 1 also include the emissions from three startup events per day for each engine and emissions from a natural gas heater, emergency diesel generator, and emergency diesel fire pump. The maximum emissions from each operating load for the combustion engines were used to demonstrate the maximum preliminary estimated potential emissions for each pollutant. The proposed combustion engine operating loads for the permit conditions will be 50 percent, 75 percent, 90 percent, and 100 percent load.

Table 1: Preliminary Estimated Potential Emissions and PSD Significance Levels for the Project

Pollutant[A]	Preliminary Estimated Potential Emissions (Tons per Year)[B]	PSD Significance Levels (Tons per Year)[D]
NO_X	**136.9**	40
CO	**228.7**	100
SO_2	2.5	40
VOC	**180.0**	40
PM	**121.1**	25
PM_{10}[C]	**121.1**	15
$PM_{2.5}$[C]	**121.1**	10
CO_2e	**524,414**	100,000
H_2SO_4 Mist	0.39	7
Lead	3.2×10^{-6}	0.6

[A] NO_x = nitrogen oxides; CO = carbon monoxide; SO_2 = sulfur dioxide; VOC = volatile organic carbons; PM= total particulate matter; PM_{10} = particulate matter less than 10 microns in diameter; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; CO_2e = carbon dioxide equivalent (greenhouse gases); H_2SO_4 Mist = sulfuric acid mist
[B] Numbers in **bold** indicate the PSD significance level is exceeded
[C] Filterable plus condensable
[D] Based on 3 startups per day at 30 minutes each plus full load operation for the rest of the year (8,213 hours per engine) for each engine (worst-case emissions scenario).

Based on the preliminary estimated potential emissions shown in Table 1, it is expected that NO_X, CO, PM, PM_{10}, $PM_{2.5}$, VOC, and CO_2e will be subject to PSD review.

Auxiliary equipment will consist of a natural gas heater, emergency diesel fire pump, and emergency diesel generator. Annual emissions for the natural gas heater will be based on 8,760 hours per year, while the annual emissions for the emergency generator and emergency fire pump will be based on 100 hours per year.

3.0 PROPOSED MODEL

MKEC is proposing to use the most current version of the AMS/EPA Regulatory Model (AERMOD) for the air quality analysis (Version 11353). The AERMOD model is an EPA-approved, steady-state Gaussian plume model capable of modeling multiple sources in simple and complex terrain.

The following default model options will be used:

- Gradual Plume Rise
- Stack-tip Downwash
- Buoyancy-induced Dispersion
- Calms and Missing Data Processing Routine
- Calculate Wind Profiles
- Calculate Vertical Potential Temperature Gradient
- Rural Dispersion

Details of the modeling algorithms contained in the AERMOD may be found in the User's Guide for AERMOD. The regulatory default option will be selected for this analysis.

4.0 MODELING PARAMETERS

It is expected that NO_X, CO, PM, PM_{10}, $PM_{2.5}$, VOC, and CO_2e will be subject to PSD review, and an air quality analysis will be performed for each of them. Since VOCs are photoreactive pollutants and are generally regional in nature in terms of their contribution to ozone formation, no reactive-pollutant modeling of VOCs from the Project is proposed at this point.

4.1 NO_2 MODELING – MULTI-TIERED SCREENING APPROACH

The annual emissions presented above represent operations at worst-case ambient conditions under various operating capacities. The AERMOD model gives the emission results for all pollutants, including NO_x. However, impacts of nitrogen dioxide (NO_2) must be examined for comparison to NAAQS, PSD increments and significance values. Therefore, MKEC proposes a three step process to analyze the 1-hour and annual NO_x modeled impacts. Step 1 uses the AERMOD regulatory default options and assumes all NO_x emissions are NO_2 (Tier 1 methodology). If Step 1 produces unacceptable results then Step 2 will be used. Step 2 uses the AERMOD regulatory default options and assumes 75 percent of the NO_x emissions are in the form of NO_2 for the annual average and 80 percent of the NO_x emissions are in the form of NO_2 for the 1-hour standard (Tier 2 methodology). If Step 2 produces unacceptable results then Step 3 will be used. Step 3 proposes to use Tier 3 methodology as presented in EPA's March 2011 memo[1], the Ozone Limiting Method (OLM) or the Plume Volume Molar Ratio Method PVMRM. If Tier

[1] March 01, 2011 EPA Memo from Tyler Fox. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard

3 is used, a separate modeling protocol specific to the Tier 3 methodology will be submitted to the KDHE.

Based on preliminary modeling, it has been determined that the Tier 3 methodology (OLM) will be used for the NO_2 1-hour air dispersion modeling. The OLM modeling protocol that proposes the modeling methodology that will be used for the NO_2 1-hour air dispersion modeling for the Project is shown in Appendix B.

The OLM methodology will not be applied to the NO_2 annual averaging period. The modeled concentrations of annual NO_X will be adjusted using the EPA-approved Ambient Ratio Method (ARM) (Tier 2 methodology). Tier 2 of the ARM allows the use of an empirically derived NO_2/NO_X ratio of 0.75, which means that approximately 75 percent of the NO_X emissions will be converted to NO_2, the regulated pollutant. This factor will be applied to the annual modeled results for NO_X to determine the predicted ground-level concentration of NO_2.

4.2 GOOD ENGINEERING PRACTICE STACK HEIGHT

Sources included in a PSD permit application are subject to Good Engineering Practice (GEP) stack height requirements outlined in 40 CFR Part 51, Sections 51.100 and 51.118. As defined by the regulations, GEP height is calculated as the greater of 65 meters (measured from the ground level elevation at the base of the stack) or the height resulting from the following formula:

$$GEP = H + 1.5L$$

Where,

H = the building height; and

L = the lesser of the building height or the greatest crosswind distance of the building - also known as maximum projected width.

To meet stack height requirements, the proposed point sources will be evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if the discharge from each stack will become caught in the turbulent wake of a building or other structure, resulting in downwash of the plume. Downwash of the plume can result in elevated ground-level concentrations. EPA provides guidance for determining whether building downwash will occur in *Guideline for Determination of Good Engineering Practice Stack Height* (EPA 1985). The downwash analysis will be performed consistent with the methods prescribed in this guidance document. The point sources will be evaluated in terms of their proximity to nearby structures.

Calculations for determining the direction-specific downwash parameters will be performed using the most current version of the EPA's Building Profile Input Program – Plume Rise Model Enhancements, otherwise referred to as the BPIP-PRIME downwash algorithm (Version 04274).

4.3 EMISSION SOURCE PARAMETERS

Modeling runs will be conducted at full load and partial loads to confirm that operation of the Project will not exceed the required air dispersion modeling thresholds. In addition to modeling steady state operation of the proposed engines, startup operation will be modeled. The emission rates modeled will represent the projected worst-case ambient conditions under various operating loads. Annual emissions will be based on 3 startups per day at 30 minutes each plus full load operation for the rest of the year (8,213 hours per engine). No fugitive emission sources are proposed for this project.

5.0 MODELING METHODOLOGY

5.1 RECEPTOR GRID

The overall purpose of the modeling analysis is to ensure that operation of the proposed facility will not result in, or contribute to, concentrations above the NAAQS or PSD Class II Increments. The modeling runs will be conducted using the AERMOD model in simple and complex terrain mode within a 10- by 10-kilometer Cartesian grid to determine the significant impact area (SIA) for each pollutant. The grid will incorporate the following spacing between receptors: 100-meter out to 2 kilometers, 250-meter out to 5 kilometers, and 1,000-meter out to 10 kilometers. If the SIA exceeds 10 kilometers, the grid will be extended to encompass the entire SIA. If the modeling impacts show "hot spots" outside 1,000 meters, 100-meter grid spacing will be used to encompass the maximum concentrations to ensure that the maximum impact has been identified. Receptors will also be placed along the fence line boundary at a spacing of 50 meters.

After reviewing the topography of the project area, it was determined that terrain elevations should be incorporated into the model. Therefore, the appropriate U.S. Geological Survey (USGS) National Elevation Dataset (NED) will be used to obtain the necessary receptor elevations. North American Datum of 1927 (NAD 27) will be used to develop the Universal Transverse Mercator (UTM) coordinates for this project.

AERMOD has a terrain preprocessor (AERMAP) which uses gridded terrain data for the modeling domain to calculate not only a XYZ coordinate, but a representative terrain-influence height associated with each receptor location selected. This terrain-influenced height is called the height scale and is separate for each individual receptor. AERMAP (Version 11103) will utilize the electronic NED data to populate the model with receptor elevations.

5.2 METEOROLOGICAL DATA

AERMOD requires a preprocessor called AERMET to process meteorological data for five years from off-site locations to estimate the boundary layer parameters for the dispersion calculations. Meteorological inputs from AERSURFACE obtained from the KDHE will be used. Surface air meteorological data from the Garden City Regional Airport (station # 23064) and upper air data from the Dodge City Regional Airport (station #13985) will be used in the analysis. A profile base elevation value of 878.4 meters will be used. The most recent five-year data set available covers the period of 2006 to 2010.

5.3 LAND MODELING PARAMETERS

Based on the Auer scheme, the existing land use for a three-kilometer area surrounding the proposed project site is more than 50 percent rural. Also, the population density is less than 750 people per square kilometer for the same area. Because this area is considered rural, the rural dispersion coefficients option in the AERMOD model will be selected.

5.4 EMISSION FACTORS

Emissions factor (EMISFACT) modeling options in AERMOD allow a user to model emissions only when certain criteria are met. EMISFACT will be used to model the appropriate hourly restrictions on any equipment activities that only occur over a certain number of hours per day or seasons per year. A more detailed breakdown of operation times will be presented with the final modeling analysis if this option is utilized.

5.5 SIGNIFICANT IMPACT AREA DETERMINATION

To determine the facility's SIA, all emission sources from the proposed Project will be modeled alone; that is, modeled without existing sources in the area. The initial step in defining the SIA will be to model the engine at 50, 75, 90, and 100 percent capacity for each pollutant and at startup/shutdown conditions along with all other emission sources from the proposed facility. The initial modeling analysis will be performed using the KDHE approved five-year meteorological data set. The SIA is determined to be the distance from the proposed fence line where any pollutant concentration exceeds its PSD modeling significance threshold. Each load case will be analyzed using the five years of meteorological data. If the modeling results indicate that a pollutant exceeds the PSD modeling significance threshold for any averaging period, the maximum distance from the property line that the pollutant concentration exceeds the threshold level will be determined. This distance is then considered as a radius from the source, creating a circular SIA around the proposed source. The radius of impact (ROI) will then be identified

and submitted to the KDHE for refined modeling purposes. The maximum possible radius of impact (ROI) distance will be 20 kilometers, in accordance with KDHE correspondence.

A cumulative analysis including all point sources within the ROI will be required for that pollutant. Depending on the initial modeling results, MKEC will request from KDHE an emission inventory of PSD Class II Increment-consuming sources and NAAQS sources that are located within the ROI and that should be included in the modeling analyses.

5.6 BACKGROUND AIR QUALITY

As stated previously, if any pollutant exceeds its respective PSD significance level, a refined analysis (cumulative analysis) will be performed for that pollutant and averaging period. This analysis will be used to determine compliance with the PSD Class II Increments and the NAAQS. The NAAQS are set up to protect the air quality for all sensitive populations and attainment is determined by the comparison to the NAAQS thresholds. As such, there are existing concentrations of each criteria pollutant that is present in ambient air that must be included in an analysis to account for items such as mobile source emissions that are not accounted for in the model. Monitored ambient emission levels will be added to the modeled ground level impacts to account for these sources.

KDHE provided background values for each pollutant which will require a refined analysis. These values are based available monitors in the area. The monitored background levels will be added to the modeled impacts and are shown in Table 3.

Table 2: Background Levels

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)	Air Quality System Monitor ID
NO_2	1-hour	49.0	20-191-0002 (Peck)
PM_{10}	24-hour	89.0	20-057-0002 (Dodge City)
$PM_{2.5}$	24-hour	17	20-195-0001 (Cedar Bluff)

5.7 NAAQS AND CLASS II INCREMENT ANALYSIS

If refined modeling is required, the inventories of sources within the ROI will be developed in accordance with applicable EPA guidance, input from the KDHE, and neighboring state agencies. For the NAAQS and PSD Class II Increment analysis, all stationary sources identified by KDHE that emit pollutants subject to this analysis and are located within the ROI will be addressed. Some sources within the ROI may be eliminated from the analysis if it is determined to have a negligible contribution to impacts when combined with the Project impacts. MKEC will consult with KHDE to determine acceptable methods of eliminating sources from the analysis.

Background air quality values were selected (as described in the previous section) to add to model-predicted concentrations for comparison to the NAAQS and are shown in Table 4. If the refined analysis does not result in any concentrations above the NAAQS or PSD Class II Increments, no further modeling will be conducted.

5.8 AMBIENT MONITORING

The modeling analysis for emissions sources for the proposed Project will also address the pre-construction monitoring provision of the PSD regulations. The regulations specify monitoring *de minimis* levels for each PSD pollutant that, if exceeded, trigger the requirement to perform one year of pre-construction ambient air monitoring. If any predicted concentrations reach or exceed the monitoring *de minimis* levels, MKEC will consult with the KDHE to determine if pre-construction ambient air monitoring will be required. If modeled values exceed their respective monitoring *de minimus* values, MKEC will request a waiver to use local ambient monitoring data to fulfill the pre-construction monitoring provisions of the PSD regulations or develop an acceptable monitoring plan at that time. For any impacts predicted to be below the monitoring *de minimis* levels, MKEC will request an exemption from pre-construction ambient air monitoring, given that representative monitors in the area may be used for appropriate background concentrations.

Potential VOC emissions from the Project are estimated to be more than 100 tons per year. MKEC requests that local ambient monitoring data for ozone that is available be used to fulfill the pre-construction monitoring provisions of the PSD regulations.

The NAAQS, modeling/monitoring significance levels, and PSD Class II Increments are presented in Table 4.[2]

[2]The pollutants that are allowed one NAAQS exceedance per year and one PSD Increment exceedance per year are: 1-hour and 8-hour CO; 3-hour SO_2; and 24-hour PM_{10}.

Table 3: NAAQS, Significance/Monitoring, and PSD Class II Increments (µg/m^3)

Pollutant	Averaging Period	NAAQS	Modeling Significance Level	Monitoring Significance Level	PSD Class II Increment
NO_2	annual	100	1	14	25
	1-hour	188.7	7.5	NA	NA
CO	8-hour	10,000	500	575	NA
	1-hour	40,000	2,000	NA	NA
PM_{10}	annual	NA	1	NA	17
	24-hour	150	5	10	30
$PM_{2.5}$	annual	15	0.3	NA	4
	24-hour	35	1.2	4	9
SO_2	annual	NA	1	NA	20
	24-hour	NA	5	13	91
	3-hour	1,300[A]	25	NA	512
	1-hour	195	7.8	NA	NA

[A]Secondary standard

For PSD Class II increment, the 24-hour PM_{10}, 24-hour $PM_{2.5}$, and 3-hour and 24-hour SO_2 will all be compared to the second highest high. Annual standards will be compared to the first highest high. The NAAQS thresholds will be compared to the following highs shown in Table 5 for each averaging period.

Table 4: Modeled Highs

Pollutant	Averaging Period	Modeled High
NO_2	Annual	Annual Mean
	1-hour	98th Percentile
CO	1-hour	Second High
	8-hour	Second High
PM_{10}	24-hour	Sixth High
$PM_{2.5}$	Annual	Annual Mean
	24-hour	98th Percentile
SO_2	3-hour	Second High
	1-hour	99th Percentile

In addition, in accordance with EPA's March 2011 memo, MKEC proposes to only model continuous operation for the 1-hour standard. The emergency diesel generator and emergency diesel fire pump will be limited to 100 hours per year (for testing and maintenance) and hence will not be included in the 1-

hour modeling analysis, as they will be intermittent sources. In addition, startup and shutdown of the combustion turbine (three startup/shutdown events per day at 30 minutes each) will be considered intermittent and will not be included in the 1-hour analysis. These operations will not contribute significantly to the annual distribution of the daily maximum 1-hour concentrations.

6.0 CLASS I AREA IMPACTS

Recent Federal Land Manager (FLM) guidance requires that a proposed major source, in the course of a PSD application, perform an assessment of air quality impacts at Class I areas if these areas are located within approximately 300 kilometers of the proposed facility. There are no Class I areas that are within 300 kilometers of the proposed Project; therefore, no assessment of air quality impacts at Class I areas will be performed for this Project.

7.0 ADDITIONAL IMPACT ANALYSIS

The additional impacts analysis requirement under PSD will include the ambient air quality impact analysis, soils and vegetation impacts, visibility impairment, and growth analysis on Class II areas. This analysis will follow EPA's guidance provided in the New Source Review Workshop Manual (October 1990 draft).

The growth analysis will quantify the number of employees, the availability of housing in the area, and associated commercial and industrial growth, and construction related activities and mobile sources. The number of employees is not envisioned to be large enough to result in a quantifiable increase in emissions from residential, commercial, or industrial growth.

While there are no Class II visibility standards, a visual plume blight analysis will be performed in accordance with the guidelines set forth in EPA-450/4-88-015, Workbook for Plume Visual Impact Screening and Analysis (Revised). A visual plume blight analysis will be conducted for surrounding Class II areas for emissions from the project.

8.0 SUMMARY

Modeling methodology has been presented for the construction of twelve nominal 10-MW, natural gas-fired, internal combustion engines and associated equipment for the proposed Project. MKEC would like to proceed with the initial modeling analysis as soon as possible in order to ensure that a pre-construction ambient air monitoring study will not be required. Also, if emission inventories and background air quality data are needed from KDHE and other agencies to complete refined modeling analyses, initial

modeling to determine the ROI for each pollutant will be expedited to give KDHE enough time to process these requests.

9.0 REFERENCES

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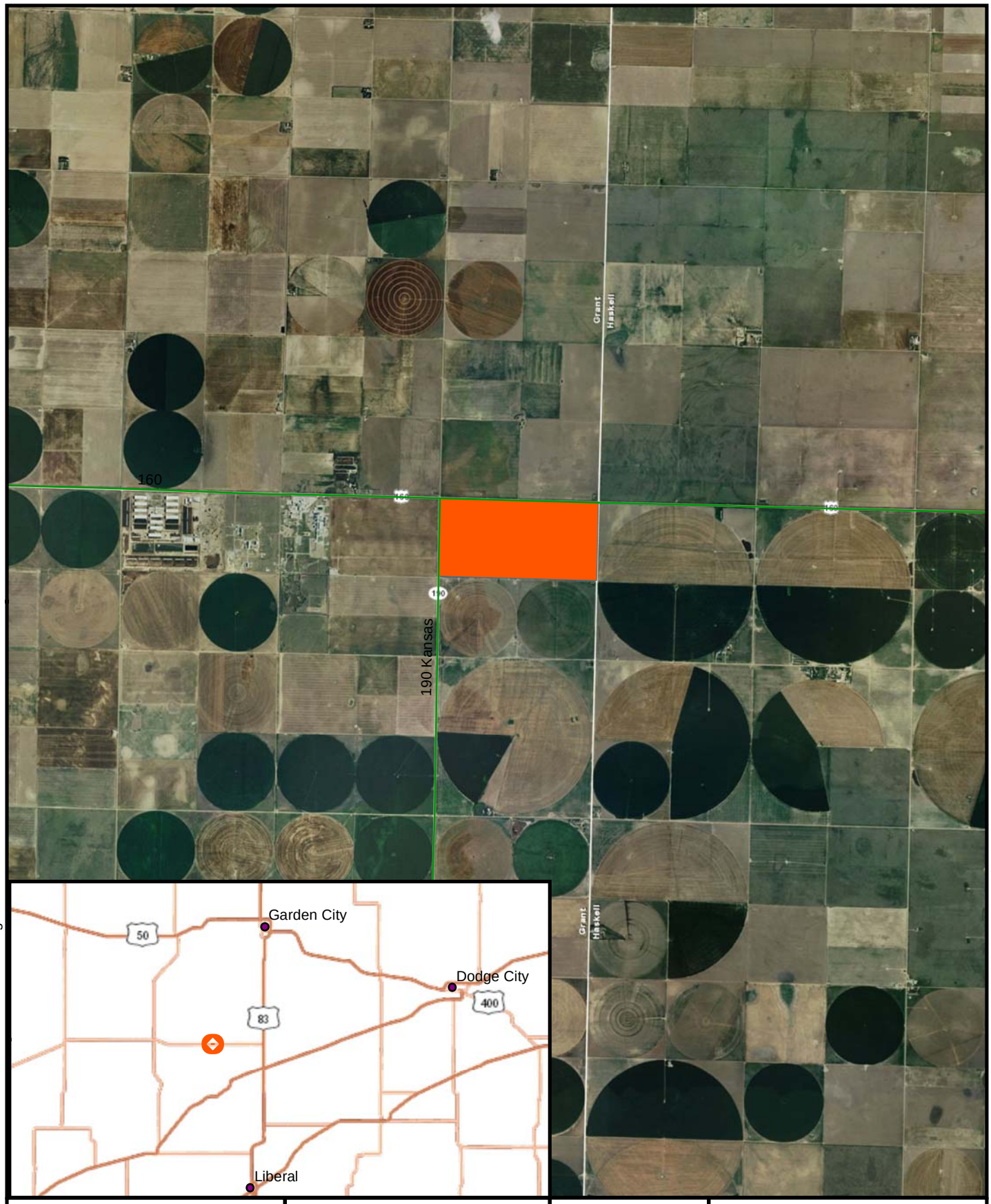
APPENDIX A



Legend

- Cities
- Proposed Site Location

N

0 0.5 1 Miles

Burns & McDonnell
SINCE 1898

Figure 1: Proposed Site Location

V:\Sunflower\63716\GIS\DataFiles\ArcDocs\Sunflower Site Figure Round 2.mxd

APPENDIX B

APPENDIX B

Ozone Limiting Method Modeling Protocol for AERMOD

Mid-Kansas Electric Company, LLC

Rubart Station Project

Project No. 63716

February 2012

Ozone Limiting Method Modeling Protocol for AERMOD

prepared for

Mid-Kansas Electric Company

February 2012

Project No. 63716

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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1.0 INTRODUCTION

Mid-Kanas Electric Company, LLC (MKEC) is proposing to construct a nominal 120-megawatt (MW) power facility in Grant County, Kansas. The proposed facility will consist of twelve nominal 10-MW internal combustion engines and associated equipment (gas heater, emergency fire pump, and emergency generator) and will be operated by Sunflower Electric Power Corporation. The Rubart Station Project (hereinafter referred to as Project) will be located on a greenfield site in the north half of Section 1, T29S, R35W. Preliminary estimated potential emissions indicate that the proposed facility will be a major source under Prevention of Significant Deterioration (PSD) rules; as a result, the project will be subject to PSD construction permit review. A PSD permit requires an assessment of ambient impacts for those pollutants subject to PSD review.

This modeling protocol addresses the ozone limiting method (OLM) methodology that will be used for the nitrogen dioxide (NO_2) 1-hour air dispersion modeling for the Project. This modeling protocol has been drafted in accordance with the U.S. Environmental Protection Agency (EPA) and the Kansas Department of Health and Environment (KDHE) modeling guidelines.

2.0 PROPOSED MODEL

MKEC is proposing to use the most current version of the AMS/EPA Regulatory Model (AERMOD) for the air quality analysis (version 11353). AERMOD is an EPA-approved, steady-state Gaussian plume model capable of modeling multiple sources in simple and complex terrain. AERMOD is currently approved for industrial sources and PSD permits, and has been approved by the EPA as an appropriate model to demonstrate regulatory compliance.

The following default model options will be used:

- Gradual Plume Rise
- Stack-tip Downwash
- Buoyancy-induced Dispersion
- Calms and Missing Data Processing Routine
- Calculate Wind Profiles
- Calculate Vertical Potential Temperature Gradient
- Rural Dispersion

Additionally the following non-default model option will be used:

- NO_2 Modeling

Details of the modeling algorithms contained in AERMOD may be found in the User's Guide for AERMOD. The regulatory non-default option will be selected for this analysis to perform the OLM NO_2 modeling. The OLM modeling parameters that will be used in the model are discussed in Section 3.0.

Per KDHE guidance and EPA's March 2011 memo[1] the emergency generator and emergency fire pump will operate less than 100 hours annually and are considered intermittent sources; therefore, these sources will not be included in the 1-hour modeling analysis.

3.0 MODELING METHODOLOGY

3.1 1-HOUR NO_2 AVERAGING PERIOD - OZONE LIMITING METHOD

The emission rates to be modeled will represent operations at worst-case ambient conditions under various operating capacities. The AERMOD model predicts ground-level concentrations of any generic pollutant without chemical transformations. Thus, the modeled nitrogen oxides (NO_X) emission rate will give ground-level modeled concentrations of NO_X. NAAQS values are presented as NO_2.

The (EPA) has a three tier approach to modeling NO_2 concentrations.

- Tier I – total conversion, or all $NO_x = NO_2$
- Tier II – use a default NO_2/NO_x ratio
- Tier III – case-by-case detailed screening methods, such as OLM and Plume Volume Molar Ratio Method (PVMRM)

Initial modeling was performed using both Tier I and Tier II methodologies. It was determined from these modeling iterations that less conservative methods for determining 1-hour NO_2 compliance would be needed for this project. To account for the conversion of NO_x to NO_2 in the modeling, the Tier III approach using the OLM method will be used for the 1-hour NO_2 PSD significance and refined (cumulative) air dispersion modeling. The PSD significance threshold will be compared to the modeled first high, while the NAAQS threshold will be compared to the five-year average modeled 98th percentile of the annual distribution of maximum daily 1-hour values.

The amount of NO_2 present in the stack gases was determined for each piece of equipment being modeled and was determined from published data. Based on available information provided by the San Joaquin Valley Air Pollution Control District (APCD)[2], the following in-stack NO_2/NO_x ratios will be used:

- Natural gas-fired reciprocating engine with post combustion controls: 0.0115
- Natural gas-fired fuel heaters: 0.10

The selection of source-specific in-stack ratios instead of using a default in-stack ratio is in accordance with methodology presented in EPA's March 2011 memo.

Some inventory sources being included in the cumulative modeling for this Project were also included in the Holcomb Expansion Project 1-hour NO_2 modeling. Therefore, previously accepted in-stack NO_2/NO_x ratios that were applied to the inventory sources for the Holcomb Expansion Project 1-hour NO_2 modeling will be used for this Project. In summary, the inventory provided by KDHE for this Project will be used, but the in-stack ratios from the Holcomb Expansion Project will be applied to the current inventory sources. An in-stack ratio of 0.2 will be used for remaining unidentified inventory sources.

Additionally, an equilibrium NO_2/NO_x ratio of 0.90 will be used per EPA's March 2011 memo.

3.2 ANNUAL NO_2 AVERAGING PERIOD

The OLM methodology will not be applied to the NO_2 annual averaging period. The modeled concentrations of annual NO_X will be adjusted using the EPA-approved Ambient Ratio Method (ARM) (Tier 2 methodology). Tier 2 of the ARM allows the use of an empirically derived NO_2/NO_X ratio of 0.75, which means that approximately 75 percent of the NO_X emissions will be converted to NO_2, the regulated pollutant. This factor will be applied to the annual modeled results for NO_X to determine the predicted ground-level concentration of NO_2.

3.3 BACKGROUND OZONE

Hourly background ozone concentrations were obtained from the KDHE for years 2006 to 2010 for the Cedar Bluff monitoring station located in Trego County, Kansas (AQS ID: 20-195-0001). A default value of 34 parts per billion (ppb) was used as a substitute for missing ozone data from the ozone file.

[1] March 1, 2011 EPA Memo from Tyler Fox. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard
[2] http://www.valleyair.org/busind/pto/Tox_Resources/AirQualityMonitoring.htm#no2_data (Found under "Modeling Guidance", titled "NO_2/NOx In-Stack Ratios").

The background ozone data was formatted to be used in the AERMOD model and matches the meteorological data years that are currently being used in the modeling.

3.4 NAAQS AND NO_2 BACKGROUND VALUE

The NO_2 1-hour background air quality value was obtained from the KDHE for years 2006 to 2010 for the Peck monitoring station located in Sumner County, Kansas (AQS ID: 20-191-0002). The five year average monitored 98th percentile of the annual distribution of maximum daily 1-hour concentration for NO_2 is 49.0 micrograms per cubic meter (µg/m^3).

This background value will be added to the model-predicted concentration (98th percentile) for comparison to the 1-hour NO_2 NAAQS value of 188.0 µg/m^3.

4.0 SUMMARY

This modeling protocol has been presented for an OLM modeling method for NO_2 1-hour modeling using AERMOD for the construction of twelve new 10-MW, natural gas-fired, internal combustion engines and associated equipment for the proposed Project. The modeling protocol has been submitted for KDHE and EPA concurrence with the modeling methods.

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Nelson, Minda

From: Mindy Bowman <mbowman@kdheks.gov>
Sent: Tuesday, February 21, 2012 2:36 PM
To: Mary Hauner-Davis, Reynolds, Paul; Seacat, Derek; Penrod, Wayne; Nelson, Minda; Graves, Tom
Cc: Marian Massoth; Gerald McIntyre; Susana Pjesky; Daye.Richard@epamail.epa.gov; Ward Burns (burns.ward@epa.gov); Smith.Marka@epamail.epa.gov; BAR ImageNow
Subject: Re: Sunflower Electric Power Cooperative's Modeling Protocol for Rubart Station

Mid-Kansas Electric Company, LLC
Rubart Station
Source ID No. 0670173
C-10021
Modeling

Mary,

KDHE has reviewed the modeling protocol submitted on February 3, 2012. We also shared the modeling protocol with EPA Region 7, and have not received comments. KDHE comments are as follows:

- Section 2.0 Project Description, page 2 states that annual emissions for the emergency generator and emergency fire pump will be based on 100 hours per year.

  Comment:

  KDHE typically allows 500 hours per year operation for emergency equipment and models for 500 hours operation when modeling annual standards. If operating hours are limited to 100 hours per year in the model, a permit condition may be required.

- Section 4.1 NO_2 Modeling – Multi-Tiered Screening Approach, page 4 states that the OLM method will be used for the NO_2 1-hour air dispersion modeling analysis.

  Comment:

  This method requires approval from EPA Region 7. KDHE has shared your request with EPA Region 7. Please see March 1, 2011 EPA Memorandum by Tyler Fox, Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard and June 28, 2010 EPA Memorandum by Tyler Fox, Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard.

- Section 4.3 Emission Source Parameters, page 5 states that annual emissions for the proposed engines will be based on 3 startups per day at 30 minutes each plus full load operation for the rest of the year.

  Comment:

  For the scenario described, as well as all other scenarios, KDHE recommends a careful review to ensure that all units are modeled based on representative operating conditions. The final permit typically includes a permit condition similar to the following:

If significant changes are made, or modeling parameters are not representative of site conditions, the facility shall document compliance with the NAAQS and increments and submit documentation of compliance to KDHE prior to making the change(s). KDHE has final authority in determining what constitutes a significant change. If modeling indicates a potential NAAQS or increment violations, then mitigation shall be required. [K.A.R. 28-19-301(e)]

- Section 5.1 Receptor Grid, page 5 states that NAD 27 will be used to develop UTM coordinates for this project.

  Comment:

  KDHE recommends that NAD 83 be used to develop UTM coordinates. KDHE recommends the following receptor grid be used:

Receptor Spacing for Significant Impact Modeling	
Distance from Facility Boundary (meters)	**Receptor Spacing (meters)**
Fenceline to 1,000	50
1,000 m to 2,000	100
2,000m to 10,000	250
>10,000	500

- Section 5.4 Emission Factors, page 6 states that EMISFACT modeling options may be used to model the appropriate hourly restrictions on any equipment activities that only occur over a certain number of hours per day or seasons per year.

  Comment:

  Hourly restrictions in modeling may require associated permit conditions.

- Section 5.5 Significant Impact Area Determination, page 7 states that the maximum possible radius of impact distance will be 20 kilometers, in accordance with KDHE correspondence.

  Comment:

  KDHE typically uses a radius of 20 kilometers to select nearby sources for short term standards. If a large source outside this radius is identified and is expected to cause a significant concentration gradient in the vicinity of the proposed source, it may also be included. If refined modeling is required for annual standards, a nearby source inventory will be provided for the radius of impact plus 50 kilometers.

- Table 4 on page 9 identifies the Modeled High to use for each pollutant and averaging period. For PM_{10}, 24-hour averaging period, the modeled high referenced is the sixth high. For $PM_{2.5}$, annual averaging period, the modeled high referenced is the annual mean. For $PM_{2.5}$, 24-hour averaging period, the modeled high referenced is the 98th percentile.

  Comment:

  KDHE requests that the facility follow the March 23, 2010 EPA Memorandum by Stephen Page, Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS. For PM_{10}, 24-hour averaging period, the NAAQS

should not be exceeded more than once per year on average over 5 years. For $PM_{2.5}$, annual averaging period, the high first high should be compared to the NAAQS. For $PM_{2.5}$, 24-hour averaging period, the high first high should be compared to the NAAQS.

- Appendix B, page 3 includes a discussion of in-stack NO_2/ NO_x ratios that will be used.

  Comment:

  Please provide additional supporting documentation for the proposed ratio of 0.0115 to be used for natural gas fired reciprocating engines with post combustion controls. This documentation should demonstrate why a ratio of 0.0115 is representative for the in-stack NO_2/ NO_x ratios of these engines. The documentation could be in the form of performance testing for an engine similar to the engines for which the ratio will be used. Regarding the proposed ratio of 0.2 for remaining unidentified inventory sources, KDHE requests that all sources be identified and documentation demonstrating representativeness of associated ratios. The use of in-stack NO_2/ NO_x ratios under Tier 3 is considered to be a non-regulatory default option and requires approval from EPA Region 7.

If have questions, please feel free to contact me at (785) 296-6421 or Susana Pjesky at (785) 296-1691.

Sincerely,

Mindy Bowman

_____

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Nelson, Minda

From: Richard Daye <Daye.Richard@epamail.epa.gov>
Sent: Wednesday, February 22, 2012 9:58 AM
To: Mindy Bowman
Cc: Mary Hauner-Davis, Reynolds, Paul; Seacat, Derek; Penrod, Wayne; Nelson, Minda; Graves, Tom; Marian Massoth; Gerald McIntyre; Susana Pjesky; Ward Burns; MarkA Smith; BAR ImageNow
Subject: Re: Sunflower Electric Power Cooperative's Modeling Protocol for Rubart Station

Hi Mindy
Your comments are similar to the ones that I planned to send to you.
In addition to your comments:

Section 4.3 & Section 5.8 page 10 The 3 startups per day of the engines should be modeled, short-term and annual. I do not believe that these are "intermittent" conditions as they occur every day. I have asked the clearing house for its thoughts but I have not yet heard back.

Section 5.2 I assume that 1-minute meteorological data are included in the meteorological files.

Please call me if you have any questions (913-551-7619).

Mick

Richard L Daye
Regional Meteorologist
Environmental Protection Agency Region 7 AWMD/APDB/APS
901 North 5th Street
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From: Mindy Bowman <mbowman@kdheks.gov>
To: "Mary Hauner-Davis, Reynolds, Paul" <preynolds@sunflower.net>, "Seacat, Derek" <dseacat@sunflower.net>, "Penrod, Wayne" <WPenrod@sunflower.net>, "Nelson, Minda" <mnelson@burnsmcd.com>, "tgraves@burnsmcd.com" <tgraves@burnsmcd.com>
Cc: Marian Massoth <MMassoth@kdheks.gov>, Gerald McIntyre <GMcIntyre@kdheks.gov>, Susana Pjesky <spjesky@kdheks.gov>, Richard Daye/R7/USEPA/US@EPA, Ward Burns/R7/USEPA/US@EPA, MarkA Smith/R7/USEPA/US@EPA, BAR ImageNow <BImagenow@kdheks.gov>
Date: 02/21/2012 02:35 PM
Subject: Re: Sunflower Electric Power Cooperative's Modeling Protocol for Rubart Station

San Joaquin Valley Air Pollution Control District
Background Information

and

Rubart Station In-stack Ratios

http://www.valleyair.org/busind/pto/Tox_Resources/AirQualityMonitoring.htm#no2_data

(Found under “Modeling Guidance”, titled “NO2/NOx In-Stack Ratios”).

Recommend In-stack NO2/NOx Ratios				
Refer #	**Fuel**	**Equipment Category (Controls)**	**Range of Ratios (%)**	**Recommended Ratio (%)**
		Boilers		
1	**NG**	Default	10	10
2		6.6 MMBtu/Hr (Force Draft)*L	0.0 – 2.90	1.58**
2		7.6 MMBtu/Hr (SCR / FGR)*	3.45 – 15.79	9.65**
2		11.4 MMBtu/Hr (Force Draft)*L	1.81 – 3.51	2.68**
		Compressor IC Engines		
1	**NG**	Default	60	60
2a		225 BHP IGN Timing BTC 17***	11.61 – 11.86	11.76**
2a		350 BHP IGN Timing BTC 18***	4.37 – 4.83	4.66**
2a		550 BHP IGN Timing BTC 20***	0.93 – 2.98	1.96**
2a		625 BHP IGN Timing BTC 10***	10.97 – 11.96	11.6**
2a		773 BHP IGN Timing BTC 9***	58.04 – 58.54	58.3**
2a		773 BHP IGN Timing BTC 20***	72.65 – 73.42	73.12**
2a		880 BHP IGN Timing BTC 8***	9.79 – 14.14	11.93**
2a		880 BHP IGN Timing BTC 15***	0.7 – 8.28	2.52**
2a		1500 BHP IGN Timing BTC 12***	10.32 – 12.03	11.47**
2a		1500 BHP IGN Timing BTC 6.5***	18.42 – 21.33	19.97**
2a		4000 BHP IGN Timing BTC 5***	22.36 – 25.69	23.82**
2a	**Waste Gas (Field Gas)**	880 BHP IGN Timing BTC 20***	1.77 – 6.10	3.86**
2a		1000 BHP***	0.40 – 0.81	0.64**
		Dryer		
	NG	20 MMBTU/Hr (Milk -Tower Dryer)*	3.85 – 11.11	6.88**
		Glass Furnace		
2	**NG**	**Glass Furnace**	2.45 – 11.59	4.32**
		Heaters		
2	**NG / Refinery Gas**	14.1 MMBTU/Hr (John Zink PSMR)*	11.54 – 52.63	32.0**
		IC Engines		
2	**Biogas**	200 BHP*	0.0 – 1.90	0.37**
1	**Diesel**	Default	20	20
		322 BHP (WP)*	0.0 – 50.0	15.64**
4	**NG**	Default – Lean Burn	5-10	10
2		120 BHP (3-Way Catalyst)*	0.1 – 2.83	0.9**
2		162 BHP (Catalytic converter, air/fuel ratio)*	0.0 – 12.5	1.81**
2		165 BHP (3-Way Catalyst)*	0.0 – 17.58	3.16**
2		180 BHP (NSCR)*	1.02 – 3.41	1.82**
2		208 BHP (Catalytic converter, air/fuel ratio)*	0.0 – 1.44	0.48**
2		1,070 BHP (LB/WP–Turbocharger/Intercooler)*	20.91 – 39.62	34.41**
2		1,529 BHP (LB - CO Catalyst, SCR)*	2.70 – 4.58	3.59**
2		2,775 BHP (SCR)*	14.53 – 26.33	19.46**
2		4,175 BHP (SCR,CO & VOC Catalysts)*	0.0 – 21.28	1.15**
		Transportation Refrigeration Units (TRUs)		
5		CARB= CARB Diesel GTL = Gas To Liquid	Fuel / Eng Speed / Exhaust	NO_2/ NO_x Ratio
			CARB / High / Muffler	15.37
			GTL / High / Muffler	16.17
			CARB / High / pDPF	25.71
			CARB / Low / Muffler	22.66
			GTL / Low / Muffler	25.12
			CARB / Low / pDPF	12.98
		Truck / Cars		
6	**Gas/Diesel**	Light / Medium Duty	16-25	25
	Diesel	Heavy Duty	6-11	11
		Turbines		
3	**NG**	GE Turbines	8.33 – 9.1	9.1
2a		Solar Centaur T-4702 (3.4 MW)***	8.43 – 12.42	10.32**

* Samples taken each minute or several minutes

**Value represents the statistical average of all data points

*** 30 min / 1 hour Source Test

L = Load ratings have been included in average

LB = Lean Burn

WP = Water Pump

References

1. Barrie Lawrence, Environmental Scientist, Government of Newfoundland and Labrador, "Guideline for Plume Dispersion Modeling" 1st Revision: November 20, 2006, Page 14

2. District Database "NO2 -NOx Ratio.mdb" - Data is based on CEMs, source test, and portable analyzer data collected in the San Joaquin Valley

a. District Database "NO2 -NOx Ratio.mdb" - Data is based on source test data collected from out of state (Arkansas Department of Environmental Quality Office of Air Quality)

3. Roointon Pavri and Gerald D. Moore, GE Energy Services Atlanta, GA, "Gas Turbine Emissions and Control" March 2001 Page 6

4. Nigel N. Clark, Center for Alternative Fuels, Engines and Emissions Department of Mechanical and Aerospace Engineering West Virginia University Morgantown, WV 26506, "Selective NOx Recirculation for Stationary Lean-Burn Natural Gas Engines" April 30, 2007 Page 64

5. Robb A. Barnitt, National Renewable Energy Laboratory, "Emissions of Transport Refrigeration Units with CARB Diesel, Gas-to-Liquid Diesel, and Emissions Control Devices", May 1, 2010

6. P G Boulter, I S McCrae, and J Green, Transportation research Laboratory, "Primary NIO2 Emissions From Road Vehicles in the Hatfield and Bell Commons Tunnels", July 2007

Rubart Station Source	In-stack NO2/NOx Ratio	Source		Fuel
All Engines (1-24)	0.0115	SJVCA*	Excel Line 42	NG
HTR_1	0.1	SJVCA*	Excel Line 4	NG
GEN_1_S	0.1	SJVCA*	Excel Line 33	NG
GEN_1_L	0.1	SJVCA*	Excel Line 33	NG
FP_1_S	0.2	SJVCA*	Excel Line 31	Diesel
FP_1_L	0.2	SJVCA*	Excel Line 31	Diesel

*See spreadsheet "AssessmentofNon-RegulatoryOptioninAERMODAppendixC32111.xls"

Nelson, Minda

From: Hauner-Davis, Mary
Sent: Thursday, March 29, 2012 3:50 PM
To: Nelson, Minda
Subject: FW: NO2-NOx Ratio Citations
Attachments: c3775 1926693 .pdf

Background information on the NOx ratios.

Mary Hauner-Davis
Burns & McDonnell
Phone: 816-822-4252
Mobile: 402-730-9631
Fax: 816-822-4299

From: Leland Villalvazo [mailto:leland.villalvazo@valleyair.org]
Sent: Thursday, March 29, 2012 3:49 PM
To: Hauner-Davis, Mary
Subject: RE: NO2-NOx Ratio Citations

Here's the data you requested.

Leland Villalvazo
Supervising Air Quality Specialist
San Joaquin Valley APCD
1990 E Gettysburg Ave
Fresno, CA 93726
Ph:(559) 230-5881
Fax(559) 230-6061
Emails:
leland.villalvazo@valleyair.org
HRAModeler@valleyair.org
inventory@valleyair.org

HEALTHY AIR LIVING™
www.healthyairliving.com
Make one change for clean air!

From: Hauner-Davis, Mary [mailto:mhauner@burnsmcd.com]
Sent: Thursday, March 29, 2012 11:47 AM
To: Leland Villalvazo
Cc: Nelson, Minda
Subject: NO2-NOx Ratio Citations

Please send me the data for 4175 BHP IC Engines from your posted NO2-NOx ration database. Thank you very much!!

Citation:

2. District Database “NO2 -NOx Ratio.mdb” - Data is based on CEMs, source test, and portable analyzer data collected in the San Joaquin
Valley

Mary Hauner-Davis
Manager, Air/Noise Department, Env. Studies & Permitting
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Please consider the environment before printing this e-mail.

SJVAPCD
Variance

Compliance Verification Report

03/17/2010
11:41 am

Variance: C-10-05E **Type:** Emergency **Hearing Date:** 02/16/2010

Source: CALIFORNIA POWER HOLDINGS LLC

Location: 16457 AVENUE 24 1/2 **City:** Chowchilla

Rule(s): 1081,2070,2201,4702

Equipment: The subject equipment consists of a 4,157 HP Deutz natural gas fired engine used to generate electricity. The emissions are controlled by a selective catalytic reduction (SCR) system

Scope Of Variance: The variance shall allow for the operation of the subject engine with excess NOX while CPH operates the engine to diagnose the reason behind the high NOX measurements. In addition, the variance will allow for the postponement of the annual source test.

Please verify that the following increments of progress have been met. After verifying that final compliance has been achieved, send the report with any supporting documentation to the Central Region Office.

DATE	INCREMENTS OF PROGRESS	COMPLETED
02/16/2010	Variance Begins	2/16/2010
03/17/2010	Variance Ends/Compliance Required	3/01/2010
04/01/2010	Summary Report Due	3/15/2010

Compliance with all applicable District rules was achieved on 3 / 01 / 2010

Compliance with all of the above increments was achieved on 3 / 01 / 2010

Final compliance with this variance was verified on 3 / 17 / 2010

Method of verification: Summary Report
(CEM Data, Correspondence, District Action, Email, Hearing Board Action, Inspection, Production Data, Report, Source Test, Notice, or VEE)

Excess emissions associated with variance: Ø

Pollutant	Quantity	Units	Pollutant	Quantity	Units	Pollutant	Quantity	Units

Pollutant	Quantity	Units	Pollutant	Quantity	Units	Pollutant	Quantity	Units

Inspector

Supervisor

BEFORE THE HEARING BOARD
OF THE
SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT
CENTRAL REGION
STATE OF CALIFORNIA

In the matter of: California Power Holdings, LLC 16457 Avenue 24 ½ Chowchilla, CA 93610	**DOCKET NO. C-10-05E**
For a variance from: 1081 – *Source Sampling* 2070.7.0 – *Operation According to the Permit to Operate Conditions* 2201 – *New and Modified Stationary Source Review Rule* 4702 – *Internal Combustion Engines*	**ORDER GRANTING AN EMERGENCY VARIANCE**
District Permit Number: C-3775-12-5	**Granted on:** February 16, 2010
EPA Airs Number: N/A	**Effective from:** February 16, 2010 **Effective to:** March 17, 2010

On February 11, 2010, California Power Holdings, LLC, (CPH) filed with the Central Region Hearing Board a petition for an emergency variance. CPH requested that the Hearing Board grant an emergency variance from San Joaquin Valley Unified Air Pollution Control District (District) Rules 1081, 2070.7.0, 2201, and 4702.

On February 16, 2010, CPH came before Mr. Robert Schumacher, Vice Chair of the Central Region Hearing Board, to obtain an emergency variance. The hearing was held pursuant to California Health and Safety Code (CH&SC) Section 42359.5 and District Rule 5200 – *Emergency Variance*. Mr. Ron Dahlin represented CPH, while Mr. Patrick Houlihan, Senior Air Quality Specialist, represented the District.

LOCATION AND EQUIPMENT

1. CPH operates a "peaker plant" electrical power generating facility located at 16457 Avenue 24 ½ in Chowchilla, CA.

2. The subject equipment consists of a 4,157 HP Deutz natural gas fired engine used to generate electricity. The emissions are controlled by a selective catalytic reduction (SCR) system.

3. The operation of the subject equipment is authorized by duly issued District Permit to Operate (PTO) #C-3775-12-5.

BACKGROUND

CPH operates 16 natural gas fired engines that are used to generate electricity. Each engine is connected to a 3.1 mega-watt generator. CPH is a "peaker plant" and only operates their engines when called upon to provide electricity to the grid. These engines were due for their annual source test by February 26, 2010. In anticipation of the source test, CPH started the engines to pre-test the exhaust emissions and perform any maintenance if deemed necessary. CPH pre-tested the emissions with a portable exhaust analyzer. Engine #12 tested with high NO_X emissions of 9.5 ppm. The PTO requires that NO_X emissions stay below a concentration of 9 ppm. CPH shut the engine down and replaced the catalyst, adjusted the engine valves, and replaced the spark plugs. Unfortunately, this still did not reduce emissions down below the PTO limit. CPH preceded with the source tests on the other 15 engines, but had to postpone engine #12's source test. Since CPH still hadn't brought the engine into compliance, they had to request a variance to allow for excess emissions and to postpone the source test. CPH needs to evaluate the engine and control technology to bring the engine into compliance quickly because they stand the chance of losing revenue if called upon to provide electricity and can't do so.

RULE REQUIREMENTS AND VIOLATIONS

1. The equipment subject to this variance is regulated by the following District Rules:

   A. 1081 – *Source Sampling*
   B. 2070.7.0 – *Operation According to the Permit to Operate Conditions*
   C. 2201 – *New and Modified Stationary Source Review Rule*
   D. 4702 – *Internal Combustion Engines*

2. District Rule 2070.7.0 requires that the subject equipment be operated in accordance with the conditions of the applicable PTO. District Rules 2201 and 4702 limits NO_X emissions. District Rules 1081 and 4702 require a source test every 12 months for this engine.

3. The subject equipment will be in violation of the applicable District Rules and PTO conditions if the subject engine operates during the variance period with excess NO_X emissions.

FINDING OF FACT

Pursuant to CH&SC Sections 42352 - 53 and District Rule 5200 – *Emergency Variance*, the following findings have been made:

1. ***That the petitioner for a variance is, or will be, in violation of Section 41701 or of any rule, regulation, or order of the District.***

   The Hearing Board finds that the operation of the engine with excess NO_X emissions is a violation of District Rules 2070.7.0, 2201, and 4702, in addition to the applicable PTO conditions. Not source testing every 12 months is a violation of District Rules 1081 and 4702 in addition to the applicable PTO conditions.

2. ***That, due to conditions beyond the reasonable control of the petitioner requiring compliance would result in either (1) an arbitrary or unreasonable taking of property, or (2) the practical closing and elimination of a lawful business.***

The Hearing Board finds that CPH attempted to correct the emissions violation within the timeframe allotted by the conditions of the PTO. The attempts were unsuccessful and a proper cause of the excess emissions was not diagnosed. Because the PTO does not allow for anymore operation with excess emissions, CPH would not be allowed to operate this engine without receiving a Notice of Violation. CPH did shut down the engine after measuring the excess emissions and have not operated it since. Not allowing future operation of this engine would result in an arbitrary or unreasonable taking of property.

3. ***That the closing or taking would be without a corresponding benefit in reducing air contaminants.***

The Hearing Board finds that given the minimal excess emissions, the closing or taking would be without a corresponding benefit in reducing air contaminants. In addition, if the variance is not granted to allow CPH to fix the engine, CPH could lose approximately $1000 a day each time the subject engine is called upon by the California Independent System Operator (Cal ISO) to provide electricity to the grid.

4. ***That the applicant for the variance has given consideration to curtailing operations of the source in lieu of obtaining a variance.***

The Hearing Board finds that CPH shut down the engine upon discovering the excess emissions. However, a long term operational curtailment is not feasible due to the contractual requirements to provide power when called into service by the Cal ISO. Also, a curtailment will not allow CPH to diagnose the problem. The engine needs to be in operation for diagnosis.

5. ***During the period the variance is in effect, that the applicant will reduce excess emissions to the maximum extent feasible.***

The Hearing Board finds that excess emissions will be reduced to the maximum extent feasible by only operating the engine as necessary to diagnose and fix the cause of the excess NO_X.

6. ***During the period the variance is in effect, that the applicant will monitor or otherwise quantify emission levels from the source, if requested to do so by the District, and report these emissions levels to the District pursuant to a schedule established by the District.***

The Hearing Board finds that during the variance period, CPH will continue to monitor emissions from the subject engine with a portable exhaust emissions analyzer. This information will be provided to the District upon request.

CONCLUSIONS AND ORDER

NOW, THEREFORE, the CENTRAL REGION HEARING BOARD ORDERS that an emergency variance be granted to California Power Holdings, LLC, subject to the following conditions:

1. The variance shall be effective from February 16, 2010 to March 17, 2010, or until such time the engine achieves compliance with the permitted emissions limit, whichever occurs first.

2. Variance relief shall only be granted from the applicable sections of District Rules 1081, 2070.7.0, 2201, and 4702, in addition to conditions 9 and 18 of PTO #C-3775-12-5, but only as they pertain to the operation of the subject engine with excess NO_X emissions and source testing every 12 months.

3. The variance shall allow for the operation of the subject engine with excess NO_X while CPH operates the engine to diagnose the reason behind the high NO_X measurements. In addition, the variance will allow for the postponement of the annual source test.

4. Excess NO_X emissions shall not exceed 0.5 pounds per hour during operation of the subject engine during the variance period.

5. No relief from other excess emissions shall be provided.

6. No relief shall be provided from the results of the source test.

7. No exceedences of the Daily Emission Limit shall be allowed.

8. CPH shall maintain records in accordance with condition #31 of PTO C-3775-12-5 and shall report those on the summary report as required below.

9. CPH shall utilize a portable exhaust analyzer to measure the emissions every time the subject engine operates. The results reported to the District shall be the average of a consecutive 15 minute run corrected to 15% oxygen.

10. Should the District receive complaints or if the facility experiences operation conditions likely to cause a public nuisance, CPH shall cease the operations causing the complaints or problems and take all necessary actions to abate the problem immediately.

11. By April 1, 2010, or 15 days after the emergency variance is completed, whichever occurs first, CPH shall submit to the District a summary report. However, if another variance or series of variances regarding this same matter should be granted by the Central Region Hearing Board, submittal of said summary report should occur in accordance with the time frames established within said variances. The report shall include:

    A. A summary of all corrective actions taken to bring the engine's emissions into compliance;
    B. Date, time, and duration of operation of the engine;
    C. Date of source test;

D. Copies of all emissions sampling and calibration data from the portable exhaust analyzer; and

E. Calculation of the actual excess NO_X emissions released during the variance period.

12. All notifications and submittals to the District pursuant to this variance shall be submitted to the attention of:

Mr. Ryan Hayashi, Supervising AQS
SJVUAPCD – Compliance Department
1990 E. Gettysburg Avenue
Fresno, CA 93726
Telephone: (559) 230-6000
E-mail: ryan.hayashi@valleyair.org

13. Failure to comply with any condition of this variance may render the variance null and void.

THE FORGOING DECISION IS APPROVED:

Mr. Robert Schumacher, Vice Chair
Hearing Board – Central Region
San Joaquin Valley Unified APCD

2-28-10
Date

ATTEST:

Angie DeSantiago, Clerk to the Boards

3/2/10
Date

Corrective Actions Summary

PTO Emissions Variance

California Power Holdings, Chow II Facility
Date: March 5, 2010
Asset Manager: John Walsh
Facility Manager: Ron Dahlin
Operator: Gary Dean

RE: Statement of corrective actions taken to correct Engine 12 emissions problem including sampling & calibration data.

February 24, 2010

- Replaced worn ball joints for both A & B side speed governor throttle linkages after they were found to be sticky.
- Re-checked all valve clearances to confirm proper adjustment.
- The engine was not operated.

February 25, 2010

- During calibration of the two fuel stepper motors, a strange sound was noticed from the B-side unit. The motor was tested off the engine and found to be intermittently faulty. It failed to move properly in both directions.
- Replaced the faulting stepper motor with spare.
- At 10:28 engine 12 was started and brought to proper operating temperature then operated until 14:53. While monitoring with the portable analyzer the engine emission levels were below permit limits.
- Measured 15-min average NOx @ 15% O2 – 4.6ppm

February 26, 2010

- At 08:59 engine 12 was started and brought to normal operating temperature then operated until 13:48.
- Adjustments were made to the jacket water control valve to improve engine load fluctuations.
- Adjusted SCR dosing system back to standard operating levels.
- While monitoring with the portable analyzer emission levels were below permit limits.
- Measured 15-min average NOx @ 15% O2 – 4.5ppm

March 1, 2010

- At 08:34 engine 12 was started and brought to normal operating temperature then operated until 12:26.
- Made additional adjustments to jacket water control system to further improve engine load fluctuations. Engine load now running with very little fluctuation, improving overall engine performance.
- While monitoring with the portable analyzer emission levels were below permit limits.
- Measured 15-min average NOx @ 15% O2 – 5.8ppm

Conclusion

- Corrections for engine 12 are complete and the unit is available to operate normally with all emissions within compliance of the PTO.
- The follow-up source test for Engine 12 is scheduled for March 12, 2010.
- Copies of all emissions sampling and calibration data are attached.
- There were no excess NOx emissions during the period of time that the unit operated.

In accordance with Condition 1 of the Emergency Variance, Engine 12 achieved compliance with the permitted emission limits and was returned to normal operation on March 1, 2010. Therefore, the Emergency Variance is no longer in effect.

Asset Manager_____ Date _____

Corrective Actions Summary

PTO Emissions Variance

California Power Holdings, Chow II Facility
Date: March 8, 2010
Asset Manager: John Walsh
Facility Manager: Ron Dahlin
Operator: Gary Dean

RE: Statement of corrective actions taken to correct Engine 12 emissions problem including sampling & calibration data.

February 24, 2010

- Replaced worn ball joints for both A & B side speed governor throttle linkages after they were found to be sticky.
- Re-checked all valve clearances to confirm proper adjustment.
- The engine was not operated.

February 25, 2010

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- There were no excess NOx emissions during the period of time that the unit operated.

In accordance with Condition 1 of the Emergency Variance, Engine 12 achieved compliance with the permitted emission limits and was returned to normal operation on March 1, 2010. Therefore the Emergency Variance is no longer in effect.

Asset Manager _____ Date 3/12/10

2-25-10

Engine #12
During Variance

ECOM-A Plus

Date	Time
02.25.10	12:22:12 PM

Gas analysis

Fuel type
Natural gas

T.Air		68	°F
T.Gas		65	°F
O2		9.1	%
CO	15.0%	12	ppm
NO	15.0%	3.4	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	3.5	ppm
CO2		6.6	%
Exc.air		1.76	
Sen.temp.		71	°F

California Power
Holdings, LLC.
16457 Avenue 24 1/2
Bldg. 6
Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date	Time
02.25.10	02:24:10 PM

Gas analysis 12

Fuel type
Natural gas

T.Air		76	°F
T.Gas		68	°F
O2		9.3	%
CO	15.0%	10	ppm
NO	15.0%	4.7	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	4.7	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

California Power
Holdings, LLC.
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Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date	Time
02.25.10	12:22:44 PM

Gas analysis

Fuel type
Natural gas

T.Air	68	°F
T.Gas	65	°F
O2	9.1	%
CO	25	ppm
NO	10.3	ppm
NO2	0.1	ppm
NOx	10.4	ppm
CO2	6.6	%
Exc.air	1.76	
Sen.temp.	71	°F

California Power
Holdings, LLC.
16457 Avenue 24 1/2

ECOM-A Plus

Date	Time
02.25.10	02:24:31 PM

Gas analysis

Fuel type
Natural gas

T.Air	76	°F
T.Gas	68	°F
O2	9.3	%
CO	21	ppm
NO	9.1	ppm
NO2	0.0	ppm
NOx	9.1	ppm
CO2	6.5	%
Exc.air	1.79	
Sen.temp.	79	°F

California Power
Holdings, LLC.
16457 Avenue 24 1/2
Bldg. 6

2-25-10

ECOM-A Plus

Date 02.25.10 Time 01:58:35 PM

Gas analysis

Fuel type
Natural gas

T.Air		73	°F
T.Gas		68	°F
O2		9.3	%
CO	15.0%	9	ppm
NO	15.0%	6.1	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	6.1	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		76	°F

California Power
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Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date 02.25.10 Time 02:01:17 PM

Gas analysis

Fuel type
Natural gas

T.Air		74	°F
T.Gas		68	°F
O2		9.2	%
CO	15.0%	10	ppm
NO	15.0%	5.1	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	5.1	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		76	°F

California Power
Holdings, LLC.
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Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date 02.25.10 Time 02:05:08 PM

Gas analysis

Fuel type
Natural gas

T.Air		74	°F
T.Gas		68	°F
O2		9.2	%
CO	15.0%	10	ppm
NO	15.0%	4.4	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	4.4	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		77	°F

California Power
Holdings, LLC.
16457 Avenue 24 1/2
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Chowchilla, CA 93610
Phone: 559-665-4577
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ECOM-A Plus

Date 02.25.10 Time 02:09:30

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		69	°F
O2		9.3	%
CO	15.0%	10	ppm
NO	15.0%	4.2	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	4.2	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		78	°F

California Power
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Phone: 559-665-4577
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ECOM-A Plus

Date 02.25.10 Time 01:59:02 PM

Gas analysis

Fuel type
Natural gas

T.Air	73	°F
T.Gas	68	°F
O2	9.3	%
CO	19	ppm
NO	11.4	ppm
NO2	0.0	ppm
NOx	11.4	ppm
CO2	6.5	%
Exc.air	1.79	
Sen.temp.	76	°F

California Power
Holdings, LLC.
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Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date 02.25.10 Time 02:01:17 PM

Gas analysis

Fuel type
Natural gas

T.Air	74	°F
T.Gas	68	°F
O2	9.2	%
CO	20	ppm
NO	10.1	ppm
NO2	0.0	ppm
NOx	10.1	ppm
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	76	°F

California Power
Holdings, LLC.
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Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date 02.25.10 Time 02:05:32 PM

Gas analysis

Fuel type
Natural gas

T.Air	74	°F
T.Gas	68	°F
O2	9.3	%
CO	20	ppm
NO	8.7	ppm
NO2	0.0	ppm
NOx	8.7	ppm
CO2	6.5	%
Exc.air	1.79	
Sen.temp.	77	°F

California Power
Holdings, LLC.
16457 Avenue 24 1/2
Bldg. 6
Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date 02.25.10 Time 02:09:30 PM

Gas analysis

Fuel type
Natural gas

T.Air	75	°F
T.Gas	69	°F
O2	9.3	%
CO	21	ppm
NO	8.2	ppm
NO2	0.0	ppm
NOx	8.2	ppm
CO2	6.5	%
Exc.air	1.79	
Sen.temp.	78	°F

California Power
Holdings, LLC.
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Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

2-25-10

Engine #12
During Variance.

ECOM-A Plus

Date Time
02.25.10 02:12:42 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		69	°F
O2		9.2	%
CO	15.0%	10	PPM
NO	15.0%	4.7	PPM
NO2	15.0%	0.0	PPM
NOx	15.0%	4.7	PPM
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		78	°F

California Power
Holdings, LLC.
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Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date Time
02.25.10 02:16:08 PM

Gas analysis

Fuel type
Natural gas

T.Air		76	°F
T.Gas		69	°F
O2		9.3	%
CO	15.0%	10	PPM
NO	15.0%	5.0	PPM
NO2	15.0%	0.0	PPM
NOx	15.0%	5.0	PPM
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date Time
02.25.10 02:18:50 PM

Gas analysis

Fuel type
Natural gas

T.Air		76	°F
T.Gas		69	°F
O2		9.2	%
CO	15.0%	10	PPM
NO	15.0%	4.7	PPM
NO2	15.0%	0.0	PPM
NOx	15.0%	4.7	PPM
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		79	°F

California Power
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ECOM-A Plus

Date Time
02.25.10 02:13:06 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		69	°F
O2		9.3	%
CO		20	PPM
NO		9.0	PPM
NO2		0.0	PPM
NOx		9.0	PPM
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		78	°F

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ECOM-A Plus

Date Time
02.25.10 02:16:33 PM

Gas analysis 12

Fuel type
Natural gas

T.Air		76	°F
T.Gas		69	°F
O2		9.3	%
CO		21	PPM
NO		9.5	PPM
NO2		0.0	PPM
NOx		9.5	PPM
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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ECOM-A Plus

Date Time
02.25.10 02:22:29 PM

Gas analysis

Fuel type
Natural gas

T.Air		76	°F
T.Gas		69	°F
O2		9.2	%
CO		21	PPM
NO		8.7	PPM
NO2		0.0	PPM
NOx		8.7	PPM
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		79	°F

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2-26-10

ECOM-A Plus

Date 02.26.10 Time 10:17:11 AM

Gas analysis

Fuel type
Natural gas

T.Air	71	°F
T.Gas	67	°F
O2	9.2	%
CO 15.0%	11	PPM
NO 15.0%	6.3	PPM
NO2 15.0%	0.1	PPM
NOx 15.0%	6.4	PPM
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	75	°F

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ECOM-A Plus

Date 02.26.10 Time 10:18:05 AM

Gas analysis

Fuel type
Natural gas

T.Air	72	°F
T.Gas	67	°F
O2	9.2	%
CO	24	PPM
NO	11.9	PPM
NO2	0.3	PPM
NOx	12.2	PPM
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	75	°F

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ECOM-A Plus

Date 02.26.10 Time 10:52:04 AM

Gas analysis

Fuel type
Natural gas

T.Air	73	°F
T.Gas	68	°F
O2	9.2	%
CO 15.0%	11	PPM
NO 15.0%	6.7	PPM
NO2 15.0%	0.1	PPM
NOx 15.0%	6.8	PPM
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	76	°F

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ECOM-A Plus

Date 02.26.10 Time 10:52:27 AM

Gas analysis

Fuel type
Natural gas

T.Air	73	°F
T.Gas	68	°F
O2	9.2	%
CO	23	PPM
NO	13.4	PPM
NO2	0.2	PPM
NOx	13.6	PPM
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	76	°F

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ECOM-A Plus

Date 02.26.10 Time 11:10:53 AM

Gas analysis

Fuel type
Natural gas

T.Air	73	°F
T.Gas	67	°F
O2	9.2	%
CO 15.0%	12	PPM
NO 15.0%	6.2	PPM
NO2 15.0%	0.2	PPM
NOx 15.0%	6.4	PPM
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	77	°F

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ECOM-A Plus

Date 02.26.10 Time 11:11:15 AM

Gas analysis

Fuel type
Natural gas

T.Air	73	°F
T.Gas	67	°F
O2	9.2	%
CO	24	PPM
NO	10.9	PPM
NO2	0.3	PPM
NOx	11.2	PPM
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	77	°F

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2-26-10

ECOM-A Plus

Date 02.26.10 Time 11:42:17 AM

Gas analysis

Fuel type
Natural gas

T.Air		74	°F
T.Gas		68	°F
O2		9.3	%
CO	15.0%	11	ppm
NO	15.0%	5.0	ppm
NO2	15.0%	0.1	ppm
NOx	15.0%	5.1	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		78	°F

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ECOM-A Plus

Date 02.26.10 Time 11:47:17 AM

Gas analysis

Fuel type
Natural gas

T.Air		74	°F
T.Gas		68	°F
O2		9.2	%
CO	15.0%	11	ppm
NO	15.0%	3.9	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	3.9	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		78	°F

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ECOM-A Plus

Date 02.26.10 Time 11:51:52 AM

Gas analysis

Fuel type
Natural gas

T.Air		74	°F
T.Gas		68	°F
O2		9.3	%
CO	15.0%	10	ppm
NO	15.0%	4.3	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	4.3	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		78	°F

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ECOM-A Plus

Date 02.26.10 Time 12:05:55 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.2	%
CO	15.0%	11	ppm
NO	15.0%	4.5	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	4.6	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		79	°F

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ECOM-A Plus

Date 02.26.10 Time 11:42:40 AM

Gas analysis

Fuel type
Natural gas

T.Air		74	°F
T.Gas		68	°F
O2		9.3	%
CO		22	ppm
NO		9.0	ppm
NO2		0.2	ppm
NOx		9.2	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		78	°F

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ECOM-A Plus

Date 02.26.10 Time 11:47:38 AM

Gas analysis

Fuel type
Natural gas

T.Air		74	°F
T.Gas		68	°F
O2		9.2	%
CO		23	ppm
NO		8.1	ppm
NO2		0.1	ppm
NOx		8.2	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		78	°F

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ECOM-A Plus

Date 02.26.10 Time 11:52:13 AM

Gas analysis

Fuel type
Natural gas

T.Air		74	°F
T.Gas		68	°F
O2		9.3	%
CO		22	ppm
NO		8.3	ppm
NO2		0.1	ppm
NOx		8.4	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		78	°F

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ECOM-A Plus

Date 02.26.10 Time 12:06:19 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.2	%
CO		22	ppm
NO		10.0	ppm
NO2		0.1	ppm
NOx		10.1	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		79	°F

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2-26-10

ECOM-A Plus

Date 02.26.10 Time 12:21:22 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.3	%
CO	15.0%	10	ppm
NO	15.0%	4.1	ppm
NO2	15.0%	0.1	ppm
NOx	15.0%	4.2	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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ECOM-A Plus

Date 02.26.10 Time 12:27:20 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.3	%
CO	15.0%	11	ppm
NO	15.0%	4.3	ppm
NO2	15.0%	0.1	ppm
NOx	15.0%	4.4	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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ECOM-A Plus

Date 02.26.10 Time 12:33:47 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.3	%
CO	15.0%	11	ppm
NO	15.0%	4.8	ppm
NO2	15.0%	0.1	ppm
NOx	15.0%	4.9	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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ECOM-A Plus

Date 02.26.10 Time 12:40:43 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.3	%
CO	15.0%	11	ppm
NO	15.0%	4.6	ppm
NO2	15.0%	0.1	ppm
NOx	15.0%	4.7	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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ECOM-A Plus

Date 02.26.10 Time 12:21:45 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.3	%
CO		21	ppm
NO		7.7	ppm
NO2		0.1	ppm
NOx		7.8	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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ECOM-A Plus

Date 02.26.10 Time 12:27:44 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.3	%
CO		22	ppm
NO		8.2	ppm
NO2		0.2	ppm
NOx		8.4	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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ECOM-A Plus

Date 02.26.10 Time 12:34:08 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.3	%
CO		22	ppm
NO		8.9	ppm
NO2		0.1	ppm
NOx		9.0	ppm
CO2		5.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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ECOM-A Plus

Date 02.26.10 Time 12:41:05 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.2	%
CO		22	ppm
NO		9.0	ppm
NO2		0.2	ppm
NOx		9.2	ppm
CO2		5.6	%
Exc.air		1.78	
Sen.temp.		79	°F

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2-26-10

ECOM-A Plus

Date Time
02.26.10 12:47:22 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.3	%
CO	15.0%	11	ppm
NO	15.0%	4.3	ppm
NO2	15.0%	0.1	ppm
NOx	15.0%	4.4	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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ECOM-A Plus

Date Time
02.26.10 01:01:34 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		69	°F
O2		9.3	%
CO	15.0%	11	ppm
NO	15.0%	4.4	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	4.4	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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Date Time
02.26.10 01:30:17 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		69	°F
O2		9.3	%
CO	15.0%	11	ppm
NO	15.0%	4.6	ppm
NO2	15.0%	0.1	ppm
NOx	15.0%	4.7	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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Date Time
02.26.10 12:47:48 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		68	°F
O2		9.2	%
CO		22	ppm
NO		8.6	ppm
NO2		0.2	ppm
NOx		8.3	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		79	°F

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Date Time
02.26.10 01:01:34 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		69	°F
O2		9.3	%
CO	15.0%	11	ppm
NO	15.0%	4.4	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	4.4	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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Date Time
02.26.10 01:30:41 PM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		69	°F
O2		9.3	%
CO		22	ppm
NO		9.0	ppm
NO2		0.2	ppm
NOx		9.2	ppm
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		79	°F

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3-1-10

ECOM-A Plus

Date 03.01.10 Time 09:29:15

Gas analysis

Fuel type
Natural gas

T.Air		71	°F
T.Gas		66	°F
O2		9.2	%
CO	15.0%	10	ppm
NO	15.0%	4.8	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	4.8	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		75	°F

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ECOM-A Plus

Date 03.01.10 Time 09:41:47 AM

Gas analysis

Fuel type
Natural gas

T.Air		72	°F
T.Gas		67	°F
O2		9.2	%
CO	15.0%	10	ppm
NO	15.0%	5.4	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	5.4	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		76	°F

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ECOM-A Plus

Date 03.01.10 Time 09:49:59 AM

Gas analysis

Fuel type
Natural gas

T.Air		73	°F
T.Gas		67	°F
O2		9.2	%
CO	15.0%	11	ppm
NO	15.0%	5.3	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	5.3	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		76	°F

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ECOM-A Plus

Date 03.01.10 Time 11:03:53 AM

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		69	°F
O2		9.2	%
CO	15.0%	12	ppm
NO	15.0%	5.9	ppm
NO2	15.0%	0.0	ppm
NOx	15.0%	5.9	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		79	°F

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ECOM-A Plus

Date 03.01.10 Time 09:29:43 A

Gas analysis

Fuel type
Natural gas

T.Air		71	°F
T.Gas		66	°F
O2		9.2	%
CO		21	ppm
NO		8.6	ppm
NO2		0.0	ppm
NOx		8.6	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		75	°F

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ECOM-A Plus

Date 03.01.10 Time 09:42:16 AM

Gas analysis

Fuel type
Natural gas

T.Air		72	°F
T.Gas		67	°F
O2		9.2	%
CO		21	ppm
NO		10.4	ppm
NO2		0.0	ppm
NOx		10.4	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		76	°F

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ECOM-A Plus

Date 03.01.10 Time 09:50:41 AM

Gas analysis

Fuel type
Natural gas

T.Air		73	°F
T.Gas		67	°F
O2		9.2	%
CO		22	ppm
NO		9.3	ppm
NO2		0.0	ppm
NOx		9.3	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		76	°F

California Power
Holdings, LLC.
16457 Avenue 24 1/2
Bldg. 6
Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

ECOM-A Plus

Date 03.01.10 Time 11:04:29

Gas analysis

Fuel type
Natural gas

T.Air		75	°F
T.Gas		69	°F
O2		9.2	%
CO		23	ppm
NO		11.6	ppm
NO2		0.1	ppm
NOx		11.7	ppm
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		79	°F

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3-1-10

ECOM-A Plus

Date Time
03.01.10 11:33:59 AM

Gas analysis

Fuel type
Natural gas

T.Air	77	°F
T.Gas	71	°F
O2	9.2	%
CO 15.0%	12	ppm
NO 15.0%	6.9	ppm
NO2 15.0%	0.0	ppm
NOx 15.0%	6.9	ppm
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	80	°F

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ECOM-A Plus

Date Time
03.01.10 11:38:54 AM

Gas analysis

Fuel type
Natural gas

T.Air	77	°F
T.Gas	71	°F
O2	9.2	%
CO 15.0%	11	ppm
NO 15.0%	5.5	ppm
NO2 15.0%	0.0	ppm
NOx 15.0%	5.5	ppm
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	81	°F

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ECOM-A Plus

Date Time
03.01.10 11:45:45 AM

Gas analysis

Fuel type
Natural gas

T.Air	77	°F
T.Gas	71	°F
O2	9.2	%
CO 15.0%	11	ppm
NO 15.0%	5.3	ppm
NO2 15.0%	0.0	ppm
NOx 15.0%	5.3	ppm
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	81	°F

California Power
Holdings, LLC.
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Fax: 559-665-4866

ECOM-A Plus

Date Time
03.01.10 12:11:22 PM

Gas analysis

Fuel type
Natural gas

T.Air	78	°F
T.Gas	72	°F
O2	9.2	%
CO 15.0%	11	ppm
NO 15.0%	5.8	ppm
NO2 15.0%	0.0	ppm
NOx 15.0%	5.8	ppm
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	82	°F

California Power
Holdings, LLC.
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ECOM-A Plus

Date Time
03.01.10 11:34:20 AM

Gas analysis

Fuel type
Natural gas

T.Air	77	°F
T.Gas	71	°F
O2	9.2	%
CO	24	ppm
NO	13.5	ppm
NO2	0.0	ppm
NOx	13.5	ppm
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	80	°F

California Power
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ECOM-A Plus

Date Time
03.01.10 11:39:44 AM

Gas analysis

Fuel type
Natural gas

T.Air	77	°F
T.Gas	71	°F
O2	9.2	%
CO	23	ppm
NO	14.1	ppm
NO2	0.0	ppm
NOx	14.1	ppm
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	81	°F

California Power
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ECOM-A Plus

Date Time
03.01.10 11:46:07 AM

Gas analysis

Fuel type
Natural gas

T.Air	77	°F
T.Gas	71	°F
O2	9.2	%
CO	23	ppm
NO	10.3	ppm
NO2	0.0	ppm
NOx	10.3	ppm
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	81	°F

California Power
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Chowchilla, CA 93610
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ECOM-A Plus

Date Time
03.01.10 12:11:44 PM

Gas analysis

Fuel type
Natural gas

T.Air	78	°F
T.Gas	72	°F
O2	9.2	%
CO	23	ppm
NO	11.7	ppm
NO2	0.0	ppm
NOx	11.7	ppm
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	82	°F

California Power
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3-1-10

ECOM-A Plus

Date 03.01.10 Time 11:54:16 AM

Gas analysis

Fuel type
Natural gas

T.Air		77	°F
T.Gas		71	°F
O2		9.2	%
CO	15.0%	11	PPM
NO	15.0%	6.9	PPM
NO2	15.0%	0.0	PPM
NOx	15.0%	6.9	PPM
CO2		6.5	%
Exc.air		1.78	
Sen.temp.		81	°F

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ECOM-A Plus

Date 03.01.10 Time 11:59:42 AM

Gas analysis

Fuel type
Natural gas

T.Air		78	°F
T.Gas		71	°F
O2		9.2	%
CO	15.0%	11	PPM
NO	15.0%	7.5	PPM
NO2	15.0%	0.0	PPM
NOx	15.0%	7.5	PPM
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		81	°F

California Power
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Fax: 559-665-4866

ECOM-A Plus

Date 03.01.10 Time 12:04:29 PM

Gas analysis

Fuel type
Natural gas

T.Air		78	°F
T.Gas		71	°F
O2		9.2	%
CO	15.0%	11	PPM
NO	15.0%	6.9	PPM
NO2	15.0%	0.0	PPM
NOx	15.0%	6.9	PPM
CO2		6.6	%
Exc.air		1.78	
Sen.temp.		82	°F

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Fax: 559-665-4866

ECOM-A Plus

Date 03.01.10 Time 12:08:10 PM

Gas analysis

Fuel type
Natural gas

T.Air		78	°F
T.Gas		72	°F
O2		9.3	%
CO	15.0%	11	PPM
NO	15.0%	4.9	PPM
NO2	15.0%	0.0	PPM
NOx	15.0%	4.9	PPM
CO2		6.5	%
Exc.air		1.79	
Sen.temp.		82	°F

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Holdings, LLC.
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Fax: 559-665-4866

ECOM-A Plus

Date 03.01.10 Time 11:54:39 AM

Gas analysis

Fuel type
Natural gas

T.Air	77	°F
T.Gas	71	°F
O2	9.2	%
CO	23	PPM
NO	12.0	PPM
NO2	9.0	PPM
NOx	12.9	PPM
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	81	°F

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Fax: 559-665-4866

ECOM-A Plus

Date 03.01.10 Time 11:59:26 AM

Gas analysis

Fuel type
Natural gas

T.Air	78	°F
T.Gas	71	°F
O2	9.2	%
CO	23	PPM
NO	12.8	PPM
NO2	0.0	PPM
NOx	12.8	PPM
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	81	°F

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ECOM-A Plus

Date 03.01.10 Time 12:04:52 PM

Gas analysis

Fuel type
Natural gas

T.Air	79	°F
T.Gas	71	°F
O2	9.3	%
CO	23	PPM
NO	12.8	PPM
NO2	0.0	PPM
NOx	12.8	PPM
CO2	6.5	%
Exc.air	1.79	
Sen.temp.	82	°F

lifornia Power
ldings, LLC.
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lg. 6
owchilla, CA 93610
one: 559-665-4577
: 559-665-4866

ECOM-A Plus

Date 03.01.10 Time 12:09:11 PM

Gas analysis

Fuel type
Natural gas

T.Air	79	°F
T.Gas	72	°F
O2	9.2	%
CO	23	PPM
NO	9.5	PPM
NO2	0.0	PPM
NOx	9.5	PPM
CO2	6.6	%
Exc.air	1.78	
Sen.temp.	82	°F

California Power
Holdings, LLC.
16457 Avenue 24 1/2
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Chowchilla, CA 93610
Phone: 559-665-4577
Fax: 559-665-4866

Permit Required Emission Monitoring Data Sheet - Calendar Year 2010

Engine No.	Required Data																							
																				April				
10	Reading No.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5
	Date																							
	Time																							
	NOx PPM @ 15% O2						0.0						0.0						0.0					
	CO PPM @ 15% O2						0.0						0.0						0.0					
	O2 %						0.0						0.0						0.0					
11	Reading No.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5
	Date																							
	Time																							
	NOx PPM @ 15% O2						0.0						0.0						0.0					
	CO PPM @ 15% O2						0.0						0.0						0.0					
	O2 %						0.0						0.0						0.0					
12	Reading No.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5
	Date	25-Feb-10						26-Feb-10						1-Mar-10										
	Time	14:03	14:06	14:09	14:12	14:15		12:21	12:24	12:27	12:30	12:33		11:32	11:35	11:38	11:41	11:44						
	NOx PPM @ 15% O2	4.7	4.4	4.2	4.7	5.0	4.6	4.2	4.4	4.4	4.6	4.9	4.5	6.8	6.0	5.5	5.5	5.3	5.8					
	CO PPM @ 15% O2	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.0	11.0	11.0	11.0	10.8	12.0	11.0	11.0	11.0	11.0	11.2					
	O2 %	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.2	9.2	9.2	9.2	9.2	9.2					
13	Reading No.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	3.0	1	2	3	4	5
	Date																							
	Time																							
	NOx PPM @ 15% O2						0.0						0.0						0.0					
	CO PPM @ 15% O2						0.0						0.0						0.0					
	O2 %						0.0						0.0						0.0					
14	Reading No.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5
	Date																							
	Time																							
	NOx PPM @ 15% O2						0.0						0.0						0.0					
	CO PPM @ 15% O2						0.0						0.0						0.0					
	O2 %						0.0						0.0						0.0					
15	Reading No.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5
	Date																							
	Time																							
	NOx PPM @ 15% O2						0.0						0.0						0.0					
	CO PPM @ 15% O2						0.0						0.0						0.0					
	O2 %						0.0						0.0						0.0					

ECOM AMERICA, LTD.

1628 Oakbrook Drive
Gainesville, GA 30507

*Certificate of Calibration

This ECOM Model A Plus, Serial Number **9066,** has been Calibrated and found to be within manufacturer specifications.
Technician- *James Smith*
Factory service performed **February 2010.**
Next factory service recommended **August 2010.**

Certified Calibration Gases Used By ECOM

These gases are traceable to the National Institute of Standards and Technology.

CO Low 1000 PPM 2.00% Oxygen	Lot # CC121897
NO 30.0 PPM 0.00% Oxygen	Lot # SG9138680BAL
NO2 10.0 PPM Balanced In Air	Lot # XC002496B

Calibration Data

Type Gas	Actual Gas Value	As Found Data	Calibrated To Data
CO Low	1000 PPM	1359 PPM	1000 PPM
NO	30.0 PPM	37.9 PPM	30.0 PPM
NO2	10.0 PPM	10.1 PPM	10.0 PPM

***Suitability for use is the sole responsibility of the user. Factors affecting the calibration and response of gas sensors include, but are not limited to Frequency & Duration of use, Concentration of gases measured, Shifts in ambient temperature (> 20 deg. F), & age of sensors.**
This Certificate of Calibration verifies that the analyzer responded accurately, and within specification to the calibration gas concentrations listed above.

Burns & McDonnell
SINCE 1898

August 28, 2012

Ms. Mindy Bowman
Kansas Department of Health and Environment
Bureau of Air and Radiation
1000 SW Jackson, Suite 310
Topeka, KS 66612-1366

Re: Level 2 VISCREEN Analysis

Dear Ms. Bowman:

A Prevention of Significant Deterioration (PSD) air construction permit application associated with the development and construction of a new electrical generating facility was submitted by Mid-Kansas Electric Company (Mid-Kansas) on July 9, 2012. The Project will consist of 24 reciprocating internal combustion engines (RICE) plus auxiliary equipment at the proposed Rubart Station (hereinafter referred to as Project). The Project will be located in Grant County, Kansas.

As part of the July 9, 2012 submittal, a Level 1 visibility analysis was performed in accordance with the guidelines set forth in EPA-405/4-88-015, Workbook for Plume Visual Impact Screening and Analysis. The analysis was performed on two sites: Meade State Park located approximately 72 kilometers southeast of the Project near Meade, Kansas and Ulysses Airport located approximately 24.5 kilometers west of the Project near Ulysses, Kansas.

Per guidance from the Kansas Department of Health and Environment, the analysis should continue until either the screening criteria are not exceeded at Level 2 or until the Level 3 analysis is complete. The Level 1 visual results passed the Class I screening criteria for Meade State Park located approximately 72 kilometers from Rubart Station. The Level 1 visual results did not pass the Class I criteria for Ulysses Airport located approximately 24.5 kilometers away. This letter presents the results of the Level 2 analysis performed for the Ulysses Airport.

While the Level 1 screening uses the worst-case meteorological conditions, Level 2 uses observed meteorological data to provide a better, site specific analysis of the visual impacts. The site-specific average wind speed and stability class were determined for the Level 2 analysis and the electronic spreadsheet that was used to calculate the wind speed and stability is attached to this letter for your reference (Appendix C).

Wind rose plots for Dodge City Regional Airport (station #13985) for years 1987 to 1991 and Garden City Regional Airport (station #23064) for years 2006 to 2010 were generated to confirm that the data was similar. The wind rose plots are shown in Appendix A and were determined to be comparable. Therefore, to determine the wind speed and stability class, integrated surface hourly meteorological data from the Dodge City Regional Airport (station #13985) was used for years 1987 to 1991 for this analysis.

9400 Ward Parkway • Kansas City, MO 64114-3319
Tel: 816 333-9400 • Fax: 816 333-3690 • www.burnsmcd.com

Using the wind speed and stability parameters from the calculations, the Level 2 visual results pass the Class I screening criteria for Ulysses Airport located approximately 24.5 kilometers from Rubart Station. The results of the Level 2 VISCREEN model are provided in Appendix B.

As KDHE proceeds with the evaluation process, please contact the following persons with questions or for additional information:

Paul Reynolds
Sunflower Electric Power Corporation
2440 Holcomb Lane/PO Box 430
Holcomb, KS 67851
Phone: 620-277-4522
E-mail: preynolds@sunflower.net

Mary Hauner-Davis
Burns & McDonnell
9400 Ward Parkway
Kansas City, Missouri 64114
Phone: 816-822-4252
e-mail: mhauner@burnsmcd.com

Mid-Kansas appreciates the input and efforts to date by your office to help expedite this permit application and the subsequent review process. If we can be of any assistance to facilitate your staff's efforts, please do not hesitate to contact us.

Sincerely,

Mary Hauner-Davis

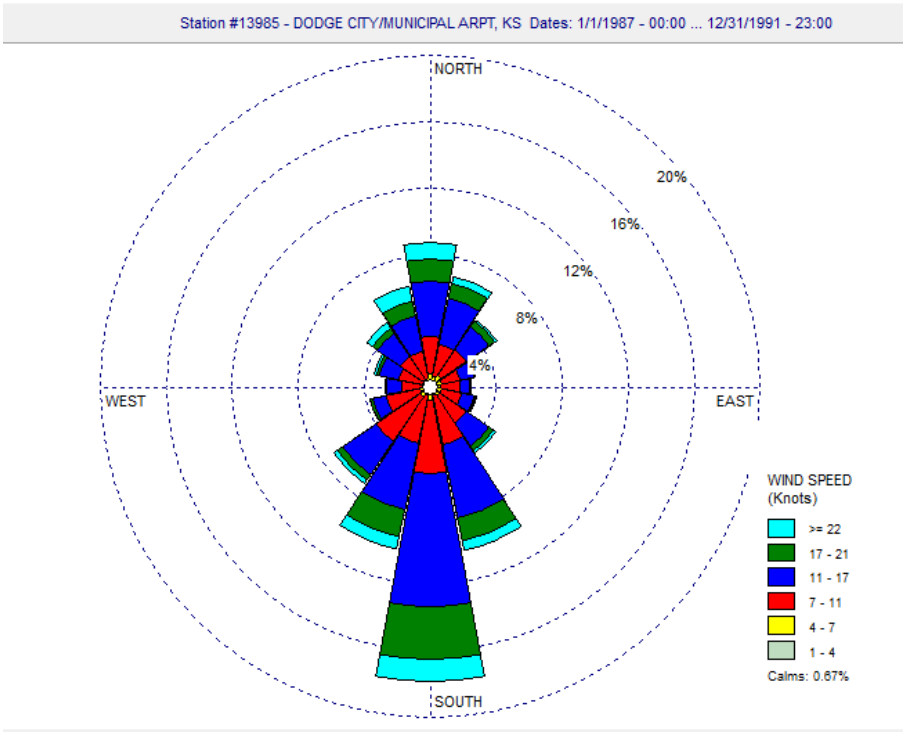
Mary Hauner-Davis
Project Manager

Attachments

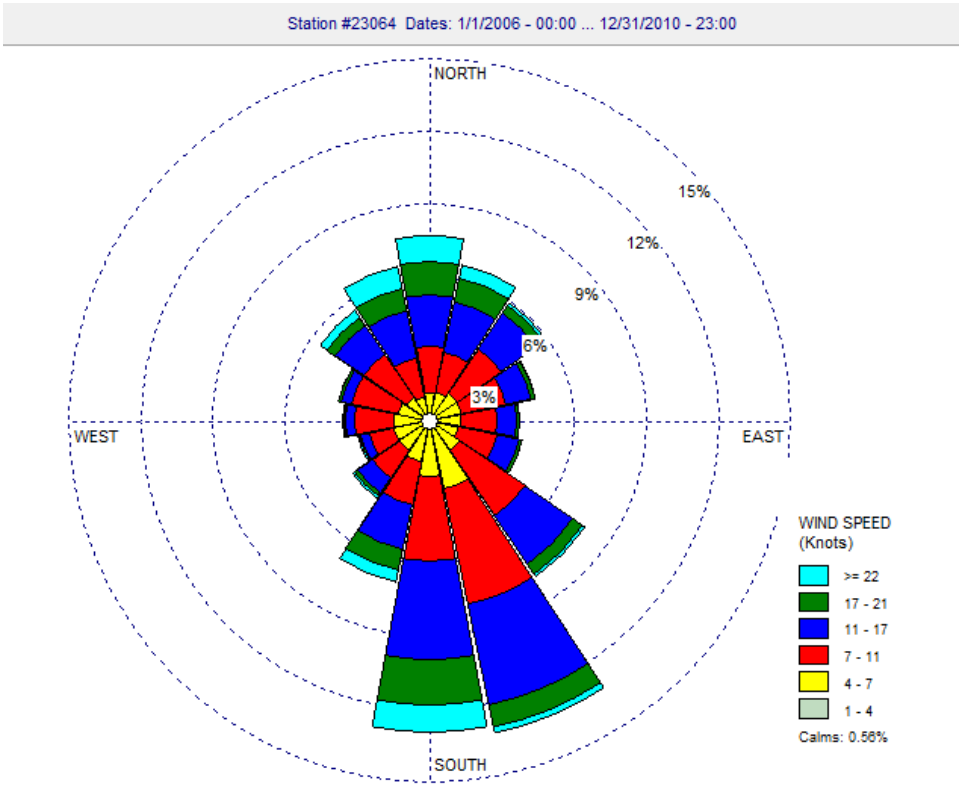
cc: Paul Reynolds, Mid-Kansas
Wayne Penrod, Mid-Kansas
Susanna Pjesky, Burns & McDonnell
Minda Nelson, Burns & McDonnell

APPENDIX A – WIND ROSE PLOTS

Wind Rose Plot – Dodge City 1987-1991



Wind Rose Plot – Garden City 2006-2010



APPENDIX B – VISCREEN LEVEL-2 ANALYSIS RESULTS

Visual Effects Screening Analysis for
Source: Rubart Station
Class I Area: Ulysses Airport

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	151.20	TON/YR
NOx (as NO2)	401.80	TON/YR
Primary NO2	.00	TON/YR
Soot	.00	TON/YR
Primary SO4	.00	TON/YR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	24.50 km
Min. Source-Class I Distance:	24.50 km
Max. Source-Class I Distance:	24.50 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	5
Wind Speed:	5.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	24.5	84.	2.32	.219	.05	.001
SKY	140.	84.	24.5	84.	2.00	.086	.05	-.002
TERRAIN	10.	84.	24.5	84.	2.00	.178	.05	.002
TERRAIN	140.	84.	24.5	84.	2.00	.030	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	0.	1.0	168.	2.00	.681	.05	.005
SKY	140.	0.	1.0	168.	2.00	.123	.05	-.006
TERRAIN	10.	0.	1.0	168.	2.00	.778	.05	.010
TERRAIN	140.	0.	1.0	168.	2.00	.208	.05	.009

Date: October 9, 2012

To: Susana Pjesky, KDHE

From: Mid-Kansas Electric Company, LLC

Subject: Carbon Capture Technology for Rubart Station

Project Background

In July 2012, Mid-Kansas Electric Company, LLC (Mid-Kansas) submitted a Prevention of Significant Deterioration construction permit application for the installation of 24 RICE reciprocating internal combustion engines (RICE) and auxiliary equipment at a new site to be called Rubart Station located in Grant County, Kansas. In response to KDHE's initial question regarding whether carbon capture might be applicable to this facility Mid-Kansas has prepared the following discussion of the substantial technical issues involved with integrating carbon capture and sequestration (CCS) technologies for the rapid-response RICE generation resources to be installed at Rubart Station.

Rubart Station Duty-Cycle

As noted in the application, production of energy from the Rubart units will be controlled by the Southwest Power Pool (SPP) and will be dispatched in response to nearly constant changes in energy and voltage demand signals arising from wind resource integration in the sub-region.[1] The RICE will be frequently started, loaded in response to wind-resource swings or SPP dispatch, and then stopped. Indeed, Mid-Kansas expects to subject each Rubart RICE to up to three start/stop sequences each day. To satisfy the anticipated energy needs of the SPP, the Rubart units must be capable of rapid response and the proposed RICE will meet that criterion.

The development of ancillary services essential to reliable operation of the SPP resources may be expected to result in the hourly decisions for the operation of the individual units at Rubart Station. The means and processes by which this is to occur are as yet under development, but it is reasonably certain that the rapid-response afforded by the Rubart units will result in them being utilized just for that purpose.

From the limited information that is available concerning the application of CCS systems to these rapid-response facilities might be limited to amine-type capture processes, and given the necessary 6 to 12 hours required to place an amine plant into service, it is difficult to imagine

[1] The Rubart units will have automatic voltage control and automatic generation control, and the described changes will take place more frequently and with more severe ramp rates than current types of generating units have experienced.

adding a series of complex chemical plants and processes to the tail-pipe of the rapid-start, rapid-loading machines that are to be installed at Rubart.

Carbon Capture Discussion for Rubart Station

Carbon capture, compression, transport, and storage are the terms typically used to describe a series of technologies designed to capture CO_2 emitted from industrial and energy-related sources before it enters the atmosphere, compressing it to super-critical pressures, injecting it deep underground in secure geological formations, and then ensuring it remains stored there indefinitely.[2] The EPA generally considers CCS to be an "available" add-on pollution control technology for facilities emitting CO_2 in large amounts and industrial facilities with high-purity CO_2 streams.[3] However, EPA also recognizes that CCS may not be an available option in all cases.[4]

The RICE units proposed for Rubart are such a source where CCS is not an available technology. Current post-combustion CO_2 capture processes (e.g., amine systems) that may potentially be applicable to the Rubart RICE are complicated chemical processes that do not lend themselves to the rapid cycling and ramp rates associated with the Rubart facility, which is discussed above. Additionally, they have never been demonstrated on the exhaust of a natural gas fired RICE at any scale. There is not even a single reference plant design that describes exactly what such systems might include for such a source, nor to our knowledge has one been conceived. The BACT process does not require a source to consider unavailable technology that would require research and development before it can be designed, tested and deployed.

Unlike the sources where EPA has concluded that CCS is technically available, the exhaust gases from the individual RICE sources at Rubart will neither be continuous, of large amounts, nor of a high-purity CO_2 concentration. The full load PTE of each of the 24 individual RICE sources would be less than 50,000 tons per year, and the CO_2 concentration will be only about 6% of the gas stream. Further, even if the individual RICE exhaust gas streams were combined, the CO_2 concentration in such streams would be expected to vary from less than 5 tons/hour (1 RICE) to

[2] In the alternative, CO_2 injected into oil-bearing formations at supercritical pressures is useful in tertiary oil recovery operations. CO_2 has been used for these purposes, primarily in the Permian basin of Texas, for over two decades. Studies for similar utilization have been suggested to the U.S. Department of Energy for Kansas oil fields, but decisions for funding this research have been declined in favor of those in central Oklahoma. While EOR has been in use for many years, its purpose has not been the indefinite storage of CO_2 and therefore it is unknown whether current EOR practices result in the actual removal of the CO_2 from the atmosphere or simply transfers the release to a different location. EPA has raised these very issues in their evaluation of EOR as CCS.

[3] EPA. PSD and Title V Permitting Guidance for Greenhouse Gases (EPA-457/B-11-001). March 2011. Page 35.

[4] EPA. PSD and Title V Permitting Guidance for Greenhouse Gases (EPA-457/B-11-001). March 2011. Page 36.

as much as 128 tons/hour (24 RICE), making it difficult to design a system to handle such a wide range.

Nonetheless, Mid-Kansas has attempted to identify the type and components of such as system. Mid-Kansas has been unable to find any chilled-ammonia capture system that has been installed experimentally in a few large, base-load central station power applications that would have applicability at Rubart. Regardless, none of these have been particularly successful and none are currently being operated in the U.S. A CO_2 capture plant for Rubart might be more like an amine system such as those that have been used in stripping small amounts of very-low concentration CO_2 in natural gas cryogenic processing plants. These types of systems have never been installed experimentally in any power application. Further these unproven, untried systems would have to be deployed 24 times at Rubart, once for each engine, just as the NO_X, CO, and VOC control technologies that are being deployed on each of the 24 units.

An amine plant would require several additional plant systems, including the provision of relatively large amounts of steam. Since simple Otto-cycle engines like the proposed RICE do not produce steam, the cycle would either need to be augmented with auxiliary boilers or combined with substantial heat recovery systems, duct burners, or other regenerative-type heaters. It is our understanding that it takes 6 to 12 hours to place a typical amine system in service. In addition, relatively large amounts of cooling water, associated water and waste water treatment systems, a very large cooling tower system (not unlike that found in a typical steam plant for recirculation of the cooling water), an exhaust gas amine-based CO_2-absorber to strip the CO_2 from the engine exhaust, a chemical CO_2-desorber to regenerate amine for reuse, as well as substantial amounts of piping and mass and heat transfer systems between the various pieces of equipment would at a minimum be required for a CO_2 amine-based capture system.

Furthermore, once the CO_2 is captured, large compressors, including variable speed compressors to account for the variable CO_2 capture rates, must be used to compress CO_2 to super-critical pressure conditions before discharging it into a special high-pressure pipeline for re-use in enhanced oil recovery operations or disposal in deep injection wells for sequestration. But, as previously stated, such a system has not been demonstrated for a source like the proposed Rubart Station and would require considerable research and development with no guarantee that it would successful.

<u>Conclusion</u>

But for the analysis above, in which Mid-Kansas found that CCS is not an available technology, Mid-Kansas would have reached the same conclusion that was reached by every other proposed project for which it was evaluated under BACT. No other power production facility – peaking or otherwise (including natural gas combined-cycle), no natural gas compressor station or processing facility, nor any ethanol-producing facility or other major source sector has concluded

that CCS is feasible (step 2) or affordable (step 4) in any BACT analysis prepared for this purpose.

For all the reasons provided above, CCS is not an available control technology for the Project.

1.0 BACT FOR GREENHOUSE GASES (GHG) – CIRCUIT BREAKERS AND CIRCUIT SWITCHERS

1.1 INTRODUCTION

Sulfur hexafluoride (SF_6) is a very potent greenhouse gas (GHG) with a global warming potential of 23,900, which means that it is 23,900 times more potent as a greenhouse gas than CO_2. SF_6 is a gaseous dielectric used in circuit breakers and circuit switchers. The Project will have a maximum of 12 circuit breakers and a maximum of four circuit switchers that will contain small amounts of SF_6. Leakage is expected to be minimal, and is expected to occur only as a result of circuit interruption and at extremely low temperatures. The following presents the GHG BACT analysis for the SF_6 emissions from the SF_6-containing circuit breakers and circuit switchers that are part of this project.

1.2 EMISSIONS OF GREENHOUSE GAS EMISSIONS – CIRCUIT BREAKERS AND CIRCUIT SWITCHERS

Emissions of SF_6 from the circuit breakers and switchers are calculated in Table 1, below. Emissions are based on a maximum leakage rate of 0.5% per year, based on vendor guarantees, to calculate the annual potential to emit emissions. Based on the calculations for all 12 circuit breakers and all four circuit switchers, the maximum greenhouse gas emissions as CO_2e are 44.7 tons per year.

Table 1
Emissions of Greenhouse Gases from Circuit Breakers and Switchers for Rubart Station

	Number of Units	Quantity of SF_6 per Breaker or Switcher (lbs)	Emissions of SF_6 Per Breaker or Switcher* (lbs/yr)	Total SF_6 Emissions (lbs/yr)	Global Warming Potential of SF_6	Total CO_2e Emissions (tons/yr)
Circuit Breakers	12	61.2	0.306	3.67	23,900	43.88
Circuit Switchers	4	3.3	0.0165	0.07	23,900	0.79
Total				**3.74**		**44.67**

*Based on a maximum SF_6 leakage rate of 0.5% per year.

1.3 STEP 1 AND STEP 2. IDENTIFY POTENTIAL CONTROL STRATEGIES AND ELIMINATE TECHNOLOGICALLY INFEASIBLE OPTIONS

The first steps in a top-down BACT analysis are to determine the potential control strategies and then determine if the control strategy is technically feasible for the project. There are no add-on control technologies for SF_6, only inherent controls are available. The following control strategies have been

identified and considered in determining BACT for SF_6 emissions from circuit breakers and circuit switchers:

1. **Use state-of-the-art SF_6 technology with leak detection systems to limit fugitive emissions.**

   The use of state-of-the-art gas-filled circuit breakers using SF_6 with leak detection to limit fugitive emissions is the proposed control option. Modern circuit breakers and switchers are designed as a totally enclosed-pressure system with far lower potential for SF_6 emissions than older circuit breakers. The International Electrotechnical Commission (IEC) recommends that new equipment be built to low leakage limits (standard for new equipment leakage is 0.5% per year).[1] Therefore, the newest modern equipment can be guaranteed to leak at a rate of no more than 0.5% per year by weight. In addition, the effectiveness of leak-tight closed systems can be enhanced by equipping them with a density alarm (weight change) that provides a warning when SF_6 has leaked from the breaker. Therefore, this type of technology is available to limit emissions and is feasible for use and is the baseline established for this BACT analysis.

2. **Substitution of another, non-greenhouse-gas substance for SF_6 such as the use of a different dielectric oil or compressed air (air-blast) circuit breaker as the dielectric material in the breakers.**

   One alternative to SF_6 would be the use of a dielectric oil or compressed air (air-blast) circuit breaker, which historically were used in high-voltage installations prior to the development of SF_6 breakers. SF_6 has become the predominant insulator and arc quenching substance in circuit breakers today because of its superior capabilities over oil and air-blast circuit breakers and switchers. The main drawback to oil and air-blast breakers are that these type of breakers require significantly larger equipment to replicate the same insulating and arc-quenching capabilities of the SF_6 breakers and air-blast breakers can have significant noise impacts to nearby residences. This type of technology is not feasible for use here, however, because oil breakers are no longer available from vendors, other than as used equipment and, air-blast breakers are no longer made for this size voltage (145 kV). According to vendors, air-blast breakers are available only up to 69 kV currently. Therefore, oil and air-blast breakers and switchers are not available control technology for circuit breakers and switchers.

[1] U.S. EPA, J. Blackman (U.S. EPA, Program Manager, SF_6 Emission Reduction Partnership for Electric Power Systems), M. Averyt (ICF Consulting), and Z. Taylor (ICF Consulting), *SF_6 Leak Rates from High Voltage Circuit Breakers – U.S. EPA Investigates Potential Greenhouse Gas Emissions Source*, June 2006, first published in Proceedings of the 2006 IEEE Power Engineering Society General Meeting, Montreal, Quebec, Canada, June 2006 (available at: www.epa.gov/electricpower-sf6/documents/leakrates_circuitbreakers.pdf).

3. **Use an emerging technology to replace SF_6 with a material that has similar dielectric and arc-quenching properties, but without the drawbacks of oil and air-blast breakers.**

   The availability of emerging technologies alternative to SF_6 was researched. According to the most recent report released by the EPA SF_6 Partnership, "no clear alternative exists for this gas that is used extensively in circuit breakers, gas-insulated substations, and switch gear, due to its inertness and dielectric properties."[2] Research and development efforts have been focused on finding substitutions for SF_6 that have comparable insulating and arc quenching properties in high-voltage applications.[3] Most studies have concluded, "there is no replacement gas immediately available to use as an SF_6 substitute"[4] for high-voltage applications. Therefore, the alternative to use an emerging technology to replace SF_6 is not an available control technology.

4. **Develop and implement a Leak Detection and Repair (LDAR) program, similar to NSPS, Subpart Wa (40 CFR 60.480a through 60.489a).**

   A written LDAR program similar to the requirements of 40 CFR Part 60, Subpart Wa, Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry, is a control technology proposed by other facilities to control SF_6 emissions from circuit breakers. Under a normal LDAR program documentation regarding observations and/or repairs made in accordance with the LDAR program is provided to KDHE for a demonstration of compliance with this control. A similar program would be developed specifically for SF_6. Leak detection and repair is an available control technology for this project.

Table 2 displays the control options and feasibility for SF_6.

[2] U.S. EPA, *SF_6 Emission Reduction Partnership for Electric Power Systems 2007 Annual Report*, December 2008, Page 1 (available at http://www.epa.gov/electricpower-sf6/documents/sf6_2007_ann_report.pdf).

[3] U.S. Climate Change Technology Program, Technology Options for the Near and Long Term, 4.3.5, *Electric Power System and Magnesium: Substitutes for SF_6*, November 2003, Page 185 (available at: www.climatetechnology.gov/library/2003/tech-options/tech-options-4-3-5.pdf)

[4] Siemens Power Transmissions & Distribution, Inc., Siemens TechTopics No. 53, *Use of SF_6 Gas in Medium Voltage Switchgear*, June 3, 2005, Page 3 (available at: www.energy.siemens.com/cms/us/US_Products/CustomerSupport/TechTopicsApplicaionNotes/Documents/TechTopics53.Rev0.pdf).

Table 2. Summary of Potential GHG Control Technologies

GHG Technology	Evaluation Status
State-of-the-art SF_6 technology with leak detection systems	Considered and Applied
Oil/air-blast circuit breakers	Considered (Not Feasible)
Use of emerging technology to replace SF_6	Considered (Not Feasible)
LDAR	Considered and Applied

1.4 STEP 3. RANK THE TECHNICALLY FEASIBLE CONTROL TECHNOLOGIES

Table presents the ranked technically feasible control options.

Table 3: GHG Technology Rankings for Circuit Breakers and Circuit Switchers Equipment Leaks

Rank	Control Technology	Emission Rate (short tons CO_2e/year)	Emissions Reduction (short tons CO_2e/year)
1	State-of-the-art SF_6 technology with leak detection systems	44.7	N/A
2	LDAR*	N/A	N/A

*Implementation of the LDAR program will not generate emissions, nor will it control emissions beyond the baseline. The LDAR program is used to monitor equipment leaks for repair.

1.5 STEP 4. EVALUATE THE MOST EFFECTIVE CONTROL TECHNOLOGIES

1.5.1 Environmental, Energy, and Economic Feasibility of Control Options

1.5.2 LDAR

A LDAR program is technically feasible control option for the SF_6-containing circuit breakers and circuit switchers and does not have any environmental or energy considerations. There will be very minor economic costs associated with implementation of a LDAR program. However, these costs are considered minimal for this project.

1.6 STEP 5. GHG BACT EMISSION LIMITATION

Based on this top-down analysis, Mid-Kansas has determined that GHG BACT for the onsite circuit breakers and switches consist of the following:

- State-of-the-art enclosed-pressure SF_6 circuit breakers and switchers with a guaranteed loss rate of 0.5% by weight or less by year;

- Density monitor alarm system; and
- Develop and implement a written LDAR program.

The recently issued (2011) Abengoa Bioenergy Biomass of Kansas, LLC a PSD permit contained a BACT analysis for a similar source of SF_6. The KDHE issued this permit with a similar BACT determination as the BACT proposed here. In addition, recent permits for power plants (most of them combined-cycle plants) have been issued in other states that have a similar or the same BACT determination. The Russell City Energy Center (Bay Area Air Quality Management District), Calpine Deer Creek plant (Texas, EPA Region VI), and Moxie Liberty Generation Plant (Pennsylvania) were also issued PSD permits with very similar BACT for SF_6 emissions from similar sources in 2010 and 2011. All of these plants are similar in that they combust natural gas to produce power and have circuit breakers that are assumed to be of similar size to the circuit breakers to be used at Rubart Station.

1.7 COMPLIANCE WITH GHG BACT FOR CIRCUIT BREAKERS AND SWITCHERS

Any SF_6 emissions from these sources will be fugitive emissions. Fugitive emissions are, by their nature, very difficult to monitor directly, as they are not emitted from a discrete emission point. Fugitive SF_6 emissions can be estimated very accurately, however, by measuring "top-ups," i.e., the replacement of lost SF_6 with new product.[5] It is conservatively assumed that the amount of SF_6 that has leaked and entered the atmosphere is the amount that has to be topped up to maintain a full SF_6 level. Therefore, Mid-Kansas proposes that no direct monitoring of SF_6 fugitive emissions be required. In place of direct monitoring, Mid-Kansas proposes surrogate monitoring through measuring the amount of SF_6 lost and using a conversion factor to assess annual SF_6 fugitive emissions in terms of CO_2e.

The overall effectiveness of the leak-tight closed systems will be enhanced by equipping them with a density alarm that provides a warning when SF_6 has leaked from the breaker. BACT was determined for the Abengoa Bioenergy Biomass facility, Russell City Energy Center, Moxie Liberty plant, and the Calpine Deer Creek plant projects to be state-of-the-art enclosed-pressure SF_6 circuit breakers with leak detection and the use of an alarm system to alert controllers when a circuit breaker loses10 percent of its SF_6. As established in various EPA publications[6], an SF_6 circuit breaker is classified as leaking if it had documented "top-ups" of SF_6, which occurred after a density alarm sounded, indicating that 10 percent of

[5] *SF6 Leak Rates from High Voltage Circuit Breakers – U.S. EPA Investigates Potential Greenhouse Gas Emissions Source*, supra note 2, Page 1.
[6] *SF6 Leak Rates from High Voltage Circuit Breakers – U.S. EPA Investigates Potential Greenhouse Gas Emissions Source*, supra note 2, Page 1.

the circuit breaker gas volume has been emitted. Some recent industry studies[7] have indicated that the leak monitoring set point of the density alarm may be lowered with a reasonable degree of certainty.

A density monitor is used to monitor for and determine SF_6 leaks by measuring the circuit breaker and circuit switcher internal pressure and temperature. The monitor then "compensates" for the difference between the measured temperature and the reference standard of a fully charged breaker defined at installation and calculates the temperature compensated pressure. Because SF_6 is a real gas, not an ideal gas, it has a pressure-temperature-density relationship described by a curved equation while an ideal gas functions on a straight equation. Because of the pressure-temperature-density relationship, the accuracy of the mechanical monitoring device (density alarm) proposed is impacted by both pressure and temperature changes. The accuracy of most density monitors is plus or minus 2.5 percent (or 2 psi).[8]

Mid-Kansas will implement a density alarm threshold of 10 percent, based on the data available for review. According to circuit breaker vendors, 10 percent alarm is standard on most SF_6-containing circuit breakers and switchers. In the event of an alarm, Mid-Kansas will investigate the event and take any necessary corrective action to address any problems. This is consistent with the previous BACT determinations identified above.

Mid-Kansas also proposes to develop and implement a written LDAR program similar to the requirements of 40 CFR Part 60, Subpart Wa, Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry, but modified for this source and pollutant. Mid-Kansas will provide a copy of the LDAR program and documentation regarding observations and/or repairs made in accordance with the LDAR program to KDHE upon request to demonstrate compliance with BACT.

[7] Thesen, Sven. Pacific Gas & Electric Co, *PG&E and the New Breaker SF6 Leak Study,* Page 2 (available at http://www.epa.gov/electricpower-sf6/documents/conf04_thesen_paper/pdf).
[8] *PG&E and the New Breaker SF_6 Leak Study,* Page 3

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MEMORANDUM

TO: Wayne Penrod

FROM: Ralph L. Roberson, P.E.

DATE: November 2, 2012

SUBJECT: Analysis of NO_X Emission Data for New Facility

INTRODUCTION

Mid-Kansas Electric Company, LLC (Mid-Kansas) asked RMB Consulting & Research, Inc. (RMB) to review an oxides of nitrogen (NO_X) emission dataset compiled from a large group of new SCR-equipped reciprocating internal combustion engines (RICE) to support its application for a new 240-MW electric generating station to be known as Rubart Station (Rubart). Rubart will deploy up to 24 nominal 10-MW 20-cylinder Caterpillar® (CAT) RICE generating units. These 20-cylinder engines are 40 percent larger than any similar unit yet constructed by CAT and will require a significant scaling-up of the cylinder configuration used for existing CAT engines. Rubart will be a major source of several criteria air pollutants, including NO_X, and subject to best available control technology (BACT) emissions limitations, which will be established in the construction permit.

Mid-Kansas is a part of the Southwest Power Pool (SPP), a power pool that will begin operating a Day-2 market on or about March 1, 2014[1]. The SPP includes a significant amount of intermittent wind-based resources, and many of those resources (wind-farms) are located within the Mid-Kansas balancing area. The number of wind-farms is expected to increase by 2014. Accordingly, by the time Rubart commences operation, Mid-Kansas expects to be required to provide rapid start-up resources with substantial voltage support capabilities to assure continued grid reliability within the northern reaches of the SPP. Rubart is being designed to be able to respond to the expected intermittent nature of renewable resources. The Rubart units are expected to operate a significant number of hours at varying loads each year, and each unit could undergo frequent start-ups. The total unit start-ups for the facility are expected to be more than 1,000 annually.

Because the deployment of a large number of state-of-the-art RICE-based generating units is a relatively recent phenomenon and because of the expected operating challenges

[1] The federal energy regulatory commission (FERC) approved the SPP "Day 2" market program on October 18, 2012. SPP became the last of the country's regional transmission organizations (RTOs) to gain approval of this enhanced market-based daily operating program. Mid-Kansas will not dispatch the Rubart facility. Rather, decisions regarding starting and stopping the units and the actual generator loadings will be determined for each hour of the day by the SPP operators.

for Rubart, Mid-Kansas asked RMB to analyze the existing RICE compliance test dataset for the express purpose of determining a pound per hour (lb/hr) NO_X emission rate that is achievable at a very high level of confidence. A high level of confidence is necessary because the Kansas Department of Health and Environment (KDHE) and the U. S. Environmental Protection Agency (EPA) expect continuous compliance with BACT emission limitations, under all operating conditions (including startup and shutdown) for the expected operating life of the source.[2] Mid-Kansas has determined that a 99.5% confidence (one-tailed) expectation for compliance with the established BACT-based limitation is necessary[3]. Mid-Kansas requested RMB to opine as to the confidence with which compliance test results might be expected to remain below the vendor-guaranteed emission rate of 2.13 lb/hr at steady-state operation, such that it might serve as a BACT emission limitation for the individual engines to be constructed for the plant.

DESCRIPTION OF RICE NO_X DATASET

Mid-Kansas engaged EnviroMet, LLC (EnviroMet) to develop the NO_X emission dataset for analysis by RMB. Because CAT engines of this size do not exist, EnviroMet compiled compliance test report data for similarly-sized Wärtsilä engines (between 8.4 and 9.5 MW) with selective catalytic reduction (SCR) systems and oxidation catalysts. Additionally the Humboldt Bay facility (consisting of 16.3 MW Wärtsilä engines similarly equipped) was also included in the analysis. Humboldt Bay differs from the other facilities in that it has back-up fuel capability (ultra-low sulfur diesel). Humboldt Bay was the first application of the larger 16.3 MW Wärtsilä units, and so in that way it is similar to the first application of the larger 10 MW CAT units at Rubart. RMB believes that the use of these data as a surrogate for the CAT RICE to be installed at Rubart is reasonable for the purpose of estimating the probability of the expected emissions performance for the proposed RICE sources.

Available stack test report data was provided to RMB for the following five (5) facilities[4,5]:

- Goodman Energy Center (Kansas)
- Western 102 Power Plant (Nevada)

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[2] While BACT emission limitations are required for all operating conditions, including start-up and shutdown, the database evaluated included only stack test data obtained during steady-state operation. Thus, RMB's analysis of an achievable NO_X emission limitation is limited to steady-state operation and does not address what emission limitation is achievable during startup and shutdown of the RICE.

[3] The one-tailed analysis is appropriate because the only emission test results of concern are those have the potential to exceed the emission limit. Test results below the mean are not of interest in matters of compliance.

[4] EnviroMet also collected data for the Woodland 3 Generation Project (California) but those data are not expressed in terms of lb/hr and therefore are not included in RMB's analysis. Data reported for demonstrating compliance vary from facility to facility depending upon the emission units specified by the permitting authorities in the respective permits. The most common expression of emission rate found among the reports is lb/hour (the units in which modeled ambient air impact analysis is expressed).

[5] Data for the Antelope Power Station in Texas, which is also similar to Rubart, were not available at the time the dataset was developed. The Antelope facility commenced operation in early summer 2011.

- Pearsall Power Plant (Texas)
- Humboldt Bay Generating Station (California)
- Plains End Generating Station (Colorado)

The data collected are from stack tests conducted between 2007 and 2011. Data were gathered in fall 2011 and provided to RMB for further analysis. The mass emission rate (lb/hr) of any pollutant, including NO_X, is a function of the size or rated capacity of the engine. Since none of the test data came from 10 MW engines, the hourly NO_X emission rate test results were scaled by assuming a linear relationship between the reported emission rate and the rated capacity of the engine tested to that of Rubart. In other words, if the engine tested was 9 MW, the reported emission rate was multiplied by 10/9 to scale up the emissions to the size of the Rubart engines. All NO_x emission rates were determined using EPA Method 7E, and the engines were operating at or near full load during the tests that were included in the NO_X dataset. Not all test results were found to be below the respective permit limitations.

DISCUSSION OF ANALYTICAL APPROACH

For this analysis, RMB used the statistical approach developed by EPA for predicting achievable emissions limitations based on stack test data. Specifically, EPA has used an upper prediction limit (UPL), which is computed with the Student's t-test using the TINV function in Microsoft Excel®, to determine achievable emission limitations at some probability level. EPA has used the UPL approach in accounting for emission variability in maximum achievable control technology (MACT) rulemaking for the following industries: electric generating units (EGUs); industrial boilers (IB) and Portland cement. Although the statutory requirements governing EPA's development of emission limitations based on application of MACT are different from the requirements for setting emission limitations based on BACT, EPA's statistical analysis approach is appropriate for evaluating the stringency of the proposed NO_X BACT limit of 2.13 lb/hr.

A prediction interval for a future observation is an interval that will, with a specified degree of confidence, contain the next randomly selected observation from a population. In other words, the prediction interval estimates what the range of future values will be based upon present or past background samples taken. Given this definition, the UPL represents the value which one can expect the mean of three future observations (3-run average) to fall below, based upon the results of an independent sample from the same population. In other words, if one were to randomly select a future test condition from any of these sources (*i.e.,* average of 3 runs), RMB can be 99.5 percent confident that the reported level will fall at or below the UPL value. To calculate the UPL, we used the sample mean and an estimate of the standard deviation, which are two statistical measures calculated from the available data. The average is a measure of centrality of the distribution. Symmetric distributions such as the normal distribution are centered about the average. The standard deviation is a common measure of the dispersion of the data set around the average.

When the sample size is 15 or larger, EPA has cited the Central Limit theorem as a basis for assuming that the distribution of 3-run averages of the emission data is approximately normal, regardless of the parent distribution (individual sampling runs) of the data. According to EPA, this assumption justifies selecting the normal-distribution-based UPL equation for calculating the floor. EPA used the following formula to estimate the UPL for each MACT dataset:

$$UPL = \bar{x} + t(0.99, n-1) \times \sqrt{s^2\left(\frac{1}{n} + \frac{1}{m}\right)}$$

Where:

n = the number of test averages in the dataset
m = the number of test average required to determine compliance
$\bar{x}$ = mean of the dataset
t(0.99, n – 1) = 99th percentile of the T-Student distribution with n – 1 degrees of freedom
s^2 = variance of the dataset.

RESULTS OF ANALYSIS

The NO_X dataset analyzed by RMB was obtained from five, distinct physical facilities and represent 49 individual spark ignition (SI) engines. The dataset consists of a total of 97 3-run test averages. The arithmetic mean of the dataset is 1.26 lb/hr; the standard deviation is 0.284 lb/hr. The UPL (99.5th percentile) is calculated to be **2.01 lb-NO_X/hr**. In other words, if an engine were tested 200 times, only <u>one</u> 3-run test average would be expected to exceed 2.01 lb/hr. These results are consistent with the CAT guarantee of 2.13 lb/hr as reported by Mid-Kansas.[6] This is especially the case given the expected intermittent operations and the frequent start-ups for these RICE units as they have been described by Mid-Kansas. Additional uncertainty may be expected but which cannot be evaluated since these particular engines have never before been operated.

DISCUSSION OF TESTING VARIABILITY

RMB's analysis was conducted on NO_X mass emission rate data (i.e., lb/hr) as this was the data most readily available from the test reports. The NO_X lb/hr values require the measurement of two distinct parameters: (1) NO_X concentration and (2) stack volumetric flow rate. All of the NO_X concentration measurements in the dataset were made with EPA Method 7E. Method 7E is called an "instrumental" reference method because it relies on an analytical instrument instead of manual stack testing procedures. Because Method 7E relies less on human control and more on electronics, Method 7E measurements tend to be more precise than those from manual methods.

The stack volumetric flow rate must be determined by using EPA Method 2. Method 2 is a classical manual method in which the tester literally traverses the exhaust stack with a

[6] The contract guarantee from Caterpillar is that these engines will perform at or below 2.13 lb/hr at full load with SCR control technology equipment operating as designed.

pitot tube, stopping to measure the velocity pressures at prescribed locations. There are a number of factors that can contribute to the variability of Method 2 measurements. Obviously, it is dependent upon a tester's experience and attention to details. The quality of the volumetric flow data can also depend on the measurement location. For optimal results, Method 2 measurements should be made at stack locations with fully developed turbulent flow. Such conditions are typically associated with long, straight runs of exhaust duct or stack. To the extent that RICE facilities do not have such stack sampling locations, volumetric flow determinations can be expected to have more variability and uncertainty than do the Method 7E NO_X concentration measurements. RMB understands these measurements for Rubart will occur on the exhaust duct.

CONCLUSIONS

RMB's statistical analysis of nearly 100 separate compliance tests, based on an upper prediction limit approach used by EPA in several recent rulemakings, suggests that, all other things being equal, 99.5% of all future compliance test reports on the those engines within the dataset would yield results at or below 2.01 lb/hr. It also indicates that one test in 200 will exceed that emission rate. However, the results of RMB's statistical analysis is not an absolute prediction of the expected performance of the RICE to be installed at Rubart Station simply because units of this size and of this particular manufacturer are <u>not</u> represented in the dataset.

The scaling-up assumptions in the manufacturer's existing design involve some additional engineering, the impact of which cannot be predicted using statistical analysis. Finally, there may be other independent limitations in the design, manufacture, and operation of the units that may lead to unexpected deviations in the actual Rubart test results than those that are analyzed. Indeed, there were more than a few engines in the dataset analyzed that did not meet their initial emission performance guarantees. Therefore, RMB cannot assert positively that the emission limitations in the PSD construction permit will always be met.

RMB's analysis provides technical support for the Rubart owner to expect with some confidence that the CAT NO_X contract guarantee of 2.13 lb/hr is likely achievable during steady-state operating conditions. No conclusions regarding emissions during startup or at loads other than those at or near full-load are implied because there were no data presented upon which to base such a representation.

Mid-Kansas
ELECTRIC COMPANY, LLC
neighbors serving neighbors

November 20, 2012

Via: Email

Ms. Mindy Bowman
Kansas Department of Health and Environment
Bureau of Air and Radiation
1000 SW Jackson, Suite 310
Topeka, Kansas 66612-1366

Re: MID-KANSAS ELECTRIC COMPANY, LLC'S PSD PERMIT APPLICATION FOR RUBART STATION—NO_X EMISSION LIMITATION

Dear Ms. Bowman:

This letter summarizes our review of the BACT emission limitation for nitrogen oxides (NO_X) selected by Mid-Kansas Electric Company, LLC (Mid-Kansas) for the Rubart Station (Rubart) 10-MW reciprocating internal combustion engine (RICE) generating units. Mid-Kansas and Burns & McDonnell established the NO_X BACT emission limitation for Rubart only after a comprehensive review of the emission limitations contained in various permits for other facilities. With few exceptions, this information was presented in the Rubart PSD application. Those exceptions and the implications for BACT limitation are reviewed below.

Mid-Kansas has identified those factors relevant to the type of operations which Rubart will carry out to determine whether other factors might influence the BACT determination for other facilities. These are recent developments, learned since the application was submitted.

Finally, in response to your request for additional information about facilities similar to Rubart, Mid-Kansas engaged RMB Consulting and Research, Inc. (RMB) to analyze such compliance test data as might be available on similarly sized and equipped (control technology) RICE generating units to determine with what degree of confidence one could reasonably expect those units to maintain compliance with the proposed BACT limit. A letter report from RMB summarizing its research was submitted to KDHE on November 2, 2012.

In summary, Mid-Kansas finds nothing in review but confirmation that a BACT emission limitation of 2.13 lb/hr for NO_X is appropriate for Rubart.

PO Box 980~Hays, KS 67601-0980~Tel.1.800.354.3638 midkansaselectric.net

BACT INFORMATION – OTHER PERMITS

You asked Mid-Kansas to again review other permits so as to ascertain specific information about other facilities that might inform more completely the proposed 0.07 g/bhp-hr NO_X emission limitation for Rubart.[1] That review included determining whether, based upon available information, these other limitations were expressed as BACT limits or whether they were established on some other basis.

The Rubart RICE units will combust natural gas only. The Mid-Kansas air permit application (at Table 5-4) identified several projects similar in size and fuel to Rubart. All of the engines referenced in the table were manufactured by Wärtsilä. Rubart will deploy the largest engines produced by Caterpillar for use as electricity generators. These larger machines will employ both larger individual cylinder displacement, as well as a larger number of cylinders than any previously manufactured by Caterpillar. Indeed, only the Humboldt Wärtsilä engines are larger.

TABLE 5-4 (MODIFIED) EMISSION LIMITATIONS (G/BHP-HR) FOR ENGINES SIMILAR TO RUBART

PLANT	STATE	NO_X	PSD?
Western 102	Nevada	0.054	No
Plains End 2	Colorado	0.059	No
Goodman	Kansas	0.097	No
Humboldt	California	0.064	Yes
Pearsall	Texas	0.087	Yes
Antelope	Texas	0.052	No
Lea County	New Mexico	0.054	No
Woodland 3	California	0.053	No
Hutchinson	Minnesota	0.030	No
Quail Brush	California	0.048	No

Rubart limitations are BACT limits that are established based upon predicted control technology performance and the expected operation of the facility. In a BACT evaluation it is appropriate to compare permit conditions, including emission limitations, with other facilities that have undergone the same level of analysis. As shown in Table 5-4 from the Rubart application, only the Humboldt and Pearsall facilities' limitations are BACT-based because, like Rubart, they are major sources of criteria pollutants. The Humboldt NO_X limitation is slightly lower than Rubart, which might be expected since California's

[1] The proposed Rubart NO_X limitation is 2.13 lb/MWh; this equates to 0.070 g/bhp-hr.

ozone compliance status will impact NO_X limitations established in that state.[2] The Pearsall NO_X limitation is slightly higher than Rubart. Both of these facilities are located at or near sea level and therefore will require less fuel to generate an identical amount of electricity than will Rubart. Because the site elevation at Rubart is nearly 3000 feet, all other things being equal, then, higher NO_X emissions would be expected at Rubart than at either Humboldt or Pearsall.

The Humboldt units are the largest Wärtsilä engines (in terms of output)–nearly twice the next larger size; and the PSD emission limitation for Humboldt is also higher than all non-PSD facilities but Goodman. As this is the only example, an absolute conclusion as to a size/emissions relationship cannot be drawn; but this size distinction suggests that emissions for larger engines might be expected to be higher than for smaller engines.

Further, the Rubart RICE units will utilize Selective Catalytic Reduction (SCR) for control of NO_X emissions. EPA's AP-42, Section 3.2 Natural Gas-fired Reciprocating Engines, states that "SCR is most suitable for lean-burn engines operated at constant loads, and can achieve efficiencies as high as 90 percent." In this case, the Caterpillar RICE at Rubart will be designed to achieve more than 92% control of NO_X emissions, which is higher than the presumptive reductions referenced in AP-42.

Moreover, the operation of the Rubart units will be anything but steady-state. The units will be frequently started, as the loads will be dispatched in response to wind-resource loading and other dispatch criteria established by the Southwest Power Pool (SPP). Each of these conditions is addressed in more detail in the application.

Additionally, catalyst will also degrade with use. Accordingly, this gradual deterioration must also be taken into account when establishing the emission limitation.

The Pearsall facility, a 24-unit plant as is proposed for Rubart, has the highest capacity factor (CF) of any of the facilities reviewed. The Pearsall emission limitation is likewise higher than any large facility reviewed except Goodman. Again, this is the only example, so an absolute CF/emissions relationship cannot be drawn; but this operational distinction suggests that higher CFs would tend to be associated with higher emission limitations.

All of the factors discussed above distinguish Rubart, Pearsall, and Humboldt from the other facilities in Table 5-4. Those facilities are intended for peaking use, therefore they are not major sources of criteria pollutants. Therefore, the emission limits for those units are not BACT limitations and therefore are not directly comparable to the Rubart permit NO_X limitations. The non-PSD units will generate substantially lesser annual amounts of energy than is expected from Rubart. All of them, but for Goodman, have slightly lower emission limitations.

Finally, regardless of whether limitations are BACT-based or not, it is appropriate to review the compliance performance of these engines. Notably, six of the units at Western exceeded their emission limitations during one or more of their initial

[2] NO_X is an ozone precursor; a lower NO_X limitation may, in conjunction with certain atmospheric conditions, result in lower ground-level ozone levels.

compliance tests. Further, one or more runs on more than one Western unit, in subsequent compliance tests (an annual test requirement is established for these units), produced results above the limit, although these were averaged–out by the other test runs. This discussion serves to indicate that facilities with emission limitations established at about 0.060 g/bhp-hr may be at substantial risk of non-compliance.

For these reasons, establishing an emission limitation which is based solely on existing Wärtsilä units without evaluating the individual facility characteristics is not appropriate.

OTHER FACTORS AFFECTING EMISSIONS PERFORMANCE

Of particular significance in the expected operation is the recent approval of the latest reliability assurance plan in the SPP. Beginning about the time Rubart commences operation, Mid-Kansas will no longer dispatch its own resources. Rather the SPP balancing authority will assume those obligations. So long as natural gas cost is relatively low, Mid-Kansas expects that SPP will operate Rubart as needed to balance the large and increasing wind-based resources in the region. This will likely mean more frequent load swings and more frequent startups than initially assumed. Mid-Kansas expects this dispatch will increase emissions from the individual Rubart units for the reasons discussed above.

Can urea flow be increased to the SCR and thereby improve the NO_X emission performance? No. The SCR will utilize urea as the injection reagent to reduce NO_X emissions in the presence of a catalyst. Can urea flow be increased to the SCR and thereby improve the NO_X emission performance? No. This process has already been optimized. Therefore, while injecting more urea into the SCR might yield slightly higher removals, it will also result in excess ammonia slip in the exhaust gas stream. While ammonia slip is not regulated in Kansas, any unnecessary increase will result in additional, unnecessary particulate matter emissions from and near to the Rubart facility.

The high expectation of continuous compliance expressed by the Mid-Kansas Board of Directors, KDHE, EPA, and the general public does not suggest a lower BACT limitation is achievable as a practical matter. On the whole, the guarantee proffered by Caterpillar, expressed as 2.13 lb/hr, is the appropriate BACT-based NO_X emission limitation.

RMB LETTER REPORT – STATISTICAL ANALYSIS OF COMPLIANCE TESTS

Finally, you asked Mid-Kansas about its expectations of achieving compliance with the proposed BACT emission limitation. In response, Mid-Kansas evaluated the existing database of compliance tests conducted on units similarly equipped as Rubart. RMB conducted this analysis based upon actual compliance test data constructed by EnviroMet.[3] The statistical demonstration employed in the analysis is the same as that used by EPA to establish the utility MACT limitations in its recent mercury and air toxics (MATS) rulemaking.

[3] EnviroMet is a general air quality consultant in air permitting and air impact analysis, including due diligence investigation and regulatory analysis, EnviroMet is located in Cherry Hill, NJ.

The data analyzed by RMB were derived from all of the actual NO_X emission rates observed from similar units as reported during compliance tests. All available US-based units equipped with the emission control technology that will be employed with the Rubart RICE were identified; and all of the data for these units were included in the analysis reported. All the units tested were manufactured by Wärtsilä.[4] The analysis yielded an expected upper prediction level (UPL) NO_X emission rate of 2.01 lb/hr at a 99.5% confidence level.

As with other combustion sources, engine emissions are frequently specific to the manufacturer and the particular duty cycle expected of the equipment.[5] Therefore, as stated in the RMB report, it does not necessarily follow that Caterpillar and Wärtsilä emissions performance will be the same.

Caterpillar will not provide a guarantee that NO_X emissions from its engines will be less than 2.13 lb/hr. This is in part because of the expected Rubart duty-cycle and in part because the engine size is being increased by about 35% over that of existing Caterpillar units. Indeed, the proposed Rubart NO_X limitation is only 6% higher than the statistical analysis of all compliance tests would indicate is achievable for units of a normal size and a normal operating expectation. As indicated in the BACT review and as restated above, an expectation of higher emissions on a larger engine, operating at non-steady-state conditions must be presumed by the vendor, the operator, and the agency.

In short, the RMB report confirms an emission limitation of 2.13 lb/hr for NO_X as an appropriate—even an aggressive—BACT emission limitation for the Rubart units,

CONCLUSION

Mid-Kansas finds nothing in its BACT review that suggests the emission limitation proposed is anything but appropriate. There is not yet any test data available for Caterpillar engines of this size, and none are expected to be available prior to the issuance of a final permit to construct Rubart. A more severe dispatch plan for these units is no less likely than when the project was first conceived.

A review of actual compliance test data for existing units indicates that all of the presently known and assumed relevant factors and for high expectations of compliance, a NO_X BACT emission limitation of 2.13 lb/hr for the Rubart generating units is aggressive.

[4] Engines of Caterpillar manufacture were not included in the dataset analyzed, because engine-generators of this size equipped with this control technology have not been sold in commerce.

[5] The expected Rubart duty-cycle, which may include several startups each day, will include balancing intermittent wind-based resources in response to dispatch signals issued by the Southwest Power Pool.

Please contact either me at (785) 623-3313 or Mary Hauner-Davis at (816) 822-4252 should you have questions or require more information on this matter.

Sincerely,

Signature: Wayne E Penrod (Nov 20, 2012)

Email: wpenrod@sunflower.net

Wayne E. Penrod
Executive Manager, Environmental Policy

Attachments: RMB Analysis of NO_X Emission Data

c. _SunflowerRecords@sunflower.net
WC Blanton
Mary Hauner-Davis

WEP/mnp

Mid-Kansas
ELECTRIC COMPANY, LLC
neighbors serving neighbors

November 28, 2012

Via: Email

Ms. Mindy Bowman
Kansas Department of Health and Environment
Bureau of Air and Radiation
1000 SW Jackson, Suite 310
Topeka, Kansas 66612-1366

Re: MID-KANSAS ELECTRIC COMPANY, LLC'S PSD PERMIT APPLICATION FOR RUBART STATION—REDUNDANT EMERGENCY AC GENERATOR

Dear Ms. Bowman:

In July 2012, Mid-Kansas Electric Company, LLC (Mid-Kansas) submitted a Prevention of Significant Deterioration (PSD) construction permit application for the installation of 24 reciprocating internal combustion engine (RICE) generators and certain auxiliary and ancillary equipment at a new site to be called Rubart Station located in Grant County, Kansas (the Project). The permit application identified that one 450-kilowatt (kW), equivalent to 603.5 horsepower (hp), emergency AC generator would be installed as part of the Project. Mid-Kansas has now determined that a redundant emergency AC generator will be necessary for the Project.[1] Therefore, Mid-Kansas amends its application to include a redundant emergency AC generator for Rubart Station.

The redundant emergency AC generator will be identical in all respects to the generator initially proposed. It will be the same size (450 kW) and will be limited to the same annual hours of operation (100 hours) as the first emergency AC generator. Both generators will be limited to combusting natural gas only for fuel. Only one emergency AC generator will be operated at a time and only one generator will be tested at a time. The generators will be located within 50 feet of each other and the stack parameters will be exactly the same as the stack parameters for the initial emergency AC generator as proposed.

Because only one AC generator will operate at a time, the addition of a redundant emergency AC generator will not affect the air dispersion modeling analysis that has already been submitted to KDHE. For the 1-hour NO_X analysis, the emergency equipment is considered intermittent and is therefore not evaluated in the modeled impacts. For the annual NO_X averaging period, the emissions will increase by 0.1 ton per year (tpy) which is a 0.03% increase from the 400.5 tpy that is the current potential

[1] It is essential that Mid-Kansas complete the Project as "black-start" capable. The Southwest Power Pool (SPP) will require that Mid-Kansas maintain one such black-start facility to be used to restore electricity in the event a regional electricity outage should occur. The failure of an emergency AC generator or the unavailability of such a generator due to maintenance would deprive the SPP and Mid-Kansas of an essential facility to restore electricity supply in the event of a regional grid failure. Only a redundant emergency AC generator will satisfy this requirement.

to emit. This increase is insignificant for an annual NO_X air dispersion modeling analysis.

The percentage increase for $PM_{2.5}$ emissions will be only 0.001 pound annually; therefore, there will be no change in the air dispersion impacts. The 24-hour average models includes an emergency AC generator operating every hour; therefore no change in needed because only one piece of equipment would be operating in any given hour for air dispersion modeling purposes.

Mid-Kansas requests that two identical emergency AC generators be authorized by the air permit for Rubart Station. The emission profile, stack parameters, size, fuel, and general locations are identical for both the primary and the redundant emergency AC generator. While it is possible to engineer control systems that would only allow one engine to be operated at a time, it is disadvantageous to include such a limiting system to essential equipment such as a black-start system that only functions in electrical system emergencies. Therefore, Mid-Kansas proposes an administrative permit condition that allows the facility to operate only one emergency AC generator at any given time, including testing.

Please contact either me at (785) 623-3313 or Mary Hauner-Davis at (816) 822-4252 should you have questions or require more information on this matter.

Sincerely,

Wayne Penrod (Nov 28, 2012)

wpenrod@sunflower.net

Wayne E. Penrod
Executive Manager, Environmental Policy

c. _SunflowerRecords@sunflower.net
WC Blanton
Mary Hauner-Davis

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MID-KANSAS ELECTRIC COMPANY, LLC'S PSD PERMIT APPLICATION FOR RUBART STATION—REDUNDANT EMERGENCY AC GENERATOR

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Mindy Bowman

From: Hauner-Davis, Mary [mhauner@burnsmcd.com]
Sent: Wednesday, December 05, 2012 8:49 AM
To: Mindy Bowman
Cc: Penrod, Wayne (WPenrod@sunflower.net)
Subject: Filterable PM limit

Hi Mindy:

We've received some verification on the detection limit (DL) for Method 5 testing. The DL is 1 mg/m^3 exhaust flow. Based on this DL, Mid-
Kansas requests a limit of 0.25 lb/hr (which includes a very small safety factor above the DL) for filterable PM. Please let us know if you'd like to discuss this.

Mary Hauner-Davis
Manager, Air/Noise Department, Env. Studies & Permitting
Burns & McDonnell
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Kansas City, MO 64114
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